5.6 Noise and Vibration

5.6.1 Introduction

This section describes the existing noise and vibration setting of the project area and surrounding areas, and evaluates whether the development of the proposed desalination plant and related facilities would result in adverse noise and vibration. Specifically, the evaluation focuses on whether the proposed project would generate noise or ground-borne vibration levels in excess of established standards; create a substantial permanent increase in ambient noise; or create a substantial temporary or periodic increase in ambient noise levels.

The description of the existing setting and evaluation of impacts is based on field observations and noise measurements of the project area conducted in November 2011, and on a review of calculated noise and vibration generated by project activities. Additional information in this section related to environmental setting, regulatory framework, and the analysis of impacts and mitigation measures is derived from Section 5.6, Noise and Vibration of the *Integrated Water Plan Program Environmental Impact Report* (IWP Program EIR) (City, 2005a), as well as from other references, as cited throughout this section.[1]

Public and agency comments related to noise and vibration were received during the public scoping period in response to the Notice of Preparation, and are summarized below.

- Discuss noise and vibration impacts during construction and operation of the project on sensitive receptors.

To the extent that issues identified in public comments involve potentially significant effects on the environment according to the California Environmental Quality Act (CEQA), and/or are raised by responsible and trustee agencies, they are identified and addressed in this EIR. For a complete list of public comments received during the public scoping period, refer to **Appendix A, Scoping Report City of Santa Cruz and Soquel Creek Water District (scwd²) Regional Seawater Desalination Project**.

[1] Referenced documents in this EIR are available for review at the City of Santa Cruz Water Department offices at 212 Locust Street, Suite D, Santa Cruz, California 95060, Monday through Thursday 8:00 a.m. to Noon and 1:00 p.m. to 5:00 p.m., except holidays. Likewise, these documents are available for review at the Soquel Creek Water District offices at 5180 Soquel Drive, Soquel, CA 95073, Monday through Friday 8:00 a.m. to Noon and 1:00 p.m. to 5:00 p.m., except holidays.

5.6.2 Environmental Setting

Fundamentals of Environmental Noise and Vibration

Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB), with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in **Table 5.6-1, Definition of Acoustical Terms in this Report.**

Table 5.6-1. Definitions of Acoustical Terms Used in this Report

Term	Definitions
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in microPascals (or 20 microNewtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 microPascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hertz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hertz (Hz) and 20,000 Hz. Infrasonic sounds are below 20 Hz and ultrasonic sounds are above 20,000 Hz.
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.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L01, L10, L50, L90	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	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 p.m. and 7:00 a.m.
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 p.m. to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Most of the sounds we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the fact that human hearing is less sensitive at low frequencies and extreme high frequencies. This is called "A" weighting, and the decibel level so measured is called the A-weighted sound level (dBA). 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. Typical A-weighted levels measured from various noise sources are shown in **Table 5.6-2, Typical Noise Levels in the Environment**.

Table 5.6-2. Typical Noise Levels in the Environment

Common Outdoor Noise Source	Noise Level (dBA)	Common Indoor Noise Source
	120 dBA	
Jet fly-over at 1,000 feet		Rock concert
	110 dBA	
Pile driver at 100 feet	100 dBA	
		Night club with live music
	90 dBA	
Large truck pass by at 50 feet		
	80 dBA	Noisy restaurant
Freeway at 100 feet		Garbage disposal at 3 feet
Gas lawn mower at 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial/Urban area daytime		Normal speech at 3 feet
Suburban expressway at 300 feet	60 dBA	
Suburban daytime		Active office environment
	50 dBA	
Urban area nighttime		Quiet office environment
	40 dBA	
Suburban nighttime		
Quiet rural areas	30 dBA	Library
		Quiet bedroom at night
Wilderness area	20 dBA	
Most quiet remote areas	10 dBA	Quiet recording studio
Threshold of human hearing	0 dBA	Threshold of human hearing

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources creating a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L01, L10, L50, and L90, are commonly used. They are the A-weighted noise levels equaled or exceeded during 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the average A-weighted noise level during a stated period of time.

In determining the daily level of environmental noise, it is important to account for the difference in response that people have to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, L_{dn} or DNL (day/night average sound level), was developed. The DNL divides the 24-hour day into the daytime of 7:00 a.m. to 10:00 p.m., and the nighttime of 10:00 p.m. to 7:00 a.m. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The Community Noise Equivalent Level (CNEL) is another 24-hour average that includes both an evening and nighttime weighting.

Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves, with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the Peak Particle Velocity (PPV), and another is the Root Mean Square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this section, a PPV descriptor with units of inches per second (in/sec) is used to evaluate construction-generated vibration for building damage and human complaints. **Table 5.6-3, Human Reaction and Building Damage from Vibration,** describes the reactions of people and the effects on buildings that continuous vibration levels produce, based on a vibration guidance manual prepared by the California Department of Transportation (Caltrans, 2004). The perception levels shown in **Table 5.6-3** are to be used as a guide, because vibrations approaching the threshold of perception levels depend on the level of sensitivity of individuals.

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

Table 5.6-3. Human Reaction and Building Damage From Vibration

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

Source: Caltrans, 2004. Transportation- and Construction-Induced Vibration Guidance Manual.
Acronyms: PPV = peak particle velocity

Regional Setting

Roadway Traffic Noise

The *City of Santa Cruz General Plan 2030 EIR* (General Plan 2030 EIR) provides an overview of existing sources of noise in the area (City, 2012a). The most significant and ubiquitous source of noise is vehicular traffic on the roadway network in the City. The noise level produced by a roadway is a function of the traffic volume and speed. As a result, State Route 1 and State Route 17 generate the highest noise levels that affect large areas. The effect of noise from vehicular traffic on arterials and local streets affect development that is directly adjacent. The effects are significantly reduced beyond the first row of buildings. Examples of these roadways cited in the General Plan 2030 include Mission Street (State Route 1), Water Street, Soquel Avenue, Ocean Street, Broadway, River Street, Bay Street, and Laurel Street. Delaware Street through the project area is another example. Based on selected noise measurements and existing noise contour maps developed as part of the General Plan 2030, noise levels range from 60 to 70 dBA L_{dn} at 50 feet from the center of these and other City roadways (City, 2012a).

Noise levels in the unincorporated County portion of the project area are predominately influenced by traffic on local roadways and in particular along Highway 1. A review of traffic noise contour maps of surrounding jurisdictions indicate that noise levels adjacent to local arterial roadways would reach 65 dBA L_{dn} 50 feet from the roadway edge. Noise levels along Highway 1 would reach 70 dBA L_{dn} as far as 400 feet from the roadway edge (City, 2005a; Capitola, 1989).

The primary noise source in Capitola is largely from traffic (cars and trucks) traveling on local roadways (Capitola, 2011a). As a general rule, peak pass-by noise levels for passenger vehicles on local streets are 60 to 70 dBA at 25 feet. Buses, trucks, motorcycles, and poorly muffled cars produce pass-by noise level 5 to 15 dBA higher. The highest noise levels are generated along Highway 1 and the northerly portion of 41st Avenue, where traffic volumes are the greatest.

High levels of traffic-generated noise exist along Capitola's arterial roads, including the southern portion of 41st Avenue (where the roadway narrows from four to two lanes), Capitola Road, Clares Street, Wharf Road, the 4-lane sections of Bay Avenue, and Park Avenue (Capitola, 2011a). Noise contour maps included in the *City of Capitola General Plan 1989* (Capitola General Plan) indicate that noise levels adjacent to local arterial roadways reach 65 dBA Ldn at 50 feet from the roadway edge (Capitola, 1989); noise levels and contours are being updated as part of the General Plan Update that is in progress (Capitola, 2011a).

Railroad Noise

Railroad tracks cross Santa Cruz County in an east-west direction and are used for limited freight movements and recreational trains during the summer (and limited days during the winter holidays). Freight rail service has operated on a branch line of the Southern Pacific Railroad that traverses the County between the cities of Davenport and Watsonville. This rail line has recently been purchased by the Santa Cruz County Regional Transportation Commission (SCCRTC). The SCCRTC refers to this rail road as the Santa Cruz Branch Rail Line. The SCCRTC selected Iowa Pacific Holdings to operate freight and tourist passenger service on the Santa Cruz Branch Rail Line (SCCRTC, 2012).

The Santa Cruz, Big Trees, and Pacific Railway Company owns and operates a rail line between the City of Santa Cruz and Felton, offering minor freight and recreational passenger service. Several daily passenger trains are operated on this line during the summer.

According to the General Plan 2030 EIR, locomotives typically produce maximum noise levels (L_{max}) of 88 dBA at a distance of 50 feet, and whistles produce an L_{max} of 105 dBA at 50 feet (City, 2012a). If there are two round trips a day, this corresponds to an L_{dn} of 49 dBA. The L_{dn} would increase to 65 dBA near grade crossings, because the train would be required to sound its warning horn (whistle).

Aircraft Noise

Aircraft are a small but audible contributor to the soundscape throughout the area. There are no airfields or airports in the Santa Cruz area. Therefore, the noise of aircraft is limited to flyovers of airplanes to and from Watsonville Municipal Airport, occasional California Department of Forestry aircraft, as well as sporadic commercial over-flights. Occasional helicopter operations are associated with the emergency helipad at Dominican Hospital.

Marine Noise

Marine transportation facilities within the area are devoted predominately to recreational activities and commercial fishing activities. Santa Cruz Small Craft Harbor forms the eastern edge of the City and is composed of an upper and lower harbor area (separated by Murray and Eaton streets). There are no cargo shipment harbors or terminals for commercial passenger ports in the County. The closest port facility is at Moss Landing in Monterey County.

Other Sources of Noise

Most of the industrial lands in the City and the general area are north of Highway 1 and west of River Street (State Route 9). The Granite Rock concrete facility is identified in the City's General Plan 2030, and was reported to generate noise levels of 65 to 67 dBA at a distance of 185 feet. Additionally, the Natural Bridges Industrial Park area on the western side of the City, where the proposed desalination plant would be located, also has industrial lands. Ambient noise levels for this area are described below.

The Santa Cruz Beach Boardwalk—and the vehicular traffic associated with it—is the predominant noise source at the beach area during the summer months. Major noise sources include roller coasters, people screaming, and outdoor concerts. Noise measurements conducted for the Beach Area/South of Laurel Master Plan EIR indicated that roller coasters generate maximum noise levels (L_{max}) of 69 to 78 dBA at the residences and businesses across Beach Street. The 24-hour DNL along Leibrandt Street was 68 dBA. Along East Cliff Drive, homes on the bluff overlooking the Boardwalk were exposed to an L_{max} of 60 to 65 dBA from music at the bandstand; and 65 to 70 dBA from the screams of people on the Giant Dipper Coaster (Rosen, Goldberg, Der, and Lewitz, Inc., 2007).

Other noise sources in the project area include waves and wind from the ocean, and noise typical of residentially developed areas (e.g., children playing, lawn mowers, dogs barking). Occasional noise disturbances have been noted with respect to local nightlife in the downtown portion of the City and in Capitola; however, this appears to be limited in nature. In many parts of the project area, the loudest continuous sounds come from the ocean.

Project Area Setting

Project Area Locations

Land uses sensitive to noise identified in the project area include residential areas, schools, daycare facilities, hospitals, churches, passive recreational areas, transient lodging, and certain professional and commercial activities such as buildings with outdoor dining areas.

The proposed desalination plant and its related components would be located in the City of Santa Cruz (City), unincorporated Santa Cruz County (County), City of Capitola (Capitola), and offshore in the Pacific Ocean. Beginning in the Pacific Ocean, a number of alternative intake structure and pipeline locations near the Municipal Wharf and along West Cliff Drive are being considered, and would extend from potential pump station locations. These pump station locations include a site on the Municipal Wharf (SI-17); two sites near the Wharf (SI-9 and SI-18); several sites along West Cliff Drive (SI-4, SI-5, and SI-7); two inland sites: one behind the Pacific Collegiate School[2] (SI-16); and the other at the alternative desalination plant site (SI-14).

[2] Pacific Collegiate School is Santa Cruz City School's property.

The intake transfer pipeline would run from the pump stations through the City's paved rights-of-way to the desalination plant.

Three alternative plant sites are being considered in the industrial area generally bounded by the Santa Cruz Branch Rail Line tracks on the north, Natural Bridges Drive on the west, Delaware Avenue on the south, and the realigned Arroyo Seco Canyon Creek on the east. The pipeline to convey the brine from the desalination plant to the City's Wastewater Treatment Facility (WWTF) outfall pipeline would be in the City's paved rights-of-way. The pipeline to convey the product water to the existing City potable water distribution system would run from the alternative desalination plant sites to the existing adjacent distribution pipe, located in Delaware Avenue to the south, or in Natural Bridges Drive to the west of the desalination plant sites. The new intertie system between the City and the District service areas, consisting of new pipelines, pump station upgrades, and City-District valve connection point improvements, would run from Morrissey Boulevard in the City to the DeLaveaga water storage tanks, then through portions of the unincorporated County to McGregor Drive in Capitola.

The site for potential solar PV panels is the desalination plant site described above. The site for the potential micro-hydro system is the basement of the Graham Hill Water Treatment Plant (GHWTP). Given that the micro-hydro system would involve only interior improvements and would not affect the ambient noise of the area; ambient noise in the vicinity of the GHWTP is not described.

Ambient Noise

A noise measurement survey was completed in November 2011 to measure existing baseline noise levels at noise-sensitive land uses in the vicinity of the various project components. The noise survey included unattended long-term measurements over a period of at least 24 hours at eight locations designated LT-1 to LT-8; and attended short-term measurements at 16 additional locations designated ST-1 to ST-16. The noise measurement locations are shown on **Figures 5.6-1a/b, Noise Measurement Locations**.

Noise measurements were made with Larson Davis Laboratories Model 820 sound-level meters fitted with precision microphones and windscreens. The meters were calibrated before and after the measurements. Weather conditions during the survey included gentle winds and mild temperatures.

The long-term measurements are summarized in **Table 5.6-4, Summary of Long-Term Noise Measures;** and the short-term measurements are summarized in **Table 5.6-5, Summary of Short-Term Noise Measures** discussed below. Charts showing the hour-by-hour distribution of noise levels at each of the long-term measurement locations are shown in **Appendix U, Long-Term Noise Measurement Data**. The average noise level during each hour is represented by the hourly L_{eq}. During each hour, the variation in noise levels is shown from the L_{max} to the background noise level (represented by the L90, the sound level exceeded during 90 percent of the measurement interval).

Existing Waste Water Treatment Facility (WWTF) Effluent Outfall Pipeline; new valves to be installed on diffuser ports

Brine Discharge Alternatives; includes brine discharge pipeline and brine discharge/WWTF outfall point of connection

Raw Water Transfer Pipeline Alternatives

Seawater Intake (SI) Alternatives; includes pump station (PS), intake pipeline, and intake structure

Desalination Plant Site Alternatives

- A-1
- A-2
- A-3

Noise Measurement Location

- Long Term
- Short Term

N

0 1,000 2,000

FEET

Base map source: Microsoft Bing Maps

URS

City of Santa Cruz and Soquel Creek Water District
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Figure 5.6-1a
Noise Measurement Locations - Desalination System Area

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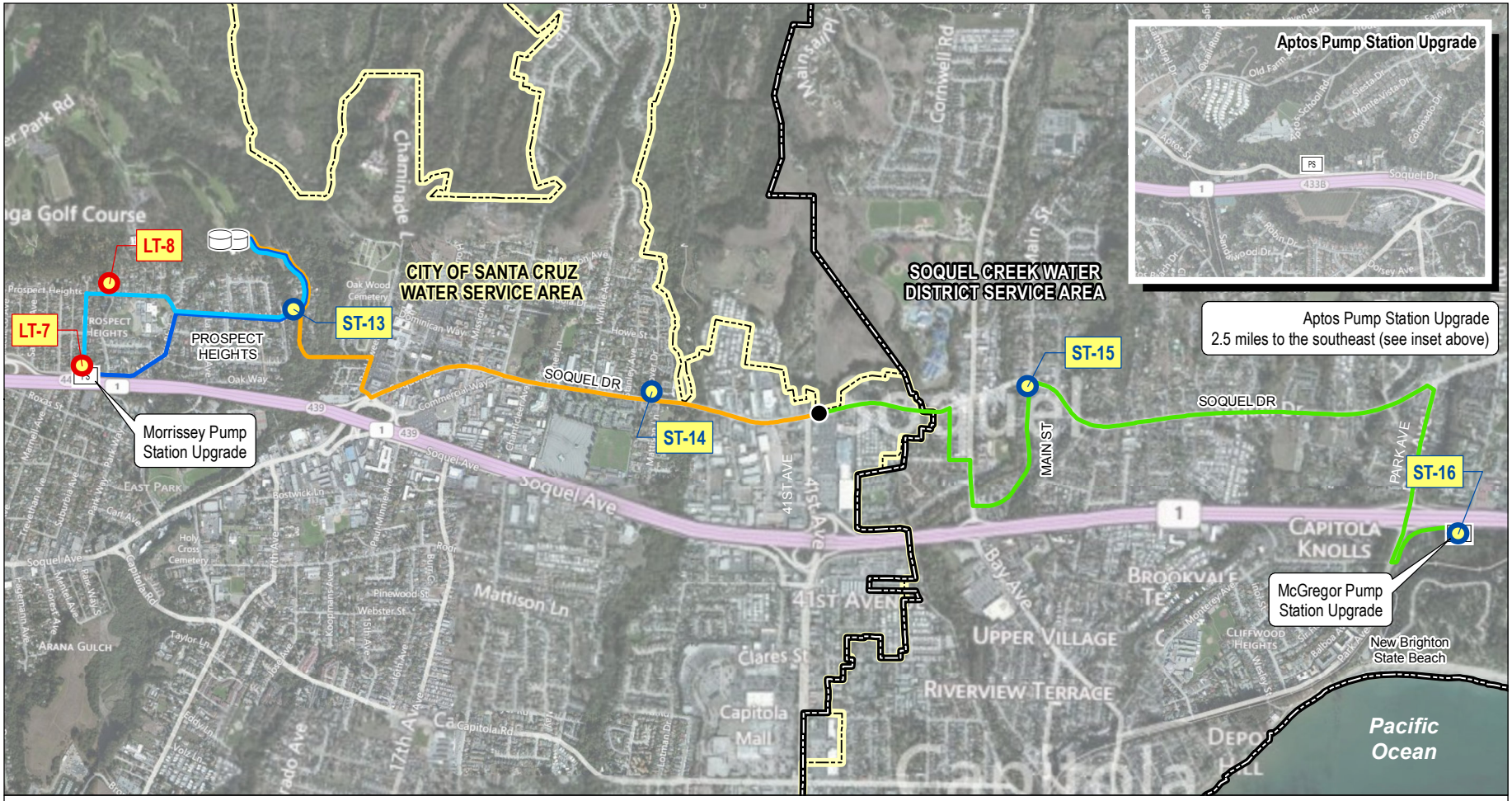

City of Santa Cruz and Soquel Creek Water District
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Figure 5.6-1b
Noise Measurement Locations - City-District Intertie System Area

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Long-Term Measurements

Measurement location LT-1 was selected to characterize baseline noise levels at sensitive receptors near the alternative desalination plant sites (see **Table 5.6-4**). The sensitive receptors are along Natural Bridges Drive north or west of the alternative plant sites, and include Flutterby Preschool, an adjacent residence, and Global College of Natural Science. The measured day/night average noise level at location LT-1 was 57 DNL. Average noise levels during the daytime typically ranged from 52 to 56 dBA L_{eq}. Background noise levels at night were about 42 to 44 dBA L90. Noise sources noted in the area included vehicular traffic on Delaware Avenue, some driveway traffic for the nearby light industrial uses, and mechanical equipment also associated with the light industrial uses.

Table 5.6-4. Summary of Long-Term (24-Hour) Noise Measurements

Site	Location/Description	Date	Time	DNL (dBA)[1] 24-hour	Nighttime L90 (dBA)[2]
LT-1	East property line of desalination Plant Site A-2, 300 feet north of Delaware Avenue	11/22/11 – 11/23/11	11:00 a.m.	57	42-44
LT-2	Along Modesto Avenue east of Auburn Avenue	11/7/11 – 11/8/11	10:00 a.m.	52	40
LT-3	50 feet from Swift Street centerline (across from 342 Swift Street), south of Delaware Avenue	11/7/11 – 11/8/11	11:00 a.m.	60	38-41
LT-4	131 Merced Street, between Modesto Avenue and West Cliff Drive	11/7/11 – 11/8/11	11:00 a.m.	50	40
LT-5	70 feet from Woodrow Avenue centerline. 110 feet from West Cliff Drive centerline	11/7/11 – 11/8/11	12:00 p.m.	58	40
LT-6	Edgewood Beach Motel east side of lower parking lot overlooking Beach Street	11/8/11 – 11/9/11	3:00 p.m.	57	41-45
LT-7	Morrissey Pump Station site on Trevethan Avenue about 150 feet from edge of Morrissey Avenue/State Route 1 corridor	11/8/11 – 11/9/11	2:00 p.m.	62	40-45
LT-8	Park Way 150 feet north of Prospect Heights	11/8/11 – 11/9/11	4:00 p.m.	52	35-40

Notes:
1. DNL represents the average A-weighted noise level (dBA) during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
2. L90 is representative of background noise levels because it is the A-weighted noise level that is exceeded 90 percent of the time.

Noise measurement locations LT-2 through LT-5 were in the residential neighborhood between Delaware Avenue and West Cliff Drive. Location LT-2 was in the residential neighborhood south of Delaware Avenue and west of Natural Bridges State Beach along Modesto Avenue, east of Auburn Avenue. The measured day/night average noise level was 52 DNL. Average noise levels during the daytime ranged from 50 to 55 dBA. At night background noise levels were about 40 dBA L90.

Measurement location LT-3 was on Swift Street just below Delaware Avenue. This location was selected to characterize existing noise levels along the pipeline routes. Sensitive receptors in the area include residences along the eastern side of Swift Street, and both sides of Delaware Avenue

east of Swift Street; and Pacific Collegiate School on the western side of Swift Street. The measured day/night average noise level was 60 DNL. Noise levels were higher in this area because of the higher traffic volumes along Swift Street and Delaware Avenue. Average noise levels during the daytime typically range from 60 to 63 dBA. Noise levels were elevated during one hour in the afternoon, likely due to a localized event such as an emergency siren. Background noise levels at night typically range from 38 to 41 dBA L90.

LT-4 through LT-6 were selected to characterize existing noise levels near several of the alternative pump station locations, as further described below. Measurement location LT-4 was at 131 Merced Street, in the residential area just north of West Cliff Drive. This is a quiet area with little local traffic. The noise from traffic on West Cliff Drive propagating up the street contributed to measured levels, and the surf was also audible in the background. The measured 24-hour average noise level was 50 DNL. Typical average noise levels during the daytime ranged from 45 to 52 dBA. Background noise levels at night were steady at about 40 dBA L90, resulting from the surf.

Measurement location LT-5 was in the residential area at the southern end of Bethany Curve Green Belt, 70 feet from the center of Woodward Avenue, and about 110 feet from the center of West Cliff Drive. Vehicular traffic on West Cliff Drive and Woodrow Avenue was the major noise source. Noise levels were affected on the morning of November 8th by park maintenance activities occurring in the area, including the operation of a wood chipper. The measured 24-hour average noise level was 58 DNL. Average noise levels due to traffic ranged from about 55 to 57 dBA throughout the afternoon. Background noise levels at night were again about 40 dBA L90, and resulted from ocean surf.

Noise measurement location LT-6 was in the lower parking lot of the Edgewood Beach Motel, one of the sites proposed for the intake pump station (SI-9). The measurement was on the eastern property line fence of the parking lot, about 220 feet from the centerline of Beach Street, a location representative of the adjacent motel buildings. Vehicular traffic in the area was a significant source of community noise. The measured day/night average noise level was 57 DNL. Average noise levels during the daytime range from about 53 to 58 dBA. Background noise levels at night range from 41 to 45 dBA L90. There were no activities at the Boardwalk contributing to the noise environment.

Measurement Location LT-7 was in the residential area on Trevethan Street above Morrissey Avenue. This location was selected to characterize noise levels at residential land uses near the Morrissey Pump Station. The major source of noise is vehicular traffic on State Route 1. There is a sound wall at the right-of-way of the highway that reduces highway noise in the residential area. Vehicular traffic on local streets also contributed to measured noise levels. The day/night average noise level was 62 DNL. Average noise levels during the daytime typically range from 60 to 63 dBA L_{eq}. Background noise levels at night were as low as 40 to 45 dBA L90 between midnight and 4:00 a.m.

Measurement location LT-8 was on Park Way north of Prospect Heights in the residential neighborhood along the pipeline route to the water tank, and below the water tank site. The measured noise level was 52 dBA DNL. Distant vehicular traffic on State Route 1 and local traffic were the major contributors to the noise environment. Average noise levels during the daytime were typically 48 to 51 dBA L_{eq}. Background noise levels at night ranged from 35 to 40 dBA L90.

Short-Term Measurement

Short-term measurements were used to establish daytime noise levels along the pipeline routes that could potentially be affected by construction noise, and to supplement the long-term measurements at proposed pump station locations (see **Table 5.6-5**). Location ST-1 was on the Wharf near the proposed location for the intake pump station (SI-17). The sound of the surf, birds, traffic on the Wharf, and motorboats contributed to measured levels. Measurement locations ST-2, ST-3, ST-4, and ST-6 were along Delaware Avenue near residences and proposed pipeline conveyances. Location ST-5 was in the residential neighborhood on Sunset Avenue at Almar Street near a proposed pump station site (SI-4). Typical daytime noise levels along Delaware ranged from 55 to 60 dBA L_{eq}. Intermittent maximum noise levels resulting from local traffic were typically between 60 and 70 dBA L_{max}, except when buses and trucks passed by that resulted in noise levels of up to 77 dBA L_{max}. The noise level along Bay Street west of West Cliff Drive was higher, at about 65 dBA L_{eq}, due to a higher volume of traffic on the roadways in this area.

Locations ST-7 and ST-8 are near the proposed alternative desalination plant sites close to the buildings, north of the railroad right-of-way. Artist studios are housed in the buildings near Location ST-7; and the U.S. Geological Survey Pacific Coastal and Marine Science Center and light industrial and office park uses are in the buildings near Location ST-8. Noise levels in this area resulted from existing mechanical equipment at the industrial uses, the artists themselves, and intermittent traffic on the street network. Location ST-9 is in the residential neighborhood adjacent to the Pacific Collegiate School sports field, which is one of the proposed sites for an intake pump station (SI-16). This is a quiet area at the end of a cul-de-sac, with average daytime noise levels of 41 to 45 dBA L_{eq}, and background levels during the daytime between 36 and 38 dBA L90. School children in the playground were heard during the measurements at this site. Location ST-10 is at the northern entrance of Natural Bridges State Beach on Delaware Avenue, near the alternative desalination plant sites and related conveyances. The noise environment here results from vehicular traffic on Delaware Avenue. The typical daytime noise level is about 51 dBA L_{eq}.

Table 5.6-5. Summary of Short-Term (10-Minute) Noise Measurements

Site	Location/Description	Date	Time	L_{max}	L_{min}	L_1	L_{10}	L_{50}	L_{90}	L_{eq}
ST-1	On eastern side of Wharf near proposed pump station site.	11/7/2011	12:55 p.m.	65	46	63	59	52	48	55
		11/8/2011	12:44 p.m.	62	44	58	53	48	46	50
		11/9/2011	9:30 a.m.	64	45	62	50	50	48	52
ST-2	On Bay Street, west of West Cliff Drive 50 feet to centerline of Bay.	11/7/2011	1:28 p.m.	85	50	77	65	59	53	65
		11/9/2011	9:47 a.m.	86	46	79	65	59	52	66
ST-3	On Delaware Avenue at Laguna Street.	11/7/2011	2:05 p.m.	68	44	67	62	55	48	58
		11/9/2011	10:05 a.m.	76	34	68	59	48	39	57
ST-4	Delaware Avenue at Surfside Avenue, 45 feet to Delaware Avenue centerline.	11/7/2011	2:27 p.m.	77	41	73	65	54	44	59 (w/bus)
		11/9/2011	10:22 a.m.	77	36	75	66	55	42	63
ST-5	Almar Avenue at Sunset Avenue. Near pump station site and pipeline route. 50 feet to Almar Avenue centerline.	11/7/2011	2:47 p.m.	65	43	63	58	50	46	53
		11/9/2011	10:58 a.m.	71	42	68	58	50	46	55
ST-6	Delaware Avenue at Getchell Street Southeast corner. ~50 feet to Delaware Avenue centerline.	11/7/2011	3:09 p.m.	74	45	73	65	59	51	62
		11/9/2011	10:39 a.m.	70	34	67	61	51	38	56
ST-7	Northeast of plant site in artists' complex parking lot.	11/7/2011	3:40 p.m.	57	51	56	54	53	52	53
		11/9/2011	11:20 a.m.	58	44	58	54	48	46	50
ST-8	Desalination plant site. North property line at railroad right-of-way.	11/7/2011	4:05 p.m.	65	39	63	52	44	41	49
		11/9/2011	11:40 a.m.	64	41	60	55	47	43	51
ST-9	219 Stockton Avenue - Adjacent to Pacific Collegiate School sports field.	11/8/2011	9:13 a.m.	51	34	50	43	39	36	41
		11/9/2011	12:15 p.m.	58	36	54	48	42	38	45
ST-10	North entrance to Natural Bridges State Beach, 120 feet from Delaware Avenue centerline.	11/8/2011	9:43 a.m.	65	35	60	55	45	38	51
		11/9/2011	12:00 p.m.	63	40	60	54	49	44	51
ST-11	Market Street North of Hubbard Street 33 feet to Market Street centerline.	11/9/2011	1:20 p.m.	68	41	65	61	51	43	56
ST-12	Branciforte Street at Goss Street.	11/9/2011	1:40 p.m.	70	48	67	62	54	50	58
			4:10 p.m.	70	49	69	61	54	51	58
ST-13	Prospect Heights at Brookwood Drive.	11/9/2011	2:00 p.m.	74	43	72	58	47	45	56
			3:50 p.m.	66	40	65	62	53	43	57

Table 5.6-5. Summary of Short-Term (10-Minute) Noise Measurements

Site	Location/Description	Date	Time	L_{max}	L_{min}	L_1	L_{10}	L_{50}	L_{90}	L_{eq}
ST-14	Soquel Drive at Dover Drive 50 feet to Soquel Drive centerline.	11/9/2011	2:23 p.m.	82	50	77	70	64	56	67
ST-15	Soquel Drive – across from 4770 Soquel Drive 45 feet to centerline.	11/9/2011	2:45 p.m.	76	55	75	70	64	58	66
ST-16	McGregor Pump Station upgrade site. 30 feet to centerline of McGregor Drive. 110 feet to State Route 1 centerline.	11/9/2011	3:15 p.m.	80	67	77	74	71	69	72

Measurement locations ST-11 through ST-16 were taken along the intertie portion of the project area along the pipeline routes. Location ST-11 is in a residential area along Market Street, north of Hubbard Street. Location ST-12 is in the residential neighborhood north of State Route 1 along Branciforte Street at Goss Avenue. Location ST-13 is along Prospect Heights at Brookwood Drive in the residential neighborhood. Noise levels throughout this area typically ranged from 56 to 58 dBA L_{eq} during the daytime. Maximum noise levels resulting from intermittent vehicle passbys ranged from 68 to 74 dBA. Locations ST-14 and ST-15 are on Soquel Drive. The average noise level detected at both locations was 66 to 67 dBA L_{eq}, resulting from steady heavy traffic on Soquel Drive. The final short-term measurement (ST-16) was taken at the McGregor pump station upgrade site; 30 feet from the centerline of McGregor Avenue, and 110 feet from the centerline of State Route 1. Vehicular traffic on State Route 1 was the dominant noise source. The measured noise level during the afternoon was 72 dBA L_{eq}.

5.6.3 Regulatory Framework

The proposed project would be subject to applicable regulations pertaining to noise and vibration. Regulations pertaining to noise and vibration in the project area that are relevant to the analysis of project impacts are detailed below. See also **Section 5.4, Land Use, Planning, and Recreation** for additional evaluation of potential conflicts with relevant land use plans, policies, and regulations of agencies that have jurisdiction over the proposed project.

City of Santa Cruz

The adopted General Plan 2030 includes a Hazards, Safety, and Noise chapter that sets forth goals, policies and actions that address noise issues in the City (City, 2012c). This chapter of the General Plan includes “land use noise compatibility” standards based on recommendations of the State of California Office of Planning and Research. These standards provide recommended exterior noise level standards for different land uses to assure compatibility with ambient noise levels. These standards describe the compatibility of various land uses with a range of environmental noise levels in terms of dBA CNEL. According to the State, exterior noise levels

of 75 dBA or less CNEL are considered to be "normally acceptable" for industrial uses. **Figure 5.6-2, Land Use Noise Compatibility Standards**, illustrates the standards that have been incorporated in the General Plan 2030.

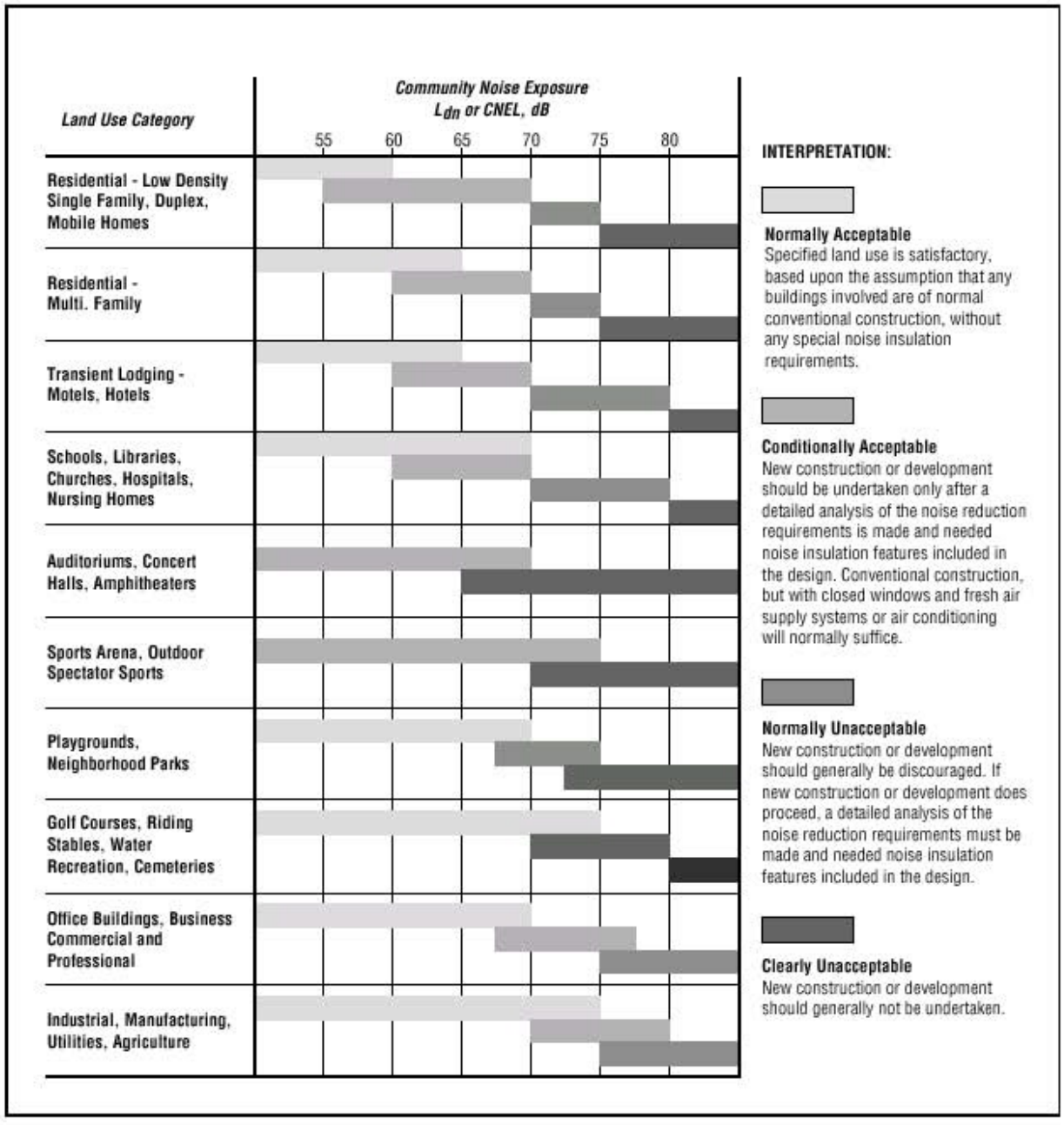

Figure 5.6-2. Land Use Noise Compatibility Standards

Source: City, 2012c. City of Santa Cruz General Plan 2030.

City of Santa Cruz Municipal Code regulations include performance standards regarding noise and vibration. Section 24.14 includes performance standards for the control of land uses to enable potential nuisance factors to be measured factually and objectively where possible, and to protect the community as a whole from hazards and nuisances that can be prevented by methods of control and elimination (City, 2012a). Section 24.14.220 indicates that no land or building in any district shall be used or occupied in any manner so as to create noise or vibration in such a manner or in an amount as to adversely affect the surrounding area or adjoining premises. Section 24.14.260 establishes the maximum sound level that shall not be exceeded as more than 5 dBA above the local ambient for residential uses; and 6 dBA for commercial and industrial uses. Section 24.14.262 indicates that no vibration (other than from transportation facilities or temporary construction work) shall be permitted that is discernible without instruments at the points of measurement specified in the regulations.

Chapter 9.36 of the Municipal Code prohibits offensive noise—defined as loud, boisterous, irritating, penetrating, or unusual—between the hours of 10:00 p.m. and 8:00 a.m. within 100 feet of any building regularly used for sleeping, or which disturbs any person of ordinary sensitivities. Exceptions are provided for emergencies and public works. The exception for public works allows construction for an additional hour between 7:00 a.m. and 8:00 a.m., for performance of public works that would disrupt traffic, or where time constraints would hamper the contractor's ability to complete the project in conformance with the contract. Additionally, on a case-by-case basis, the City Manager may authorize construction work outside these hours.

Santa Cruz County

Santa Cruz County adopted a Public Safety and Noise Element as part of its 1994 Santa Cruz County General Plan and Local Coastal Program (County General Plan) (County, 1994). The Element identifies objectives and policies for noise control in the County as they relate to stationary and rail sources. Applicable to this project are maximum allowable noise exposure standards for noise from stationary sources (see **Table 5.6-6, Maximum Allowable Noise Exposure Stationary Noise**). However, allowable levels shall be raised to the ambient noise levels where the ambient levels exceed the allowable levels.

The County has adopted a noise ordinance, Chapter 8.30, as a part of the County Code. The noise ordinance is similar to the City of Santa Cruz noise ordinance in regulating noise between the hours of 10:00 p.m. and 8:00 a.m. within 100 feet any building regularly used for sleeping.

City of Capitola

The City of Capitola has adopted a Noise Element as part of its General Plan (Capitola, 1989). The Noise Element identifies goals and related policies for noise control in Capitola. Specifically, Policy 2 indicates that new development or proposed changes to development will mitigate noise to acceptable levels, defined as 60 dB L_{dn} in Policy 5.

Table 5.6-6. Maximum Allowable Noise Exposure Stationary Noise[1]

	Daytime[5] 7:00 a.m. to 10:00 p.m.	Nightime[2,5] 10:00 p.m. to 7:00 a.m.
Hourly L_{eq} – Average Hourly Noise Level[3]	50	45
Maximum Level, dB[3]	70	65
Maximum Level, dB – Impulse Noise[4]	65	60

Source: County, 1994. Santa Cruz County General Plan and Local Coastal Program - Public Safety and Noise Element.
1. As determined at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property line noise mitigation measures.
2. Applies only where the receiving land use operates or is occupied during nighttime hours.
3. Sound-level measurements shall be made with "slow" meter response.
4. Sound-level measurements shall be made with "fast" meter response.
5. Allowable levels shall be raised to the ambient noise levels where the ambient levels exceed the allowable levels. Allowable levels shall be reduced if the ambient level is at least 10 dB lower than the allowable level.

Acronyms: dB = decibel Leq = equivalent noise level

The Capitola noise ordinance is set forth in Chapter 9.21 of the Capitola Municipal Code. The ordinance prohibits any noise-generating construction activity in the City between the hours of 9:00 p.m. and 7:30 a.m. on weekdays. Construction noise shall be prohibited on weekends, with the exception of Saturday work between 9:00 a.m. and 4:00 p.m., or emergency work approved by the Building Official. The noise curfew regulations related to construction noise shall not apply to any person engaged in performance of a contract for public works awarded by the City of Capitola—or other governmental agency—where the City of Capitola Director of Public Works determines that the project has the potential to disrupt traffic; and that this disruption could be alleviated by authorizing construction work during noise curfew hours, or that due to time constraints on project completion, it is necessary to allow the contractor to work during noise curfew hours.

5.6.4 Impacts and Mitigation Measures

This section contains the evaluation of potential environmental impacts associated with the proposed project related to noise. The section identifies the standards of significance used in evaluating the impacts; the methods used in conducting the analysis; and a detailed evaluation of impacts for the proposed project and any potential future expansion.

Standards of Significance

Based on CEQA Guidelines Section 15065; Appendix G of the CEQA Guidelines; applicable plans, policies, and/or guidelines described above; and agency and professional standards; the proposed project would cause a significant impact related to noise and vibration if it would result in:

6a. 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;

6b. Substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

6c. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; and

6d. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

Analysis Methodology

The above standards of significance are assessed in this section as the basis for determining the significance of project impacts related to noise. Additional detail about the implementation of the above standards of significance and methodology for the analysis is provided below, based on local general plans and ordinances, as described in **Section 5.6.3, Regulatory Framework**, and based on other information described below. If necessary, mitigation measures are proposed to reduce significant impacts to less than significant.

Impact Significance

Construction Noise and Vibration Impacts

Impacts would be considered significant under standard 6c above if noise-generating construction activities occur outside the allowed hours of 8:00 a.m. to 10:00 p.m. (City and County), and 7:30 a.m. and 9:00 p.m. (Capitola), within 100 feet of any building used for sleep, unless otherwise allowed under local noise ordinances (see **Section 5.6.3**).

Impacts would be considered significant under standard 6d above if short-term construction activities cause vibration levels to exceed the building damage threshold of 0.3 in/sec PPV at a vibration-sensitive structure (see **Table 5.6-3**), based on a vibration guidance manual prepared by the California Department of Transportation (Caltrans, 2004). This threshold is used as there is a potential that certain types of construction-related vibration could cause damage to buildings.

Operational Noise and Vibration Impacts

The basis for determining the significance of operational noise impacts under standards 6a and 6b is provided below. Impacts would be considered significant under standard 6d if operation of the project causes vibration levels to exceed 0.04 in/sec PPV that could be distinctly perceptible to an occupant within a vibration-sensitive structure (see **Table 5.6-3**). This threshold is used as there is a potential that long-term operational vibration could be distinctly perceptible to adjacent receptors, but would be unlikely to cause damage to buildings.

City of Santa Cruz. *Standard 6a* - According to the City's General Plan 2030 EIR, impacts would be considered significant under standard 6a above, if persons would be exposed to noise levels in excess of “normally acceptable” standards established in the State of California General Plan Guidelines’ (2003) “Noise Element Guidelines” for compatible community noise levels (see

Figure 5.6-2), which is included in the City's General Plan 2030 and is based on a 24-hour ambient noise level.

Standard 6b - According to the City's General Plan 2030 EIR, a substantial permanent increase in ambient noise levels under standard 6b above would occur if a project resulted in an increase in ambient noise levels as shown below, based on the 24-hour L_{dn}, in the project vicinity; or expose outdoor activity areas of noise-sensitive land uses to:

- 5 dB increase in noise, where existing noise levels are below 60 dBA L_{dn}, or
- 3 dB increase in noise, where existing noise levels are above 60 dBA L_{dn}.

The ambient noise level typically is based on the 24-hour Day-Night level. However, because the proposed project includes components that are in operation throughout the day and night, performance standards in the City's Zoning Ordinance, which are intended to prevent nuisances, are also considered. According to Section 24.14.250 of the Santa Cruz Municipal Code, noise levels from facilities in a general industrial district (IG), such as the proposed desalination plant, are measured at any point on or outside of the boundary of the district in which the activity is conducted. Based on Section 24.14.260, the noise threshold in this case would be ambient noise at the IG property line, plus 6 dBA. In the instance where the project component would be in a residential zoning district, the calculated noise threshold would be ambient noise at the residential property line, plus 5 dBA, per Section 24.14.260.

Both 24-hour ambient noise level changes and changes that would occur using the City's Zoning Ordinance performance standards are considered for determining whether a substantial permanent increase in noise levels would occur with the proposed project under standard 6b. Calculated noise from the project component is then compared to the calculated noise threshold.

Municipal Code Sections 24.14.250 and 24.22.488 establish the means of measurement to be used, as well as the method, to determine the local ambient levels. Although Section 24.22.488 describes a local ambient measurement duration of 6 minutes, the standards make no mention of the exact noise metric to be used for conformance with this code. The standard is written in terms of "maximum noise level," which could refer to a number of noise-level metrics extrapolated from a 6-minute ambient noise measurement. For this analysis, the local ambient noise is represented by the L90 noise metric,[3] and this is compared to the steady noise level resulting from the mechanical equipment associated with the project. The maximum allowable noise level resulting from the project would be the ambient noise level plus 5 dBA or 6 dBA, depending upon the location of the noise-producing project component. The project would generate noise continuously throughout the day and night, so the impact is evaluated during the daytime and the nighttime.

[3] The L90 noise metric is a conservatively low acoustical descriptor of background noise, which forms the basis for a worst-case analysis of operational impacts from the proposed project.

As indicated in the City's General Plan EIR, a change in noise level of 3 dB is considered just a noticeable difference. A 5 dB change is clearly noticeable, but not dramatic. A 10 dB change is perceived as a halving or doubling in loudness (City, 2012a). It is also noted that the DNL metric includes a penalty for nighttime noise, so it takes into account sound level increases that may have the potential to disrupt sleep patterns. Therefore, the 5-6 dBA increase identified in the Zoning Ordinance standards is considered to be adequate in terms of protecting surrounding uses from excessive nighttime noise.

County of Santa Cruz. According to the County General Plan and noise ordinance, impacts would be considered significant for any project components in the County if stationary noise generated onsite during project operation would generate noise levels greater than 50 dBA L_{eq} during daytime hours, or greater than 45 dBA L_{eq} during evening hours, at the property line of adjacent noise-sensitive receptors. However, allowable levels shall be raised to the ambient noise levels where the ambient levels exceed the allowable levels.

City of Capitola. According to the Capitola General Plan and noise ordinance, impacts would be considered significant if stationary noise generated onsite by the proposed project would generate noise levels of 60 dB (L_{dn}) or above. The City of Santa Cruz Zoning Ordinance and General Plan Guidelines are also used in this analysis to determine what constitutes a substantial permanent increase in noise in the City of Capitola (standard 6b).

Noise Evaluation

The first step in the analysis of noise impacts is to establish existing baseline conditions at sensitive receivers in the vicinity of project components. The existing noise levels are the basis against which project impacts are assessed. It is this existing baseline that determines whether or not noise resulting from the project would cause a substantial increase in noise at sensitive receivers; and whether or not noise levels from the project would exceed the allowable limits in a local general plan or noise ordinance. The next step is to calculate noise levels that would result from the project.

This project is expected to generate noise during the construction phase and the operational phase. Noise levels are calculated for the construction phase using the Federal Highway Administration (FHWA) Roadway Construction Noise Model. As provided for in **Appendix N, scwd² Regional Seawater Desalination Project EIR Project Construction Assumptions**, the numbers and types and pieces of construction equipment anticipated during each of the phases of construction for the desalination plant and various project components are used to calculate construction noise using this model. Construction noise levels are then calculated at sensitive receptors.

Operational noise levels from the desalination plant and pump stations are calculated using information on anticipated equipment sizes and types that have been developed for the project. The next step is to assess the significance of operational noise impacts by comparing projected noise levels to existing noise levels, and the calculated noise thresholds described above.

Ambient vibration levels are typically below the perception threshold at vibration-sensitive receptors, and this is assumed to be the baseline condition. Vibration levels that would result from construction activities and operational equipment are taken from the literature. Standard propagation losses are assumed. The significance of vibration impacts are evaluated based on the construction and operational vibration limits identified above.

Impacts and Mitigation

This section provides a detailed evaluation of noise-related impacts of the proposed project. The noise impact analysis addresses permanent increases in noise during project operation (standards 6a and 6b), temporary increases in noise during project construction (standard 6c), and project-related vibration during construction and operation (standard 6d).

This section provides an evaluation of environmental impacts for all project components and related component alternatives, where relevant. The impacts of the proposed project related to noise are summarized in **Table 5.6-7, Summary of Potential Noise Impacts**, and are categorized as either "not applicable," "no impact," "less than significant impact," "less than significant impact with mitigation," or "significant and unavoidable impact." A detailed analysis of noise impacts and mitigation measures follows this table.

Table 5.6-7. Summary of Potential Noise Impacts

Impacts	LEVEL OF SIGNIFICANCE													
	Seawater Intake Site Alternatives								Plant Site Alternatives			Other Components	Project Overall	Possible Future Expansion
	SI-4	SI-5	SI-7	SI-9	SI-14	SI-16	SI-17	SI-18	A-1	A-2	A-3			
5.6-1: Operational Noise	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTS	LTSM	LTSM
5.6-2: Construction Noise	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS
5.6-3: Vibration	LTS	LTS	LTS	LTS	LTS	LTS	LTSM	LTS	LTSM	LTS	LTS	LTS	LTS/LTSM*	LTS/LTSM*

Notes:
SU = Significant and Unavoidable Impact
LTSM = Less Than Significant Impact With Mitigation
LTS = Less Than Significant Impact
NI = No Impact
-- = Not Applicable
* Impact significance of project overall will depend on the site alternative selected.

OPERATIONAL NOISE	
Impact 5.6-1:	If not properly controlled, the operation of the desalination plant and seawater intake pump station could potentially cause a substantial permanent increase in ambient sound levels with respect to the City's ambient sound increase criteria and Zoning Ordinance performance standards regarding noise increases.
Significance before Mitigation:	Potentially significant
Mitigation Measures:	See Mitigation Measure 5.6-1
Significance after Mitigation:	Less than significant

Proposed Project

The primary permanent noise-generating components of the project, including the plant and seawater intake pump station, would be in the City of Santa Cruz, and would fall under the policies and regulations contained in the City of Santa Cruz Zoning Ordinance, Noise Ordinance, and General Plan. Other noise-generating components of the project associated with the potable water distribution system would be in the County and Capitola, and would be subject to the policies and regulations of those jurisdictions.

General Plan Action HZ3.2.1 specifically calls for application of noise/land use compatibility standards for new development. According to the City's General Plan 2030, normally acceptable exterior noise levels for industrial uses are 70 to 75 decibels, while conditionally acceptable noise levels are 70 to 75 decibels, and normally unacceptable levels are above 75 decibels. The proposed desalination plant would be sited in a location that would be within compatible ambient noise levels, even with increased noise levels associated with project operations. Therefore, new employees and visitors of the desalination plant would not be exposed to noise levels in excess of normally acceptable standards for compatible community noise levels incorporated in the City's General Plan 2030. Therefore, the impact related to exposure of persons to noise levels in excess of standards established in the local general plan (standard 6a) would be less than significant.

Operation of the proposed project could result in increased noise levels resulting from stationary noise-generating equipment. The most significant source of mechanical equipment noise would be the pumps at the proposed desalination plant and at the intake pump station. The evaluation of operational noise associated with this equipment is provided below. **Table 5.6-8, Operational Noise Impacts Compared to Zoning Ordinance Performance Standards**, provides a summary of the operational noise evaluation with respect to the Zoning Ordinance. **Table 5.6-9, Operational Noise Impacts Compared to 24-Hour Ambient Levels**, provides a summary of the operational noise evaluation with respect to the General Plan.

Table 5.6-8: Operational Noise Impacts Compared to Zoning Ordinance Performance Standards

Project Component	Receptor Type	Background Level (dBA, L90)[1]	Impact Threshold (dBA, L90)[2]	Operational Noise Level (dBA)	Exceedance above Threshold (dBA)	Significant Impact Yes/No
Desalination Plant						
Plant Site A-1	IG Boundary (NW of Natural Bridges Dr. and Railroad Tracks)	43 (N) 51 (D)	49 57	61 61	12 4	Yes
	Nearest Residence	43 (N) 51 (D)	49 57	68 68	19 11	Yes
	College	43 (N) 51 (D)	49 57	68 68	19 11	Yes
	Preschool	51 (D)	49 57	68 68	19 11	Yes
	Beachview Avenue (Residential)	45 (N) 51 (D)	51 57	45 45	--	No
Plant Site A-2	IG Boundary (Natural Bridges State Beach)	51 (D)	57	68	11	Yes
	Nearest Residence	43 (N) 51 (D)	49 57	56 56	7 --	Yes
	College	43 (N) 51 (D)	49 57	55 55	6 --	No
	Preschool	43 (N) 51 (D)	49 57	58 58	9 1	Yes
	Beachview Avenue (Residential)	45 (N) 51 (D)	51 57	39	--	No
Plant Site A-3	IG Boundary (northwest of Natural Bridges Dr. and Railroad Tracks)	43 (N) 51 (D)	49 57	55 55	6 --	Yes
	Nearest Residence	43 (N) 51 (D)	49 57	57 57	8 --	Yes
	College	43 (N) 51 (D)	49 57	57 57	8 --	No
	Preschool	43 (N) 51 (D)	49 57	57 57	8 --	No
	Beachview Avenue (Residential)	45 (N) 51 (D)	51 57	45 45	-- --	No

Table 5.6-8: Operational Noise Impacts Compared to Zoning Ordinance Performance Standards

Project Component	Receptor Type	Background Level (dBA, L90)[1]	Impact Threshold (dBA, L90)[2]	Operational Noise Level (dBA)	Exceedance above Threshold (dBA)	Significant Impact Yes/No
Seawater Intake Pump Stations						
SI-4, SI-5, SI-7	Residential					
Above-Grade Option		50 (D) 40 (N)	55 45	72 72	17 27	Yes
Below-Grade Option		50 (D) 40 (N)	55 45	57 57	2 12	Yes
SI-9	CB District (1,100 ft.)					
Above-Grade Option		54 (D) 44 (N)	60 50	40 40	-- --	No
Below-Grade Option		54 (D) 44 (N)	60 50	<40 <40	-- --	No
SI-9	Motel					
Above-Grade Option		54 (D) 44 (N)	60 50	72 72	12 22	Yes
Below-Grade Option		54 (D) 44 (N)	60 50	57 57	-- 7	Yes
SI-14	See Plant Sites	See Plant Sites	See Plant Sites	See Plant Sites	See Plant Sites	See Plant Sites
SI-16	Residential					
Above-Grade Option		45 (D) 40 (N)	50 45	72 72	22 27	Yes
Below-Grade Option		45 (D) 40 (N)	50 45	57 57	7 12	Yes
SI-17	Commercial	50 (D)	56	72	16	Yes
SI-18	Residential					
Above-Grade Option		50 (D) 40 (N)	55 45	54 54	-- 9	Yes
Below-Grade Option		50 (D) 40 (N)	55 45	39 39	-- --	No

Notes:
1. D=Daytime; N=Nighttime
2. The noise threshold related to the Zoning Ordinance performance standards is the ambient plus 5 dBA for sources in residential districts and plus 6 dBA for commercial areas and noise sources located in the IG District.

Table 5.6-9: Operational Noise Impacts Compared to 24-Hour Ambient Levels

Project Component	Receptor Type	Existing DNL (dBA)	Impact Threshold (dBA, DNL)[1]	Operational Noise Level (dBA, DNL)	Exceedance above Threshold (dBA, DNL)	Significant Impact Yes/No
Desalination Plant						
Plant Site A-1	IG Boundary (NW of Natural Bridges Dr. and Railroad Tracks)	NA*	NA*	67	NA*	NA*
	Nearest Residence	57	62	74	12	Yes
	College	57	62	74	12	Yes
	Preschool	57	62	74	12	Yes
	Beachview Avenue (Residential)	60	63	51	--	No
Plant Site A-2	IG Boundary (Natural Bridges State Beach)	NA*	NA*	74	NA*	NA*
	Nearest Residence	57	62	62	--	No
	College	57	62	61	--	No
	Preschool	57	62	64	2	Yes
	Beachview Avenue (Residential)	60	63	45	--	No
Plant Site A-3	IG Boundary (NW of Natural Bridges Dr. and Railroad Tracks)	NA*	NA*	46	NA*	NA*
	Nearest Residence	57	62	63	1	Yes
	College	57	62	63	1	Yes
	Preschool	57	62	63	1	Yes
	Beachview Avenue (Residential)	60	63	51	--	No
Seawater Intake Pump Stations						
SI-4, SI-5, SI-7	Residential					
Above-Grade Option		50	55	78	23	Yes
Below-Grade Option		50	55	63	8	Yes
SI-9	Motel					
Above-Grade Option		57	60	78	18	Yes
Below-Grade Option		57	60	63	3	Yes
SI-14	See Plant Sites above	See Plant Sites above	See Plant Sites above	See Plant Sites above	See Plant Sites above	See Plant Sites above
SI-16	Residential					
Above-Grade Option		50	55	78	23	Yes
Below-Grade Option		50	55	63	8	Yes
SI-17	Commercial	NA*	NA*	78	NA*	NA*
SI-18	Residential					
Above-Grade Option		50	55	60	5	Yes
Below-Grade Option		50	55	45	--	No

Notes:
1. The noise threshold related to the General Plan is the ambient plus 5 dB where existing noise levels are below 60 dBA Ldn, or 3 dB where existing noise levels are at or above 60 dBA Ldn.

*NA – General Plan limits only apply at sensitive receptors (e.g., residences, schools).

The worst-case noise impacts are represented by the maximum exceedance above the thresholds at each location. The maximum exceedance above the thresholds is always greater when assessed with respect to the Zoning Ordinance performance standards (**Table 5.6-8**), as compared to the 24-hour average DNL thresholds set forth in the General Plan (**Table 5.6-9**) as can be seen in the shaded "Exceedance above Threshold" column found in both of these tables. The maximum exceedance would normally occur at night with respect to the nighttime threshold set forth in the Zoning Ordinance. Therefore, the evaluation of impacts discussed below by project component focuses on the performance standards in the City of Santa Cruz Zoning Ordinance (see **Table 5.6-8**). Mitigation measures recommended to reduce the impact to less than significant based on the Zoning Ordinance performance standards would also reduce the impact to less than significant based on the General Plan 24-hour ambient noise level standard.

Seawater Desalination Plant

Information on equipment for the proposed plant is included in **Appendix L, scwd² Seawater Desalination Plant – Phase 1 Preliminary Design: Volume 1 – Report & Volume 2 – Drawings**. Noise resulting from equipment is a function of its horsepower. The largest pumps at the proposed plant site would be high-pressure feed pumps with a motor size of 600 horsepower. Other feed water pumps and booster pumps are rated at 50 to 200 horsepower. There are numerous smaller pumps with horsepower ratings from 10 horsepower to 25 horsepower. The largest high-pressure feed pumps have an estimated combined noise level of 110 dBA at a distance of 3 feet, and the combined noise level from the 50 to 200 horsepower pumps is 105 dBA at a distance of 3 feet. All pumps with a horsepower rating of 10 horsepower or greater are expected to generate noise levels of 85 dBA or higher at a distance of 3 feet. The calculated total reference noise level from all of the pumps that are included in the equipment lists is 112 dBA at a distance of 3 feet.

For Occupational Safety and Health Administration compliance, noise exposure levels inside the plant would normally be limited to 85 to 90 dBA through the use of engineering controls such as barriers or enclosures. All major noise sources would be inside the plant building. Interior levels could be as high as 110 dBA in the vicinity of the high-pressure feed pumps. The indoor-to-outdoor noise reduction provided by an industrial building is typically 20 to 30 dBA, depending upon the size and orientation of ventilation openings, and whether or not ventilation openings incorporate sound-attenuating features such as fan silencers and acoustical louvers. An evaluation of operational noise levels for each plant site alternative is provided below. This evaluation is based on the noise reduction associated with a typical industrial building, but no additional noise controls are assumed.

Plant Site A-1. Plant Site A-1 is proposed southeast of the intersection of the railroad tracks and Natural Bridges Drive. The nearest boundary for the IG district is located diagonally across this intersection to the northwest, where there is an area designated Multiple-Residence Low-rise (RL). This zoning district boundary would be about 200 feet from the corner of Plant Site A-1. The calculated noise level at this zoning boundary would be up to 61 dBA (**Table 5.6-8**). This is

a residential zoning boundary, so nighttime ambient noise is appropriate for determining the noise threshold, which is the ambient noise level plus 6 dBA for sources in an IG District, according to the City's Zoning Ordinance. Measurements in the vicinity show a nighttime ambient noise level of about 43 dBA, indicating a noise threshold of 49 dBA. Projected noise levels at the Zoning Ordinance boundary are calculated to exceed the noise threshold by up to 12 dBA (**Table 5.6-8**).

Noise-sensitive receptors, including a residence, pre-school, and college, adjoin the western property line of Plant Site A-1. These receptors are inside the IG District. Assuming a distance between the boundary and the noise source at the project site of 100 feet, the projected noise level at the boundary is 68 dBA. Noise from the project would exceed the daytime threshold by up to 11 dBA and the nighttime threshold by up to 19 dBA.

At all of the adjacent locations identified above, the increase in noise would exceed the allowable increase, which would result in a significant impact with respect to the limits in the Zoning Ordinance, as demonstrated in **Table 5.6-8**, and therefore would result in a substantial permanent increase in noise. The 24-hour average DNL threshold set forth in the General Plan would also be exceeded at the noise-sensitive receptors, but the exceedance would not be as high, as shown in **Table 5.6-9**.

Implementation of Mitigation Measure 5.6-1 would ensure that the desalination plant is properly designed to provide noise control treatments; including, but not limited to, sound insulating building structures, noise-control enclosures or barriers for individual pieces of equipment, sound-absorbing materials, fan sound attenuators, landscape berms, etc. **Table 5.6-10, Noise Attenuation from Noise Control Treatments**, shows the range of sound attenuation that would be expected to be achieved by these types of treatments. The table demonstrates that some combination of these treatments could be used to reduce the worst-case exceedance of calculated noise thresholds of 19 dBA, and meet the performance standards in the Zoning Ordinance. The related acoustical report identified in the mitigation would document that noise-control treatments are incorporated into the project design, and would reduce noise to acceptable levels that would comply with the City of Santa Cruz Zoning Ordinance performance standards. The 24-hour average DNL threshold would also be met with these treatments. With the implementation of Mitigation Measure 5.6-1, the impact related to operational noise associated with the desalination plant at Plant Site A-1 would be reduced to less than significant.

Plant Site A-2. Plant Site A-2 is at the northeastern corner of the intersection of Natural Bridges Drive and Delaware Avenue. The nearest IG zoning district boundary is directly across Delaware Avenue at Natural Bridges State Beach, which is designated “parks” (PK). Assuming a distance of 100 feet between the boundary and the noise source at the site, the projected project noise level at the boundary would be 68 dBA (**Table 5.6-8**). The park is a daytime use, so daytime ambient noise level is used as the basis for establishing the calculated noise threshold, which is the ambient noise level plus 6 dBA. Daytime ambient noise levels in the area are about 51 dBA. The threshold level is therefore 57 dBA. Noise from project operation would exceed the

threshold by 11 dBA. The increase in noise at the park would result in a significant impact with respect to the limits in the Zoning Ordinance, and therefore would result in a substantial permanent increase in noise (see **Table 5.6-8**).

Table 5.6-10, Noise Attenuation from Noise Control Treatments

Noise Control Treatment	Noise Attenuation (dBA)
Sound Insulating Building Structures	10-20
Noise Control Enclosures or Barriers	5-30
Sound Absorbing Materials	5-10
Fan Sound Attenuators	5-10
Landscape Berms	5-15
Orientation Away from Sensitive Receivers/Behind Buildings	5-10

Noise-sensitive receptors identified in the discussion of Plant Site A-1 would be within 300 to 600 feet north of the Plant Site A-2. Noise levels are projected to exceed the threshold by up to 1 dBA during the daytime and 9 dBA during the nighttime. The increase in noise would result in a significant impact with respect to the threshold levels established in the Zoning Ordinance, and therefore would be considered a substantial permanent increase in noise. The 24-hour average DNL threshold would also be exceeded at one of the noise-sensitive receptors, but the exceedance would not be as high, as shown in **Table 5.6-9**. Implementation of Mitigation Measure 5.6-1 would reduce the impact to less than significant, as described above for Plant Site A-1.

Plant Site A-3. The nearest IG boundary to Plant Site A-3 is diagonally across the intersection of Natural Bridges Drive and the railroad tracks to the northwest, where there is an area designated RL. The noise level resulting from project operation at this zoning boundary is calculated to be up to 55 dBA. This is a residential zoning boundary, so nighttime ambient noise is appropriate for determining the noise threshold, which is the ambient noise level plus 6 dBA, for sources in an IG Zoning District, according to the City's noise ordinance. Measurements in the vicinity result in a nighttime ambient noise level of about 43 dBA, indicating a noise threshold of 49 dBA. Projected noise levels at the Zoning Ordinance boundary are calculated to exceed the threshold by up to 6 dBA (see **Table 5.6-8**).

Noise-sensitive receptors, including a residence, pre-school, and college, are west of Plant Site A-3. Noise from the project would not exceed the daytime threshold at these receptors; however, the nighttime threshold would be exceeded by up to 8 dBA (see **Table 5.6-8**). The increase in noise would result in a significant impact with respect to the limits in the Zoning Ordinance, and therefore would result in a substantial permanent increase in noise. The 24-hour average DNL threshold would also be exceeded at noise-sensitive receptors, but the exceedance would not be as high, as shown in **Table 5.6-9**. As described above for Plant Site A-1, the

implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

Seawater Intake and Conveyance System

There are eight alternative locations for an intake pump station (SI-4, SI-5, SI-7, SI-9, SI-14, SI-16, SI-17, and SI-18). The pump station locations are designated according to the intake site that they serve. The capacity of the pump station would provide for the pumping of up to 7 mgd of seawater, which could be provided by three vertical turbine pumps, with a forth in standby mode. There are two design options being considered: a concrete vault installed under the ground, and an above-grade structure that would enclose the equipment. Both options would have a footprint of approximately 2,500 square feet. With the below-grade option, some components would still be placed above grade, such as access hatches, electrical transformers, parking, driveways, and fencing. The other option would be constructed in an above-grade one-story building approximately 10 to 15 feet in height.

A major source of noise at the pump stations would be the operating pumps. Based on available equipment information, the pumps would have an estimated noise level of 102 dBA, measured at a reference distance of 3 feet. If the pumps are in a vault below ground, then the dominant source of community noise at the pump station would be the transformers that would be above grade. Noise of transformers was measured at the existing Morrissey Pump Station. The transformer noise was 65 dBA, measured at a distance of 10 feet from the transformers. There was no other audible noise emanating from the existing Morrissey Pump Station.

SI-4, SI-5, and SI-7 (West Cliff Drive). An intake pump station could be located at SI-4, SI-5 or SI-7 along West Cliff Drive. SI-4 is at Woodrow Avenue and West Cliff Drive; SI-5 is at 1102 David Way at West Cliff Drive; and SI-7 is at 1700 West Cliff Drive at Merced Avenue. Each of these sites is adjacent to residences and overlooking the beach. Because these pump station sites are in a residential district, the calculated noise threshold would be based on ambient noise, plus 5 dBA, according to the City's Zoning Ordinance. The noise measurement survey results showed the daytime ambient noise level is about 50 dBA, and the nighttime ambient noise level is about 40 dBA (controlled by surf). The thresholds are therefore 55 dBA during the daytime, and 45 dBA during the nighttime (see **Table 5.6-8**). For the purposes of this analysis, it is assumed that the distance between the source of noise at the pump station and the receptors is 25 feet.

If the pump station is built above grade in an enclosure with no additional noise controls, the predicted noise level from the operation of the pump station is 72 dBA. Noise from the pump station is calculated to exceed the daytime noise threshold by 17 dBA, and the nighttime noise threshold by 27 dBA. If the pump station is built in a below-grade vault, then noise from the pumps is expected to be adequately attenuated by the structure. The primary noise source in this case would be the transformers, which would be above ground. The transformers are estimated to generate a noise level of 65 dBA at a distance of 10 feet, based on measurements made at the Morrissey Pump Station. The predicted noise level from the above-grade noise sources is

57 dBA. The noise level would exceed the daytime noise limit by 2 dBA, and the nighttime noise limit by 12 dBA (see **Table 5.6-8**).

The increase in noise associated with either an above-grade or below-grade pump station at these sites would result in a significant impact with respect to the limits in the Zoning Ordinance, and therefore would result in a substantial permanent increase in noise. However, the below-ground pump station would reduce the exceedance above the noise threshold substantially. The 24-hour average DNL threshold would also be exceeded at noise-sensitive receptors, but the exceedance would not be as high, as shown in **Table 5.6-9**. As described above for Plant Site A-1, the implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

SI-9 (Beach Area). SI-9 is in a Beach Commercial (CB) district. Pursuant to the Municipal Code, the noise limits in this district are enforced at any point over 1,100 feet from the noise source. Based on the results of the ambient noise survey, the nighttime ambient noise level is about 44 dBA; and the daytime ambient noise level is about 54 dBA. With the additional 6 dBA, the noise threshold would be 50 dBA during the nighttime, and 60 dBA during the daytime. At a distance of 1,100 feet, the noise from an above-grade pump station is calculated to be about 40 dBA, a level substantially below the daytime and nighttime noise threshold (see **Table 5.6-8**).

The nearest noise-sensitive receptors in the vicinity of the site are the adjacent motels on the parcels to the east. Following the same analysis as described above, assuming a distance of 25 feet from the noise source to the noise-sensitive receiver, noise from operation of the pump station is calculated to exceed the noise threshold by 22 dBA during the nighttime, and 12 dBA during the daytime. If the pump station is built in a below-grade vault, then noise from the pumps is expected to be adequately attenuated by the structure. The primary noise source would be the transformers. The transformers are estimated to generate a noise level of 65 dBA at a distance of 10 feet. Noise levels would again be below the Municipal Code limits. The predicted noise level at the adjacent property lines is 57 dBA. The noise level would be below the daytime noise limit, but would exceed the nighttime noise threshold by 7 dBA.

The increase in noise associated with either an above-grade or below-grade pump station at this site would result in a significant impact with respect to the limits in the Zoning Ordinance, and therefore would result in a substantial permanent increase in noise. However, the below-ground pump station would reduce the exceedance above the noise threshold substantially. The 24-hour average DNL threshold would also be exceeded at noise-sensitive receptors, but the exceedance would not be as high, as shown in **Table 5.6-9**. As described above for Plant Site A-1, the implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

SI-14 (Desalination Plant Site-Area A). SI-14 would be at the selected desalination plant site in Area A. For the purpose of the EIR analysis, the SI-14 pump station is assumed to be in the overlap area between Plant Sites A-1 and A-3. Noise impacts from the desalination plant were

discussed previously. Noise levels from the pump station are predicted to be about 10 dBA lower than noise levels from desalination plant pumping equipment. The pumps in the pump station were treated in the same way as the pumps in the desalination plant. The conclusions regarding the impact from the pump station would be the same as the conclusions for the desalination plant, because this equipment would simply become one more piece of major noise-generating equipment within the desalination plant boundary. As described above for Plant Site A-1, the implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

SI-16 (Pacific Collegiate Sports Field). A pump station at SI-16 would be on a high school sports field surrounded by single-family residences. The results of the noise measurement survey indicate ambient noise levels of about 40 dBA during the nighttime, and 45 dBA during the daytime. The noise impact thresholds would be 50 dBA during the daytime, and 45 dBA during the nighttime. The same assumptions outlined above for the West Cliff Drive sites (SI-4, SI-5, and SI-7) would apply to the school's sports field site. Noise from the operation of the above-grade pump station is calculated to exceed the daytime noise threshold by 22 dBA, and the nighttime noise threshold by 27 dBA.

If the pump station is built in a below-grade vault, then noise from the pumps is expected to be adequately attenuated by the structure. The primary noise source would be the transformers. The transformers are estimated to generate a noise level of 65 dBA at a distance of 10 feet. The predicted noise level at the adjacent property lines is 57 dBA. The noise level would exceed the daytime noise threshold by 7 dBA, and would exceed the nighttime noise threshold by 12 dBA.

The increase in noise associated with either an above-grade or below-grade pump station at this site would result in a significant impact with respect to the limits in the Zoning Ordinance, and therefore would result in a substantial permanent increase in noise. However, the below-ground pump station would reduce the exceedance above the noise threshold substantially. The 24-hour average DNL threshold would also be exceeded at noise-sensitive receptors, but the exceedance would not be as high, as shown in **Table 5.6-9**. As described above for Plant Site A-1, the implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

SI-17 (Santa Cruz Municipal Wharf). The site for the pump station at SI-17 would be adjacent to the Municipal Wharf, about 2,000 feet from the wharf entrance. Activities on the wharf are only sensitive to noise during the daytime and evening. This is a commercial area, so the Zoning Ordinance threshold limits are equal to the ambient noise level plus 6 dBA. Ambient noise measurements made on the wharf indicate typical ambient daytime noise level is about 50 dBA. Noise levels are temporarily elevated due to the passage of automobiles or boats. The threshold level is, therefore, 56 dBA. Following the same analysis assumptions outlined above, noise levels from the operation of the pump station could exceed the noise threshold by up to 16 dBA at a sensitive receiver location (see **Table 5.6-8**). Noise from the pump station would result in a substantial increase in noise at outdoor pedestrian circulation areas and dining areas on the

wharf. The increase in noise would result in a significant impact with respect to the limits in the Zoning Ordinance, and therefore would result in a substantial permanent increase in noise. The 24-hour average DNL threshold would not be exceeded at SI-17, as shown in **Table 5.6-9**. As described above for Plant Site A-1, the implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

SI-18 (SCCRTC property): The site for the pump station at SI-18 would be on SCCRTC property being leased by the City for wharf maintenance and storage, located across Chestnut Street with residences about 200 feet away. The results of the noise measurement survey indicate ambient noise levels of about 40 dBA during the nighttime and 50 dBA during the daytime. The noise impact thresholds would be 55 dBA during the daytime and 45 dBA during the nighttime. Noise from the operation of the above-grade pump station is calculated to be 54 dBA at a distance of 200 feet, and would not exceed the daytime noise threshold, but would exceed the nighttime noise threshold by 9 dBA (see **Table 5.6-8**).

If the pump station is built in a below-grade vault, then noise from the pumps is expected to be adequately attenuated by the structure. The primary noise source would be the transformers. The transformers are estimated to generate a noise level of 65 dBA at a distance of 10 feet, corresponding to a noise level of 39 dBA at a distance of 200 feet. Noise levels would be below the Zoning Ordinance limits. The predicted noise level at the adjacent property lines is 39 dBA. The noise level would not exceed the daytime noise limit or the nighttime noise limit. Therefore, a below-grade pump station at this site would not be considered a substantial permanent increase in noise at the adjacent residences with respect to the limits in the Zoning Ordinance, and the impact would be less than significant. The 24-hour average DNL threshold would also not be exceeded at SI-17, as shown in **Table 5.6-9**.

The increase in noise from an above-grade pump station at SI-18 would be considered a substantial permanent increase at the adjacent residences, and the impact would be considered significant with respect to the limits in the Zoning Ordinance. The 24-hour average DNL threshold would also be exceeded at noise-sensitive receptors with an above-grade pump station, but the exceedance would not be as high, as shown in **Table 5.6-9**. As described above for Plant Site A-1, the implementation of Mitigation Measure 5.6-1 would reduce the noise impact to less than significant.

Other Project Components

Pipelines and conveyance systems would not generate noise during project operations. The Morrissey pump station upgrade would upgrade pumps in a below-grade vault or in an above-grade building. Noise from the pumps would continue to be inaudible in the surrounding area, which is dominated by traffic noise from State Route 1. The McGregor pump station site is also adjacent to State Route 1, and traffic noise from the highway is the dominant source of noise in the area. The noise from the pump station upgrade would be substantially below traffic noise levels in the area (72 dBA Leq, 69 dBA L90). An emergency generator would be added at the Aptos pump station if the desalination project is constructed. The pump station also adjoins State

Route 1. The generator would only operate during a power failure. A pump station standby generator would typically produce a noise level of up to 75 dBA at a distance of 25 feet. There are no sensitive receptors in the vicinity of the Aptos pump station. The noise associated with these pump station upgrades would increase ambient noise levels by less than 1 dBA, and would not exceed the impact thresholds, as described above. The impact of operational noise from these components would be less than significant.

The potential solar PV panels installed at the desalination plant would not generate noise during project operations. The potential 1.3 million gallon per day, 65 kilowatt micro-hydro turbine system would be installed in the basement of the GHWTP, and no new equipment would be installed outdoors. Given the existing noise generated from existing equipment at the GHWTP, the additional equipment for the micro-hydro system would not result in any increase in ambient noise levels.

Potential Future Expansion

If expansion of the proposed plant and related facilities were pursued in the future, additional noise-generating equipment would be installed in existing structures at the plant, and at the intake pump station. All additional noise-generating equipment would be required to comply with Mitigation Measure 5.6-1, which would reduce any potential significant noise impacts from the operation of the additional equipment to less than significant.

Mitigation Measures

Mitigation Measure 5.6-1

This mitigation measure applies to the desalination plant and the intake pump station. The final design of the desalination plant and intake pump station shall include noise control treatments including, but not limited to:

- Sound-insulating building structures.
- Noise control enclosures for individual pieces of equipment, both inside and outside of the buildings, for major noise generators such as high-pressure pumps.
- Sound-absorbing materials to minimize reverberation within enclosures.
- Fan sound attenuators.
- Acoustical barriers such as solid equipment screen walls or quilted noise control blankets.
- Landscape berms.
- Orientation away from sensitive receivers, and behind buildings or other structures that could provide shielding.

The specific design and details of these treatments shall be completed during project design, and shall be included in the construction plans and specifications for the project. Prior to the issuance of any building or grading permit, an acoustical analysis report shall be submitted to the City documenting the noise control treatments that have been incorporated into the project. The acoustical report shall also document that the design would reduce noise so as to comply with the Zoning Ordinance performance standards established in Municipal Code Section 24.14.260. These standards indicate that maximum sound levels shall not be more than 6 dBA above the local ambient for noise sources at the plant site; and 5 dBA above the local ambient for noise sources at the pumping station, if in a residential area. Meeting these standards will also ensure that the 24-hour average DNL thresholds set forth in the General Plan will be met.

CONSTRUCTION NOISE	
Impact 5.6-2:	The construction of the proposed project would not create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
Significance:	Less than significant
Mitigation Measures:	None required

Proposed Project

The construction of the project would generate noise and would temporarily increase noise levels at nearby sensitive land uses. Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive receptors and existing ambient noise levels.

Noise levels resulting from construction activities are shown for each construction area and component of the project in **Table 5.6-11, Construction Noise Levels**. Construction noise levels were modeled using the FHWA Construction Noise Model. The model takes into account the numbers and types of equipment that would be operating, and the percentage of time the equipment would operate (see **Appendix N**). The types of equipment include, but are not limited to: backhoe, excavator, compactor, bulldozer, loader, pile driver, forklift, generator, air compressor, crane, and trucks. Based on that information, it was conservatively assumed that each piece of operating equipment would be operating 8 hours per day, or 100 percent of a typical daily construction shift. **Table 5.6-11** shows the maximum instantaneous noise level and the hourly average noise level that would be expected at a reference distance of 50 feet from the center of the construction activities.

Table 5.6-11. Construction Noise Levels[1]

Construction Area/Component	L_{max} (dBA)	L_{eq} (dBA)	Duration (Months)[2]
Desalination Plant			
Site Grading	85	86	3
Underground Utilities	85	87	6
Civil Work – Foundations, Structures and Buildings – during Pile Driving	101	95	3
Major Equipment Installation	85	87	9
Piping and Electrical Work	85	87	22
Final Grading, Paving, Landscaping and Site Restoration	85	87	4
Testing and Commissioning	85	84	6
Intake Pump Station			
Civil Work – Foundations during Pile Driving at Site 17	101	95	1
Site Grading	81	82	2
Pump Station/Shaft Excavation	81	83	2
PS Building/Elec/Mech	85	87	2
Final Grading, Paving & Site Restoration	81	82	2
Intake Pipeline – Tunnel			
Intake Pipeline/Tunnel	85	87	6
Hauling Spoils to Disposal Site	85	83	4
Intake Pipeline – Dredging			
Intake Pipeline/Dredging	85	85	3
Intake Structure			
Screens (sandy bottom)	85	85	1
Screens (bedrock)	85	85	2
Intake Transfer Pipeline			
Transfer Pipeline	80	83	3
Brine Conveyance			
Brine Conveyance	81	84	3
Potable Water Distribution Pipelines			
Intertie System Improvements	80	83	14
Morrissey Pump Station Upgrade			
PS Elec/Mech Upgrades	81	82	5
McGregor Pump Station Upgrade			
PS Elec/Mech Upgrades	81	81	4
Construction Traffic – All Components			
Construction Light-Duty Trucks	70	53	varies

Notes:
1. Noise levels are calculated 50 feet from the center of construction activities.
2. Some of the construction elements identified above overlap and therefore are not necessarily consecutive.

Noise, particularly pile-driving activities conducted for short periods, could sporadically disturb nearby residences and businesses. It should be noted, however, that construction-related noise levels would be temporary, and would vary throughout the day and over the entire construction schedule, depending on the type of equipment in use at any one time, and the distance to adjacent receptors. Because construction noise impacts would be temporary and would conform with the

applicable noise ordinances of the City, County, and Capitola, impacts would be less than significant. Nevertheless, environmental design features are incorporated into the project description to minimize construction noise impacts. See environmental design features below and in **Section 4, Table 4-12**. Additional information is provided below about construction noise by project component.

Seawater Desalination Plant

The proposed desalination plant would take approximately 30 to 32 months to construct. During construction of the plant, the noisiest construction activity would be the construction of the foundation structures and buildings; this would be expected to last up to 16 months. Within that time frame, if pile driving is the selected foundation support method, there would be a period of 3 months of pile driving, which would be the loudest source of construction noise. Given that the alternative plant sites are in an industrial area of the City, there not very many noise-sensitive uses adjacent to these sites. However, there are a few noise sensitive receptors on Natural Bridges Drive in proximity to all three alternative plant site locations. It is expected that construction of the desalination plant would occur only during daylight hours, in compliance with the City's Noise Ordinance. As indicated above, construction noise impacts would be less than significant.

Seawater Intake and Conveyance System

The seawater intake and conveyance system would take approximately 16 months to construct. During the construction of the intake system, the noisiest activity would be the construction of the pump station building and the intake pipeline tunneling (see **Table 5.6-11**), which would take 2 months and 6 months, respectively. If a pump station at SI-17 (Municipal Wharf) is selected, piles for the pump station foundation would be driven adjacent to the existing wharf in close proximity to restaurants, shops, and outdoor circulation areas. However, this pile driving would occur over a relatively short period—estimated to be approximately 1 month. It is expected that construction of the seawater intake and conveyance system would occur only during daylight hours, in compliance with the City's Noise Ordinance. As indicated above, construction noise impacts would be less than significant.

Brine Conveyance System

The brine conveyance system would take approximately 3 months to construct. As indicated in **Section 4, Project Description**, to address corrosion potential with the addition of brine to the WWTF outfall pipeline, the sluice gates in the Junction Structure would either have to be coated with corrosion-resistant material, or replaced. Replacement or coating of the gates would require removal of the existing covers over the sluice gate junction box, removal of the existing gates, and installation of new gates; or coating the existing gates in place. The use of a crane over several weeks would be required, which would be at street level above Mitchell's Cove. No construction on the beach would be required. Because the WWTF outfall discharges continuously, work would require several flow outages from the WWTF, and from the City of

Scotts Valley and County of Santa Cruz discharges that also flow through the outfall system. This would likely require nighttime construction work during low wastewater flow periods for a short duration (several weeks).

Although Chapter 9.36 of the City's Municipal Code prohibits offensive noise between the hours of 10:00 p.m. and 8:00 a.m. within 100 feet of any building regularly used for sleeping, exceptions are provided for emergencies and public works. The exception for public works allows construction for an additional hour between 7:00 a.m. and 8:00 a.m., for performance of public works that would disrupt traffic, or where time constraints would hamper the contractor's ability to complete the project in conformance with the contract. Additionally, on a case-by-case basis, the City Manager may authorize construction work outside these hours under the Code, which could be required for the improvements of the sluice gates identified above. As indicated above, construction noise impacts would be less than significant.

Potable Water Distribution System

Construction of intertie pipelines and the McGregor, Morrissey, and Aptos pump station upgrades would occur for a period of approximately 14 months. Along all of the pipeline conveyance and intertie system improvement routes, sensitive receptors would be exposed to noise levels for the short period of time when construction activities would be occurring adjacent to or within a few hundred feet of a particular receptor. Construction would then move on. In no case is it expected that elevated construction noise levels would last for more than 1 month at any of the receptors along these construction pipeline routes. Construction is not anticipated to occur during the nighttime unless there is an emergency condition. As indicated above, construction noise impacts would be less than significant.

Potential Energy Projects

The potential solar PV panels would be installed at the desalination plant, which is evaluated above. The potential micro-hydro system would be installed in the basement of the GHWTP. Given that the micro-hydro system would involve only interior improvements and no ground-disturbing activities, it would not likely have the potential to cause elevated construction noise levels. As indicated above, construction noise impacts would be less than significant.

Potential Future Expansion

If expansion of the proposed plant and related facilities were pursued in the future, the majority of the additional equipment would be installed inside existing structures at the plant and at the intake pump station. Some additional construction activities would be involved in the construction of additional brine storage structure(s) and dissolved air floatation basin(s) at the plant, but would not occur elsewhere in the project area. Pile driving and other noisy construction activities would not be expected to be required or would be limited in duration. However, if such activities would need to be conducted in the future, the noise impact of such

activities would also be less than significant. Recommended environmental design features would further reduce construction noise levels.

Environmental Design Features

The environmental design features (**Section 4**, **Table 4-12**) of the proposed project related to construction-phase noise control include the following:

- Construction equipment will be properly outfitted and maintained with noise-reduction devices to minimize construction-generated noise. Wherever possible, noise-generating construction equipment will be shielded from nearby residences by noise-attenuating buffers, such as temporary structures, equipment, or trucks. Stationary construction equipment will be situated on site at the greatest distance possible from nearby noise-sensitive receptors.

- Impact tools (e.g., jackhammers, pavement breakers, and rock drills) used for project construction will be hydraulically or electrically powered whenever possible to avoid noise associated with compressed-air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed-air exhaust will be used; such mufflers can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves will be used where feasible, which could achieve a reduction of 5 dBA. Quieter procedures shall be used, such as drills rather than impact equipment, whenever feasible.

- Require contractors to assure that mobile noise-generating equipment and machinery are shut off when not in use.

- At least 72 hours prior to commencing nighttime construction, if required, the City will notify (in writing) all residents within 300 feet of proposed construction sites of the date and time construction will occur. The notice will provide a contact name, phone number, and a location where noise complaints may be submitted.

Mitigation Measures

None required.

VIBRATION	
Impact 5.6-3:	Pile driving at Plant Site A-1 and/or at the pump station at SI-17 could generate excessive ground-borne vibration.
Significance before Mitigation:	Potentially significant
Mitigation Measures:	See Mitigation Measures 5.6-3
Significance after Mitigation:	Less than significant

Proposed Project

Construction

Construction activities that would potentially generate excessive ground-borne vibration include the use of heavy equipment for excavation of below-grade spaces at the desalination plant and intake pump station site; foundation work at the desalination plant if pile driving is required; and street work involving impact tools. Short-term impacts from construction would be considered significant if construction activities cause vibration levels to exceed 0.3 in/sec PPV at a vibration-sensitive structure, as described under Analysis Methodology.

Table 5.6-12, Vibration Source Levels for Construction Equipment, presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities such as pile driving, drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (e.g., tracked vehicles, compactors) could generate substantial vibration in the immediate vicinity. Erection of the building structures and the balance of the construction work would not be anticipated to be a source of substantial vibration.

The foundation for the desalination plant could be supported on driven piles. The nearest sensitive receptor structure is about 55 feet from the western property line of Plant Site A-1. Pile driving typically generates vibration levels of about 0.2 in/sec PPV, with maximum levels of up to about 0.4 in/sec PPV at a distance of about 50 feet. Pile driving within about 75 feet of a sensitive structure could exceed the 0.3 in/sec PPV threshold. Plant Site A-1 is the only desalination plant site within that distance, and therefore is the only site for which the 0.3 in/sec PPV threshold could be exceeded.

Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Again, vibration levels would vary depending on soil conditions, construction methods, and equipment used. At a distance of 25 feet, construction activities—with the exception of pile driving—would be unlikely to generate vibration levels exceeding the threshold of 0.30 in/sec PPV. Because pile driving could exceed this threshold, the impact of this activity would be significant at Plant Site

A-1, because it could cause structural damage to nearby structures. Mitigation Measure 5.6-3 would reduce this impact to less than significant by requiring the preparation and implementation of a pile-driving vibration monitoring and construction contingency plan. This plan would identify and monitor vibration-sensitive structures, if any, adjacent to Plant Site A-1. Construction measures and post-construction measures would minimize and/or repair damage to such structures.

If a pump station is constructed at SI-17 on the Municipal Wharf, the pump station would be supported on a foundation with driven piles. Pile driving would be adjacent to the wharf. As shown on **Table 5.6-12**, the upper range of ground vibration levels could be as high as about 1 in/sec PPV, which could exceed the 0.3 in/sec PPV threshold on the wharf structure. The resultant vibration levels in the existing wharf structure would be lower because of energy losses that would occur between the ground and the pile-supported structure. Vibration levels in restaurants and shops in the area where the pile driving would occur would be expected to range from strongly perceptible to severe over the 1-month period in which such activities would take place. Vibration levels in the buildings could be unpleasant, resulting in rattling of dishes, items on shelves, and so forth. Because the PPV threshold could be exceeded, the impact is considered significant. Mitigation Measure 5.6-3 would reduce this impact to less than significant.

Table 5.6-12. Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 feet (in/sec)	PPV at 50 feet (in/sec)
Pile Driver (Impact)	upper range	1.158	0.409
	typical	0.644	0.228
Pile Driver (Sonic)	upper range	0.734	0.260
	typical	0.170	0.060
Clam shovel drop		0.202	0.071
Hydromill (slurry wall)	in soil	0.008	0.003
	in rock	0.017	0.006
Vibratory Roller		0.210	0.074
Hoe Ram		0.089	0.031
Large bulldozer		0.089	0.031
Caisson drilling		0.089	0.031
Loaded trucks		0.076	0.027
Jackhammer		0.035	0.012
Small bulldozer		0.003	0.001

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

In areas where vibration would not be expected to cause structural damage, vibration levels could still be perceptible. However, as with any type of construction, this would be anticipated, and it would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (jackhammers and other high power tools).

By use of administrative controls identified in the environmental design features below, such as notifying adjacent land uses of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration to hours with least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

Operation

The operation of the proposed project would not involve the use of equipment that generates impulses that could cause ground-borne vibration or ground-borne noise. The major pieces of equipment are pumps. Pumps do not cause ground-borne vibration perceptible beyond the building footprint. Ground-borne vibration levels would be below the threshold of 0.04 in/sec PPV established for the project, and would be imperceptible at the boundary lines of the desalination plant property and intake pump station property. This impact would be less than significant.

Potential Future Expansion

If expansion of the proposed plant and related facilities were pursued in the future, the majority of the additional equipment would be installed inside existing structures at the plant, and at the intake pump station. Pile driving and related activities would not be expected to be required. However, if Plant Site A-1 were selected and pile driving were to be needed during future construction at this site, implementation of Mitigation Measure 5.6-3 would be required to reduce any potentially significant vibration impacts to less than significant.

Environmental Design Features

The environmental design feature (**Section 4**, **Table 4-12**) of the proposed project related to construction-phase vibration control includes the following:

- Notify land uses within 200 feet of scheduled pile-driving activities and other activities producing vibration (jackhammers and other high-power tools), and schedule construction activities involving pile driving with the highest potential to produce perceptible vibration to the hours with least potential to affect nearby businesses.

Mitigation Measures

Mitigation Measure 5.6-3

This mitigation measure applies to pile driving that could occur at the desalination plant at Plant Site A-1, and/or the intake pump station at SI-17. A pile-driving vibration monitoring plan shall be implemented to document conditions prior to, during, and after pile driving. All plan tasks shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California, and shall be in accordance with industry-accepted standard methods. The pile-vibration monitoring plan should include the following tasks:

- Identification of the sensitivity of nearby structures to ground-borne vibration. Vibration thresholds (0.3 in/sec PPV) should be applied to all vibration-sensitive structures within 75 feet of the project site.
- Performance of a photo survey, elevation survey, and crack monitoring survey for each sensitive structure within 75 feet of pile-driving activities. Surveys shall be performed prior to any pile driving, in regular intervals during and after the pile driving, and shall include internal and external crack monitoring in each sensitive structure, settlement, and distress; and shall document the condition of foundations, walls, and other structural elements in the interior and exterior of said structures.
- Development of a vibration monitoring and construction contingency plan to: identify structures where monitoring would be conducted; establish a vibration-monitoring schedule; define structure-specific vibration limits; and address the need to conduct photo, elevation, and crack surveys to document before and after construction conditions. Construction contingencies would be identified for when vibration levels approached the limits.
- If vibration levels approach the 0.3 in/sec PPV threshold, suspend construction and implement contingencies to either lower vibration levels or secure the affected structures.
- Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.
- Conduct post-survey on structures where either monitoring has indicated high levels of damage, or complaints of damage have been made. Make appropriate repairs or compensation where damage has occurred as a result of construction activities.