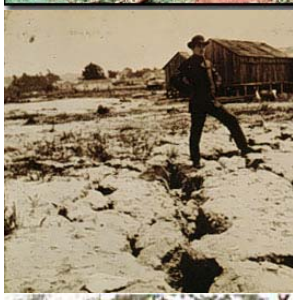
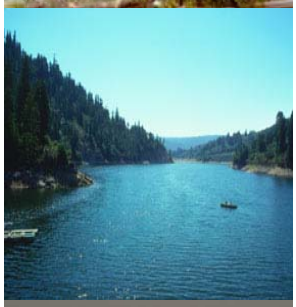




City of Santa Cruz
Local Hazard Mitigation Plan

2007-2012

PART 1 — INTRODUCTION AND ADOPTION 1

i. Introduction 1
ii. Acknowledgements..... 3
iii. Summary 4

***CHAPTER 1 — ADOPTION BY CITY COUNCIL*.....6**

***CHAPTER 2 —COMMUNITY PROFILE* 7**
Community Profile 7
Community Vision 13
Community Facilities..... 15

PART 2 — THE PLANNING PROCESS.....18

***CHAPTER 3 — THE PLANNING PROCESS* 19**
The Purpose of the Plan..... 19
Planning Process 20
Documentation of the Planning Process..... 20
Local Capabilities Assessment and Integration 21
Community Participation..... 22

PART 3 — HAZARD IDENTIFICATION AND RISK ASSESSMENT.....23

Significant Risks

***CHAPTER 4 - EARTHQUAKES AND LIQUEFACTION* 28**
4.3.0 Risk Assessment 28
4.3.1 Identifying Earthquake Hazards..... 28
4.3.2 Hazard Profile – Earthquakes and Liquefaction..... 30
4.3.3 Assessing Vulnerability: Overview..... 35
4.3.4 Assessing Vulnerability: Identifying Structures 37
4.3.5 Assessing Vulnerability: Estimating Potential Losses 44
4.3.6 Assessing Vulnerability: Analyzing Development Trends..... 46
4.4.0 Mitigation Strategy 46
4.4.2 Identification and Analysis of Mitigation Actions 47

***CHAPTER 5 – WILDFIRES* 48**
5.3.0 Wildfire Risk Assessment..... 48
5.1.1 Identifying Wildfire Hazards 48
5.3.2 Profiling Wildfire Hazard Events 49
5.3.3 Assessing Wildfire Vulnerability: Overview 51
5.3.4 Assessing Vulnerability: Identifying Structures..... 52
5.3.5 Assessing Vulnerability: Estimating Potential Losses 52
5.3.6 Assessing Vulnerability: Analyzing Development Trends..... 54
5.4.0 Mitigation Strategy 54
5.4.1 Mitigation Goals 55
5.4.2 Identification and Analysis of Mitigation Actions 55

CHAPTER 6 — FLOODS AND ASSOCIATED COASTAL STORMS **56**
6.3.0 Flood Risk Assessment 56
6.3.1 Identifying Flood Hazards 56
6.3.2 Profiling Flood Hazard Events 57
6.3.3 Assessing Flood Vulnerability: Overview 61
6.3.4 Assessing Flood Vulnerability: Identifying Structures 62
6.3.5 Assessing Vulnerability: Estimating Potential Losses 63
6.3.6 Assessing Vulnerability: Analyzing Development Trends 64
6.4.0 Mitigation Strategy 65
6.4.1 Mitigation Goals 65
6.4.2 Identification and Analysis of Mitigation Actions 66

CHAPTER 7 — DROUGHT **67**
7.3.0 Drought Risk Assessment 67
7.3.1 Identifying Drought Hazards 67
7.3.2 Profiling Drought Hazard Events 68
7.3.3 Assessing Vulnerability: Overview 72
7.3.4 Assessing Vulnerability: Identifying Structures 73
7.3.5 Assessing Vulnerability: Estimating Potential Losses 73
7.3.6 Assessing Vulnerability: Analyzing Development Trends 74
7.4.0 Mitigation Strategy 75
7.4.1 Mitigation Goals 75
7.4.2 Identification and Analysis of Mitigation Actions 75
7.4.3 Implementation of Mitigation Actions 77

CHAPTER 8 — TSUNAMI **78**
8.3.0 Tsunami Risk Assessment 78
8.3.1 Identifying Tsunami Hazards 78
8.3.2 Profiling Tsunami Hazard Events 78
8.3.3 Assessing Tsunami Vulnerability: Overview 82
8.3.4 Assessing Vulnerability: Identifying Structures 82
8.3.5 Assessing Vulnerability: Estimating Potential Losses 83
8.3.6 Assessing Vulnerability: Analyzing Development Trends 84
8.4.0 Mitigation Strategy 84
8.4.1 Mitigation Goals 85
8.4.2 Identification and Analysis of Mitigation Actions 85

CHAPTER 9 — COASTAL EROSION **86**
9.3.0 Coastal Erosion Risk Assessment 86
9.3.1 Identifying Coastal Erosion Hazards 86
9.3.2 Profiling Coastal Erosion Hazard Events 87
9.3.3 Assessing Coastal Erosion Vulnerability: Overview 89
9.3.4 Assessing Vulnerability: Identifying Structures 89
9.3.5 Assessing Vulnerability: Estimating Potential Losses 90
9.3.6 Assessing Vulnerability: Analyzing Development Trends 91
9.4.0 Mitigation Strategy 91
9.4.1 Local Hazard Mitigation Goals 91
9.4.2 Identification and Analysis of Mitigation Actions 92

Lesser Risks

CHAPTER 10 — DAM FAILURE **94**
10.3.0 Dam Failure Risk Assessment 94
10.3.1 Identifying Dam Failure Hazards 94
10.3.2 Profiling Dam Failure Hazard Events 94
10.3.3 Assessing Dam Failure Vulnerability: Overview 95
10.3.4 Assessing Vulnerability: Identifying Structures 95
10.3.5 Assessing Vulnerability: Estimating Potential Losses 96
10.3.6 Assessing Vulnerability: Analyzing Development Trends 96
10.4.0 Mitigation Strategy 96
10.4.1 Mitigation Goals 97
10.4.2 Identification and Analysis of Mitigation Actions 97

CHAPTER 11 — LANDSLIDE **98**
11.3.0 Landslide Risk Assessment 98
11.3.1 Identifying Landslide Hazards 98
11.3.2 Profiling Landslide Hazard Events 100
11.3.3 Assessing Landslide Vulnerability: Overview 104
11.3.4 Assessing Vulnerability: Identifying Structures 104
11.3.5 Assessing Vulnerability: Estimating Potential Losses 105
11.3.6 Assessing Vulnerability: Analyzing Development Trends 105
11.4.0 Mitigation Strategy 106
11.4.1 Mitigation Goals 106
11.4.2 Identification and Analysis of Mitigation Actions 107

CHAPTER 12 — MULTI-HAZARD SUMMARY **109**

PART 4 — MITIGATION STRATEGY **110**

CHAPTER 13 — MITIGATION STRATEGY **111**
4.4.0 Mitigation Strategy 111
4.4.2 Identification and Analysis of Mitigation Actions 113

PART 5 — PLAN MAINTENANCE PROCESS **131**

CHAPTER 14 —PLAN MAINTENANCE PROCESS **132**
14.5.1 Monitoring, Evaluating and Updating the Plan 132
14.5.2 Incorporation into Existing Planning Mechanisms 134
14.5.3 Continued Public Involvement 135

Appendices

A	Hazards not a significant risk to Santa Cruz
B	Acronyms and abbreviations
C	Glossary of terms
D	Critical facilities
E	Public schools
F	Private schools
G	Day care facilities
H	Senior residence and care facilities
I	City of Santa Cruz facilities
J	References for tsunami run-up
K	Successful programs and projects
L	Water Shortage Contingency Plan
M	Census characteristics 2000
N	Critical structures map-larger area
O	Emergency Management Plan (EMP) JAN 2007
P	FEMA Region IX crosswalk

Maps and Figures

1	City limits with greenbelts	4
2	Santa Cruz location within state	7
3	Transportation corridors	11
4	Critical facilities	15
5	Schools, daycare and senior facilities	17
6	Areas in Santa Cruz vulnerable to liquefaction	31
7	Intensity and magnitude of the 1989 Loma Prieta Earthquake in Santa Cruz	33
8	Scenario N -9 Repeat 1906 Earthquake	38
9	Scenario N -9 Repeat 1906 Earthquake building economic loss by county	39
10	Scenario N -9 Repeat 1906 Earthquake loss by census tract	40
11	Scenario N -7 Santa Cruz Mountains	41
12	Scenario N -7 Santa Cruz Mtns economic loss by county	42
13	Scenario N -7 Santa Cruz Mtns economic loss by census tract	43
14	Wildfire hazard areas within the City of Santa Cruz	49
15	FEMA Flood Map showing 100 year and 500 year floods	57
16	Water service area	69
17	Total Annual Runoff in the San Lorenzo River	72
18	Tsunami inundation area	80
19	Areas susceptible to coastal erosion	88
20	Slides and earth flows in Santa Cruz County	101
21	Potential slides threatening Santa Cruz	102

Tables

2-1 Temperature Averages for Santa Cruz
2-2 City of Santa Cruz Population and Household Growth - 2000 Census
3-1 List of Meetings
A-1 A Risk Assessment Table
A-2 Hazards identification and screening Santa Cruz
4-1 Modified Mercalli Intensity Scale
4-2 Ten most likely damaging Earthquake scenarios in California
4-3 Earthquake potential loss inventory
5-1 Wildfire potential loss inventory
6-1 Flood probability terms
6-2 Flood potential loss inventory
7-1 Single Dry Year Supply and Demand Assessment
7-2 Multiple Dry Year Supply and Demand Assessment
7-3 Relationship of Water Shortages with Various Recurrence Intervals to the Probability of Occurrence over Time
8-1 Locally generated tsunami source
8-2 Tsunami potential loss inventory
9-1 Coastal erosion potential loss inventory
11-1 Landslide potential loss inventory

How to Use This Plan

FEMA has defined very specific requirements of Local Hazard Mitigation Plans and this plan follows those guidelines. The organization of the Plan follows FEMA's structural requirements and includes the four following organizational levels:

- Parts
- Chapters
- Sections
- Subsections

This LHMP is organized into five primary parts and 14 chapters that follow the phases of the plan's development (and the FEMA LHMP checklist or "crosswalk") as follows:

- Part 1-Prerequisites- introduction, acknowledgements, adoption and summary
- Part 2-The Planning Process
- Part 3-Risk Assessment
- Part 4-Mitigation Strategies
- Part 5-Plan Implementation and Maintenance

The **Risk Assessment (Part 3**) is organized into specific hazards by chapter (chapter 4 through chapter 12.) Within each of these chapters all elements required by the FEMA crosswalk are addressed and the sections and subsections of each of these chapters follow the section numbering of the crosswalk. (e.g. Subsection *3.1 Identifying Risk Hazards* is §*7.3.1* in chapter 7 – Drought) Each of the specific hazard **Risk Assessment** chapters contains the following subsections:

- **3.0 Risk Assessment**

- 3.1 Hazard Identification
- 3.2 Hazard Profile including subsections on location, extent, previous occurrences and probability of future events.
- 3.3 Assessing Vulnerability
- 3.4 Identifying Structures
- 3.5 Estimating Potential Losses
- 3.6 Analyzing Development Trends

Mitigation Strategy (§4.0 through §4.2) is addressed briefly under each hazard chapter and covered comprehensively in Part 4. Goals and actions specific to a particular hazard are included within the hazard chapter and are labeled by hazard (e.g. Earthquake Goal 1). Goals, objectives and actions which apply to one or more potential hazards are listed in Part 4.

Goals, objectives and action items identified as part of the mitigation strategy were formulated in collaboration with the departments responsible for implementation of the actions. These goals and supporting actions are not new but have been taken from various plans adopted by the City Council including the General Plan Safety Element, the CIP, the 2005 Urban Water Management Plan, the Integrated Water Plan, the Emergency Management Plan and several fire safety plans.

Crosswalk sections that do not apply to the City of Santa Cruz such as multi-jurisdiction plan requirements are not included.

Each part of the LHMP includes required elements specified under Section 201.6 of Title 44 of the *Code of Federal Regulations* (44 CFR). Since one of the objectives established for the LHMP is to achieve compliance for the City of Santa Cruz under the DMA, the requirements specified for program compliance are often cited at the beginning of a subsection to illustrate how that subsection attempts to comply with the requirement.

At the end of this LHMP are **Appendix A** through **Appendix O**. These appendices include vital information or explanations to support the main content of this plan. Technical terms, acronyms, and abbreviations are used throughout this document. To aid the reader, technical terms used are defined in the glossary. The list of acronyms and abbreviations defines all shortened forms used in hazard Mitigation planning and/or this LHMP.

PART 1 — INTRODUCTION AND ADOPTION

Prerequisites

- Introduction
- Acknowledgements
- City Council Resolution Adopting Plan
- Summary

PART 1 — INTRODUCTION AND ADOPTION

i. Introduction

People and property in Santa Cruz are at risk from a variety of hazards which have the potential to precipitate wide spread loss of life, damage to property, infrastructure and the environment. Some hazards are natural, such as earthquakes, others are natural hazards exacerbated by the use of land, such as building along the cliff and development within floodplains. A natural hazard can result in damages and hardships for an entire community for many years following the event. Flooding, drought, earthquakes and cliff retreat have all occurred in the City within the last fifty years. Until 1989, flooding on the San Lorenzo River had caused the most severe damage in the City. However, the Loma Prieta earthquake in 1989 changed that history. Although prone to droughts, the City will experience flood conditions in the future. There is a very strong possibility of an earthquake equal to or larger than the Loma Prieta quake occurring in the Santa Cruz area. (table # 4-2)

The City of Santa Cruz is somewhat unique in that the water service is provided by the City Water Department to an area beyond the City limits and a significant portion of the water service infrastructure extends outside the City limits including the primary ground storage facility, Loch Lomond. Although Santa Cruz is a city of approximately 60,000 residents, this hazard mitigation plan impacts approximately 90,000 people inside and outside the City limits because of the City water service boundaries.

Hazard Mitigation

The purpose of hazard mitigation is to implement and sustain actions that reduce vulnerability and risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation actions include both short-term and long-term activities which reduce the impacts of hazards, reduce exposure to hazards, or reduce effects of hazards through various means including preparedness, response and recovery measures. Effective mitigation actions also reduce the adverse impacts and cost of future disasters.

The City of Santa Cruz developed this Local Hazard Mitigation Plan (LHMP) to create a safer community. The City of Santa Cruz LHMP represents the City's commitment to reduce risks from natural and other hazards, and serves as a guide for decision-makers as they commit resources to reducing the effects of potential hazards. The City of Santa Cruz LHMP serves as a basis for the State Office of Emergency Services (OES) to provide technical assistance and to prioritize project funding. (Code of Federal Regulations (CFR) §201.6.)

For disasters declared after November 1, 2004, the City of Santa Cruz must have an approved LHMP pursuant to CFR §201.6 in order to receive FEMA Pre-Disaster Mitigation (PDM) project grants or to receive post-disaster Hazard Mitigation Grant Program (HMGP) project funding. The LHMP is written to meet the statutory requirements of the Disaster Mitigation Act (DMA) 2000, enacted October 30, 2000 and Title 44 of the *Code of Federal Regulations* CFR Part 201 – Mitigation Planning, Interim Final Rule, published February 26, 2002.

ii. Acknowledgements

City Council

Emily Reilly, Mayor
Ryan Coonerty, Vice Mayor
Tony Madrigal
Cynthia Mathews
Ed Porter
Lynn Robinson
Mike Rotkin

Project Committee Staff	Department	Position
Ceil Cirillo	Economic Development	Director
Greg Larsen	Planning	Director
Bill Kocher	Water	Director
Ron Oliver	Fire	Chief
Mark Dettle	Public Works	Director
Dannettee Shoemaker	Parks & Recreation	Director
Cathlin Atchison	Economic Development	Project Coordinator
Andrew Flagg	Economic Development	Project Manager
Robert Solick	Public Works	EOC Manager
Joe Hall	Economic Development	Project Manager
Kate Silva	Redevelopment	Administration
Rich Westfall	Info Technology	GIS Coordinator
Dick Stubendorff	Planning	Building Director
Michele King	Planning	Senior Planner
Toby Goddard	Water	Conservation Manager
Heidi Luckenbach	Water	Engineer
Linette Almond	Water	Deputy Director
Eric Aasen	Fire	Battalion Chief
Barbara Choi	Human Resources	Risk Manager
Chris Schneiter	Public Works	Assistant Director
Tom Sharp	Public Works	Engineering Associate
Siobhan O'Neill	Public Works	Administrative Analyst

Technical Advisors	Organization	Position
Gary Griggs	UCSC	Scientist
David Soroka	NOAA	Meteorologist
Patsy Hernandez	Red Cross	Emergency Services Director
Joe Hanna	SC County	Geologist
David Hill	USGS	Scientist
Julia Burrows	Roseville	Assistant City Manager
Jeff Trapp	UCSC	Assistant Fire Chief
Dick Moss	City Schools	Assistant Superintendent
Mike Dever	SC County ES	Director of Emergency Services
Lynda McClanahan	OES	Staff Services Analyst
David Roemer	AMBAG	Planner

iii. Summary

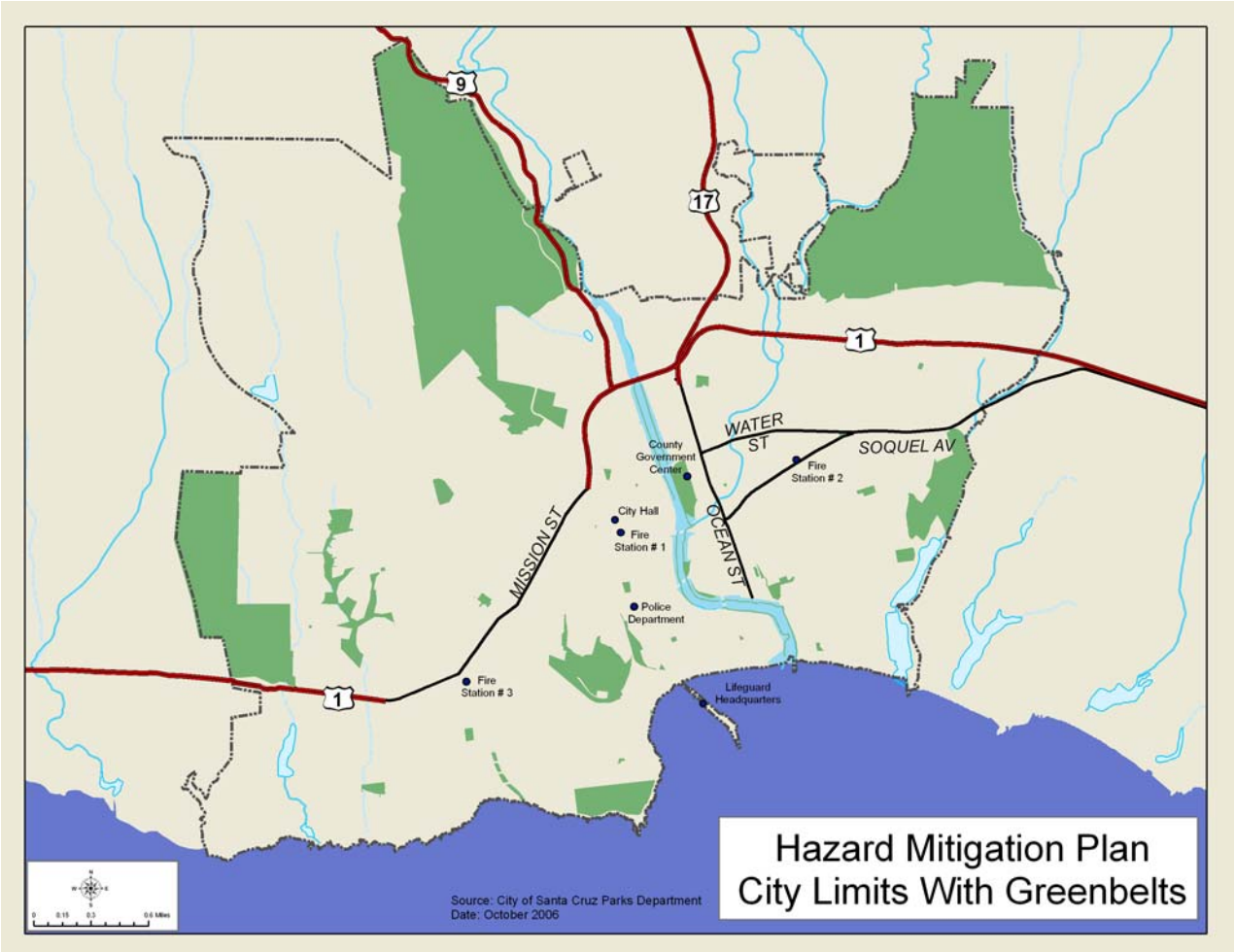


Figure 1 City Limits of Santa Cruz with Surrounding Greenbelts)

Surrounded by greenbelt and the Pacific Ocean, Santa Cruz is a compact, vibrant beach community that preserves the diversity and quality of its natural and built environments, creates a satisfying quality of life for its diverse population and workers, and attracts visitors from around the world. But every aspect of the city – its economic prosperity, social and cultural diversity, scenic beauty and historical character – could be dramatically altered by a serious earthquake, flood, tsunami or fire.

Natural hazards that have affected Santa Cruz in the past and those that may affect it in the future can be identified with a high degree of probability. However, the future extent of these hazards is unknown. Flooding, earthquakes and cliff retreat have all occurred in the City within the past thirty-five years. The City is prone to reoccurring droughts and the City will periodically witness flood conditions in the future. Until 1989, flooding on the San Lorenzo River had caused the most severe damage in the City. However the Loma Prieta earthquake changed that history. [1]

On October 17, 1989, the Loma Prieta earthquake, the largest earthquake to hit an urban area in California since the 1906 San Francisco earthquake struck the City of Santa

Cruz. The earthquake destroyed over 50% of the downtown commercial core, displacing over 205 commercial, professional and service businesses, 5,000 employees, and hundreds of residents.[2]

While we cannot predict or protect ourselves against every possible hazard that may strike the community, we can anticipate many impacts and take steps to avoid or reduce the harm they will cause. This Local Hazard Mitigation Plan (LHMP) is part of an ongoing process to evaluate the risks that different types of hazards pose to Santa Cruz and will engage the City and the community in dialogue to identify the most important steps to pursue in order to reduce these risks.

The City of Santa Cruz and community members have been working together during the past several years to identify and address the risks posed by earthquakes, floods, fires and other potential hazards. Many measures such as raising levees, vegetation management, a comprehensive water management plan and seismic retrofits have significantly reduced the community's vulnerability to these hazards. Over time, this constant focus on disaster preparation will make the City a much safer and more sustainable community.

It is the intention of this plan to meet the requirements of the federal Disaster Mitigation Act of 2000. Section 322 of the Act specifically addresses mitigation planning at the state and local levels. Following approval of this LHMP by FEMA, the City of Santa Cruz will be eligible to apply for mitigation grants before disasters strike.

Mitigation Plan Objectives and Actions

Santa Cruz strives to be a disaster-resistant community that can avoid, mitigate, survive, recover from, and thrive after a disaster while maintaining its unique character and way of life. City government should be able to provide critical services in the immediate aftermath of a devastating event of any kind. The people, buildings and infrastructure of Santa Cruz should be resilient to disasters. The City's overall objective is to have basic government services and commercial functions resume quickly after a damaging earthquake or other significant event.

This Plan has four primary goals for reducing disaster risk in Santa Cruz.

1. Avoid or reduce the potential for loss of life, injury and economic damage to Santa Cruz residents from earthquakes, wildfires, floods, drought, tsunami, coastal erosion, landslide and dam failure.
2. Increase the ability of the city government to serve the community during and after hazard events.
3. Protect Santa Cruz's unique character, scenic beauty and values from being compromised by hazard events.
4. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and systems essential to a functioning Santa Cruz.

CHAPTER 1 — ADOPTION BY CITY COUNCIL

(Attach City Council Resolution)

CHAPTER 2 —COMMUNITY PROFILE

Community Profile

Sources:

Bay Area Economics (BAE) Economic Development Background Report (June 2006)
UCSC Final Draft LRDP & UCSC LRDP EIR
UCSC Academic Human Resources

Figure 2 City of Santa Cruz location within the State of California

The City of Santa Cruz, one of the oldest cities in California, was founded in 1791 and incorporated in 1866; it is located approximately 75 miles south of San Francisco in Santa Cruz County, and situated on the northern shore of Monterey Bay. (See Figure # 2) As home to the Monterey Bay Marine Sanctuary and University of California at Santa Cruz (UCSC) Longs Marine Lab; the bay, beaches and coastline are appreciated by the community as a valuable natural resource as well as a key economic resource. This location along the coast also presents several potential hazards to the community such as tsunami, coastal erosion and flooding.

The City's mild weather, proximity to several northern California metropolitan centers, and scenic and recreation resources make it a popular day and extended-stay recreation area. As a result, the population is subject to large seasonal variations due to an influx of visitors during summer and other peak recreational periods. Planning for potential hazards in Santa Cruz must address the safety of its visitor population as well as residents, large student population, and workers within the community.

Santa Cruz is the largest city in Santa Cruz County and serves as the County government seat. Since its founding, it has been the urban center of the County, providing employment and commercial, governmental, social, educational and cultural services to the larger area. The establishment (1964) and growth of the University of California at Santa Cruz (UCSC) have reinforced the City's role as a major social and cultural center.

The City occupies a picturesque location along the banks of the San Lorenzo River, between the Pacific Ocean on the Monterey Bay and the Santa Cruz Mountains. Public and privately owned lands along the City's western, northern and eastern boundaries form a greenbelt of open space; land uses, including agriculture and grazing lands, natural areas, parks, coastal recreation and low-density residential areas. This picturesque location also contributes to the potential hazards faced by the City. The downtown and higher density urban core is located within a flood plain. There are only four bridges across the river connecting the two sides of the community. Past experience has shown that losing even one of these bridges in a disaster presents significant problems in addition to traffic impacts.

The City's Mediterranean climate is characterized by warm, dry summers and mild, rainy winters. Warm temperatures and low precipitation are the norm from approximately April through August. November through March is dominated by cooler temperatures and heavy rains. Though winters are typically mild, colder winds from inland regions with more continental climates can result in short-term cold snaps. During the year the average temperature is approximately 56 degrees. The average high temperature is 69 degrees Fahrenheit and the average low temperature is 44 degrees Fahrenheit. Because of this temperate climate, extreme heat is rarely a threat to the community. Both summer and winter temperatures are moderated by the marine influence and summer fog is a common occurrence. Winds are generally northwesterly and seldom reach severe intensities. The Santa Cruz Mountains form a natural barrier to winds from the north and from the hot interior valleys. Rainfall averages approximately 30 inches per year. Over the past 25 years, it has ranged from 15 inches in 1989 to 59.8 inches in 1983 with an average 32 inches of rainfall annually. (UCSC 2005 Long Range Development Plan (LDRP)

Table 2-1 Temperature Averages for Santa Cruz

Average High/Low Temperature	Average Rainfall
January 60˚/38˚F (15˚/3˚C)	January 5.6 inches (140mm)
August 76˚/51˚F (24˚/10˚C)	August 0.1 inch (2.5mm)

Table 2-2 City of Santa Cruz Population and Household Growth - 2000 Census

Population(s)	Number	Percent
Total population	54,593	100.0
SEX AND AGE		
Male	27,180	49.8
Female	27,413	50.2
Median age (years)	31.7	
18 & under	9,463	17.3
65 years and over	4,663	8.5
Disabled	7,814	15.2
Total households	20,442	100.0
Households with individuals under 18 years	5,513	27.0
Households with individuals 65 years and over	3,433	16.8
Average household size	2.44	
HOUSING OCCUPANCY		
Total housing units	21,504	100.0
Occupied housing units	20,442	95.1
Vacant housing units	1,062	4.9
For seasonal, recreational, or occasional use	508	2.4
Homeowner vacancy rate (percent)	0.7	
Rental vacancy rate (percent)	1.4	
Occupied housing units	20,442	100.0
Owner-occupied housing units	9,528	46.6
Renter-occupied housing units	10,914	53.4
Avg household size of owner-occupied unit	2.51	
Avg household size of renter-occupied unit	2.39	

The population of the City of Santa Cruz grew an estimated 1.8 percent between 2000 and 2005, rising from 54,593 to an estimated 55,573 persons. Approximately 27% of the households have residents under 18 years old. Approximately 17% of the households have residents 65 or over. Approximately 15% of the population has some type of disability. In creating a hazard mitigation plan it is important to consider each of these special populations. It should also be noted that the City Water System serves approximately 90,000 people inside and outside the City limits.

The University of California at Santa Cruz (UCSC)

The City of Santa Cruz is home to the University of California at Santa Cruz (UCSC). The main University campus consists of over 2,000 acres on the northwest side of the community off High and Bay Streets. Of UCSC's 10.6-mile perimeter, 1.75 miles adjoin the City. Approximately 53 percent of the campus, including most of the developed area, is located within the Santa Cruz city limits, and the remainder of the campus lies in the unincorporated area of Santa Cruz County.[3]

In addition to the main University campus, the University also has a Marine Lab Facility at the north side of the City situated along the coast. The University owns a property at 2300 Delaware Avenue on the west side of town (used as office and research space) and leases additional space in the downtown area and on the west side of Santa Cruz. The University also leases a former hotel property on Ocean Street which is now used as off- campus student housing.

Much of the University infrastructure and services are at least somewhat dependent on the City. UC Santa Cruz receives water and sewer treatment services from the City of Santa Cruz. Water supply has been identified as a key issue for both the City and the University. While the City of Santa Cruz water supply system is essentially the same as in 1960, the service population has increased 190 percent and is expected to continue to increase. In normal and wet years, the water supply system is capable of meeting the needs of the current population, but even without population increases, the system is highly vulnerable to shortages in drought years. The City and the University are also linked through mutual aid agreements in areas such as fire services.

The University has a current enrollment of approximately 15,000 students supported by approximately 4,400 faculty and staff. [4]

The developed area of the UC Santa Cruz campus (existing and approved) includes 3,113,000 assignable square feet (ASF) and 4,825,000 gross square feet (GSF) in 420 separate buildings within 116 building complexes. This includes existing buildings and projects approved and funded after adoption of the 1988 LRDP. [5]

The University adopted its own Hazard Mitigation Plan in 2005. It also has an Emergency Response Plan that can be found online at: http://disaster.ucsc.edu. This plan provides details about hazard response, vulnerabilities and mitigation measures for the University community.

Household Income and Education

The median household income for the City of Santa Cruz in 2005 was an estimated $60,273, compared to $63,919 for the County and $72,260 for the region. Residents of the City of Santa Cruz are highly educated, with more than 44 percent of residents over age 25 having achieved a bachelor's degree or higher by 2000.

Residents' Place of Work

In addressing potential hazards it is significant that much of the workforce lives within the community. Of the total 28,869 employed residents in 2000, 15,550 worked within

the City limits, including 1,653 who worked at home and 13,897 who worked at jobs located in the City. This means that almost 54 percent of all residents who worked did so within the community, including a relatively high rate of almost six percent working at home (compared to 3.8 percent of California's workers with home-based businesses).

Just over 13,300 residents commuted outside the City to work including 8,000 working elsewhere in the county. Interestingly, only about 5,000 of the resident workforce commuted out of the county, including 4,500 to other Bay Area Counties and another 422 to Monterey County. Despite perceptions, only 3,700 of these residents commuted to Santa Clara County in 2000.

The City of Santa Cruz contained 36,804 jobs in 2000, according to the Census. Of these local jobs, 15,550 were held by City residents or just over 42 percent of total jobs in the community, meaning that nearly 58 percent of local jobs were held by in-commuters. These in-commuters came primarily from elsewhere in Santa Cruz County (17,965 job-holders), with fewer than 3,300 commuting in from surrounding counties.

Figure 3 Key Transportation Routes to and within Santa Cruz

Santa Cruz is a compact urban community with only three major access routes into and out of town; Highway 1 (north and south) and Highway 17 (east.) Major transportation routes include Mission Street (which is also Highway 1), Bay Street, Ocean Street, Water Street, and Soquel Avenue. Primary roadways in the downtown and beach area include Pacific Avenue, Front Street, Beach Street and East and West Cliff Drive. The Santa Cruz Metropolitan Transit District (Metro) provides bus service throughout Santa Cruz County. The Metro is a key link from the University to the other parts of the town. Metro also operates bus service between the City of Santa Cruz and San Jose. Access to and from the University is particularly vulnerable at present since there are only two streets, Bay and High which access campus. Both these streets intersect with Mission Street and according to the UCSC Long Range Development Plan (LRDP) Environmental Impact Report (EIR) there are unacceptable traffic service levels at several of these intersections.[4]

Santa Cruz has an extensive network of bike lanes and bike paths. Most major roads have bike lanes, including the bike lanes that were recently installed on Beach Street near the Santa Cruz Beach Boardwalk. Additionally, there are levee bike paths along the San Lorenzo River developed as part of the San Lorenzo River Levee Project, a sixty-two million dollar project which was undertaken to address flooding in the City.

Economic Trends and Retail Sales

Retail, lodging, and entertainment account for roughly 30 percent of Santa Cruz's employment base. Public Administration comprises just fewer than three percent of Santa Cruz's economic base. Health care and social assistance accounts for approximately 15 percent of the local economy. Education represents a substantial contributor to the local economy, due to both the area's K-12 schools and UCSC. This sector accounted for almost 18 percent of the local economy in 2004. A list of public and private schools in the community is attached as Appendix E - Appendix G. Technology and business services account for approximately 17 percent of Santa Cruz's economy. Manufacturing in Santa Cruz had 2,171 jobs in 2004, accounting for just less than six percent of the local economy. Logistics, including transportation, warehousing and wholesale trade accounted for six percent of the economy in 2004, with 2,208 jobs.
A significant portion of Santa Cruz's General Fund and much of its downtown economy is derived from retail sales. Since the downtown and beach areas provide a large proportion of the City's economic prosperity, potential hazards in these areas make the City particularly vulnerable to economic loss in addition to physical loss. These areas are identified as being within the potential flood area, liquefaction area and tsunami risk area.

On a per-capita basis, taxable retail sales generated $11,538 per person in the City of Santa Cruz, up just slightly from $11,469 in 1998.

Community Vision

The City of Santa Cruz is in the process of updating its General Plan including the Safety Element, which promotes public health and safety through goals, objectives and action plans addressing potential hazards such as earthquake, flood, and wildfire. The Safety Element provides a general evaluation of potential public safety hazards and also provides the direction and resources to help reduce death, injuries, property and environmental damage, and the economic and social dislocation resulting from natural hazards. The General Plan Update has informed this LHMP and this Plan has in turn informed the current Update of the General Plan. Working collaboratively both Plans support the broader vision and values of the community as reflected in the new vision statement for the General Plan update.

General Plan Vision Statement

Our Vision for Santa Cruz, 2025

Surrounded by greenbelt and the Pacific Ocean, Santa Cruz is a compact, vibrant city that preserves the diversity and quality of its natural and built environments, creates a satisfying quality of life for its diverse population and workers, and attracts visitors from around the world.

Guiding Principles

To achieve our vision, we will follow these principles in drafting our General Plan.

- **Natural resources**. We will highlight and protect our unique setting, our natural and established open space, and the sustainable use of our precious natural resources.

- **Neighborhood integrity and housing.** We will maintain the identity and vitality of our neighborhoods, actively pursuing affordable housing for a diversity of households and promoting compatible livability and high quality design in new buildings, major additions, and redevelopment.

- **The University.** We will seek a mutually beneficial relationship with UC Santa Cruz, one where the City supports the University within the context of City responsibilities, community priorities, and the constraints of City infrastructure and resources; and one where the University reciprocally supports the City by comprehensively addressing all of its needs to the greatest extent possible on the campus itself, and by fully mitigating whatever off-campus community impacts occur.
- **Mobility.** We will provide an accessible, comprehensive, and effective transportation system that integrates automobile use with sustainable and innovative transportation options—including enhanced public transit, bicycle, and pedestrian networks throughout the community.

- **Prosperity for all.** We will ensure a sustainable economy for the community, actively encouraging the development of employment opportunities for residents of all levels and ages, and actively protecting from elimination our current and potential sources of sustainable employment.

- **A dependable municipal tax base**. We will encourage diverse technology, visitor serving, industrial, home business and commercial business enterprises, and strategic redevelopment.

- **A balanced community**. We will maintain the community's longstanding commitment to shared social and environmental responsibility, fostering a balance between employment, housing affordable to persons of all income levels, transportation, and natural resources.

- **Education**. We will reflect our commitment to education through our schools, educational systems and programs, library system and facilities, life-long learning community programs, and our active communication/information network.

- **Arts and culture**. We will recognize and support our vital arts community, our unique historic areas and landmarks, our cultural heritage and resources, and our recreational facilities and community programs.

- **Community facilities and services**. We will offer excellent social services and will improve and maintain our infrastructure, community safety, and emergency preparedness.

- **An involved citizenry**. We will welcome citizen participation in government, encourage respectful cooperation and mutual regard among residents, workers, students, and visitors, and fully accept shared responsibility for community well-being.

Adopted by City Council, February 28, 2006

Community Facilities

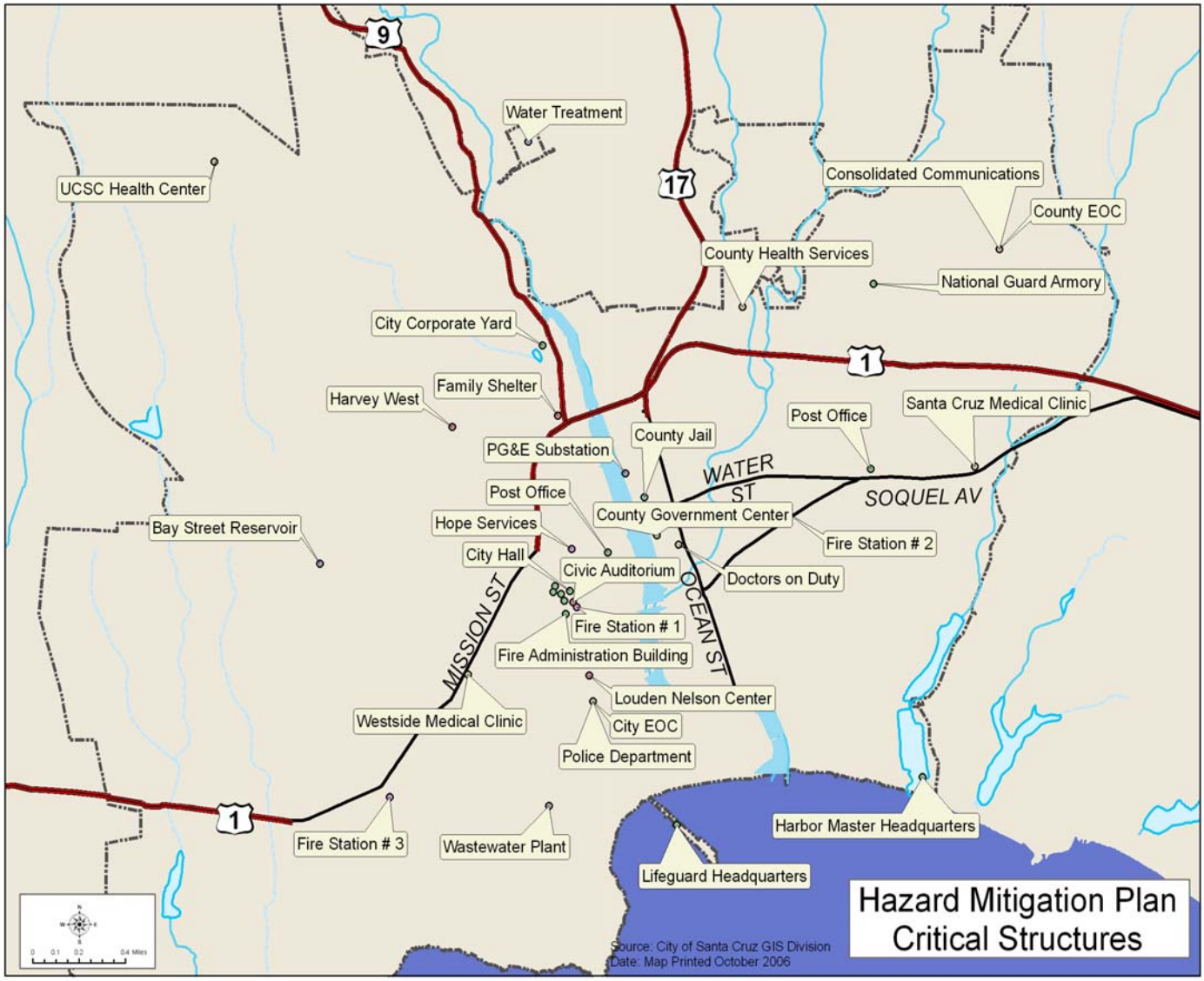


Figure 4 Critical Structures within the City of Santa Cruz

The City of Santa Cruz owns or leases approximately forty significant buildings. These buildings are used for various purposes including City government administration, providing essential and emergency services, recreation, cultural and performing arts. After the 1989 Loma Prieta Earthquake, the city began seriously examining the risks to its buildings from disasters, particularly earthquakes. A number of buildings were assessed for seismic safety and, when warranted, strengthened. Some city buildings essential for emergency response activities have been assessed and repaired or replaced.

A list of City facilities appears in Appendix I. Appendix N shows the larger Santa Cruz County area including Loch Lomond Reservoir from which Figure 4 (above) is extracted.

City of Santa Cruz-owned infrastructure consists of the following elements:

Water Treatment Plant
Loch Lomond Reservoir
Bay Street Reservoir
River levees
Roads, alleys, curbs, paths
Retaining walls
Storm drains
San Lorenzo River, creeks, open channels and culverts
Sewer treatment plant and sanitary sewer system
Water Street Bridge
Soquel Bridge
Laurel Street Bridge
Highway#1 Bridge (two sections)
Over 25 City parks and extensive network of street trees
Municipal Wharf including Marine Safety and Lifeguard Headquarters

Critical Facilities Not Owned by the City

There are a number of critical facilities within the City limits that are not owned by the City. The County Government Center, the County Jail, the National Guard Armory and the U.S. Post Office are some of the buildings that are within the City but are not owned by the City.

Hospitals and schools are critical facilities that are not operated or owned by city government.

Hospitals: There are no hospitals within the City of Santa Cruz. There are several rehabilitation facilities, medical clinics, senior and long term care facilities.

Schools: Santa Cruz City Schools is independent from the City government and manages primary and secondary education and education facilities, including all public schools in the city. The City government has no authority over these structures, but does provide police and fire services to the District.

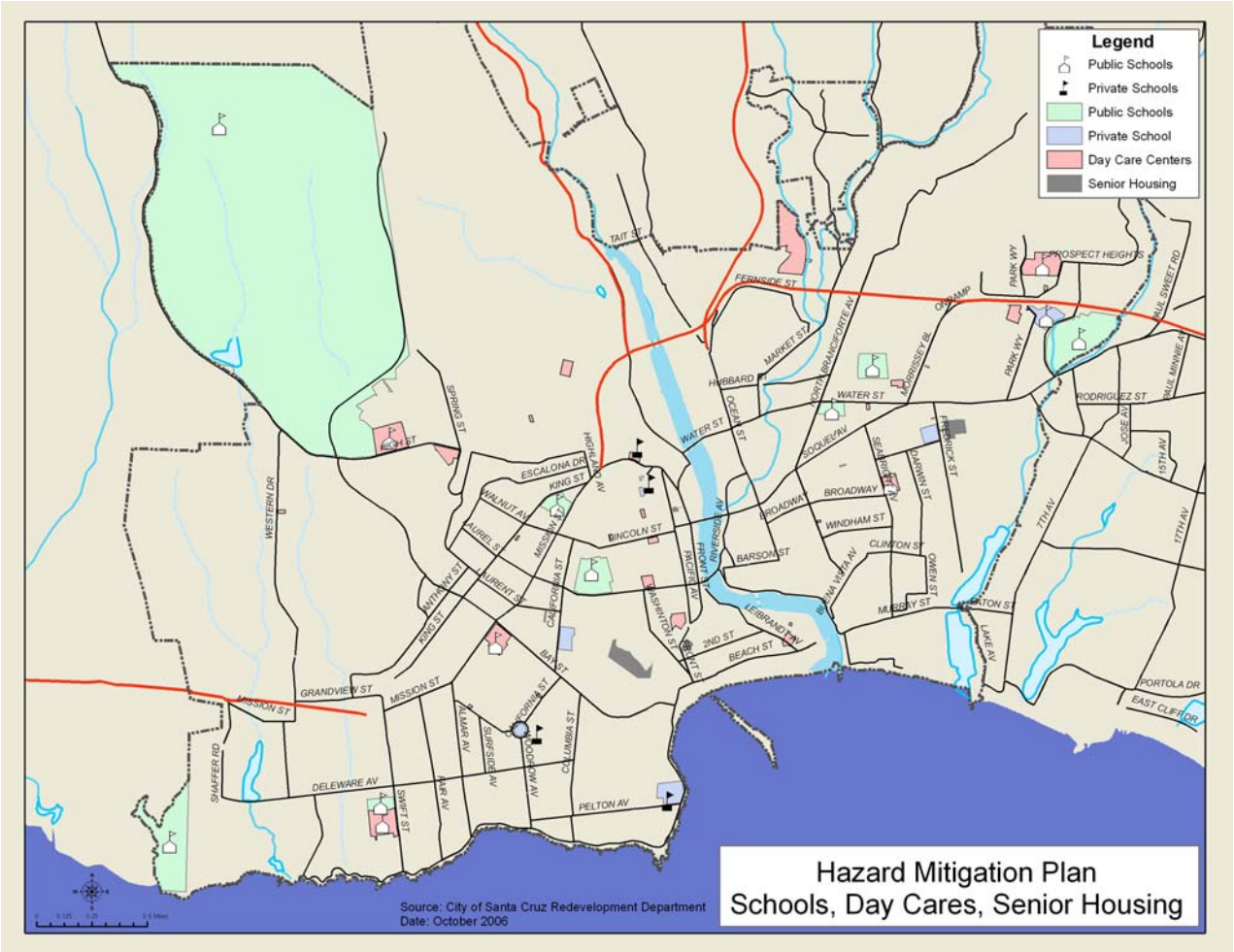


Figure 5 Public and Private Schools, Day Care and Senior Facilities

PART 2 — THE PLANNING PROCESS

- The Purpose of the Plan
- The Planning Process
- Documentation of the Planning Process
- Local Capabilities Assessment and Integration
- Community Participation

PART 2 — THE PLANNING PROCESS

CHAPTER 3 — THE PLANNING PROCESS

The Purpose of the Plan

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390), commonly known as the 2000 Stafford Act Amendments, was approved by Congress on October 10, 2000. To implement the DMA 2000 planning requirements, FEMA prepared an Interim Final Rule, published in the Federal Register on February 26, 2002 which established planning and funding criteria for states and local communities. This act required state and local governments to develop hazard mitigation plans as a condition for federal grant assistance. For the Pre-Disaster Mitigation (PDM) program, local jurisdictions must have an approved mitigation plan to receive a project grant. Prior to 2000, federal legislation provided funding for disaster relief, recovery, and some hazard mitigation planning. The DMA improves upon the planning process by emphasizing the importance of community planning for disasters before they occur. Using this initiative as a foundation for proactive planning, the City of Santa Cruz developed this hazard mitigation plan in an effort to reduce future loss of life and property resulting from disasters. Hazards are difficult to predict. Through careful planning and collaboration among public agencies, stakeholders, and citizens, it is possible to avoid or minimize losses that can occur from disasters. Hazard mitigation is any action taken to permanently eliminate or reduce long-term risks to human life and property from natural hazards. Along with preparedness, response, and recovery, mitigation is an essential element in emergency management. Disasters can have significant impacts on communities. They can destroy or damage life, property, and infrastructure, local economies, and the environment.

This LHMP is intended to assist the City of Santa Cruz in reducing its risk from all hazards by identifying resources, information, and strategies for risk reduction. The plan will also help guide and coordinate mitigation activities throughout the City. Building on a tradition of progressive planning and past mitigation successes, the City of Santa Cruz planning team set out to develop a plan that would meet the objectives summarized below.

- The plan would meet or exceed program requirements specified under the DMA
- The plan would not only meet state and federal requirements but also the needs of the City.
- The plan would coordinate existing ongoing plans and programs so that high priority initiatives and projects to mitigate possible disaster impacts would be funded and implemented. The plan would also create a linkage between the LHMP and established plans such as the City's General Plan and Emergency Management Plan so that they can work together in achieving successful mitigation for the City. It should be noted that DMA compliance is not the sole purpose of this LHMP. Santa Cruz has experienced a number of significant disasters but it also has a long-standing tradition of proactive planning and program implementation. This tradition is further enhanced by the development of this LHMP. Multiple objectives drive this planning effort, one of which is DMA compliance. Elements and strategies

included in this plan were not selected only because they meet a program requirement; they were selected because they meet the needs of the community.

Planning Process

This section describes the process in which the plan was developed. This includes the federal requirement followed by the City's actions applied to this process.

Documentation of the Planning Process

2.1 **Documentation of the Planning Process**
Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:
(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): The plan **shall** document]the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

The City of Santa Cruz has developed a local hazard mitigation plan. The Economic Department took on the initial responsibility for development of the plan. The initial phase of the planning process established a project team made up of representatives from various City of Santa Cruz departments responsible for different aspects of the hazard mitigation plan including Economic Development, Planning and Building, Public Works, Fire, and Information Systems (GIS). From this group, project team leaders were identified. Team leaders included Andrew Flagg, Economic Development Project Manager, Cathlin Atchison, Economic Development Project Coordinator, and Robert Solick, Emergency Operations Manager. The project team was formed as a task group to develop the plan. Meeting dates were set intermittently based on progress and focus. The project team invited interested parties such as the University of California at Santa Cruz, Santa Cruz County, the Cities of Capitola, Watsonville and Scotts Valley, the County Emergency Services Agency, the local American Red Cross as well as scientific and technical specialists at the local, state, and national level to review the draft at various stages. The project team is listed under acknowledgements in Part 1, section ii.

The plan was developed between June, 2006 and March 2007. The project leaders met once per week and the project team met approximately once per month from June, 2006, through December, 2006, and then as needed in 2007 until the draft plan was circulated for public review in April. The project team identified characteristics and potential consequences of natural hazards that are a potential threat to the City of Santa Cruz. With the understanding of the risks posed by the identified hazards, the team

determined priorities and assessed various methods to avoid or minimize any undesired effects. Responsible departments were consulted at several points in the development of the ***goals, objectives*** and ***actions***. As a result, the mitigation strategy including goals, objectives and actions were determined, followed by an implementation and monitoring plan. This monitoring plan included tracking of hazard mitigation projects, changes in day-to-day City operations, and continued hazard mitigation development.

Local Capabilities Assessment and Integration

2.2 Local Capabilities Assessment (State of OES Requested Information) Requirement §201.4(c)(3)(ii): - Of the Federal Register Interim Final Rule Title 44 of_the Code of Federal Regulations 44 CFR Parts 201 and 206 states, The **State** mitigation strategy **shall** include a general description and analysis of the effectiveness of local mitigation policies, programs and capabilities.

This assessment of the mitigation goals, programs and capabilities included a review of the following items:

Human and technical resources
Financial resources and funding sources
Local ordinances, zoning and building codes
On-going plans or projects

The LHMP was informed by The General Plan Safety Element, the Emergency Management Plan, the Urban Water Management Plan, the Santa Cruz Water Department Water Conservation Plan, City ordinances, zoning and building codes and the Capital Improvement Program (CIP.) Consistency between these plans, programs and policies was reviewed by using these approved plans and policies as a foundation for the LHMP and by consulting with the departments responsible for the various plans and programs. In reviewing the effectiveness of local programs, **Appendix K** lists ***Successful Programs*** that have been implemented by the City. **Appendix O** is the City's **Emergency Management Plan** updated as of January 2007. While these programs and the updated Emergency Management Plan have increased the City's hazard mitigation capabilities, funding availability is the limiting factor in the implementation of additional identified hazard mitigation programs.

The Project Team met several times with the staff and members of the General Plan Advisory Committee to insure that the LHMP was consistent with the General Plan Safety Element. The project leaders met with representatives of the Water Department to incorporate hazard mitigation efforts identified by various Water Department plans. Project leaders met with Fire Department staff to insure that the LHMP was consistent with the current and planned programs and fire safety plans. The project leaders also met with the City GIS coordinator to insure that maps were consistent with those in the General Plan and were accurate as of the draft publication date.

The City of Santa Cruz Emergency Operations Center (EOC) Manager, Robert Solick, was part of the Project Team leadership and oversaw the review and incorporation of

Plans and studies for consistency with the LHMP. This included the **Emergency Management Plan** (January, 2007) including the following appendices:

- County SEMS MOU resolution
- City of Santa Cruz Hazard Analysis Summary
- Wharf Hazard Plan
- Flood Hazard Plan
- Earthquake Hazard Plan
- Dam Inundation Hazard Plan
- Wildland Fire Hazard Plan
- Tsunami Hazard Plan

Community Participation

Public input during the development of the mitigation plan assisted in shaping plan goals and mitigations, and integrating the LHMP with the Safety Element of the General Plan Update. The Local Hazard Mitigation Plan was a topic of discussion at two public meetings of the General Plan Advisory Committee (GPAC). When the draft was completed, a 30 day public comment period was initiated. A public notice was placed in the local paper to invite the public to review and comment on the draft plan. Copies of the plan were made available at the Central Branch of the Santa Cruz Public Library and at the Economic Development Department at City Hall. A draft of the plan was posted on the City's website with an interactive response option that provided an opportunity for interested members of the public to comment on the draft LHMP on the web. Those comments are attached and were incorporated into the final document. The LHMP was presented to the City Council on April 24, 2007, which was open to the public for further comment.

The draft LHMP was also sent to members of a technical committee which consisted of national, state and local scientists and experts for review prior to creation of the Public Draft. Comments received were incorporated into the final draft LHMP.

LHMP Meetings	Date	Type
Project Team meeting	June 7, 2006	in house
GPAC presentation preparation meeting	July 12, 2006	in house
GPAC presentation and discussion	July 13, 2006	Public
GIS mapping meeting	August 8, 2006	in house
Safety Element integration meeting	September 11, 2006	in house
Department review meeting	October 19, 2006	in house
Managed meeting preparation meeting	November 19, 2006	In house
Managed meeting	November 15, 2006	in house
GIS mapping meeting	November 21, 2006	in house
Document format meeting	December 6, 2006	in house
City assets & critical buildings review	December 7, 2006	in house
GIS mapping meeting	December 13, 2006	in house
Floodplain/river levee project review	January 24, 2006	in house
CRS update meeting	February 1, 2007	in house
Team meeting on document format	March 13, 2007	In house
City Council meeting – Plan review	April 24, 2007	Public
Public Comment Period (see website)	April 18 – May 21, 2007	Public
City Council meeting – Plan adoption		

PART 3 — HAZARD IDENTIFICATION AND RISK ASSESSMENT

Significant Risks

- Earthquakes and Liquefaction
- Wildfires
- Floods and Associated Coastal Storms
- Drought
- Tsunami
- Coastal Erosion

Less Significant Risks

- Dam Failure
- Landslide

Multi-Hazard Summary

PART 3 — HAZARD IDENTIFICATION AND RISK ASSESSMENT

Identification and Profiling of Hazards
Risk Assessment of Hazards in Santa Cruz

3.0 Risk Assessment: §201.6(c)(2): The plan **shall** include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

It is important for a community's risk assessment, mitigation and preparedness efforts to be founded on accurate information about the types and scale of damage hazards pose to the community. This section of the Plan contains a description of those hazards identified as potential significant threats to Santa Cruz – earthquakes, wildfires, floods, drought, tsunami, coastal erosion, as well as the lesser threats of dam failure and landslide – and the exposure and vulnerability of the City to these hazards. These risks have been identified based on historical information of hazard events including researching past disaster declarations in the City, input from geologic, climatic, and wildfire specialists and organizations as well as public comments and newspaper articles. Probable damage and the consequences to the city's quality of life are described.

The City of Santa Cruz has expanded its GIS database, mapping critical facilities and hazard risk areas. Data from this mapping was used to determine hazards that present the greatest risk to the City
.

Table A- 1 Review of All Hazards

HAZARD	RISK	WHY/WHY NOT
Avalanche	No	The City is not in an avalanche area
Coastal Erosion	**Major**	Past history indicates probability is high, potential for loss of life is low - potential for economic and infrastructure loss is high
Coastal Storm	**included**	included with Floods
Dam Failure	**Lesser**	Past history indicates probability is low but potential loss of life is high
Drought	**Major**	Past history indicates probability is high
Earthquake	**Major**	Past history indicates probability is high
Expansive Soils	No	Does not affect City
Extreme Heat	No	Past history indicates probability is low
Flood	**Major**	Past history indicates probability is high
Hailstorm	No	Past history indicates probability is low
Hurricane	No	Past history indicates probability is low
Land Subsidence	No	Past history indicates probability is low
Landslide	**Lesser**	Past history indicates risk to water system is high
Liquefaction	**included**	Included with Earthquake
Winter Storm	No	Past history indicates probability is low
Tornado	No	Past history indicates probability is low
Tsunami	**Major**	Recorded history (200 years) indicates probability of a significant tsunami occurring is low but in the event that it should occur potential for life, property, economic and infrastructure loss is high
Volcano	No	Does not affect City
Wildfire	**Major**	The City is adjacent to many natural open space and urban /rural interface areas

3.1 Identifying Hazards - §201.6(c)(2)(i): The risk assessment **shall** include a description of the type of all natural hazards that can affect the jurisdiction.

Table A-2 Hazard Screening for City of Santa Cruz

Risk	Affected Areas
Very Significant Risk	
Earthquake (including liquefaction)	Entire City
Wildfire	Five identified wildland interface areas
Flood (including coastal storms)	San Lorenzo River floodplain including downtown & Tannery Arts Center, sections of Moore, Branciforte and Carbonera Creeks, & lower portion of Arana Gulch
Drought	Entire City
Tsunami	San Lorenzo River floodplain including beach area and downtown
Coastal Erosion	Coastal boundaries
Lesser Risk	
Dam Failure	Loch Lomond Reservoir & water delivery system Bay Street Reservoir
Landslide	Loch Lomond Reservoir & water delivery system

The City of Santa Cruz is exposed to a number of natural hazards that vary in their potential intensity and impact on the City. This mitigation plan addresses six high-risk natural hazards, selected because of the likelihood of occurrence or the potential consequences, as well as two additional hazards that present either less risk of occurrence or extent of damage. The natural hazards: floods, earthquake, and tsunami are of great concern because they can occur independently, or in combinations that can trigger secondary hazards such as dam failure. Another high risk hazard, drought, can exacerbate the potential for wildfires.

The natural hazards included in this plan were identified through a community based process including input from scientific experts in various fields and in conjunction with the update of the General Plan including the Safety Element, which is anticipated to be adopted in 2007. The Local Hazard Mitigation Plan (LHMP) was the result of a number of public meetings, project team meetings, scientific expert and community input as well as suggestions submitted by community members of Santa Cruz. Key contributors included members of the Project Team, the General Plan Advisory Committee, Gary Griggs of University of California at Santa Cruz, David Saroka of NOAA, the Association of Monterey Bay Area Governments (AMBAG) as well as many others who worked with the City on programs and research that were incorporated in the Emergency Management Plan and Safety Element. Other natural hazards that are extremely rare or non existent in Santa Cruz are not included in this plan but are listed in **Appendix A.**

The worst potential disaster that Santa Cruz might face involves multiple hazards occurring at the same time. A major earthquake could trigger tsunamis, wildfires or floods which would be exacerbated by damage to dams, stream culverts and storm drains. The City's emergency teams have practiced responding to similar, challenging, multi-hazard events. The City of Santa Cruz plans for and responds to emergency events in accordance with the Santa Cruz County Operation Area Memorandum of Understanding (MOU). The Emergency Management Plan describes the role and operation of the City departments and personnel during a major emergency (**Appendix O**.) In addition to researching each hazard individually, this Plan explores how the hazards interact, and how mitigation activities for each hazard impact the overall disaster risk in Santa Cruz.

CHAPTER 4 - EARTHQUAKES AND LIQUEFACTION

4.3.0 Risk Assessment

4.3.1 Identifying Earthquake Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the type … of all natural hazards that can affect the jurisdiction.

An earthquake is a sudden release of built-up tension in the earth's crust, i.e., lithosphere. Caused by movement along fault lines, earthquakes vary in size and severity. The **focus** of an earthquake is found at the first point of movement along the fault line, and the **epicenter** is the corresponding point above the focus at the earth's surface. Earthquake intensity is measured in various ways, the most familiar being the Richter magnitude scale which determines the amount of ground displacement or shaking that occurs near the epicenter; the Rossi-Forel scale which measures ground shaking intensity in terms of perception and damage; and the Modified Mercalli Intensity Scale which takes into account the localized earthquake effects.

Table 4 -1 Modified Mercalli Intensity Scale

Intensity	Severity	Level of Damage	Richter Scale
1-4	Instrumental to Moderate	No damage.	</= 4.3
5	Rather Strong	Damage negligible. Small, unstable objects displaced or upset; some dishes and glassware broken.	4.4 - 4.8
6	Strong	Damage slight. Windows, dishes, glassware broken. Furniture moved or overturned. Weak plaster and masonry cracked.	4.9 - 5.4
7	Very Strong	Damage slight-moderate in well-built structures; considerable in poorly-built structures. Furniture and weak chimneys broken. Masonry damaged. Loose bricks, tiles, plaster, and stones will fall.	5.5 - 6.1
8	Destructive	Structure damage considerable, particularly to poorly built structures. Chimneys, monuments, towers, elevated tanks may fail. Frame houses moved. Trees damaged. Cracks in wet ground and steep slopes.	6.2 - 6.5
9	Ruinous	Structural damage severe; some will collapse. General damage to foundations. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground; liquefaction.	6.6 - 6.9
10	Disastrous	Most masonry and frame structures/foundations destroyed. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Sand and mud shifting on beaches and flat land.	7.0 - 7.3
11	Very Disastrous	Few or no masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Rails bent. Widespread earth slumps and landslides.	7.4 - 8.1
12	Catastrophic	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted	> 8.1

Masonry A: Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.
Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.
Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.
Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

The harmful effects of an earthquake vary with the geologic composition and man-made infrastructure of the region, as well as the amount of accumulated energy released when the earthquake occurs. **Ground motion** is the primary cause of damage and injury during earthquakes and can result in surface rupture, liquefaction, landslides, lateral spreading, differential settlement, tsunamis, building failure, and broken gas and other utility lines, leading to fire and other collateral damage. The intensity and severity of ground motion is dependent on the earthquake's magnitude, distance from the epicenter and underlying soil and rock properties. Areas underlain by thick, saturated, unconsolidated soils will experience greater shaking motion than areas underlain by firm bedrock.

Fires and structural failure are the most hazardous results of ground shaking. Most earthquake-induced fires start because of ruptured power lines and gas or electrically-powered stoves and equipment, while structural failure is generally the result of age and type of building construction.

Liquefaction is the transformation of loose, water-saturated granular materials (such as sand or silt) from a solid to a liquid state. Liquefaction commonly, but not always, leads to ground failure. Liquefaction potential varies significantly and site-specific analysis is needed to accurately determine liquefaction potential in earthquake prone areas. Much of the downtown flood plain experienced liquefaction during the 1989 Loma Prieta Earthquake. Liquefaction and severe earth shaking have been the two primary causes of damage during earthquakes in Santa Cruz.

4.3.2 Hazard Profile – Earthquakes and Liquefaction

3.2 Profiling Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

A. Location

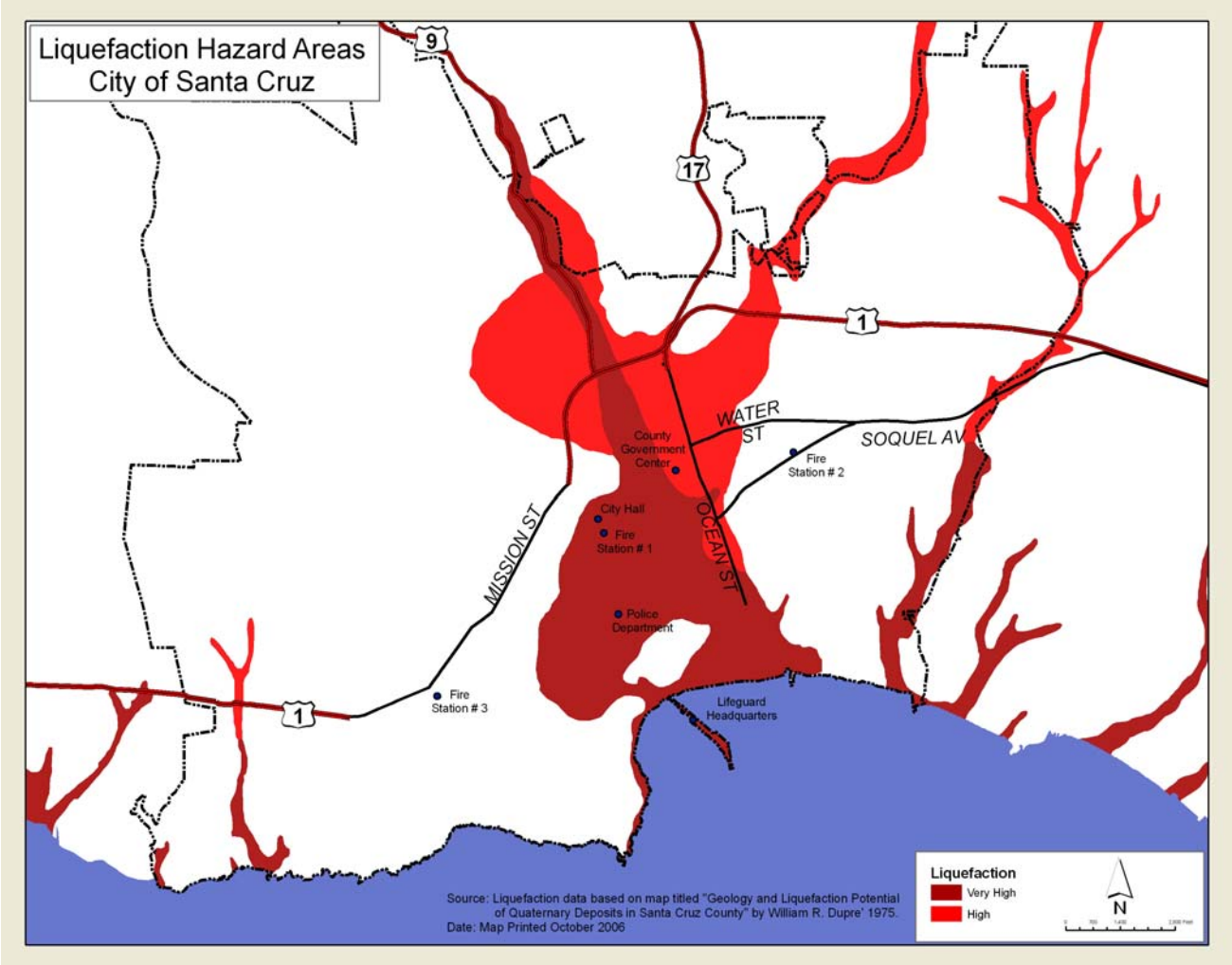


Figure 6 Areas in Santa Cruz Potentially Vulnerable to Liquefaction

Past experience has shown that the entire community is vulnerable to earthquake. Within Santa Cruz County there are several active and potentially active faults. These include the San Andreas, San Gregorio, Zayante, Ben Lomond and Butano Faults, the Monterey Bay Fault Zone, as well as numerous fault complexes and branches of these major faults.

Santa Cruz lies within 15 miles of at least six major seismic faults and fault systems, placing it in an area of high seismic risk; however there is only one fault, the Ben Lomond Fault that actually passes through the city. The Ben Lomond Fault is not considered to have moved in historic time, however, and may be inactive.

B. Extent: Magnitude or Severity

Several of the faults located in the Santa Cruz Area are considered to be either possibly active (showing signs of recent geologic movement, within the last 10,000 years) or probably inactive (movement within the last two million years). However, the Hayward, Calaveras, San Gregorio and San Andreas faults are all considered historically active (movement within the last 200 years). Even a moderate earthquake in the area could result in deaths, property and environmental damage as well as the disruption of normal economic, transportation, government and community services.

The most active region and threat to the city is the San Andreas Fault zone which passes through the Santa Cruz Mountains 12 miles northeast of the city. Based on records from the 1906 San Francisco earthquake, it is estimated that the maximum credible earthquake likely to occur along the San Andreas Fault would equal 8.3 M, which represents more than 30 times the energy released by the 1989 Loma Prieta Earthquake. The city was one of the hardest hit communities during that earthquake. This is the highest magnitude earthquake expected in the region but it is estimated that the Hayward, Calaveras and San Gregorio faults are all capable of generating earthquakes greater than 7.4 M.

C. Previous Occurrences

The following is a list of previous events, dates, severity, level of damage, duration, sources of information used, and maps (where available) to show areas affected. While Santa Cruz has sustained numerous earthquakes throughout its history, the two most destructive ones were the 1906 San Francisco earthquake and the 1989 Loma Prieta earthquake.

April 18, 1906: (Richter Magnitude: 8.3) No recorded deaths in Santa Cruz but the courthouse was almost destroyed; about 1/3 of the chimneys within the city were destroyed or damaged; there was major land sliding with gaping cracks in the earth, especially along the water; bridges were destroyed; and the water supply was shut off by broken mains and pipes.

October 1926: (Richter Magnitude: 6.1) Two large earthquakes occurred during this year. Three of the aftershocks cracked plaster in Santa Cruz, almost bringing down the chimneys of numerous buildings. It broke plate glass windows along Pacific Avenue. The city water main broke at Laguna Creek and articles fell from shelves at stores.

October 17, 1989 (Richter Magnitude: 7.1) Two people died in Santa Cruz as a direct result of this earthquake. In the greater San Francisco/Oakland Bay Area, there were sixty-two fatalities. The earthquake epicenter was located approximately 10 miles east of the City center. The earthquake destroyed much of the historic downtown and many areas of the City were very badly damaged. Roads in and out of the City were impassable and many residents lost power and water for up to a week.

Isoseismal Map - Santa Cruz Mountains (Loma Prieta), California UTC (Local 10/17/1989) [6] Magnitude 6.9 Intensity IX

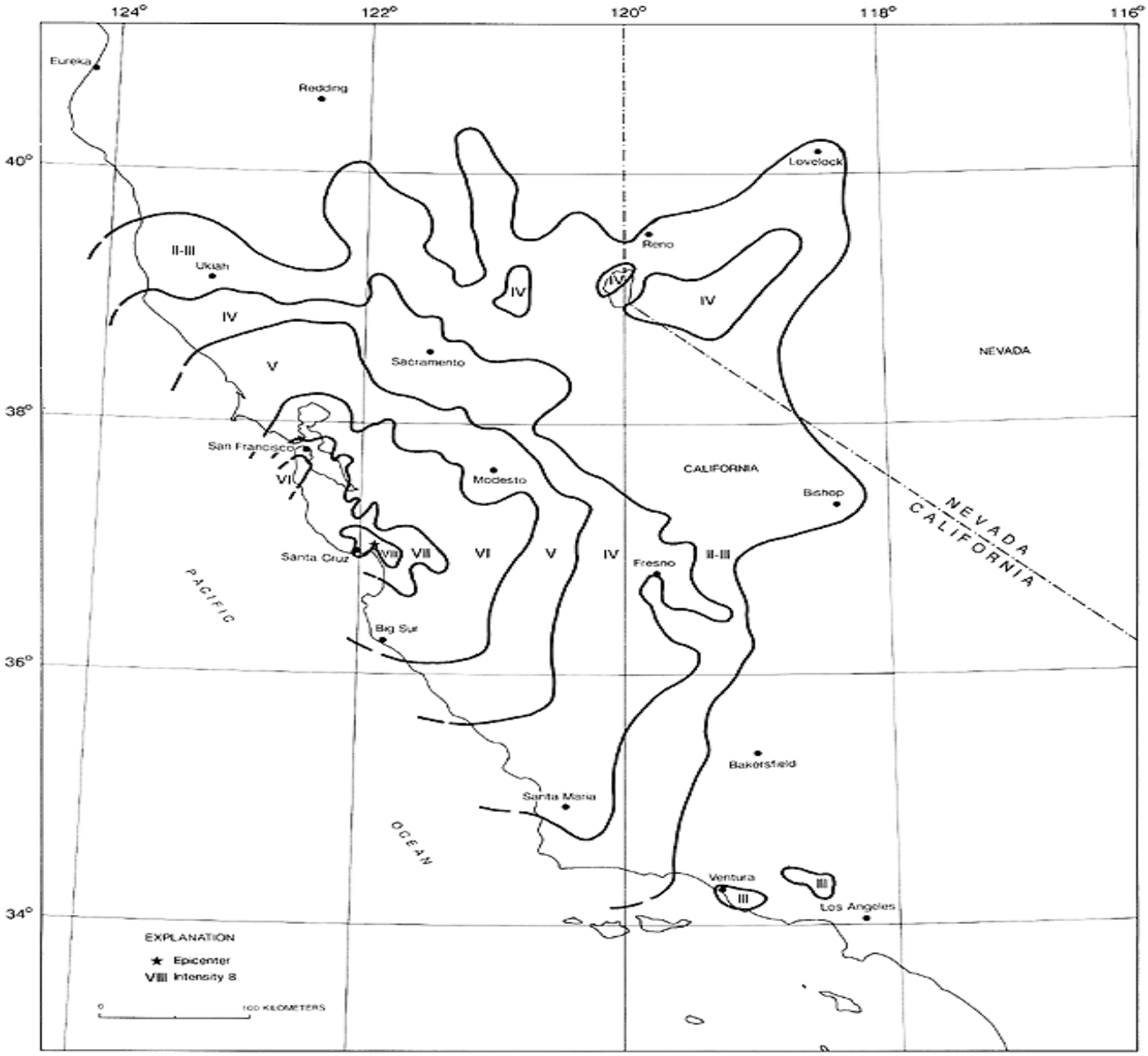


Figure 7 Intensity and Magnitude of the 1989 Loma Prieta Earthquake in Santa Cruz

D. Probability of Future Events

The City lies within 15 miles of at least six major seismic faults and fault systems, placing it in an area of high seismic risk. Because earthquakes can cause severe damage over a long distance, the Santa Cruz area remains at risk from continued seismic activity along the many faults in the region. The reduction of seismic stresses that occurred in the Loma Prieta earthquake did nothing to relieve, and possibly increased, stresses within other faults, including other sections of the San Andreas Fault. As a result, it is expected that Santa Cruz will be subjected to violent, earthquake-induced ground shaking in the future.

On the basis of research conducted since the 1989 Loma Prieta earthquake, U.S. Geological Survey (USGS) and other scientists conclude that there is a 62% probability of at least one magnitude 6.7 or greater quake, capable of causing widespread damage, striking the San Francisco Bay region (including Santa Cruz) before 2032. Major quakes may occur in any part of this region. This emphasizes the urgency for all communities in the region to continue preparing for earthquakes.[7]

The USGS, the California Office of Emergency Services, the California Geological Survey and the Association of Bay Area Governments jointly conducted a loss estimation study focused on the ten most likely damaging earthquakes. These earthquakes occur on six of the seven major fault systems in the area and range in size from a magnitude 6.7 on a blind thrust underlying Mt. Diablo to a magnitude 7.9 repeat of the 1906 rupture on the San Andreas Fault in northern California. Their 30-year probabilities range from a high of 15.2% for a M7.0 rupture of the Rodger's Creek fault to 3.5% for a M7.4 combined rupture of the Peninsula and Santa Cruz Mountains segment of the San Andreas. The ten most likely earthquakes and their 30-year probabilities are: [8]

Table 4-2 Ten most likely damaging Earthquake scenarios in California

Ten most likely damaging Earthquake scenarios	30-year probability	Magnitude
Rodgers Creek	15.2%	7.0
Northern Calaveras	12.4%	6.8
Southern Hayward (possible repeat of 1868 earthquake)	11.3%	6.7
Northern + Southern Hayward	8.5%	6.9
Mt. Diablo	7.5%	6.7
Green Valley-Concord	6.0%	6.7
San Andreas: Entire N. CA segment (possible repeat of 1906 earthquake)	4.7%	7.9
San Andreas: Peninsula segment (possible repeat of 1838 earthquake)	4.4%	7.2
Northern San Gregorio segment	3.9%	7.2
San Andreas: Peninsula + Santa Cruz segment	3.5%	7.4

Because the ten most likely future earthquakes in the Bay area occur on faults throughout the region, the impact and potential losses reported here reveal significant risk for the entire Bay area region including the City of Santa Cruz.

4.3.3 Assessing Vulnerability: Overview

3.3 Assessing Vulnerability: Overview - Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Earthquake

The vulnerability of a community to earthquake hazard is based on a variety of factors including proximity to active and inactive faults, the age of structures, the density of the population and development, the value of property and infrastructure, the construction materials used in residential and non-residential buildings, and the location of critical facilities in a community. Recent history indicates that Santa Cruz has a very high vulnerability to earthquakes due to proximity to faults, density of population and downtown development in the San Lorenzo River floodplain which is subject to liquefaction. A number of buildings in the downtown were rebuilt or seismically retrofitted after the 1989 Loma Prieta Earthquake which damaged or destroyed much of the old downtown.

The October 17, 1989 Loma Prieta earthquake was responsible for 62 deaths (including three in the City of Santa Cruz) and 3,757 injuries. In addition, over $6 billion in damage was reported including damage to 18,306 houses and 2,575 businesses. Approximately 12,053 persons were displaced. The most intense damage was confined to

(liquefaction) areas where buildings and other structures where situated on top of loosely consolidated, water saturated soils. Loosely consolidated soils tend to amplify shaking and increase structural damage. Water saturated soils compound the problem due to their susceptibility to liquefaction and corresponding loss of bearing strength.

During the Loma Prieta earthquake, extensive liquefaction occurred along the shoreline of the Monterey Bay. Most of the City of Santa Cruz downtown along the San Lorenzo River is in a liquefaction area. Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. Liquefaction has been responsible for tremendous amounts of damage in earthquakes around the world including the City of Santa Cruz.

Liquefaction occurs in saturated soils, that is, soils in which the space between individual particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other. When liquefaction occurs, the strength of the soil decreases and, the ability of a soil deposit to support foundations for buildings and bridges is reduced.[9] Some examples of these phenomena are shown below.

Failure and cracks induced by liquefaction have been observed in the past (photographers unknown). These images, probably from the 1906 event, show cracks formed by liquefaction at the San Lorenzo River.[10]
[11]

***See*: http://www.es.ucsc.edu/~es10/fieldtripEarthQ/Damage1.htm**

4.3.4 Assessing Vulnerability: Identifying Structures

A. Types & Numbers of Existing Buildings, Facilities & Infrastructure

Past experience has shown that the entire community is vulnerable to earthquake. The entire downtown commercial area is in a liquefaction hazard area. The remainder of the town is at risk for severe ground shaking as indicated by the maps below showing the probability of earthquake impacts to the Santa Cruz area within the next 50 years. These estimates were formulated using Hazus (HAZUS is a GIS-based, nationally standardized, loss estimation tool developed by FEMA). and are from the most recent California Geological Survey. They are limited to ground motion-induced losses to *buildings only*. In other words, the losses to other elements of the built environment, such as transportation, lifeline and communication facilities are not reported. Furthermore, the losses reported are only the *direct economic losses* due to building damage, which consist of *capital stock loss* and *income loss*.

This survey reviews 34 potential earthquake scenarios. Two of the ten most likely earthquake scenarios most damaging to Santa Cruz are shown on the following maps.

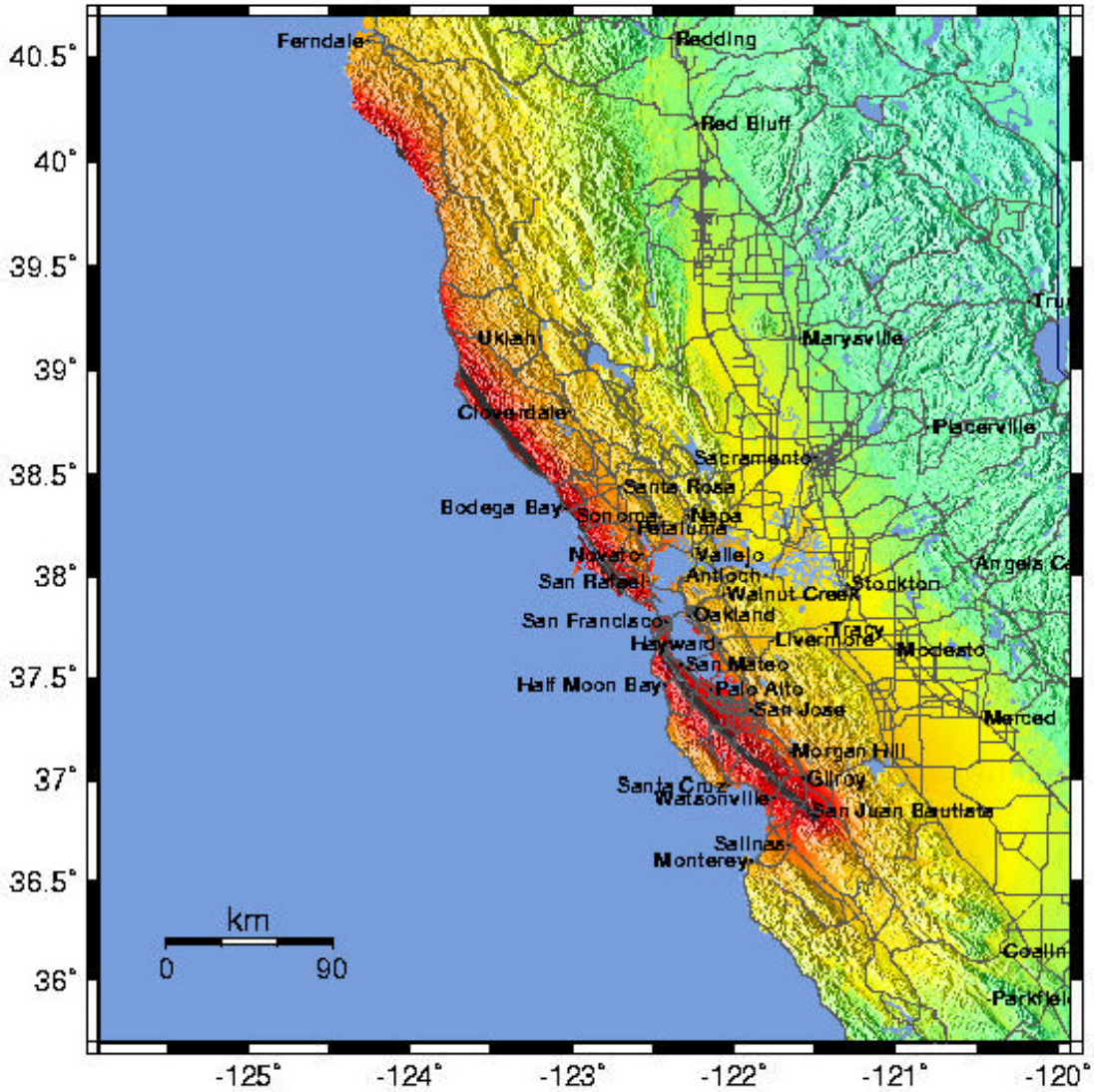
Scenario N-9 shows a possible repeat of the 1906 San Francisco Earthquake and the intensity and potential damage to the City of Santa Cruz. The map indicates that the intensity would be up to IX or X which represents violent or extreme perceived shaking and very heavy potential damage. The next map shows the peak ground acceleration for this earthquake and the following two maps show the estimated building damage and economic loss as a result of the Sceniario-9 earthquake.

Scenario N-7 shows the projected impacts of an earthquake along the Santa Cruz Mountains + Peninsula + North Coast and the potential damage to the City of Santa Cruz. The map indicates that the intensity would be VIII or IX which represents severe to violent perceived shaking and moderate to heavy damage. The next map shows peak ground acceleration for this earthquake scenario and the following two maps show the estimated building damage and economic loss as a result of the Scenario-7 earthquake.

SCENARIO: N-9

All 4 segments: possible repeat of 1906 earthquake (SAS+SAP+SAN+SAO)

-- Earthquake Planning Scenario --
Rapid Instrumental Intensity Map for SAF_SAS+SAP+SAN+SAO Scenario
Scenario Date: Thu Mar 6, 2003 04:00:00 AM PST M 7.9 N38.18 W122.92 Depth: 0.0km



PLANNING SCENARIO ONLY -- PROCESSED: Fri Apr 18, 2003 10:18:20 AM PDT

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure 8 Scenario N-9 Repeat of 1906 Earthquake

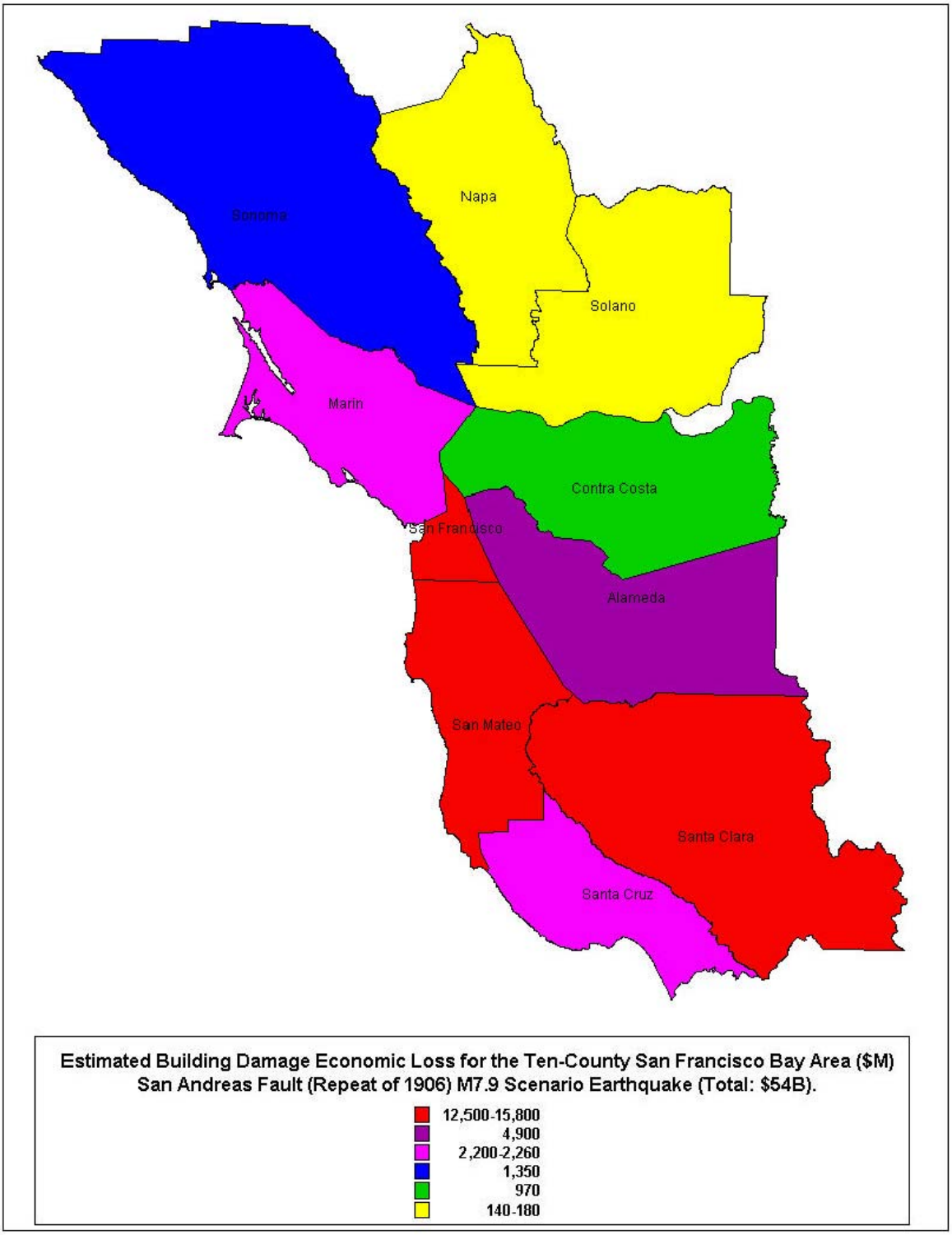


Figure 9 Scenario N-9 Repeat of 1906 Earthquake - Building Economic Loss by County

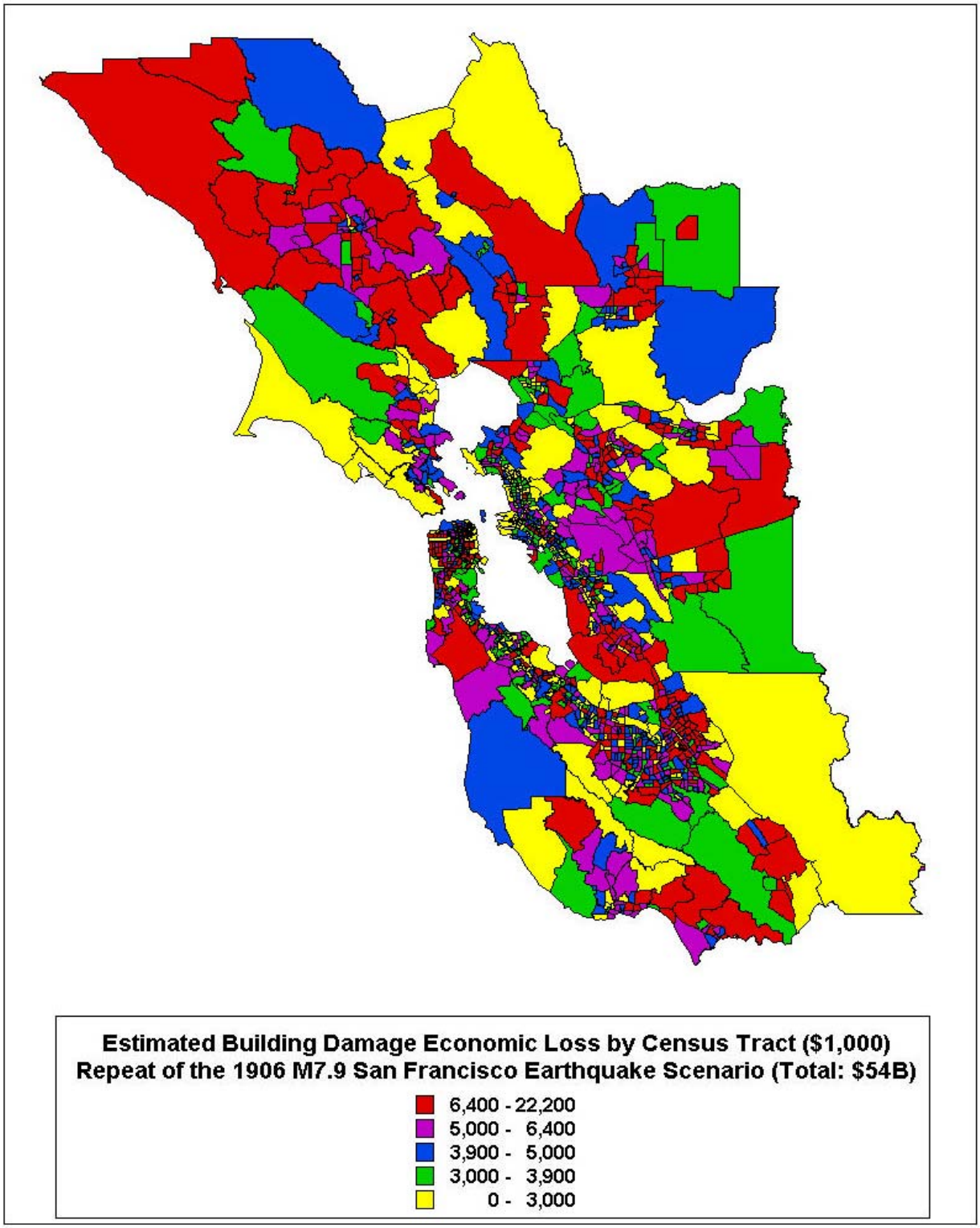
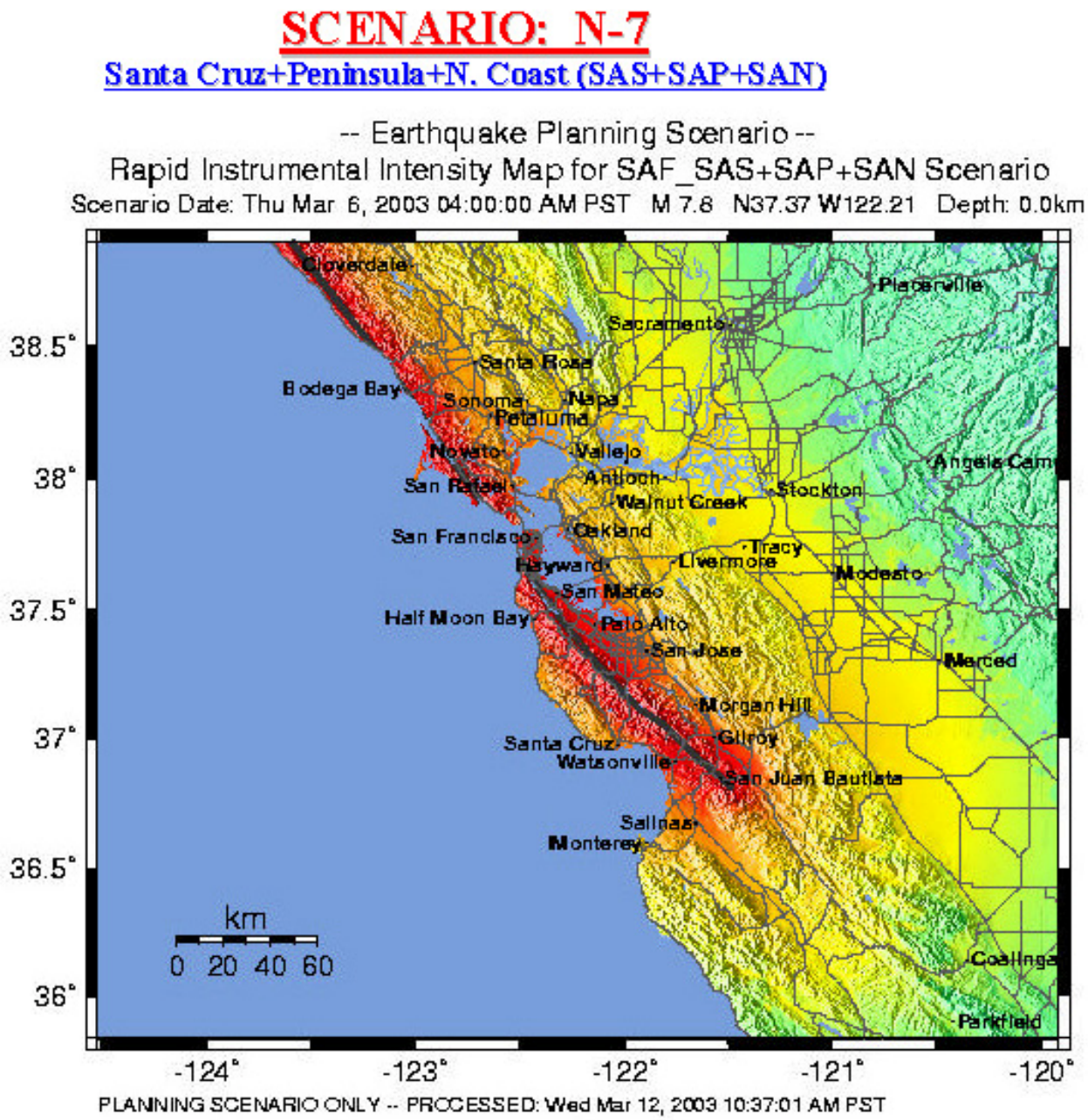


Figure 10 Scenario N-9 Repeat of 1906 Earthquake Loss by Census Tract



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure 11 Scenario N-7 Santa Cruz Mountains

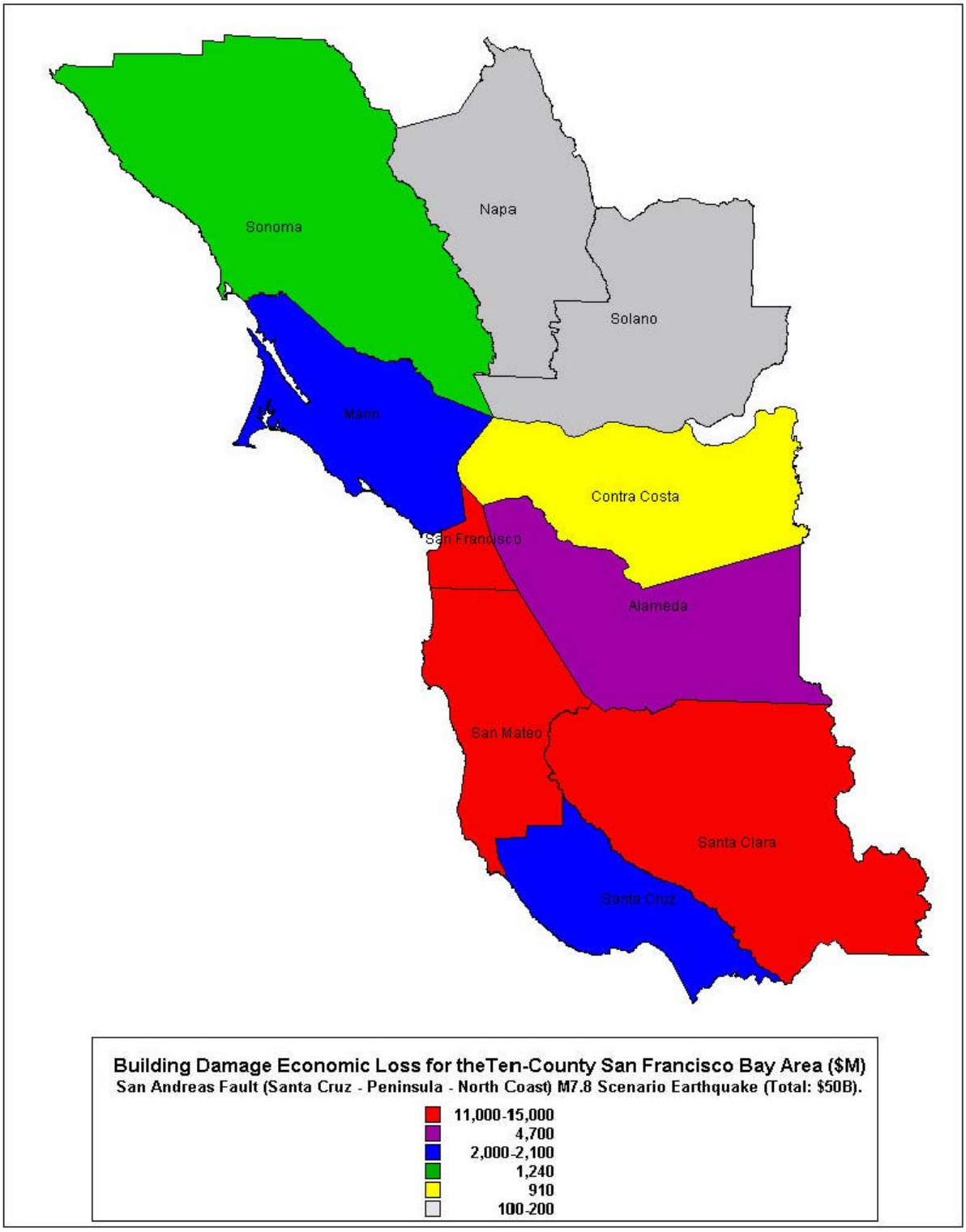


Figure 12 Scenario N-7 Santa Cruz Mountains Building Economic Loss by County

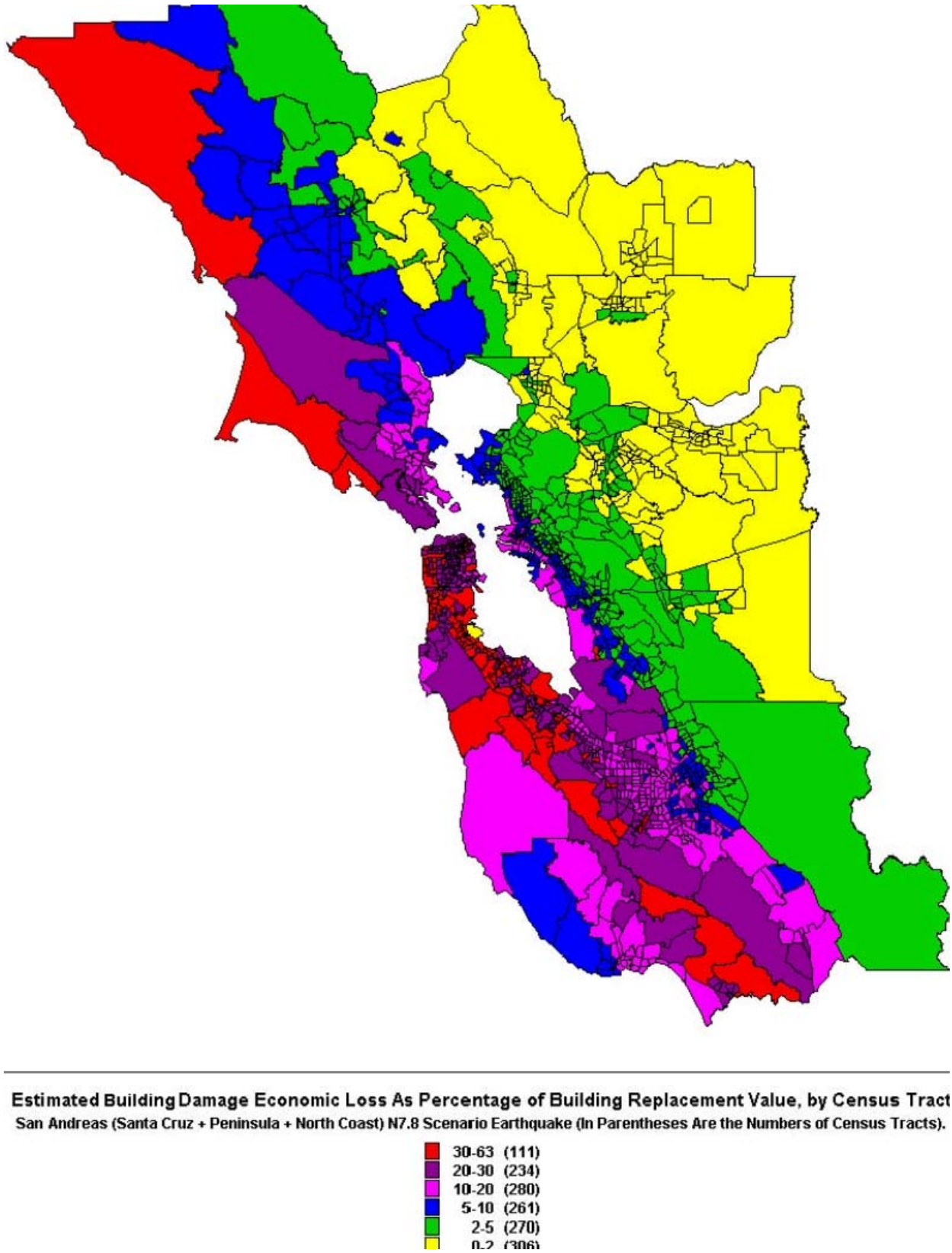


Figure 13 Scenario N-7 Santa Cruz Mountains Building Economic Loss by Census Tract

4.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses : Requirement §201.6(c)(2)(ii)(B) : The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

A. *Potential Dollar Losses to Vulnerable Structures*

Table # 4-3 Earthquake potential loss inventory

Inventory Assets

EARTHQUAKE

Type	# of Parcels	# of Structures	Critical Structures	Loss in Value$*
	Entire Community	Total	Total	Hazard
Residential	14,819	20,949		$2,177,018,720
Commercial	1,305	1,300		$512,449,080
Industrial	123	76		$70,354,758
Religious	50	63		$23,642,774
Government	389	213		$0
Utilities	7	22		$0
Total	16,740	23,349	38	$2,795,769,306
# of People	54,593			

DATE: 2006-2007
Total number & values within the entire community is the same as hazard area for Earthquake
The entire community is within the earthquake hazard area
*Loss is based on Assessment Improvement values.

B. *Methodology Used to Prepare Estimate*

Parcel Valuation:
Valuation of parcels within a hazard is based on improvement values only as collected by appraisers with the County of Santa Cruz assessor's office. They don't reflect sale value or replacement value. If a parcel intersected a hazard, the entire improvement value of that parcel was used.

Population:
Census population blocks were reduced to center points. If a hazard intersected a center point, that population was counted.

Estimates from the most recent California Geological Survey presented by Rowshandel, M. Reichle, C. Wills, T. Cao, M. Petersen, D. Branum, and J. Davis in a paper titled ***Estimation of Future Earthquake Losses in California*** are limited to ground motion-induced losses to *buildings only*. In other words, the losses to other elements of the built environment, such as transportation, lifeline and communication facilities are not reported. Furthermore, the losses reported are only the *direct economic losses* due to building damage, which consist of *capital stock loss* and *income loss*. Indirect economic losses, representing the losses due to various forms of post-earthquake socioeconomic disruptions (such as employment and income, insurance and financial aids, construction, production and import-export of goods and services) are not included in the estimates reported. This is because of the higher level of uncertainty associated with the indirect losses, as compared to the direct losses. Therefore, it is expected that once the indirect building economic losses, the economic losses to non-building facilities, and the contributions of all earthquake hazards are taken into account, the estimated economic losses would be several times the numbers presented.[12]

The analysis of the estimated losses are calculated in three forms: *losses in dollars for individual counties*, *losses in dollars for individual census tracts*, and *Loss Ratios (LR)* - the loss as a percentage of the building replacement value. Detailed results for all scenario earthquakes and for the State-wide annual losses are available on the CGS website.[13]

Among the 34 scenario earthquakes of the San Francisco Bay Area (SFBA), a repeat of the 1906 earthquake results in the largest economic loss for the ten SFBA counties. It would rupture four segments of the San Andreas fault and would cause approximately $54 billion economic loss due to building damage. A number of other earthquakes on the San Andreas fault, rupturing different combinations of these four segments are also feasible. Should one occur, it would result in an estimated loss ranging from a few billion dollars to $50 billion. Other potentially damaging earthquakes in the SFBA are: a magnitude 6.9 event rupturing the entire Hayward fault causing $23 billion in losses; and a magnitude 7.3 earthquake rupturing the entire Hayward fault and the Rodgers Creek fault causing $34 billion in losses.

Estimates were calculated using the latest version of the HAZUS software package, Service Release 2 (SR2) for the estimation of the damage and economic loss. The earthquake hazard data, obtained from the scenario shake-maps or the Probabilistic Seismic Hazards Assessment (PSHA) maps, and the liquefaction data (for the case of annualized loss) were then analyzed and supplied into the HAZUS package. HAZUS-SR2 default data was used for the information on the built environment and the demographics. This information in HAZUS-SR2 is, for the most part, derived from 1990 national census data. Using this process the most severe potential earthquake near Santa Cruz estimates a loss of over 2.2 billion dollars for the County. The City of Santa Cruz represents 20 percent of that population and has within its boundaries significantly more than 20 percent of the structures as it is the commercial center of the county.

4.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 **Assessing Vulnerability: Analyzing Development Trends**
Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Description of Land-Uses & Development Trends

The City of Santa Cruz is a compact urban community that is surrounded by natural barriers to outward expansion including the Santa Cruz Mountains, the Pacific Ocean and a designated greenbelt. "Ongoing population growth… has been mirrored by an increase in urbanization for the Monterey Bay area. Development patterns in the coastal zone since the 1970s confirm these overall urbanizing trends." [14] New development has occurred within or adjacent to the urban services line (i.e., the boundary point for such infrastructure as gas, water, and sewage hook-ups). In Santa Cruz, most development is now infill or reuse development.

Since the 1989 Loma Prieta Earthquake all commercial and public buildings have been replaced or seismically retrofitted. Seismic safety standards are a requirement for all building permits. As infrastructure is repaired or replaced updated seismic safety standards are incorporated.

4.4.0 Mitigation Strategy

4.0 Mitigation Strategy – Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The primary mitigation strategy to avoid or reduce damage from earthquake is continuation of design review and code enforcement to meet current seismic standards, including adequate geotechnical monitoring protocols to insure structural integrity.
Mapping of liquefaction areas in Santa Cruz including the map used in this plan is inadequate and out of date. More accurate mapping of potential liquefaction areas, based on data from recent events such as the 1989 earthquake has been identified as an important component in preparing updates to this Hazard Mitigation Plan.

4.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Earthquake Goals:

Earthquake 1 - Avoid or reduce the potential for life loss, injury, property or economic damage to Santa Cruz from earthquakes.

Earthquake 2 -Encourage mitigation activities that increase disaster resilience to earthquake.

4.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure**.**

Earthquake Mitigation Actions:

Earthquake is one of the most significant threats to Santa Cruz. The following actions are critical to the future safety of Santa Cruz:

- Coordinate preparedness efforts with other agencies. **(A-2)**
- Upgrade sewer, water and other infrastructure to withstand seismic shaking. **(A-10)**
- Continue retrofitting all non-complying unreinforced masonry buildings. **(C-8)**
- Upgrade seismic safety of all emergency use and critical structures. **(C-9)**

CHAPTER 5 – WILDFIRES

5.3.0 Wildfire Risk Assessment

5.3.1 Identifying Wildfire Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i):
The risk assessment **shall** include a description of the type … of all natural hazards that can affect the jurisdiction.

Wildland fire may be defined as any unwanted fire involving outdoor vegetation. While it is often thought of as occurring in forests, rangelands or crop fields, it may also occur in areas such as vacant lots, highway medians, parks and golf courses. With residential development spreading into pristine areas, a relatively new phenomenon has been created: the wildland/urban interface. This phenomenon has changed the nature of the wildland fire problem in some very significant ways. Both the life hazard and the potential economic losses in wildland areas have increased greatly, and the increase in human activity has multiplied the number and variety of potential sources of ignition.
Wildland fires are influenced by three factors: fuel, weather and topography. The spread of wildland fires depends on the type of fuel that exists within the area in the form of grasses, brush and trees. Wildland fire behavior is also influenced by local weather which can modify the burn rate (how fast the fire burns.) Examples of weather incidents that affect wildland fires are atmospheric stability, inversions, thunderstorms, relative humidity and wind. Finally, the severity of wildland fires is influenced by topography including slope, aspect, chimneys and drainages, and the accessibility of the location.

Priorities in the event of a wildfire are life safety, preservation of property and resource conservation. Life safety includes the potential for evacuation, sheltering in place (finding and directing citizens to a location safe from the threat of fire) and providing evacuation to safe refuge. Property conservation includes triage (evaluation and determination of priority of response) of threatened structures as well as evaluation of types of structures in surrounding areas. Natural resource conservation includes assessing the risk to timber, crops, wildlife, wetlands and pasture land.

5.3.2 Profiling Wildfire Hazard Events

A. Location

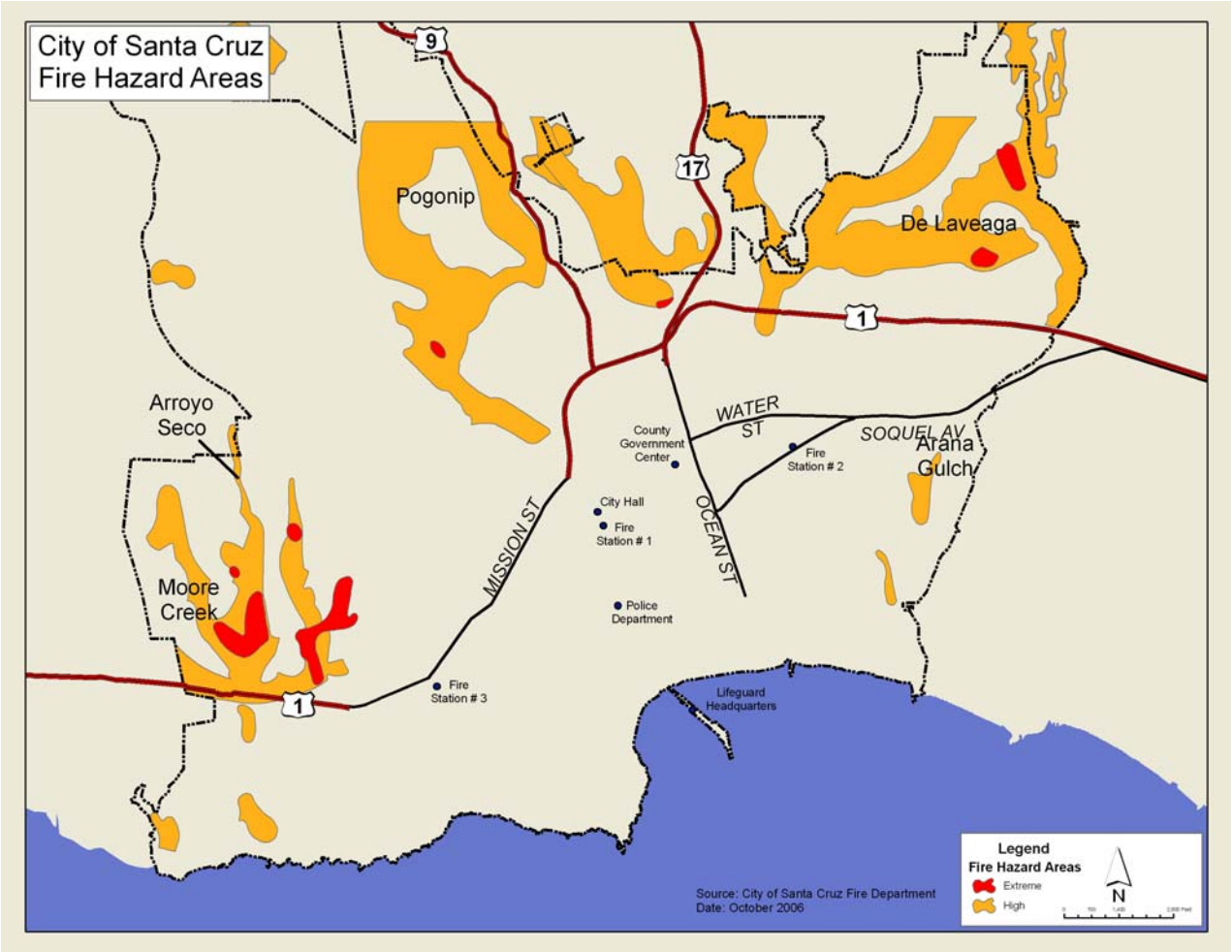


Figure 14 Wildfire Hazard Areas within the City of Santa Cruz

Within the City of Santa Cruz there are five wildland/urban interface areas including three areas designated as mutual threat zones. Mutual threat zones are defined as areas where a wildfire would threaten property within the Santa Cruz fire protection district as well as property covered by another fire protection service. For major emergencies that require more resources than can be provided by a single agency, the City of Santa Cruz, Santa Cruz County, the University of California at Santa Cruz and the State of California have an extensive mutual aid and emergency coordination system. Developed and managed in cooperation with the Governor's Office of Emergency Services, this system allows departments and districts to share personnel and equipment as needed to address and control emergencies.

These mutual threat zones are delineated in the Wildland Pre-Suppression Plan[15] for the mutual threat zone areas in and around Delaveaga Park, the Pogonip property, and the Arroyo Seco/Meder Canyon. This Plan is used to identify non-State responsibility areas in which any fire is considered a threat to adjacent State responsibility areas. These

geographic areas are designated because of the urban development that has occurred along their canyons and the vegetation that is considered significant. Wildland fires also present a risk to open space areas within the City of Santa Cruz and adjacent to residential homes. Additional areas of concern for these wildland/urban interface zones include the Arana Gulch property, Lighthouse Field, the Moore Creek Preserve as well as other smaller wildland/urban interface areas throughout the City. It should also be noted that there are City of Santa Cruz water service areas and water infrastructure areas that are located outside of the City limits that are potentially threatened by wildland fires.

B. Extent: Magnitude or Severity

According to ***Meder Canyon Vegetation Management Plan***, prepared by Wildland Resource Management, 2004, and the ***Wildland Fire Safety Plan, Delaveaga Park Area*** prepared by the Hunt Research Corporation, 1995, the potential for a significant wildland fire exists in and around various areas of Santa Cruz. Because some of these canyon areas have steep slopes with dense stands of eucalyptus trees, conifers, chaparral species and other vegetation, the potential for a fire with the intensity and effect of the 1991 Oakland Hills fire exists and many structures could be threatened.

Expected fire behavior in and around the canyons described above indicates that fire spread will be rapid and will run uphill toward structures. Without fuels modification and/or management, eucalyptus litter, shrubs and un-mowed grass would generate enough heat to cause shrubs, eucalyptus, or oak canopies to ignite, distributing embers widely and producing enough heat to potentially involve structures. Un-mowed grass and eucalyptus litter comprise the highest flash point type of fuels encountered in Santa Cruz. Trees with low branches, and shrubs—particularly coyote brush and poison oak—are most likely to serve as "ladder fuel" to enable fires beneath to spread into the tree canopy or crown. Should fire become involved in the crown or tree canopy, embers may be expected to be cast throughout the neighborhood and potentially cause several additional fires. In such a case the burning debris may travel up to 1.5 miles away in a wind of 20 mph at ground level during a crown fire according to the Santa Cruz Fire Department.

In most of the wildland fire risk areas the fuels surrounding these areas have high moisture content due to the area's marine influence. Winds tend to blow from the ocean upslope. However, in the fall, "sundowner winds" *(strong, downslope winds that develop over the southern slopes of mountains in late afternoons and evenings that pose a very serious threat during the height of fire season—NOAA*) can occur from the north/northeast towards the ocean. Wind speeds can be 20 mph or more. Temperatures can be 80 degrees or more. In Santa Cruz, fuel moistures have been recorded as low as 3-4% by the Santa Cruz Fire Department.

C. Previous Occurrences

Recent Wildland fires in the City of Santa Cruz

- 1990- Meder Canyon Fire- Several acres consumed in 20 minutes

A number of other wildland fires in the Santa Cruz area including the Santa Cruz Mountains have been a concern to the City of Santa Cruz.

D. Probability of Future Events

Despite the fact that there has not been a recent wildland fire within the city limits, residential development continues to spread into wildland/urban interface areas increasing the danger to life and property should a fire occur. Areas targeted as "likely" to have a wildland fire include the Arroyo Seco/Meder Canyon, DeLaveaga, Pogonip, Moore Creek area and Arana Gulch. Increasing use of these areas by residents, transient encampments with fires and young adults looking for a place to gather outside parental supervision exacerbates the risks.

A fire threat will always exist in a wildland/urban interface area as long as vegetation, trees, down and dead fuels, structures and humans co-exist. There is a high probability that fires will occur in one or more of these areas. It is not a question of **if** they will occur but **when** will they occur, and whether or not the City of Santa Cruz will be prepared.

5.3.3 Assessing Wildfire Vulnerability: Overview

3.3 Assessing Vulnerability: Overview Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Wildfires

Santa Cruz is a compact city surrounded by greenbelt. While the majority of the city is urban, wildfires remain a threat in several canyons and in the wildland/urban interface. The areas most vulnerable to wildfires within the city are:

- Pogonip
- DeLaveaga
- Moore Creek Preserve
- Arana Gulch
- Arroyo Seco Canyon

Vulnerability is increased in several of these areas due to limited access. Arroyo Seco Canyon is an area of particular concern as it is surrounded by homes that would be threatened in the case of a wildland fire.

5.3.4 Assessing Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures – Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

A. Types and Numbers of Existing Buildings, Facilities and Infrastructure

Most wildland fire areas are adjacent to residential or open space areas. Only a few public buildings are immediately threatened by wildland fires. Public buildings that are in threat areas are the historic Pogonip clubhouse, DeLaveaga Golf Club and associated buildings, 35 schools and day care centers and some park structures. There are eight commercial or industrial structures in the threat zone.

5.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses – Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Potential Dollar Losses to Vulnerable Structures

Table # 5-1 Wildfire potential loss inventory

Inventory Assets

WILDFIRE

Type	# of Parcels		# of Structures		Critical Structures		Loss in Value$*	
	Total	***Hazard***	*Total*	***Hazard***	*Total*	***Hazard***	*Total*	***Hazard***
Residential	14,819	921	20,949	703			$2,177,018,720	$207,499,869
Commercial	1,305	11	1,300	3			$512,449,080	$5,015,387
Industrial	123	15	76	5			$70,354,758	$13,494,919
Religious	50	2	63	2			$23,642,774	$11,209,630
Government	389	65	213	19			$0	$0
Schools/Daycare	47	4	726	35			$12,303,974	$305,492
Utilities	7	2	22	2			$0	$0
Total	**16,740**	**1,020**	**23,349**	**769**	**38**	**1**	**$2,795,769,306**	**$237,525,297**
	Community	*Hazard*						
# of People	**54,593**	**2,934**						

DATE: *2006 - 2007*

Total = total number of structures, residents, values within the entire community

Hazard= number of structures, residents, values that are located within the defined hazard area

*Loss is based on Assessment Improvement values.

*Government Parcels, Public Schools and most Utilities are not assessed.

B. Methodology Used to Prepare Estimate

Parcel Valuation:

Valuation of parcels within a hazard area is based on improvement values only as collected by appraisers with the County of Santa Cruz assessor's office. They don't reflect sale value or replacement value. If a parcel intersected a hazard the entire improvement value of that parcel was used.

Population:

Census population blocks were reduced to center points. If a hazard intersected a center point, that population was counted.

Calculated replacement value for average size home in the area times the number of structures for residential and for each of the commercial structures. The average home is approximately 1,800 square feet. Replacement value is approximately $2.20 per square foot (2006 Building Department replacement valuation) for an average replacement value of approximately $400,000.

5.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Description of Land-Uses and Development Trends

As was discussed previously, the City of Santa Cruz is a compact urban community that is surrounded by natural barriers to outward expansion including the Santa Cruz Mountains, the Pacific Ocean and a designated greenbelt. As the demand for housing increases there is an increased risk created in the urban rural interface.

Although Santa Cruz has over 3,000 acres of greenbelt and parkland, the City does not have the resources to adequately police and protect this area. This inadequate policing increases the frequency of illegal camping (Santa Cruz has a substantial chronic homeless population) which can result in fires in limited access and canyon areas.

5.4.0 Mitigation Strategy

4.0 Mitigation Strategy: Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing *tools.*

The City of Santa Cruz has initiated a number of wildfire mitigation programs in the past few years including the DeLaveaga Vegetation Management Program and the Arroyo Seco Canyon Vegetation Management project. The City continues to maintain cooperative agreements to work with the County, UCSC, the California Department of Forestry and other fire protection agencies to collaboratively avoid or minimize the threat from wildland/urban interface fires. Building partnerships with other City Departments particularly Parks and Recreation and Police in patrolling wildland areas is critical to mitigation efforts when staff resources are limited.

5.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Wildfire Goals:

Wildfire 1 - Avoid or reduce the potential for life loss, injury, property and economic damage to Santa Cruz from wildfire.

Wildfire 2 - Collaborate with other County fire districts, UCSC and the California Department of Forestry in mutual fire protection efforts.

5.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Wildfire Mitigation Actions:

Wildfire protection mitigation strategy includes the following actions:

- Cooperative fire protection agreements with other agencies **(A-7)**
- Reduction of fire risk in wildland/urban interface areas through improved vegetation management and appropriate code enforcement**(A-8)**
- Promotion of built-in fire extinguishing and warning fire alarm systems**(B-9)**
- Creation of a proactive (not reactive) hazard abatement program (**B-10)**
- Land use planning to reduce incidence of human caused wildfire **(C-4)**
- Adequate staffing to meet needs of City population and development (**C-5)**
- Fire prevention programs in schools, institutions & commercial buildings **(C-6)**

CHAPTER 6 — FLOODS AND ASSOCIATED COASTAL STORMS

6.3.0 Flood Risk Assessment

6.3.1 Identifying Flood Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(I): The risk assessment **shall** include a description of the type … of all natural hazards that can affect the jurisdiction.

Flooding and coastal storms present essentially the same risks and are frequently related types of hazards in the City of Santa Cruz.

Coastal storms can cause increases in tidal elevations (called storm surge) wind speed and erosion as well as flooding

A flood is a natural event for rivers and streams. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands adjacent to rivers, lakes and oceans that are subject to recurring floods. Several factors determine the severity of floods, including rainfall intensity (or other water source) and duration.

A flood occurs when a waterway receives a discharge greater than its capacity. Floods may result from intense rainfall, localized drainage problems, tsunamis or failure of flood control or water supply structures such as levees, dams or reservoirs. Floodwaters can carry large objects downstream with a force strong enough to destroy stationary structures such as bridges and break utility lines. Flood waters also saturate materials and earth resulting in the instability, collapse and destruction of structures as well as the loss of human life. The City of Santa Cruz has lost bridges and other infrastructure during previous storms.

Floods occur in relation to precipitation. Flood severity is determined by the quantity and rate at which water enters the waterway, increasing volume and velocity of water flow. The rate of surface runoff, the major component to flood severity, is influenced by the topography of the region as well as the extent to which ground soil allows for infiltration in addition to the percent of impervious surfaces. It is important to note that a stream can crest long after the precipitation has stopped.

6.3.2 Profiling Flood Hazard Events

3.2 Profiling Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

A. Location

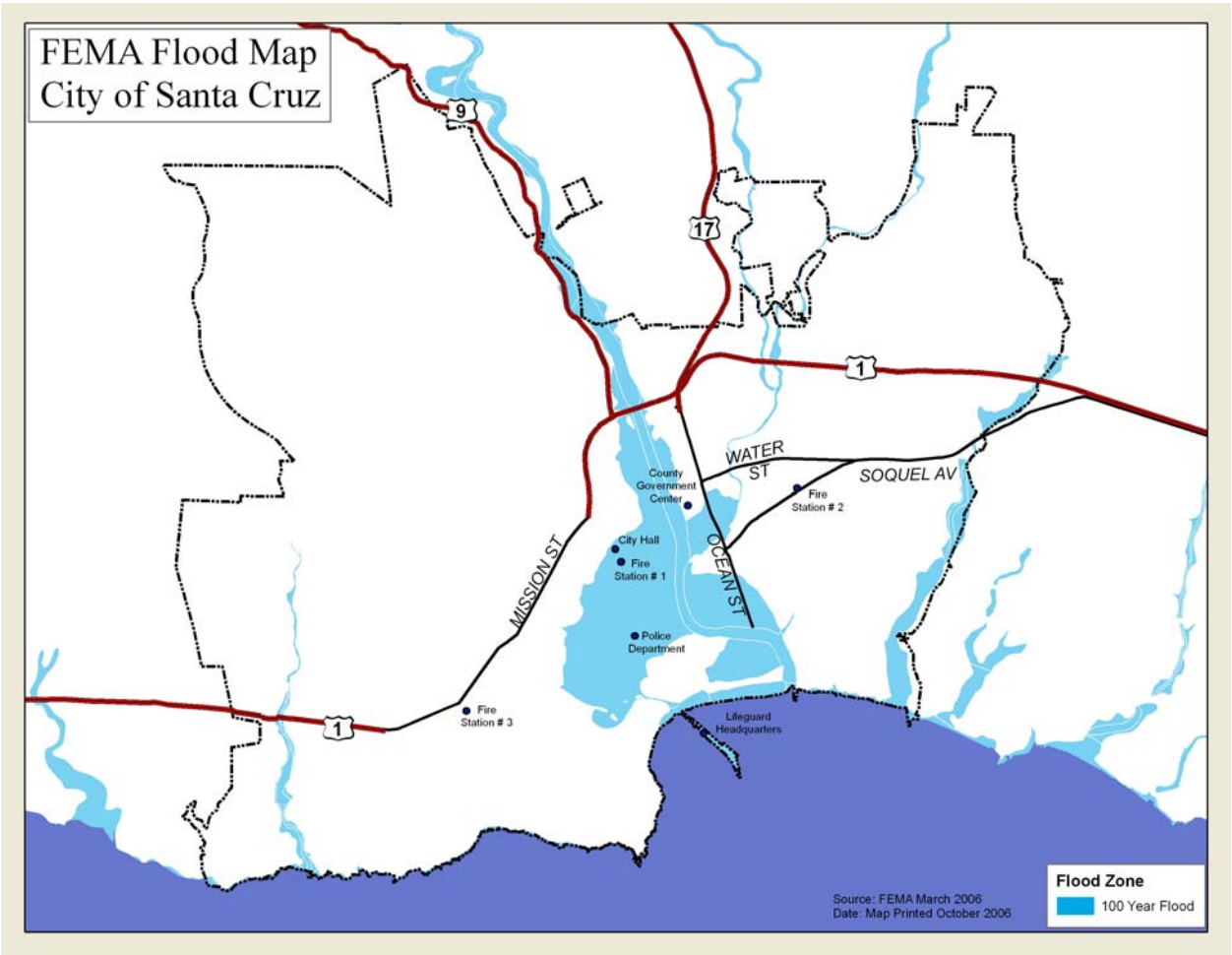


Figure 15 FEMA Flood Map showing 100-year flood zone

Most of the known floodplains in the United States have been mapped by FEMA, which administers the National Flood Insurance Program (NFIP.) Information on Santa Cruz can be found in FEMA's most recent flood Insurance Study (FIS).

Within the City of Santa Cruz there are several areas subject to flooding. The San Lorenzo River runs through the downtown corridor and the majority of the downtown area is in the San Lorenzo floodplain. The San Lorenzo River also runs along the edge of the Harvey West Commercial-Industrial area including the new Tannery Arts Center and its associated housing.

Flooding along the coast of Santa Cruz may occur with the simultaneous occurrence of large waves and storm swells during the winter. Storm centers from the southwest produce the type of storm pattern most commonly responsible for the majority of serious coastline flooding. The strong winds combined with high tides that create storm surges are also accompanied by heavy rains. When storms occur simultaneously with high tides, flood conditions including flooding at the mouth of the San Lorenzo River are exacerbated. [16]

There are several smaller creeks in the City that are subject to periodic flooding. Flooding is a hazard on the lower reaches of Moore Creek where only shallow stream channels are present, the lower portion of Arana Gulch, north of Santa Cruz Yacht Harbor, and along portions of Branciforte and Carbonera creeks. In these areas there is minimal impact on public structures and facilities and only a few residential structures are within these flood zones.

B. Extent: Magnitude or Severity

The San Lorenzo River drains 357 sq. km (138 square miles) of the central California coast range with the annual rainfall in the Redwood forest basin averaging 120 centimeters (47in).[17] The flood season for the San Lorenzo River extends from November to April with most of the historic floods occurring in December or January. The floods that have caused the most damage were generally of short duration and were the result of the small size and steepness of the basin.

The FEMA Community Rating System (CRS) has awarded the City of Santa Cruz a Class Seven rating. The CRS rating is an important factor in determining the magnitude of the potential for flood along the San Lorenzo River. The Community Rating System (CRS) is a voluntary incentive program that is part of the National Flood Insurance Program (NFIP.) The CRS recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements (FEMA 2002). As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses
- Facilitate accurate insurance rating
- Promote awareness of flood insurance

For communities participating in the CRS, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class One community would receive a 45 percent premium discount, and a Class Nine community would receive a five percent discount. (A Class Ten community does not participate in the CRS and receives no discount.) The CRS classes for local communities are based on 18 creditable activities organized under the following four categories:

- Public Information
- Mapping and Regulations
- Flood Damage Reduction
- Flood Preparedness - Currently, approximately 1,000 communities nationwide, including Santa Cruz, receive flood insurance premium discounts based on implementation of local mitigation, outreach, and educational activities that go well beyond minimum NFIP requirements.

The Flood Insurance Rate Map (FIRM) is an official map of a community for which the Federal Insurance and Mitigation Administration has delineated the Special Flood Hazard Area (SFHA) and the risk premium zones applicable to the community. All known areas of the City subject to natural flooding hazards have been designated and mapped by the Federal Emergency Management Agency (FEMA), such as the 100 year floodplain boundaries which appear on FEMA's Flood Insurance Rate Maps and are a source for the floodplain map included in this chapter.

The City of Santa Cruz has worked to improve the flood capacity of the San Lorenzo River levees over the past twenty years. In 2002, FEMA re-designated much of the downtown and beach area from A-11 to the A-99 Flood Zone designation in recognition of the significant flood improvements resulting from the **San Lorenzo River Flood Control and Environmental Restoration Project.** Under the A-99 designation, new buildings and improvements are no longer mandated to meet FEMA flood construction requirements and flood insurance premiums are significantly reduced. The FEMA Community Rating System (CRS) class seven rating for the City of Santa Cruz further reduces the National Flood Insurance Program (NFIP) A-99 flood insurance rates by five percent. At present the combination of the CRS class seven rating and the A-99 designation reduces flood insurance by 45%.

Despite recent flood control projects and improved flood rating in much of the downtown and beach area, the risk of flooding is still a concern to the City. While the levee project has resulted in a more flood-resistant downtown, floods may still occur. The levee project did not impact areas along the San Lorenzo River above the Highway One bridge (including the new Tannery Arts Center and the associated live-work studios) where flooding is still a significant risk and construction requirements must still address the risk of floods.

B. Previous Occurrences

The City of Santa Cruz is located around the floodplain of the San Lorenzo River and has been subject to floods throughout recorded history from the time the Mission was first built in 1793 to the "Christmas Flood" on December 22, 1955. Eighteen floods, eight of which have been considered severe, have occurred over the last 10 decades here in Santa Cruz. As discussed above, the **San Lorenzo River Levee Project** has significantly reduced the risk of flooding in the downtown area. However, the downtown and beach areas are still designated as floodplains.

Historical Record of Severe Floods of Santa Cruz 1862-2006

January 11, 1862: Land consumed and buildings along river banks destroyed. "Bulkhead" at Bulkhead Street was built after this flood to prevent water from reaching Main and Willow Streets (now Front Street and Pacific Avenue).

December 23, 1871: Bridges built after 1862 flood across San Lorenzo damaged.

January 25, 1890: River level highest recorded to this date. A debris dam collected against pilings behind the rail bridge at the mouth of the river. With the failure of the rail bridge, flood levels dropped dramatically. The practice of using pilings to span the river was stopped after this flood.

January 4, 1895: Levels exceeded the Bulkhead and caused basement, yard and lot flooding in the downtown area.

March 27, 1907: This flood had water levels higher than previous floods. Flood control discussion increased**.**

February 27, 1940: Very severe flooding**.**

February 9, 1941: This was the third flood to hit in four years. Flood control becomes a focus.

December 22, 1955: Highest historic flood in the area, filling 410 acres of lowlands outside the river channel including the downtown. Ninety percent of the damage in the county occurred within the City of Santa Cruz and cost the City millions of dollars.

January 4, 1982: The water rose to within two feet of the top of the levees along the San Lorenzo River and flooding occurred both north and south of the freeway along Carbonera and Branciforte Creeks in the Twin Creeks and Brookside Glen developments. This approximately 30-year event also reached the top of the concrete portion of Branciforte Creek at Market Street and overflowed. The older part of the Soquel Avenue bridge, built in 1923 also collapsed.

February 1995 Storms: Santa Cruz was one of 57 counties declared disaster areas due to flooding.

January 1997: Santa Cruz was one of 48 counties declared disaster areas due to severe storms and flooding.

February 1998 El Niño: Santa Cruz was one of a number of counties declared disaster areas due to El Nino.

April 2006: Severe storms and flooding. Santa Cruz was one of several counties to be declared a disaster area. FEMA Disaster 1646*

**06/05 California Severe Storms, Flooding, Landslides, and Mudslides*

B. Probability of Future Events

Significant storms and associated damage from flooding strike the Monterey Bay communities with a frequency of one large storm every three to four years. A 100-year flood has a one percent probability of occurring in any given year and while considered to be a severe flood, it still has a reasonable possibility of regular occurrence. For the purposes of the protection of property, life and safety, floods of other magnitudes and occurrence intervals should also be considered in mitigation efforts.

Floods and flooding are gauged by their size (width and depth of the affected area) and the probability of occurrence. The size and depth of the floodplain area is computed using mathematical models of precipitation, slope, runoff, soil type and cross-section. Flood depths are calculated at intervals along a stream or channel corridor and then mapped and interpolated between sections. This results in the floodplain map.

The probability of occurrence is expressed in a percentage of the chance of a flood of a specific extent occurring in any given year. The most widely adopted design and regulatory standard for floods in the United States is the 1-percent annual chance flood, and this is the standard formally adopted by FEMA. The 1-percent annual flood is also commonly referred to as the "100-year flood," leading to the misconception that it should occur only once every 100 years. In fact, a 100-year flood may occur in any year, regardless of the time that has passed since the last one. It is the probability that smaller floods occur more often than larger floods that compels the percentage.

Table 6-1 Flood probability terms

Flood Occurrence Intervals	Percent Chance of Occurrence Annually
10 years	10.0%
50 years	2.0%
100 years	1.0%
500 years	0.2%

6.3.3 Assessing Flood Vulnerability: Overview

3.3 Assessing Vulnerability: Overview – Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Floods

The City of Santa Cruz has worked for the past twenty years to improve the flood capacity of the San Lorenzo River levees. Work is now complete on the final phase of the Army Corps of Engineers San Lorenzo River Flood Control Project and FEMA has recognized the increased flood protection that the new higher levees provide by granting the A-99 flood zone designation. The downtown and the area along the river are still in a 100-year floodplain. Coastal storms contribute to the risk of flooding in this area.
The river bank north of Highway One Bridge (near the new Tannery Arts site) was not part of the Corps of Engineers Project and this area is subject to flooding as are some low lying areas near creeks and streams. While the most vulnerable areas along the river, particularly the downtown corridor, are now less vulnerable, they are still at risk during a 100-year storm, until the fifth phase of the Corps project is completed. Provided funding is provided by Congress this phase could be completed by 2009.

6.3.4 Assessing Flood Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures – Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Types and Numbers of Existing Buildings, Facilities and Infrastructure

Much of the downtown and beach areas are in the 100 year floodplain. The Emergency Operations Center (EOC) as well as most of the City and County government buildings are in the floodplain. The floodplain includes the following:

- 2,232 Structures (2,270 parcels)
- The Central Fire Station
- The Police Station
- City Hall
- Lifeguard and Marine Safety Headquarters
- The County Government Center
- 41 schools and day care centers

6.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses – Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate .

A. Potential Dollar Losses to Vulnerable Structures

Table 6-2 Flood potential loss inventory

Inventory Assets

FLOOD

Type	**# of Parcels**		**# of Structures**		**Critical Structures**		**Loss in Value$***	
	Total	***Hazard***	*Total*	***Hazard***	*Total*	***Hazard***	*Total*	***Hazard***
Residential	14,819	1,517	20,949	1,692			$2,177,018,720	$281,540,948
Commercial	1,305	566	1,300	415			$512,449,080	$269,380,522
Industrial	123	14	76	1			$70,354,758	$117,884
Religious	50	4	63	5			$23,642,774	$1,323,406
Government	389	149	213	69			$0	$0
Schools/Daycare	47	17	726	41			$12,303,974	$7,621,898
Utilities	7	3	22	9			$0.	$0
Total	**16,740**	**2,270**	**23,349**	**2,232**	**38**	**19**	**$2,795,769,306**	**$559,984,658**
	Community	*Hazard*						
# of People	**54,593**	**9,890**						

DATE: *2006-2007*

Total = total number of structures, residents, values within the entire community

*Loss is based on Assessment Improvement values.

*Government Parcels, Public Schools and most Utilities are not assessed.

B. Methodology Used to Prepare Estimate

Parcel Valuation:

Valuation of parcels within a hazard area are based on improvement values only as collected by appraisers with the County of Santa Cruz County Assessor's Office. They don't reflect sale value or replacement value. If a parcel intersected a hazard, the entire improvement value of that parcel was used.

Population:
Census population blocks were reduced to center points. If a hazard intersected a center point, that population was counted.

Flood Analysis:
Since FEMA flood data is mapped on the federal level, the data is extremely course in horizontal accuracy. The data was not meant to be measured against parcel level information and therefore is a rough estimate of damage and loss.

Estimating flood losses is an established process. If a "100-year" flood occurred in Santa Cruz, meaning the flood that has a 1% chance of occurring in any given year, it would impact approximately 2,230 structures to various degrees. This was determined by intersecting the city's database of structures with the FEMA developed maps of the 100-year floodplain. Santa Cruz structures in the floodplain vary in construction, size and materials, ranging from single family homes to multi-family to commercial. The downtown of the City of Santa Cruz lies almost entirely within the 100 year floodplain. Many structures in this area are multistory.

The primary purpose of the **San Lorenzo Levee Project** was to reduce flood damage and loss within the City of Santa Cruz 100 year floodplain. According to the Federal Emergency Management Agency (FEMA) the December 1955 flood caused over $40 Million in damage. The U.S. Army Corps of Engineers estimated that a 100 year flood in the downtown area in 2002 would cause $86 million in damage.[18]

6.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

A. Description of Land-Uses and Development Trends

As was described previously, the City of Santa Cruz is a compact urban community that is surrounded by natural barriers to outward expansion including the Santa Cruz Mountains, the Pacific Ocean and a designated greenbelt. In Santa Cruz, most development is now infill or reuse development. [19] The beach and downtown commercial areas are in the 100-year floodplain. Increasing residential density and mixed use development continue in the downtown core. The Tannery Arts project including a residential component is located in a floodplain next to the San Lorenzo River above the levee project area.

The City is required by Association of Monterey Bay Area Governments (AMBAG) to zone for its share of housing. Two of the three available properties with the highest density zoning are located in the floodplain.

6.4.0 Mitigation Strategy

4.0 Mitigation Strategy: Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The City of Santa Cruz addresses land use within the flood plain in the General Plan as well as actively enforcing building and zoning codes, and other land use regulations concerning development within the 100-year flood plain. The City of Santa Cruz has worked to improve the flood capacity of the San Lorenzo River levees over the past twenty years. In 2002, FEMA re-designated much of the downtown and beach area from A-11 to the A-99 Flood Zone designation in recognition of the significant flood improvements resulting from the **San Lorenzo River Flood Control and Environmental Restoration Project.**

The City will continue to work with FEMA and the Army Corps of Engineers to minimize impacts of flooding in Santa Cruz. The City will also work to maintain or improve its CRS rating.

6.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The City of Santa Cruz has developed several flood hazard mitigation goals to create a more flood resistant community.

Flood Goals:

Flood 1 - Avoid or reduce the potential for life loss, property and economic damage from flooding.
Flood 2 - Facilitate accurate insurance ratings through participation in CRS
Flood 3 - Promote public awareness of flood hazards, mitigation measures and flood insurance

6.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Flood Mitigation Actions:

The City participates in a number of ongoing mitigation actions to avoid or reduce the threats of flood. These measures are listed under the section Part 4 Mitigation Strategy. Actions include:

- The City participates with other agencies in an early warning system for evacuation of areas susceptible to flooding, tsunami or dam failure (**B-4)**
- Regulations on development and alteration of flood plains, stream channels and protective barriers that accommodate overflow are in place **(B-5)**
- Encouragement of property owners, potential buyers and residents living in flood plains and coastal inundation areas to participate in Federal Flood Insurance Program (FIP) **(B-6)**
- The City has recently adopted the Creeks and Wetlands Management Plan (February 2006) which provides guidelines including measures to reduce creek flooding **(B-7)**
- The City is continually working to rehabilitate the City's culverts and storm drainage system to reduce flooding caused by inadequate storm drainage. (**B-8**)
- Annual flood control maintenance on the San Lorenzo River by the Public Works Department. This work is required by the U.S. Army Corps of Engineers and consists primarily of managing in-stream riparian vegetation to encourage geomorphic form and function. The vegetation management is identified in the San Lorenzo Urban River Plan and requires vegetated buffer zones to be generally maintained at 10-feet at the toe of the levees and 5-feet along the wetted edge of the river. The vegetation management is required in order for winter flows not to exceed the design capacity of the San Lorenzo River and to promote scouring of the river. The maintenance generally takes about four to five weeks each year to complete. **(C-10)**

CHAPTER 7 — DROUGHT

7.3.0 Drought Risk Assessment

7.3.1 Identifying Drought Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the type … of all natural hazards that can affect the jurisdiction.

A drought is defined as "a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area." -Glossary of Meteorology (1959).

In easy to understand terms, a drought is a period of unusually dry weather that persists long enough to cause serious problems such as crop damage and/or water supply shortages.

The City of Santa Cruz relies on surface flows in coastal streams and the San Lorenzo River for most of its annual water supply needs. The yield of these sources in any given year is directly related to the amount of rainfall received and runoff generated during the winter season. Water stored in Loch Lomond Reservoir is used mainly in the summer and fall seasons when the flows in the coast and river sources decline and additional supply is needed to meet dry season demands.

The problem of supply reliability stems primarily from two factors: the wide range in the yield of surface water sources from year to year and limited storage capacity. In normal and wet years when rainfall and runoff are abundant, base flows in the coast and river sources are restored by winter rains, and Loch Lomond Reservoir is typically replenished to full capacity with runoff from the Newell Creek watershed.

The water system, however, is highly vulnerable to shortage in drought years when the San Lorenzo River and coast stream sources run low. In single dry years, the system relies more heavily on water stored in Loch Lomond to satisfy demand, which draws down the reservoir level lower than usual and depletes available storage. In multi-year or critical drought conditions, the combination of very low surface flows in the coast and river sources and depleted storage in Loch Lomond reservoir reduces available supply to a level which cannot support average dry season demands. Compounding the situation is the need to reserve some amount of storage in Loch Lomond in the event drought conditions continue into the following year. The highest priorities of the City during a drought are domestic uses, sanitation, and fire protection.

7.3.2 Profiling Drought Hazard Events

3.2 Profiling Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

A. Location

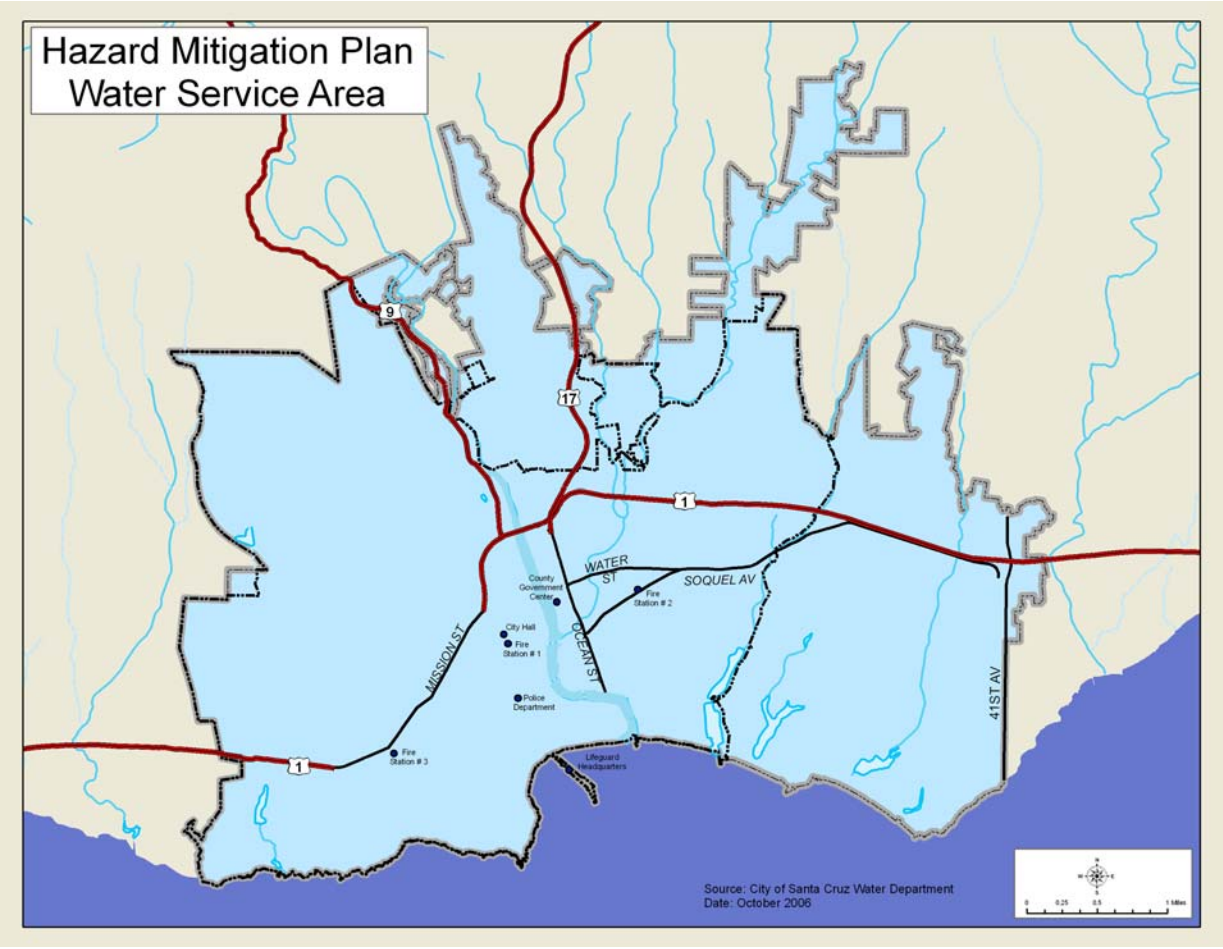


Figure 16 Water Service Area

The Santa Cruz water system includes the entire City as well as outlining areas as far away as parts of Capitola and unincorporated areas of the north coast and the DeLaveaga area. A map of the water system coverage area is included Figure # 17 above.

B. Extent: Magnitude or Severity

There is a significant difference in severity between a single dry year and multiple dry years in Santa Cruz. As can be seen from the history of drought in Santa Cruz in **Figure 18** taken from the ***2005 Urban Water Management Plan*** (UWMP***),***[20] there have been at least five multi year dry periods since 1921.

Single Dry Year: The total water supply estimated to be available to the City in single dry years is 3,800 million gallons (mg) or about 12% less than is available in normal years. **Table 7-1,** taken from the UWMP, shows that there would be a relatively small supply deficit in single dry years under current demand conditions, which will increase as demand increases over time.

Table 7-1 Single Dry Year Supply and Demand Assessment (million gallons)

	2005	2010	2015	2020	2025	2030
Supply Totals	3,800	3,800	3,800	3,800	3,800	3,800
Demand Totals	3,900	3,952	4,154	4,345	n/a	n/a
Difference	(100)	(152)	(354)	(545)	--	--

Multiple Dry Years: In an extreme two-year drought similar to the 1976-77 event, the estimated water supply available to the City in the second year of that event is 2,700 mg or about 37% less on an annual basis than is available in normal water years. **Figure 17** shows that there would be a severe water supply shortage under current demand conditions, which will grow worse as demand increases over time. The shortfall is also expressed in **Table 7-2** as the percent of supply available to meet demand during the peak season between April and October, since this is the period of year that would be most affected by a supply shortage. Under such conditions, the water system is barely able to meet half of normal requirements of the water service area.

Table 7-2 Multiple Dry Year Supply and Demand Assessment (million gallons)

	2005	2010	2015	2020	2025	2030
Supply Totals	2,700	2,700	2,700	2,700	2,700	
Demand Totals	3,900	3,952	4,154	4,345	n/a	n/a
Difference	(1,200)	(1,252)	(1,454)	(1,645)	--	--
Peak Season Deficit	46%	47%	52%	56%		

C. Previous Occurrences

The City uses a water year classification system as an index of water supply conditions for operations studies, to forecast river flows, and to communicate its water supply status to the public. The system is based on total annual runoff in the San Lorenzo River. Under this classification system, the water year (October 1- September 30) is designated as one of four types: wet, normal, dry, or critically dry, depending on the total annual river discharge **(Figure 17)**

Figure 17 shows the total annual runoff for the San Lorenzo River over the 84 year period from 1921 to 2005 and the classification for each water year[21]. The graph illustrates the dramatic variation in discharge from year to year. Average runoff during this period is about 93,000 acre-feet or 30 billion gallons[22]. The least amount of runoff, 9,500 acre feet, occurred in the drought of 1977. The maximum recorded discharge was over 280,000 acre-feet in 1983, one of the wettest years on record in California.

Over this relatively brief hydrologic record, about two-thirds of all years are classified as wet or normal and the other one-third is classified as dry or critically dry. Since 1995, water conditions have been mostly normal or wet, with only one year out of the last eleven classified as dry and none classified as critically dry. No shortage of water has been experienced over this period.

D. Probability of Future Events

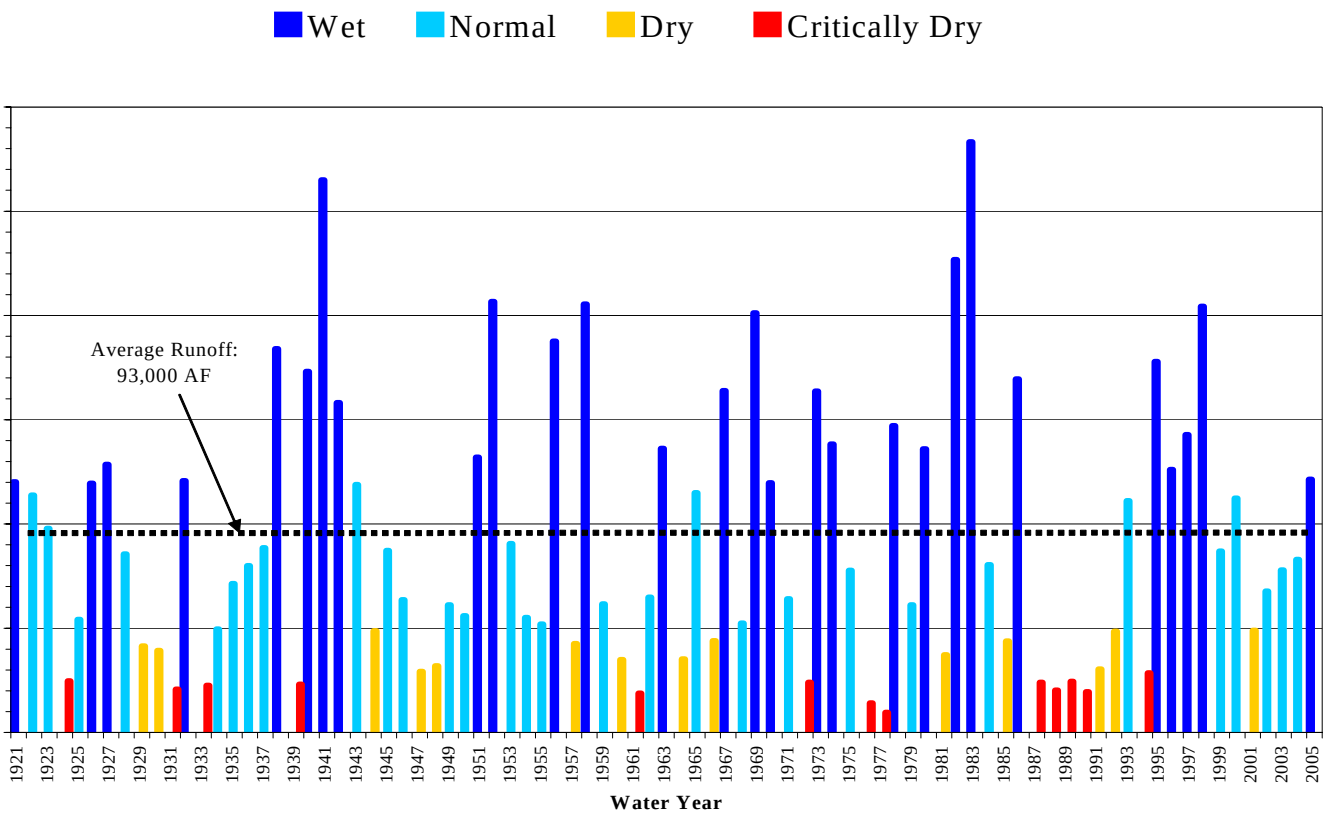


Figure 17 Total Annual Runoff in the San Lorenzo River (acre feet)

One approach to evaluating probability of future events focuses on the magnitude of the worst-case drought, because it is the degree of shortfall that determines what actions the community would have to take and the resulting hardships the public would face.

It should also take into account, though, the chance of that event occurring before a solution is achieved. The amount of time that elapses before new supply can be developed is an important consideration because it also has a bearing on the degree of risk faced by city water customers; the longer the delay, the greater the risk. As with the threat of other natural hazards like a flood or an earthquake, the probability of a severe drought in any one year may be comfortably low. For instance, the drought on record of 1977 has a recurrence interval of 1 in 59 years. This means the probability of such an event is 1/59 or 0.017, which is the same as a 1.7% chance of occurrence in any one year. But the percent probability of occurrence, or chance, of a shortage occurring over a longer time frame is considerably higher, which changes the perception of

the significance of risk. The following table presents the chance of various shortfalls occurring within the existing City water system over a specified period of time:

Table 7-3 Relationship of Water Shortages with Various Recurrence Intervals to Probability of Occurrence over Time

Shortage Magnitude	Recurrence Interval	Percent Probability of Occurrence over:			
		5 years	10 years	20 years	30 years
10% or more	7 in 59	47	72	92	98
20% or more	4 in 59	30	51	76	88
30% or more	1 in 59	8	16	29	40

To address the estimated shortages, construction of a desalination plant has been recommended. If the recommended desalination plant could be built in the next five years, the odds are about even of experiencing a moderate water shortage over this time and there is only an 8 percent chance of experiencing a critical drought like the 1977 event between now and then. On the other hand, if the project were delayed or rejected, and the earliest another project realistically could be commissioned was twenty years out, the chance of experiencing a moderate shortage over this time rises to over 90 percent and nearly 30 percent for a critical drought, which exposes the community to a much greater risk. [23]

7.3.3 Assessing Vulnerability: Overview

3.3 Assessing Vulnerability: Overview – Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Drought

The City water supply is a closed, self-reliant system. The City does not have access to outside sources should local supply be inadequate to meet demands during dry years. As a closed, isolated system, the City is highly vulnerable to shortage in drought years when the San Lorenzo River and coast sources run low. In single dry years, the system relies more heavily on water stored in Loch Lomond to satisfy demand, which draws down the reservoir level lower than usual and depletes available stored reserves. In multi-year or critical drought conditions, the combination of very low surface flows in the coast and river sources and depleted storage in Loch Lomond reservoir reduces available supply to a level which cannot support average dry season demands.

If water shortages as a result of drought do occur, rationing would go into effect. Conservation programs, curtailment programs, and plans to increase water supply are all components that will decrease the vulnerability of the community to drought.

7.3.4 Assessing Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures – Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

A. Types and Numbers of Existing Buildings, Facilities and Infrastructure

Structures and facilities are not vulnerable to drought. Physical losses would probably be limited to public and private landscaping. However, the impacts to the landscaping which occur as the result of severe drought conditions also increase the risk of wildfire and subsequent damage to structures as a result.

7.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses – Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

A. Potential Dollar Losses to Vulnerable Structures

While structures are not at risk, significant losses may occur as a result of severe rationing during a water shortage. One of the City's major industries is tourism. The vulnerability to drought (or more specifically water shortages as a result of drought) reaches its peak during the summer tourism season. Restaurants, hotels, amusement parks and other tourist serving businesses would all be at risk of closing or severe restrictions during a critical drought. This is critical to funding ongoing City services because of the City's reliance on the Transient Occupancy Tax (TOT). Other industries such as agriculture, food processing, contractors, landscapers, nurseries, golf courses, public landscaping and school grounds would all experience losses, and other water dependent businesses would suffer economic damages. These economic losses have not been calculated.

B. Methodology Used to Prepare Estimate

While potential economic losses have been considered they have not been calculated; therefore, there is no loss estimate.

7.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

A. Description of Land-Uses & Development Trends

Santa Cruz is a compact urban City surrounded by mountains, greenbelt and the Pacific Ocean. The size of the water service area is fixed. It has remained constant over time due to a policy prohibiting water main extensions to un-served areas, and the acquisition of open space lands which creates a greenbelt around the City that serves to inhibit urban sprawl. Accordingly, any growth and redevelopment that does happen going forward is expected to be concentrated within the confines of the existing service area boundary.

Within the City of Santa Cruz, only a small amount of land remains undeveloped. Because of the relative scarcity of raw land, the majority of future growth in the area is likely to be achieved through redevelopment, remodeling, infill, and increased density on underutilized land, along with new construction on the little amount of vacant land remaining. In other words, the service area has been fixed (not growing outward.)[24]

The housing element has recently been updated to address the required regional fair share housing needs established by AMBAG. These documents set forth goals and objectives for housing production, rehabilitation, and conservation for the period 2000-2007. The plans identify generally where sites are available for housing to be built and describe programs to facilitate new housing opportunities, but this does not necessarily mean such housing actually will be constructed. AMBAG originally allocated Santa Cruz a housing production goal of 2,850 new housing units for the 2000-2007 period although the City requested a lower production goal of 2,167 units, some of which are already under construction. [25]

The City of Santa Cruz Water system currently serves approximately 90,000 people and is anticipated to grow to 100,000 by 2030. (This number does not include additional University growth.)[26]

The University of California at Santa Cruz has included significant growth numbers in its Long Range Development Plan (LRDP). The impacts of the growth at the University on the City and its water supply are currently a topic of discussion between the City and the University. No decisions or agreements have been reached at this date.

7.4.0 Mitigation Strategy

4.0 Mitigation Strategy: Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The 2005 Urban Water Management Plan and the Integrated Water Plan have been adopted to overcome drought impacts.

7.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The goals of the City of Santa Cruz 2005 Urban Water Management Plan and the Integrated Water Plan (IWP) include:

Drought Goals:

Drought –1 Reduce near-term drought shortages
Drought –2 Provide a reliable supply that meets long-term needs while insuring protection of public health and safety

7.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Drought Mitigation Actions:

- Water conservation to maximize the use of existing water resources. **(A-11)**
- Curtailment of water use of up to 15% in times of drought. (**A-11)**
- Additional water supply in the form of a 2.5 million gallon (mgd) per day seawater desalination facility that would be expandable in 1.0 mgd increments up to 4.5 mgd, if needed in future years. (**A-12)**

Water Conservation Both the state water law and the City's General Plan call for a strong emphasis on water conservation and elimination of water waste to stretch existing sources, minimize the need for new water sources, and protect the environment.
The Integrated Water Plan[27] (IWP) calls for continuing to implement a broad set of conservation programs which result in long-term water savings of nearly 300 million gallons per year. These programs address all fourteen best management practices for urban water conservation in California

Use Curtailment In the process of developing the IWP the City made a recommendation to not meet full demand in drought years when surface supplies fall short. Instead the IWP calls for supplying 85% of normal demand in critical drought years like 1976-77 and for corresponding reduction in peak season water use of up to 15 percent. This cutback would be achieved through temporary watering restrictions or rationing that targets landscape irrigation and other outdoor uses.

Additional Water Supply The IWP identified seawater desalination as the only feasible alternative for a backup supply of drinking water in times of drought. Several possible options were carefully evaluated, including drilling more wells, upgrades to the north coast water system and treatment facilities, and a water transfer involving exchange of groundwater with recycled wastewater for agricultural use on state park lands north of town. Both the wells and groundwater exchange concept ultimately proved to be infeasible, however, leaving seawater desalination as the only real solution available to the City.

The project concept adopted by City Council involves constructing a seawater intake system using an existing abandoned wastewater outfall, building a new desalination plant with an initial capacity of 2.5 mgd, installing the associated pipelines and pumping stations for delivering treated water to the Bay Street Reservoir, and conveying seawater concentrate to the City's wastewater facilities where it would be blended with municipal wastewater flows and disposed via the deep ocean outfall. The purpose of this initial phase of desalination capacity is for drought protection. Accordingly, the desalination plant would only be used by the City intermittently during the dry seasons of dry and critically dry years when existing supplies fall short.

B. Actions and Projects to Reduce the Effects of Hazards on New Buildings

Drought does not present a direct hazard to buildings.

C. Actions & Projects to Reduce Effects of Hazards on Existing Buildings

Drought does not present a direct hazard to buildings.

Proper maintenance and weed abatement including removal of dead landscape vegetation adjacent to buildings will reduce the threat of structure fire during dry years.

7.4.3 Implementation of Mitigation Actions

4.3 Implementation of Mitigation Actions – Requirement §201.6(c)(3)(iii): The mitigation strategy section **shall** include an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their assorted costs.

A. Discussion of Process and Criteria Used to Prioritize Mitigation Actions

The Water Conservation Plan involved analyzing water use, identifying and screening new conservation measures, and formulating programs to meet these objectives. The various programs were evaluated against the following criteria:

a. Water savings
b. Costs
c. Implementation feasibility
d. Public acceptability
e. Drought management impacts

B. Implementation and Administration of Mitigation Actions

The *Water Conservation Plan* is in progress. The City is half way to its 2010 goal of 282 million gallons saved. The *Use Curtailment* component has been implemented and becomes effective during a drought. Ordinance No 92-10 can be found in Appendix L and goes into effect when a water shortage is declared by the City Council. The City is currently undertaking a comprehensive review of its Water Shortage Contingency Plan.

The Increased Supply through Desalination Plant is in the initial phase. The first step will be to implement a pilot program followed by design, permitting and construction.

C. Emphasis on the Use of Cost-Benefit Review

The City did not use a formal cost benefit analysis. Costs were carefully considered when determining goals and objectives but there was not an emphasis on cost benefit review to maximize benefits.

CHAPTER 8 — TSUNAMI

8.3.0 Tsunami Risk Assessment

8.3.1 Identifying Tsunami Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the type of all natural hazards that can affect the jurisdiction.

A ***tsunami*** is a series of waves generated by an impulsive disturbance in the ocean or in a small, connected body of water. Tsunamis are produced when movement occurs on faults in the ocean floor, usually during very large earthquakes. Sudden vertical movement of the ocean floor by fault movement displaces the overlying water column, creating a wave that travels outward from the earthquake source. An earthquake anywhere in the Pacific can cause tsunamis around the entire Pacific basin. Since the Pacific Rim is highly seismically active, tsunamis are not uncommon. There has been minimal damage and loss of life in Santa Cruz during recorded history. However, even though the potential for a significant tsunami may be low or possibly uncertain, the potential outcome of such a tsunami could be significant damage and loss of life.

8.3.2 Profiling Tsunami Hazard Events

3.2 Profiling Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

A. Location

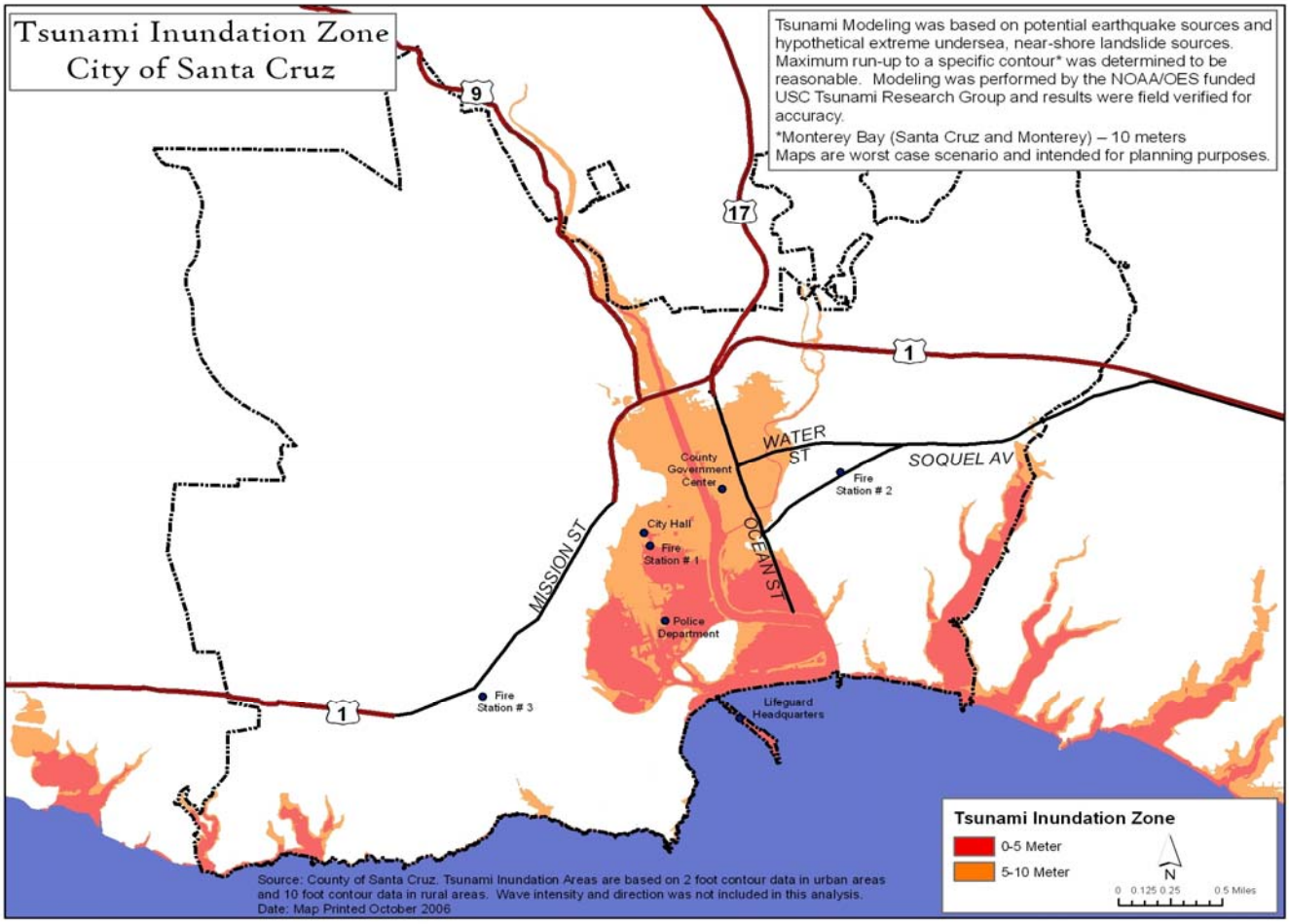


Figure 18 Tsunami Inundation Area –worst case scenario for planning purposes only

The City of Santa Cruz is located on the Monterey Bay. Several active and potentially active earthquake faults are located within or near Santa Cruz. Even a moderate earthquake occurring in or near any of the near by faults could result in local source tsunamis from submarine landsliding in Monterey Bay. Additionally, distinct source tsunamis from the Cascadia Subduction Zone to the north, or Teletsunamis from elsewhere in the Pacific Ocean are also capable of causing significant destruction in Santa Cruz.

B. Extent: Magnitude or Severity

A local source tsunami generated by an earthquake on any of the faults affecting Santa Cruz could arrive just minutes after the initial shock. The lack of warning time from such a nearby event would result in higher causalities than if it were a distant tsunami where the Tsunami Warning System for the Pacific Ocean could warn threatened coastal areas in time for evacuation. Past experience has not resulted in extensive damage from tsunami, but proximity to faults does create the possibility as a result of future quakes.

C. Previous Occurrences

On April 1, 1946 a magnitude 7.8 earthquake in the Aleutians produced a 115-foot wave which destroyed the Scotch Cap lighthouse killing five Coast Guardsmen. It was 56 feet high in Hawaii killing 173 people. The wave was observed all along the west coast. In Santa Cruz, a man drowned and minor damage was done by 10-foot waves.[28] It should be noted that scientific observations place the 1946 Tsunami run up at 1.5 meters. It should be noted that there are significant differences during a tsunami between maximum wave height and the maximum elevation reached by tsunami run-up, which is a function of the offshore bathymetry and coastal topography.

In the aftermath of the 1989 Loma Prieta Earthquake several docks in the Harbor became stuck to the piers and had to be lifted manually, or were broken implying that the water level fell below the usual low tide level. Several boats were lying on the harbor floor implying a permanent change in the water level. A small tidal wave was observed rushing out of the harbor following the earthquake that continued for 15-20 minutes. The sudden water level adjustment was probably due to a vertical uplift of 4-8 inches over a ten second interval.

California is at risk from both local and distant source tsunamis. Eighty-two possible or confirmed tsunamis have been observed or recorded in California during historic times. Most of these events were small and only detected by tide gages. Eleven were large enough to cause damage and four events resulted in deaths. Two tsunami events caused major damage.[29]

Table 8-1 Locally Generated Tsunami Source

Source Zone	Major Offshore Faults	Major Submarine Canyons	Earthquake Magnitude and Year	Historical Tsunami Run-up and Year
San Francisco to Monterey	San Gregorio Fault(s)	Pioneer, Ascension, Monterey	M=7.1 (1989)	0.3-m (1989)

D. Probability of Future Events

Tsunami Hazard

Historically, this portion of the California coast has not been subject to significant tsunami hazard although more than 20 tsunamis of different heights have been observed or recorded in the past two centuries. Given the intense coastal land use and recreational activities along the coast, even a small hazard may pose high risk[30]. **Appendix J** lists tsunami heights recorded around Monterey Bay as a result of the three major earthquakes around the Pacific Ocean in the last 50 years. Maximum tsunami wave heights reached nine feet (2.7 meters) at Monterey harbor due to the 1964 Alaskan earthquake.

The US Army Corps of Engineers has looked at potential earthquake sources around the Pacific and modeled expected tsunami impacts on the coast of the Monterey Bay (US Army Corps of Engineers, 1975). Their study estimated that a tsunami wave with a probability of occurrence of one every 100 years would be about 5.9 feet high. A tsunami with a probability of occurrence of one every 500 years is expected to be 11.5 feet high.

More recently, studies have been undertaken by Richard K. Eisner, Jose C. Borrero and Costas E. Synolakis through the Governor's office of Emergency Services and the Department of Civil Engineering at the University of Southern California, Los Angeles. In **Inundation Maps for the State of California** the authors clarify that the results are based on worst case scenario events and the maps are only to be used for emergency preparedness and evacuation planning. Pre-1994 inundation computations underestimated the inundation height. Newer inundation models have now proven capable of modeling extreme events accurately. These new inundation models (known as **MOST**) permit quantitative evaluation of the inundation from nearfield tsunamis, provided accurate regional tectonic models exist and accurate high resolution bathymetry. Even using state of the art inundation prediction tools, California presents unique challenges in assessing tsunami hazards.

- One, there is an extremely short historic record of tsunamis in the state. In California there are no known records before the 19th century.
- Two, most of the geologic work in the state has concentrated on identifying the risks associated with onshore faults and there is scant available information on offshore faults or landslide and slump scars suggestive of past submarine mass failures.
- Three, earlier estimates of tsunami hazards relied almost entirely on farfield sources and used pre-1980's technology, creating the impression among planners and the public that the tsunami hazard was small.
- Four, nearshore seismic events may trigger tsunamis arriving within less than 20 minutes from peroration, allowing little time for evacuation. [31]

The perception in California is that tsunamis are extreme events, and that there is very little we can do to mitigate the hazards," said Costas Synolakis, director of the Tsunami Research Center at the University of Southern California. "In reality, until recently we have not been able to model tsunamis adequately. It was a hazard that was ignored."

Synolakis and Borrero first proposed mapping California's tsunami zones in 1995. It's a complex undertaking that goes far beyond drawing a line on a map. In any given place, the height of the wave depends on the contours of the ocean bottom."

Ultimately, Synolakis said, California needs hazard maps that reflect the probability of flooding from tsunamis set off by specific earthquakes, not just a general worst-case scenario.[32]

8.3.3 Assessing Tsunami Vulnerability: Overview

3.3 Assessing Vulnerability: Overview – Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Tsunami

There are two primary types of tsunami vulnerability in Santa Cruz. The first is a distant source tsunami from elsewhere in the Pacific Ocean. This type of tsunami is capable of causing significant destruction in Santa Cruz. However, this type of tsunami would usually allow time for the Tsunami Warning System for the Pacific Ocean to warn threatened coastal areas in time for evacuation.

The more vulnerable risk to the City of Santa Cruz is a tsunami generated as the result of an earthquake along one of the many earthquake faults in the region. Even a moderate earthquake occurring in or near the areas mentioned above could result in local source tsunamis from submarine landsliding in Monterey Bay. A local source tsunami generated by an earthquake on any of the faults affecting Santa Cruz would arrive just minutes after the initial shock. The lack of warning time from such a nearby event would result in higher causalities than if it were a distant tsunami.

8.3.4 Assessing Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures –
Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

A. Types and Numbers of Existing Buildings, Facilities and Infrastructure

Much of the downtown and the beach areas including the core commercial centers are in the mapped tsunami inundation zone. The Emergency Operations Center as well as most of the City and County government buildings and the Lifeguard and Marine Safety Headquarters on the Municipal Wharf are located in the inundation threat zone. The tsunami inundation threat zone includes the following:

- 3,191 Structures
- The Central Fire Station
- The Police Station (including Emergency Operations Center)
- City Hall
- Lifeguard and Marine Safety Headquarters
- The County Government Center
- 29 Schools and day care centers

8.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses –
Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

A. Potential Dollar Losses to Vulnerable Structures

Table 8- 2 Tsunami potential loss inventory

Inventory Assets

TSUNAMI (10Meter Run Up)

Type	# of Parcels		# of Structures		Critical Structures		Loss in Value$*	
	Total	Hazard	Total	Hazard	Total	Hazard	Total	Hazard
Residential	14819	2,226	20,949	2,456			$2,177,018,720	$365,111,365
Commercial	1305	729	1,300	578			$512,449,080	$318,137,897
Industrial	123	20	76	4			$70,354,758	$1,127,315
Religious	50	8	63	7			$23,642,774	$12,302,265
Government	389	174	213	109			$0	$0
Schools/Daycare	47	17	726	29			$12,303,974	$7,621,898
Utilities	7	4	22	8			$0	$0
Total	**16740**	3,178	23,349	3,191	38	22	$2,795,769,306	$704,300,740
	Community	Hazard						
# of People	54,593	11,750						

DATE: 2006-2007
Total = total number of structures, residents, values within the entire community
Hazard= number of structures, residents, values that are located within the defined hazard area

*Government Parcels, Public Schools and most Utilities are not assessed.

B. Methodology Used to Prepare Estimate

Parcel Valuation:

Valuation of parcels within a hazard area is based on improvement values only as collected by appraisers with the County of Santa Cruz assessor's office. They don't reflect sale value or replacement value. If a parcel intersected a hazard the entire improvement value of that parcel was used.

Population:

Census population blocks were reduced to center points. If a hazard intersected a center point, that population was counted.

Flood Analysis:

Tsunamis create many risks similar to flood and the Tsunami and Flood risk areas are almost identical. Since FEMA flood data is mapped on the federal level, the data is extremely coarse in horizontal accuracy. The data was not meant to be measured against parcel level information and therefore is a rough estimate of damage and loss in a worst case scenario.

8.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

A. Description of Land-Uses and Development Trends

As was described previously, the City of Santa Cruz is a compact urban community that is surrounded by natural barriers to outward expansion including the Santa Cruz Mountains, the Pacific Ocean and a designated greenbelt. In Santa Cruz, most development is now infill or reuse development. [33] The beach and downtown commercial areas are in the 100-year floodplain which is similar to the tsunami inundation area. Increasing residential density and mixed use development continue in the downtown core.

The City is required by Associated Monterey Bay Area Governments (AMBAG) to zone to allow for its share of housing. Some of the potential housing properties identified with the highest density zoning are located in the tsunami inundation area.

8.4.0 Mitigation Strategy

4.0 Mitigation Strategy – Requirements §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

Mitigation strategy includes continuation of an up to date Emergency Management Plan, an effective public information program and continuing collaborative efforts

with the County, other Cities, agencies and community organizations to facilitate collaborative efforts in providing up-to-date tsunami mapping, preparation, information, warning dissemination and education.

Mapping of Tsunami inundation areas in Santa Cruz including the map used in this plan is inadequate. This map should be viewed as an estimate of a worst case scenario for planning purposes only. More accurate mapping of potential tsunami outcomes based on simulations of specific geologic events has been identified as an important component in preparing updates to this Hazard Mitigation Plan.

8.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirements §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Tsunami Goals:

Tsunami 1 - Avoid or reduce the potential for life loss, injury, property and economic damage to Santa Cruz from Tsunami events.

Tsunami 2 - Continue to enhance Emergency Management systems including a defined public information process that includes an early warning system for evacuation prior to a tsunami event.

8.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Tsunami Mitigation Actions:

- Coordination with other agencies including Santa Cruz County **(A-2)**
- Management of the early warning system. **(B-4)**
- Tsunami and Floodplain development regulations (**B-5)**
- Encouraging participation in Federal Flood Insurance Program **(B-6)**

CHAPTER 9 — COASTAL EROSION

9.3.0 Coastal Erosion Risk Assessment

9.3.1 Identifying Coastal Erosion Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the type of all natural hazards that can affect the jurisdiction.

Coastal erosion is the wearing away of coastal land. It is commonly used to describe the horizontal retreat of the shoreline along the ocean. Erosion is considered a function of larger processes of shoreline change, which include erosion and accretion. Erosion results when more sediment is lost along a particular shoreline than is re-deposited by the water body. Accretion results when more sediment is deposited along a particular shoreline than is lost. When these two processes are balanced, the shoreline is said to be stable. Erosion is measured as a rate, with respect to either a linear retreat (feet of shoreline recession per year) or volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year.) [34]

Erosion rates are not uniform, and vary over time at any single location. Annual variations are the result of seasonal changes in wave action and water levels. Erosion is caused by coastal storms and flood events, changes in the geometry of tidal inlets and bays and man-made structures and human activities such as shore protection structures and dredging.

Coastal erosion includes both cliff or bluff erosion and beach erosion, and is a result of both winter wave attack as well as a slowly rising sea level. Local residents will notice that beaches change seasonally in response to changes in wave conditions. Winter storm waves are larger, steeper and contain more energy, and typically move significant amounts of sand from the beaches to offshore bars, creating steep, narrow beaches. In the summer, lower, less energetic waves return the sand, widening beaches and creating gentle slopes. During the winter months when beaches are narrow, or absent altogether, the storm waves attack the cliffs and bluffs more frequently. There are so many factors involved in coastal erosion, including human activity, sea-level rise, seasonal fluctuations and climate change, that sand movement will not be consistent year after year in the same location.

Wind, waves, and the long-shore currents are the driving forces behind coastal erosion. The removal and deposition of sand creates long-term changes to beach shape and structure. Sand may be transported to land-side dunes, deep ocean trenches, other beaches and deep ocean bottoms.

9.3.2 Profiling Coastal Erosion Hazard Events

3.2 Profiling Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

A: Location:

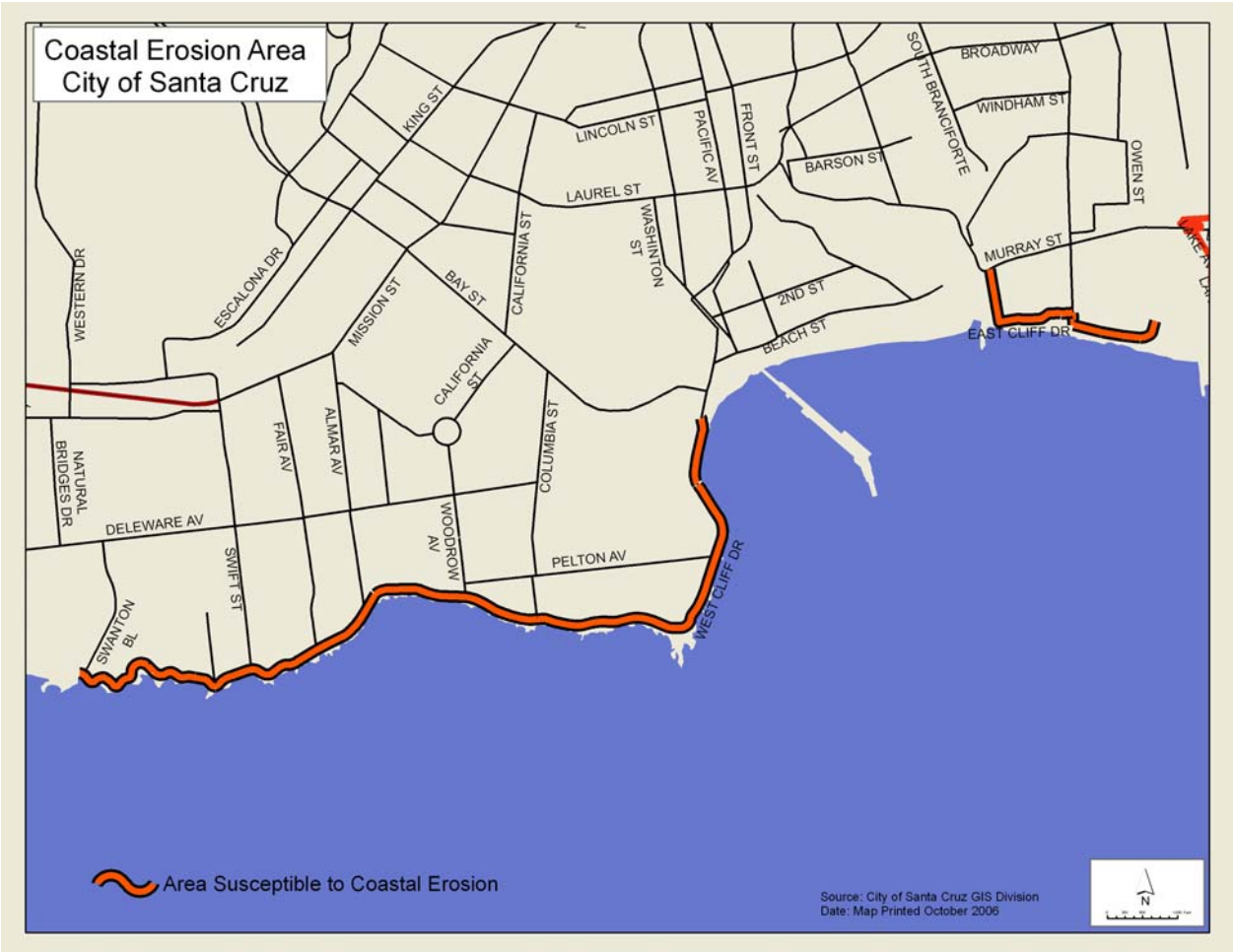


Figure 19 Areas Susceptible to Coastal Erosion

The City of Santa Cruz is bounded on one side by the Pacific Ocean. The entire coastal edge of the City is affected by coastal erosion. West Cliff Drive from Cowell Beach to Natural Bridges State Park is at the highest risk of and continues to be shaped and impacted by coastal erosion.

B. . Extent: Magnitude or Severity

Most of the significant cliff, bluff or dune erosion occurs during the winter months at times of very high tides and large storm waves. All of the cliffs along the ocean in the City of Santa Cruz and some along the San Lorenzo River experience some degree of coastal erosion. Some portions of the roadway and bike path along West Cliff Drive are at risk of being lost. The lighthouse Museum (and its supporting structures) on West Cliff Drive is also at risk due to coastal erosion.

C. Previous Occurrences

Approximately 85 percent of the California coast is actively eroding due to complex oceanographic and geologic conditions, and to human activities that affect the delivery and movement of sand along the coast.[35] Within the City of Santa Cruz, the most threatened area is West Cliff Drive where beaches are narrow or non-existent so that waves attack the bluffs and cliff directly during winter high tides.[36]

During the severe El Niño winters of 1983 and 1997-98, sea levels were further elevated and storm damage along the West Cliff Drive area was extensive. Wave attack combined with a global rise in sea level over the past 18,000 years has led to the continued migration of the shoreline. At the end of the last Ice Age about 18,000 years ago, the coastline at Santa Cruz was about 10 miles offshore. As the ice sheets and glaciers melted, sea level gradually rose and continues to rise today.

Rising sea levels and winter wave attack have led to the retreat of the Santa Cruz coastline; this process will continue into the future. Over the past several decades it has been discovered that coastal wave climate and storm frequency are related to larger scale climatic oscillations that affect the entire Pacific Ocean. During the time period from about 1945 to 1978, the California coast was characterized by a fairly calm climate, few large storms, less rainfall and less coastal erosion and storm damage. Beginning in 1978 and continuing until 1998, California experienced a period of more frequent and severe El Niño events with associated elevated sea levels, large waves, heavier rainfall and more extensive coastal storm damage and cliff and beach erosion.

D. Probability of Future Events

While the sea level rose a little less than a foot over the past century, most scientists are concerned that due to the increase in greenhouse gases from human activity, warming will accelerate. As a result, glaciers will continue to retreat and the rate of sea level rise will increase, with the best estimate being about 3 feet higher by 2100. Given these estimates, the probability of future coastal erosion is very high.

9.3.3 Assessing Coastal Erosion Vulnerability: Overview

3.3 Assessing Vulnerability: Overview – Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Coastal Erosion

Much of the West Cliff Drive coastline has been progressively armored with rip rap over the past 40 years. In 1990 the California Department of Boating and Waterways granted the City approximately four million dollars for coastal armoring. During the 1980s and 1990s the Highway Administration gave the City approximately five million dollars to repair coastal erosion as a part of declared disasters within the City. The impact of wave attack has been slowed in some areas, although large winter waves can still overtop the cliff and threaten the pathway and parking areas. The Woodrow Drive area is one good example of wave overtopping because it is at a lower elevation. Lighthouse Point is another site where some protection exists but continued wave attack has created several large caves that extend under the pathway and are getting closer to the Lighthouse. Ongoing coastal erosion is a significant problem along West Cliff Drive and this will continue as the sea levels continue to rise.

9.3.4 Assessing Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures – Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

A. Types and Numbers of Existing Buildings, Facilities and Infrastructure
Although there are only a few houses, two hotels and one City museum along the ocean cliff frontage, the City is attempting to preserve a significant amount of infrastructure including roadways, bike paths, parks and storm drains which is continually threatened by coastal erosion. Additionally, the Santa Cruz Harbor, beach frontage, and cliff frontage near the mouth of the San Lorenzo River are also threatened by varying degrees of erosion.

9.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses – Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate .

A. Potential Dollar Losses to Vulnerable Structures

Table 9-1 Coastal erosion potential loss inventory

COASTAL EROSION

Type	# of Parcels		# of Structures		Critical Structures		Loss in Value$*	
	Total	Hazard	Total	Hazard	Total	Hazard	Total	Hazard
Residential	14,819	133	20,949	168			$2,177,018,720	$26,704,222
Commercial	1,305	2	1,300	2			512,449,080	382,182
Industrial	123	0	76	0			70,354,758	0
Religious	50	0	63	0			23,642,774	0
Government	389	31	213	3			0	0
Schools/Daycare	47	0	726	0			12,303,974	0
Utilities	7	0	22	0			0	0
Total							**$2,795,769,306**	**$27,086,404**
# of People	**16,740**	**166**	**23,349**	**173**	**38**	**0**		

DATE: 2006-2007
Total = total number of structures, residents, values within the entire community
Hazard= number of structures, residents, values that are located within the defined hazard area

*Government Parcels, Public Schools and most Utilities are not assessed.

B. Methodology Used to Prepare Estimate
Assessor's valuations were used. In addition, for the Coast Hotel, the most recent sales price of $20 million (2006) was used. Potential dollar losses also include replacement of roads, paths and lighthouse including property acquisition.

9.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan should describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

A. Description of Land-Uses & Development Trends

Every coastal community in California is dealing with the issues of sea level rise and shoreline retreat. The armoring of the shoreline is becoming an increasingly controversial and contentious issue. Coastal erosion poses many problems to coastal communities in that valuable property is frequently lost to this dynamic beach-ocean system. Additionally, human activity may promulgate the process of coastal erosion through poor land use methods. Thus, issues of beach restoration and erosion control are at the forefront in coastal communities. Santa Cruz's shoreline is now part of the Monterey Bay Marine Sanctuary which will also influence development trends along the Santa Cruz coast. Protecting the natural resources of the area as well as preserving the infrastructure that is already in place, such as the lighthouse and bike path, are the primary land use objectives.

9.4.0 Mitigation Strategy

4.0 Mitigation Strategy – Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

9.4.1 Local Hazard Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Coastal Erosion Goals:

Coastal Erosion 1- Avoid or reduce the potential for life loss, injury, property and economic damage to Santa Cruz from coastal erosion.
Coastal Erosion 2- Protect and preserve natural resources.
Coastal Erosion 3- Protect and preserve current infrastructure.

9.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Coastal Erosion Mitigation Actions

- Protect and preserve coastline through permit review (**B-2)**
- Protect and preserve coastline and infrastructure through restoration efforts **(B-3)**

Minimizing Hazards from Coastal Erosion

Much of the West Cliff coastline has boulder riprap to protect the cliff. Other options include seawalls and jetties to minimize the energetic wave impacts that drive cliff erosion. Because these structures have finite life spans and often have adverse effects on other parts of the coast, engineering solutions can be very expensive in both the short- and long-term. In other cases, the solution is to leave the coastline relatively undeveloped and to allow erosion to occur naturally. This option allows for greater public access to the coastline. It also preserves the normal input of sand into the drift system, perhaps lessening erosion at neighboring beaches.

The three primary management strategies that may be used to plan for, and respond to, coastal erosion are hazard avoidance, relocation, and coastal protection. The maximum potential efficacy and acceptability of these strategies can best be determined with multi-disciplinary project planning, design, monitoring and evaluation.

Hazard Avoidance – A Commonsense Approach

The most logical method for preventing potential damage to new development in the coastal zone is to not build where coastal erosion will impact such development. This concept, known as hazard avoidance, could circumvent many subsequent permitting and legal challenges. Hazard avoidance has proven effective when used in a number of ways including designing public infrastructure to discourage development in high geologic hazard areas along the coast. Santa Cruz already has a developed coastline including significant City owned infrastructure along the cliffs including roadways, bike paths, parks and park facilities.

Relocation – Moving Development Out of Harm's Way

In some instances development is sited in unstable, erosion-prone areas that may be damaged or destroyed by natural processes acting on the coast. Relocating existing public or private development away from the erosion-prone area may be the most effective long-term option when responding to the eventual or imminent threat of dam-

age. While relocating coastal development away from hazardous areas would be the most direct way to eliminate the risk of damage and the need for coastal protection, this response may not be technically feasible. Another approach to consider under certain circumstances is the concept of “managed retreat,” that is the gradual removal or abandonment of development from areas of high geologic hazard. In the context of coastal management, the concept of managed retreat acknowledges the natural erosive processes at work along the coast.

Coastal Protection

In situations where hazard avoidance and relocation are not viable options, coastal protection strategies can be used to reduce the potential for beach loss and coastal erosion. There are two general types of coastal protection, hard and soft. A “hard” protection device utilizes concrete or rock in a variety of configurations to absorb or dissipate storm wave energy, generally in the form of seawalls, revetments or bulkheads. "Soft" protection primarily involves dune or beach restoration or enhancement to reduce the chances of storm waves from reaching the backshore. A hard protection device differs substantially from most soft erosion response alternatives in that it does not add sand to the system of sediment.

CHAPTER 10 — DAM FAILURE

10.3.0 Dam Failure Risk Assessment

10.3.1 Identifying Dam Failure Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the type of all natural hazards that can affect the jurisdiction.

Dam failure can occur as a result of earthquakes, seiches, structural instability, or intense rain in excess of design capacity. Timber, rock, concrete, earth, steel or a combination of these materials may be used to build the dam. Dams must have spillway systems to safely convey normal stream and flood flows over, around, or through the dam. Spillways are commonly constructed of non-erosive materials such as concrete. Dams also have a drain or other water-withdrawal facility to control the reservoir level and to lower or drain the reservoir for normal maintenance and emergency purposes.

10.3.2 Profiling Dam Failure Hazard Events

3.2 Profiling Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

A. Location

The City of Santa Cruz owns and operates two dams, Newell Creek Dam (NCD) and Bay Street Reservoir (BSR). NCD is located near the town of Ben Lomond in the Santa Cruz Mountains and impounds Newell Creek to form Loch Lomond Reservoir. The reservoir was constructed in the early 1960's and has a maximum capacity of 2.9 billion gallons (BG). The Loch Lomond Reservoir is the City's primary raw water storage facility. The Bay Street Reservoir is a potable water reservoir located in the upper-Westside of the City of Santa Cruz. The reservoir was constructed in the 1920's and has a maximum storage capacity of 35 million gallons. Bay Street Reservoir provides more than 80% of the City's finished (or potable) water storage. Because of their size and capacity, both dams are under the jurisdiction of the California Department of Water Resources, Division of Safety of Dams (DSOD). Maps and information on water system facilities are not available at this time. Some information may be available through the Water Department.

B. Extent: Magnitude or Severity

A major dam failure at either NCD or BSR could result in extensive property damage and loss of life.

C. Previous Occurrences

There have been no reported dam failures in the area under consideration.

D. Probability of Future Events

Accumulated data and information gives no indication that either dam would fail or otherwise sustain damage under any circumstance. (This does not include man-made disaster.)

10.3.3 Assessing Dam Failure Vulnerability: Overview

3.3 Assessing Vulnerability: Overview – Requirements §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

A. Overall Summary of Vulnerability to Dam Failure

The losses to life and property associated with complete dam failure would be high. Given the monitoring protocol at the reservoirs the probability of dam failure is very low.

10.3.4 Assessing Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures – Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

A. Types and Numbers of Existing Buildings, Facilities and Infrastructure

Information on water system facilities is not available at this time.

10.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses – Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

A. Dollar Losses to Vulnerable Structures

This information is not available at this time.

B. Methodology Used to Prepare Estimate

10.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

A. Description of Land-Uses and Development Trends

As was stated earlier, the City of Santa Cruz is a compact urban community that is surrounded by natural barriers to outward expansion including the Santa Cruz Mountains, the Pacific Ocean and a designated greenbelt. Ongoing population growth in the Recap area has been mirrored by an increase in urbanization for the Monterey Bay area. Development patterns in the coastal zone since the 1970s confirm these overall urbanizing trends. New development has occurred within or adjacent to the urban services line (i.e., the boundary point for such infrastructure as gas, water, and sewage hook-ups). In Santa Cruz, most development is now infill or reuse development. [37]
Increasing population densities expands the potential population and property at risk from a dam failure.

10.4.0 Mitigation Strategy

4.0 Mitigation Strategy – Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The primary mitigation strategy is the continuation of monitoring protocols for structural integrity. These include the monitoring of both the Bay Street Reservoir and the Newell Creek Dam as follows:

- Water pressures within the dam and seepage are monitored monthly and after established rainfall and earthquake triggers.
- Horizontal and vertical movement is monitored annually at Newell Creek Dam. California Department of Water Resources, Division of Safety of Dams, has just recently requested a similar monitoring protocol at BSR which will begin in the spring of 2007.
- Periodic seismic reviews are conducted at both dams to ensure stability with respect to current seismic standards.

10.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Dam Failure Goals:

Dam Failure 1- Avoid or reduce the potential for life loss, injury, property or economic damage to Santa Cruz from dam failure.

Dam Failure 2 -Encourage mitigation activities that increase disaster resilience of the water system essential to a functioning City of Santa Cruz.

10.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Dam Failure Mitigation Actions:

- The primary actions to mitigate the risk of dam failure are a careful monitoring program and the creation of redundancy in the water service infrastructure **(B-11)**

CHAPTER 11 — LANDSLIDE

11.3.0 Landslide Risk Assessment

11.3.1 Identifying Landslide Hazards

3.1 Identifying Hazards – Requirement §201.6(c)(2)(i): The risk assessment **shall** include a description of the type of all natural hazards that can affect the jurisdiction.

Landslides are defined as the rapid downward movement of rock, earth or artificial fill on a slope. Factors causing landsliding include the rock strength and orientation of elements on the slope, erosion, weathering, high rainfall, steepness of slopes, and human activities such as the removal of vegetation and inappropriate grading.

Landslide deposits and soil creep occur primarily on slopes in the western side of the City near Moore Creek Canyon. Deposits are also found in the upper portions of Arana Gulch and DeLaveaga Park and other isolated locations in the City.

Landslides are prevalent upstream of the City's drinking water intakes and affect production of potable water in many ways. Generally speaking, the impacts on drinking water production are the following:

- Elevated, persistent turbidity which requires increased treatment or source changes due the potential presence of pathogens in highly turbid water and total suspended solids (i.e. sand).

- "Collateral" damage on infrastructure and increased maintenance costs as pumps suffer sanding problems, basins fill with sand, pipelines burst from sediment deposition and flow changes, etc.

The raw water delivery system is also vulnerable to the risk of landslide. Loch Lomond Reservoir and a significant amount of the raw water system infrastructure are located in the Santa Cruz Mountains, some in areas that have experienced landslides. Because of this placement, the greatest threat to the City of Santa Cruz from landslides is in the Santa Cruz Mountains. [38]

Landslides occur in all U.S. states and territories. In a landslide, masses of rock, earth or debris move down a slope. Landslides may be small or large, slow or rapid. They are activated by:

- storms
- earthquakes
- volcanic eruptions
- fires
- alternate freezing and thawing alternate wetting and drying
- increase in slope steepness by erosion or human modification.

Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry". They can flow rapidly, striking with little or no warning at very high speeds. They also can travel several miles from their source, growing in size as they pick up trees, boulders, cars and other materials.

Landslide problems can also be caused by land mismanagement, particularly in mountain, canyon, and coastal regions. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Land-use zoning, professional inspections and proper design can minimize many land slide, mudflow, and debris flow problems.[39]

Landslide problems can also be caused by land mismanagement, particularly in mountain, canyon, and coastal regions. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Land-use zoning, professional inspections and proper design can minimize many land slide, mudflow, and debris flow problems.[40]

11.3.2 Profiling Landslide Hazard Events

A. Location

SUMMARY DISTRIBUTION OF SLIDES & EARTH FLOWS IN SANTA CRUZ COUNTY[41]

By Carl M. Wentworth, Scott E. Graham, Richard J. Pike, Gregg S. Beukelman, David W. Ramsey, and Andrew D. Barron

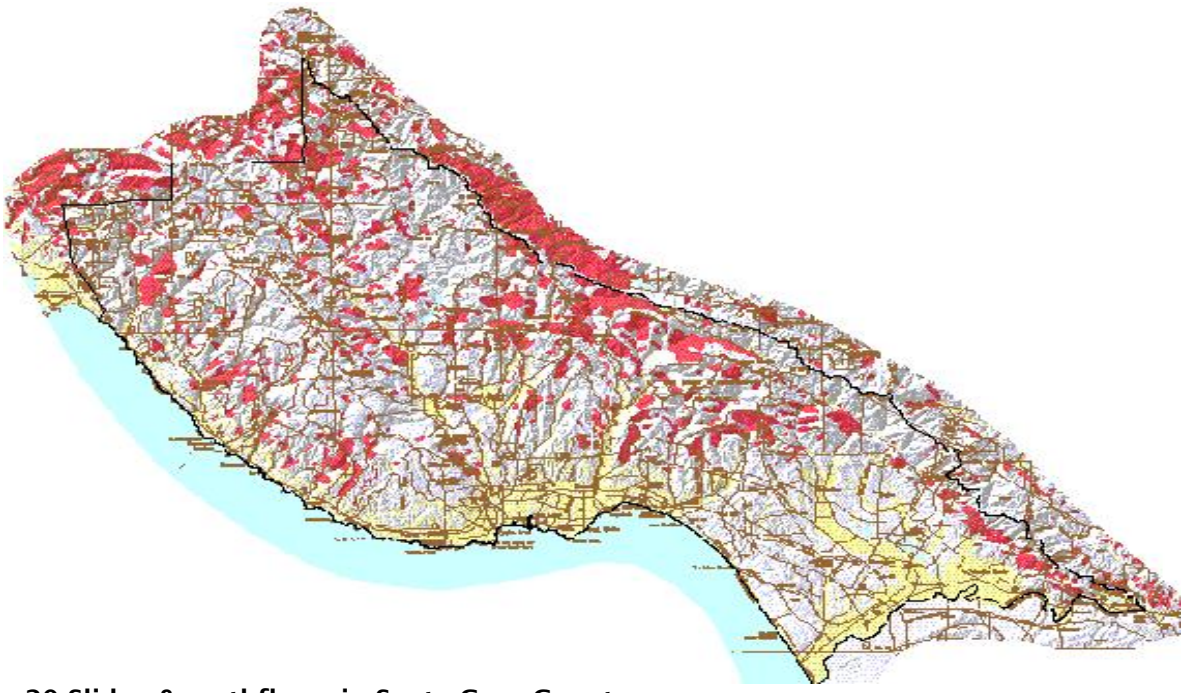


Figure 20 Slides & earthflows in Santa Cruz County

MAP UNITS

Mostly Landslide - consists of mapped landslides, intervening areas typically narrower than 1500 feet, and narrow borders around landslides; defined by drawing envelopes around groups of mapped landslides.

Many Landslides - consists of mapped landslides and more extensive intervening areas than in 'Mostly Landslide'; defined by excluding areas free of mapped landslides; outer boundaries are quadrangle and County limits to the areas in which this unit was defined.

Few Landslides - contains few, if any, large mapped landslides, but locally contains scattered small landslides and questionably identified larger landslides; defined in most of the region by excluding groups of mapped landslides but defined directly in areas containing the 'Many Landslides' unit by drawing envelopes around areas free of mapped landslides.

Flat Land - areas of gentle slope at low elevation that have little or no potential for the formation of slumps, translational slides, or earth flows except along stream banks and terrace margins; defined by the distribution of surficial deposits (Wentworth, 1997).

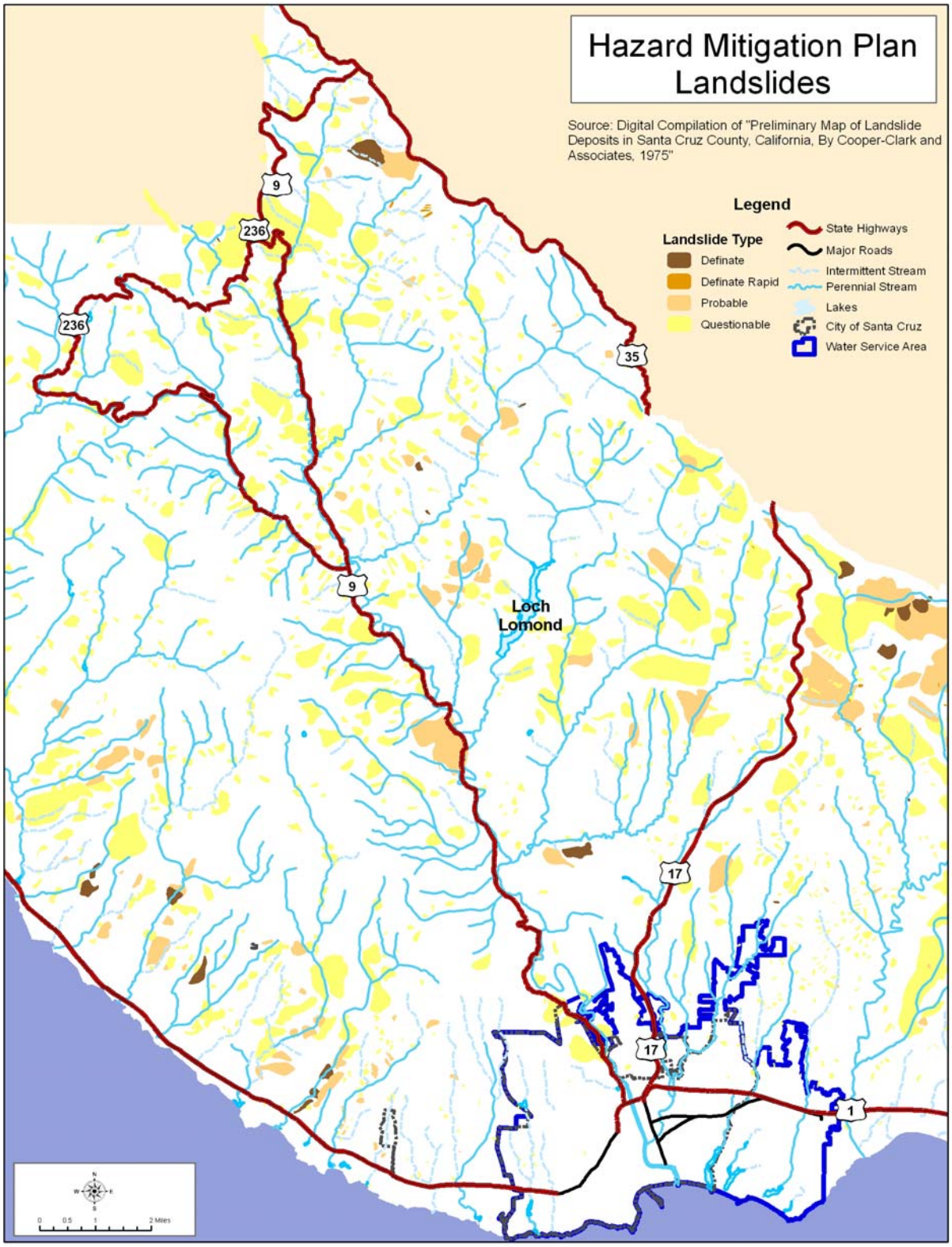


Figure 21 Potential slide threats to Santa Cruz

B. Extent: Magnitude or Severity

Landslides are a common occurrence in the Santa Cruz Mountains. Our intense winter storms, high rainfall amounts and steep terrain are all conducive to land sliding. Earthquake activity can add to the problem. The earthquake of 1906 set off dozens of large landslides in the Santa Cruz Mountains, some of which claimed human lives. The potential for loss of life and property is much greater today due to the increase in population residing in areas of possible instability.

Although nature caused landslides are beyond control, most recent landslides in the Santa Cruz Mountains have been caused by a combination of human activity and natural factors. Human activities which act to further destabilize slopes are logging, woodland conversion, road building, housing construction and any activity which alters normal drainage patterns. Whether or not any of these activities will trigger land sliding depends on the existing natural conditions. Some soil and rock types are more prone to land sliding than others. Landowners should determine the inherent geologic stability of their property before beginning construction activities.[42]

C. Previous Occurrences

The City of Santa Cruz Water Department has property, access rights of way, and infrastructure located in areas susceptible to land sliding. The earliest landslide of record affecting the City occurred in 1982 and most recently in 2006.

Historical Record of Severe Landslides of Santa Cruz

January 1982: Severe storms caused multiple landslides affecting water pipelines and access roads. One landslide along Love Creek, west of Loch Lomond Reservoir, killed ten people. While this landslide was not on City-owned property and did not affect City-owned facilities, it was and continues to be an indicator of the potential severity of landslide activity and the need for observation and/or mitigation.

The City did experience less significant landsliding along the alignment of the Newell Creek pipeline north and south of Brackney Road, in Ben Lomond. To the south, a slide created a 5-foot high scarp which encroached to within a few feet of the pipeline. Two other landslides along this alignment occurred north of Brackney Road creating 2 to 5-foot scarps that extended from the outside edge of the access road towards the river.

Also associated with these storms were 1) Two landslides along the Laguna Creek pipeline alignment downstream of the trestle bridge crossing Laguna Creek; an 8-foot high scarp exposed and undercut the pipeline. 2) Smaller landslides also affected portions of the entrance and access roads to Loch Lomond Reservoir and nine separate slides occurred around the reservoir rim.

Loch Lomond East Bank Landslide: There are two landslides located along the east bank of the City's only raw water storage reservoir, Loch Lomond Reservoir. These landslides are referred to as the "ancient and recently active" landslides.
While it is postulated that movement in the recently active landslide was initiated in 1971 or earlier, movement of the recently active landslide was actually observed in

1980 and again in 1982. The recently active landslide appears to have reactivated movement in the ancient landslide which is contiguous with, and lies directly above, the recently active landslide.

Formal study of the landslides began in 1980 with the installation of piezometers to quantify the recently active landslide, installation of tiltmeters in 1990 to observe movement in the recently active landslide, and the installation of inclinometers in 1992 to further the study of movement in both landslides.

The City continues to monitor the slide in accordance with various triggers including quarterly, after heavy rainfall events and following significant earthquakes.

The El Nino Winter Storms of 1998 caused multiple landslides affecting water pipelines and access roads. The area with the most damage occurred on the Laguna Creek Pipeline access road. The repair of the road required three retaining walls, grading and drainage at a cost of $525,000.

East Zayante Road: The City owns two parcels along East Zayante Road. Both parcels are subject to landsliding and/or debris flow due to various County and logging road cuts. In 2000, there was a debris flow from one of the locations onto the County Road. The City conducted a geotechnical paper study to provide initial recommendations on maintaining stable slopes. Due to the location, estimated probability of failure, and presumed damage in the event of a failure, the City has adopted an alternative calling for periodic observations as opposed to a major structural repair. The latter alternative would be adopted should a significant change in conditions be noted.

Brackney Slide: This is an historic slide area through which the City's raw water pipeline from Loch Lomond is aligned. In 2002, the City installed multiple wye fittings on each end of two slide areas to facilitate temporary pipeline bypass connections should the area(s) slide away. The City's long-term Capitol Improvement Program specifies replacement of the entire pipeline beginning in 2011/2012. Consideration will be given to realigning the pipeline to avoid historic slide areas.

April 2006: One landslide occurred at the **Graham Hill Water Treatment Plant**. The repair of this slide is scheduled for spring 2007 at a cost of $550,000.

D. Probability of Future Events

Many water system facilities are located in remote areas of Santa Cruz County. Facilities such as water diversions are at the water sources which are often located in remote hilly or mountainous areas. Pipelines carrying the water from the sources to the treatment facilities traverse hillsides, slopes and steep rugged terrain, much of which is prone to landslides.

11.3.3 Assessing Landslide Vulnerability: Overview

3.3 Assessing Vulnerability: Overview – Requirement §201.6(c)(2)(ii): The risk assessment **shall** include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

Past experience has shown that the water system is very vulnerable to landslides. While there could be significant expense involved in replacing landslide damaged infrastructure, there is also the risk of water outages caused by landslide events.

A. Overall Summary of Vulnerability to Landslide

The urban center of Santa Cruz is at relatively low risk for landslides although they do occur on steeper slopes within the City and can cause significant damage. However, the greatest vulnerability from landslide to the City of Santa Cruz is to the City water system. The majority of the water storage and infrastructure for delivering water to the community is outside the City limits in mountainous terrain. The storage facilities and the pipelines and treatment plants are vulnerable to landslide and have experienced landslides in the past.

11.3.4 Assessing Vulnerability: Identifying Structures

3.4 Assessing Vulnerability: Identifying Structures – Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Landslides threaten relatively few buildings and residences. The potential losses are to water storage, treatment and transport facilities and the impacts of these losses on the City of Santa Cruz water system consumers.

A. Types and Numbers of Existing Buildings, Facilities and Infrastructure

- Laguna Dam
- Laguna Pipeline (from dam to Highway 1)
- Liddell Spring
- Liddell Pipeline (from spring box to Highway 1)
- Majors Dam
- Majors Pipeline (from dam to Highway 1)
- Coast Pipeline (Highway 1 to the Coast Pump Station)
- Loch Lomond Reservoir (impounded by Newell Creek Dam)
- Newell Creek Pipeline (from Newell Creek Dam to the Graham Hill Water Treatment Plant)

11.3.5 Assessing Vulnerability: Estimating Potential Losses

3.5 Assessing Vulnerability: Estimating Potential Losses – Requirement §201.6(c)(2)(ii)(B): The plan **should** describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Table # 11-1 Landslide potential loss by structure

Facilities	Location	Costs
Laguna Dam		unknown
Laguna Pipeline	Dam to Highway 1	$150 per linear foot
Liddell Pipeline	Spring box to Highway 1	$150 per linear foot
Majors Dam		unknown
Majors pipeline	Dam to Highway 1	$150 per linear foot
Coast Pipeline	Highway 1 to Coast PS	$150 per linear foot
Loch Lomond Reservoir		unknown
Newell Creek pipeline	Dam to Graham Hill Water Treatment Plant	$150 per linear foot

B. Methodology Used to Prepare Estimate

Valuation: Engineer's Estimate

Population:
The entire community of Santa Cruz as well as surrounding water service areas is at risk if there is damage to the water supply.

11.3.6 Assessing Vulnerability: Analyzing Development Trends

3.6 Assessing Vulnerability: Analyzing Development Trends – Requirement §201.6(c)(2)(ii)(C): The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

A. Description of Land-Uses and Development Trends

Santa Cruz is a compact urban City surrounded by Mountains, greenbelt and the Pacific Ocean. The size of the water service area has remained constant over time due to a policy prohibiting water main extensions to un-served areas and the acquisition of open space lands which creates a greenbelt around the City that serves to inhibit urban sprawl. Accordingly, any growth and redevelopment that will occur in the future is expected to be concentrated within the confines of the existing service area boundary.

Within the City of Santa Cruz, only a small amount of land remains undeveloped. Because of the relative scarcity of raw land, the majority of future growth in the area is likely to be achieved through redevelopment, remodeling, infill and increased density on underutilized land, along with new construction on the little amount of vacant land remaining. In other words, the service area has been fixed (not growing outward.)[43]

The City of Santa Cruz water system currently serves approximately 90,000 people and is anticipated to grow to 100,000 by 2030. (This number does not include additional University growth.)[44]

The University of California at Santa Cruz has included significant growth numbers in its Long Range Development Plan (LRDP). The impacts of the growth at the University on the City and its water supply are currently a topic of discussion between the City and the University. No decisions or agreements have been reached at this date.

11.4.0 Mitigation Strategy

4.0 Mitigation Strategy – Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

11.4.1 Mitigation Goals

4.1 Local Hazard Mitigation Goals – Requirement §201.6(c)(3)(i): The hazard mitigation strategy **shall** include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Landslide Goals:

Landslide 1 - Avoid or reduce the potential for life loss, injury, property and economic damage from landslide hazards.

Landslide 2 - Protect the Santa Cruz water system and infrastructure from landslides including improvement in water system redundancy planning for continuous service.

11.4.2 Identification and Analysis of Mitigation Actions

4.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(3)(ii): The mitigation strategy **shall** include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Landslide Mitigation Actions:

- Protect Water System infrastructure through landslide monitoring **(A-13)**

The Landslides Hazard Program[45]

The enormous damages from landslides can be reduced. The primary objective of the National Landslide Hazards Program (LHP) is to reduce long-term losses from these hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies. The LHP has operated since the mid-1970's in gathering information, conducting research, responding to emergencies and disasters and producing scientific reports and other products for a broadly based user community. The LHP publishes results of its investigations in various outlets for use by geologists and engineers in government, by those in academia and in private practice, by planners and decision makers from governmental entities at all levels, and the general public. The results of these efforts have led to significant improvements in understanding the nature and scope of ground-failure problems nationally and worldwide. Such improvements are central to the role of the program because opportunities remain for fundamental advances in understanding that promise to save lives and dollars.

Hazard Mitigation Monitoring

In spring of 2007, the Water Department will study the extent of the ancient landslide (located above the recently active landslide) and begin to evaluate the possibility of landslide failure similar to the recently active landslide.

Due to the significant monetary and environmental expense to relocate water system facilities and the uncertainty of specific locations affected by slide events, the Water Department's strategy for minimizing loss of water service due to a slide event is to improve water system redundancy. By developing multiple water sources, treatment facilities, and storage facilities, the risk of total outages is reduced due to loss of a facility.

The Water Department monitors the Loch Lomond East Bank Landslide quarterly as well as after significant rain or earthquake events through a set of 5 inclinometers and 10 piezometers.

The Water Department has installed wye valves on each side of the Brackney Slide to facilitate installation of temporary pipe in the event of a slide. The Water Department's Long Term Capital Improvement Program calls for improvements in storage tank redundancy, replacement of pipelines and additional water supply augmentation over the next 10 years.

CHAPTER 12 — MULTI-HAZARD SUMMARY

Any of the hazards that threaten Santa Cruz could happen in combination with another hazard. In fact, there is a high likelihood that a major earthquake on the San Andreas or other faults would unleash secondary hazards that could be as disastrous to Santa Cruz as the earthquake itself. An unforgettable reference point for the Bay Area is the devastating fire in 1906 that burned down San Francisco, causing significantly more destruction than the earthquake that sparked it.

Earthquakes have started fires throughout history. Within the recent past, one example is the 1995 Kobe, Japan earthquake. Earthquake shaking can start fires in numerous ways, such as tipping over appliances with pilot lights or damaging electrical equipment leading to sparks. Ruptured gas lines, both underground and where they connect to houses, or spilled flammable chemicals can cause post-earthquake fires to spread quickly. Efforts to fight fires after an earthquake are often severely hampered by non-functional water systems, damaged electrical systems that are needed to provide energy to pump water, or roads blocked by debris or landslides. These problems coincide with fire personnel being required for search and rescue activities and other disaster response activities.

Santa Cruz may also experience landslides during the next earthquake, particularly if the earthquake occurs during rainy winter months. Small aftershocks could continue to cause slides for weeks after a quake, blocking roads and damaging homes. In addition, the next earthquake may cause significant damage to the city's water supply (which is located in a mountainous slide prone area) and storm drain systems.

Although the risk is very low, an earthquake has the potential to cause dam failure. Breaks in the dams, levees and stream culverts could lead to catastrophic flooding in areas that have not seen floodwaters previously.

Drought increases the risk of wildfires, and wildfires increase the risk of landslide and flood. When all supporting vegetation is burned away, hills become destabilized and prone to erosion. The charred surface of the earth becomes hard and absorbs less water during rainfall, leading to increased runoff resulting in more rapid coastal erosion.

Many mitigation activities reduce risk from more than one hazard. However, there are some mitigation activities that reduce risk from one possible threat while increasing it from another. One example is placing utility lines underground. Underground utilities are less damaged by a major fire than those aboveground. In an earthquake, underground utilities in areas prone to landslides or liquefaction are susceptible to damage and are more costly and time-consuming to repair than aboveground utilities. Another example of a mitigation activity with positive and negative impacts is vegetation removal for wildfire risk reduction. Trees and other established plants play a key role in securing hillsides and reducing landslide risk. They also reduce erosion and slow rain runoff time, which reduces flood peaks. It is important to remember all of the implications of any risk reduction steps when planning mitigation activities.

PART 4 – MITIGATION STRATEGY

Mitigation Strategy

- Goals
- Objectives
- Actions

PART 4 – MITIGATION STRATEGY

CHAPTER 13 — MITIGATION STRATEGY

4.4.0 Mitigation Strategy

4.0 Mitigation Strategy: Requirement §201.6(c)(3): The plan **shall** include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The City of Santa Cruz endeavors to be a disaster-resistant community that can survive and recover from a disaster while preserving the diversity and quality of its natural and built environments. The community strives to offer excellent cultural and community services as well as maintain and improve infrastructure, community safety and emergency preparedness. This Local Hazard Mitigation Plan (LHMP) is a part of this effort.

The City of Santa Cruz has developed a range of policies and programs to act as a "blueprint" for the Hazard Mitigation Strategy. Strategies include "everyday operations" that also contribute to reducing the impact of future hazards as well as specific hazard mitigation projects. While City efforts are focused on evaluation and improvement of City owned structures, particularly those identified as critical facilities, the plan also encourages the establishment of standards to encourage private property owners to upgrade the hazard resistance of their own properties. Finally, the City is actively engaged with other local and regional organizations to collaboratively work towards mitigation actions that meet the City of Santa Cruz's objective of being a disaster resistant community while striving to preserve the quality of its natural and built environments.

This plan focuses on mitigation goals and actions, meaning activities that occur prior to a hazard event that reduce or avoid damage when disasters strike. Damage prevention includes structural improvements to existing buildings, land use decisions that will minimize damage and ongoing programs such as vegetation reduction in wildland/urban interface areas. This plan does not include emergency response activities. The City of Santa Cruz has an Emergency Management Plan (EMP) to help coordinate information and resources for disasters or threat of disasters. As a part of the EMP annual training, critical information updates and drills are conducted to protect people and property. This EMP does inform this Hazard Mitigation Plan and is attached as **Appendix O.**

Goals

Goals are general guidelines that explain what is to be achieved. They are usually broad-based, policy-type statements, long-term, and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the LHMP, once implemented, should be measured by the degree to which its goals have been met the actual benefits in terms of hazard mitigation that occurs.

The City of Santa Cruz LHMP team held several meetings to review the identified risks and developed goals, objectives and actions based on the risk assessment. Goals which provided the greatest benefit in hazard reduction were identified as primary goals.

Additional goals, specifically related to each identified potential hazard are presented under each hazard heading.

The Local Hazard Mitigation Plan has four primary mitigation goals:

1. Avoid or reduce the potential for life loss, injury and economic damage to Santa Cruz residents from hazard events;
2. Increase the ability of the city government to serve the community during and after hazard events;
3. Protect the unique character, scenic beauty and values in the natural and built environment from being compromised by hazard events;
4. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and systems essential to a functioning City of Santa Cruz.

Objectives

The LHMP team selected the objectives listed below to meet multiple goals. The objectives serve as a stand-alone measurement of a mitigation action rather than as a subset of a goal. Achievement of the objectives is a measure of the effectiveness of a mitigation strategy. The objectives are also used to help establish priorities.

Objectives are defined as short-term aims which, when combined, form a course of action to meet a goal. Unlike goals, objectives are specific and measurable.

The City of Santa Cruz Local Hazard Mitigation Team identified this list of objectives:

1. Consider the impacts of hazards on future land use decisions in the City of Santa Cruz by coordinating with other planning mechanisms including the general plan and land use code development.

2. Protect and sustain reliable local emergency operations and communication facilities during and after disaster.

3. Develop new or enhance existing early warning response systems

4. Seek to enhance emergency response capabilities through improvements to Infrastructure and City programs

5. Seek mitigation projects that provide the highest degree of hazard protection at the least cost

6. Seek to update information on hazards, vulnerabilities, and mitigation measures by coordinating planning efforts and creating partnerships with appropriate local, county, state, and federal agencies

7. Seek to implement codes, standards, and policies that will protect life, property and quality of life including environmental, historic and cultural re sources from the impacts of hazards within the City of Santa Cruz

8. Educate the community on preparedness for and mitigation of potential impacts of hazards to the City of Santa Cruz

9. Encourage retrofit, purchase, or relocation of structures in high hazard areas, including those known to be repetitively damaged.

Identification and Analysis of Mitigation Actions

Identification of Actions

The Local Hazard Mitigation Goals were enumerated above. In support of those goals, The City of Santa Cruz has identified a number of hazard mitigation actions. This set of actions was developed through an inclusive community process. The LHMP team, with input from the City of Santa Cruz General Plan Update, the Emergency Management Plan, the Capital Improvement Program, the 2005 Urban Water Management Plan and the Santa Cruz Integrated Water Plan as well as other agencies, UCSC representatives and community members, has selected the following actions as the most beneficial for the City of Santa Cruz. These actions represent the highest priority mitigation actions identified for each hazard or for a multi- hazard event.

These mitigation actions have proven effective in reducing or eliminating hazard risk. Each of these actions directly meets an objective or goal listed in the City of Santa Cruz

Hazard Mitigation Strategy. These actions are not meant to be exhaustive but rather to inspire thought and provide each department of the City of Santa Cruz with a role in hazard mitigation and a baseline of actions backed by a planning process, consistent with the goals and objectives and within the capabilities of the City. The City departments were not bound to the list of alternatives presented. They were given the opportunity to edit the list. Actions not included in the action plan were eliminated based on the following:

- Action is currently outside the scope of the defined priority rankings
- City's jurisdiction is not vulnerable to the hazard
- Action has already been implemented
- Estimated cost exceeded estimated benefit

Prioritization of Actions

This Plan promotes 33 0action items. The list below summarizes all of the actions, identifies the hazard(s) each one addresses, and indicates the assigned priority level of the action. The actions were prioritized in the same way that they were identified. The team leaders proposed an initial prioritization system, dividing the actions into categories of ***Very High Priority, High Priority,*** and ***Important***. City staff, Council members, committee and community members were given an opportunity to review these categorizations.

Many factors were considered when assigning priorities. First, only those actions with strong community support were given Very High or High priority ratings. Second, addressing those hazards presenting the highest risk to Santa Cruz was given priority. The loss estimates presented in section five of this Plan show that earthquakes, floods and tsunami's have the most potential to cause great economic and human losses. Water is essential to the survival of the City so drought and threats to the water system were also ranked as High or very High Priority. Finally, availability of funding (identified in the Capital Improvement Program or other source) was a determining factor in priority determination.

Section 201.c.3.iii of Title 44 of the *Code of Federal Regulations* requires that an action plan describe how actions identified were prioritized. The planning team has developed a prioritization methodology for the action plan that meets the needs of the City while at the same time meeting the requirements of Section 201.6 of Title 44 of the *Code of Federal Regulations*. The mitigation strategies identified were prioritized according to the criteria defined below.

Very High Priority

- A project that meets multiple plan objectives
- benefits exceed cost
- has strong community support
- addresses those hazards presenting the highest risk
- funds are identified or potentially available
- project can be completed in one to five years once project is funded.

High Priority

- Project meets at least one plan objective
- Benefits exceed costs
- Funding has not been secured
- Project can be completed in one to five years once project is funded

Important

- project mitigates the risk of a hazard
- benefits exceed costs
- funding has not been identified
  and/or timeline for completion is considered long-term (five to ten years)

A formal cost benefit analysis has not been done. However, in reviewing the mitigation actions proposed, the costs and benefits of each action were considered under the following rating:

Cost ratings

High: Existing funding levels are not adequate to cover the costs of the proposed project and would require an increase in revenue through an alternative source (for example, bonds, grants, and fee increases) to implement.

Medium: The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.

Low: The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.

Benefit ratings

High: Project will have an immediate impact on the reduction of risk exposure to life and property

Medium: Project will have a long-term impact on the reduction of risk exposure to life and property or project will provide an immediate reduction in the risk exposure to property

Low: Long-term benefits of the project are difficult to quantify in the short term

In recent years, and in response to the 1989 Loma Prieta Earthquake, the City of Santa Cruz has made significant progress through efforts to reduce risk in public buildings, fire stations, major municipal facilities and public schools. This plan will continue these efforts and expand them throughout the community. These efforts will protect future generations from the devastation of natural hazards experienced by the residents of Santa Cruz in the past.

The City will pursue the implementation of these actions to meet the goals set out above. The Very high and high priority actions will be conducted actively over the next three to five years as funding becomes available.

Very High Priority

A= Very High Priority Action

#	Action	Hazard	Responsible Department	Timeline
A-1	Establish pre-event planning for post-disaster recovery as an integral element of the emergency management plan of the City Council and each of the City Departments including ongoing staff training	Multi-hazard	Emergency Operations Manager (EOM)	One year
A-2	Coordinate preparedness efforts with SC County office of Emergency Services, UCSC and other cities and agencies in the region	Multi-hazard	EOM	ongoing
A-3	Educate and inform the community about emergency preparedness options in the event of a hazard event	Multi-hazard	EOM	ongoing
A-4	Ensure completeness and availability of identified emergency supplies such as water main repair parts, road clearing equipment, sandbags, medical and communications equipment	Multi-hazard	EOM Water Public Works Fire Planning & Building	ongoing
A-5	Enhance cellular services to critical facilities	Multi-hazard	EOM	2-3 years
A-6	Encourage mitigation activities to increase the disaster resilience of institutions, private companies and systems essential to a functioning Santa Cruz	Multi-hazard	Planning & Building	ongoing
A-7	Continue cooperative fire protection agreements with UCSC, the County fire districts and the California Department of Forestry	Wildfire	Fire	ongoing
A-8	Increase efforts to reduce fire risk in existing development and in wildland/ urban interface areas particularly steep canyons and arroyos through improved vegetation management and appropriate code enforcement	Wildfire	Fire Planning & Building	ongoing
A-9	Review open space land use to reduce incidence of human caused wildfire	Wildfire	Fire + Parks & Rec & Police	on-going

#	Action	Hazard	Responsible Department	Timeline
A-10	Require upgrade of sewer water and other infrastructure to withstand seismic shaking and differential settlement	Earthquake	Public Works Planning & Building Water	5 years
A-11	Reduce near term drought shortages through water conservation and curtailment of water use	Drought	Water	ongoing
A-12	Provide a reliable water supply that meets long term needs while insuring protection of public health and safety in the form of a seawater desalination facility	Drought	Water	3-5 years
A-13	Protect water system and infrastructure from landslides	Landslide	Water	ongoing

High Priority

B= High Priority Action

#	Action	Hazard	Responsible Department	Timeline
B-1	Periodically review structural integrity of bridges connecting the City's transportation routes	Multi-hazard	Public Works	ongoing
B-2	Protect & preserve coastline and infrastructure through permit review	Coastal Erosion	Public Works Planning & Building	ongoing
B-3	Protect & preserve coastline and infrastructure through coastal restoration efforts – West Cliff Drive	Coastal Erosion	Public Works Parks & Rec	2-5 years
B-4	Insure early warning system for evacuation of areas susceptible to natural flooding, tsunami inundation, seiches or dam failure.	Flood Tsunami	EOM	ongoing
B-5	Regulate development in floodplains and increase public awareness of flood hazards	Flood Tsunami	Planning & Building Public Works	ongoing
B-6	Encourage property owners, potential buyers & residents living in floodplains and coastal inundation areas to participate in Federal Flood Insurance Program	Flood Tsunami	Planning & Building	ongoing
B-7	Reduce flooding hazards potential flood areas along Branciforte and Carbonera Creeks.	Flood	Public Works	ongoing
B-8	Rehabilitate the City's storm drain system to reduce local flooding caused by inadequate storm drainage	Flood	Public Works	
B-9	Continue programs that promote installation, inspection, and testing of built-in fire extinguishing & early warning alarm systems	Wildfire	Fire Planning & Building	ongoing
B-10	Abate hazardous conditions when identified and create program that is proactive not reactive	Wildfire	Fire Parks & Rec Police	ongoing
B-11	Dam Monitoring – conduct monthly peizometer monitoring at Newell Creek Dam and Bay Street Reservoir	Dam Failure	Water + outside agencies	ongoing

Important

C= Important Action

#	Action	Hazard	Department	Timeline
C-1	Encourage and support the protection of cultural, historic and architecturally significant structures to preserve neighborhood and community character.	Multi-hazard	Planning & Building Parks & Rec	ongoing
C-2	Update and enhance GIS systems and mapping for all hazards in the City	Multi-hazard	Information Technology Economic Development	1-2 years
C-3	Appraise City owned critical structures	Multi-hazard	Information Technology Economic Development	2-3 years
C-4	Discourage locating public facilities (other than those associated with open space uses) and above-ground utilities in high fire hazard areas	Wildfire	Fire Planning & Building	ongoing
C-5	Ensure adequate firefighting and prevention staffing and that programs meet the needs of the City's population and new construction	Wildfire	Fire	5-7 years
C-6	Continue programs to promote fire safety prevention programs for the schools, high occupancy institutional uses and commercial & industrial	Wildfire	Fire	ongoing
C-7	Global Warming?		Planning	
C-8	Complete the ongoing efforts to retrofit all remaining non-complying Unreinforced Masonry (URM) buildings during repair or alteration including risk reduction from lateral spreading	Earthquake	Planning & Building	ongoing
C-9	Working with appropriate agencies, upgrade the structural safety of all existing emergency use and critical structures, such as medical facilities, schools, police and fire stations and emergency response centers as necessary and appropriate	Multi-hazard	Planning & Building	5-7 years
C-10	Flood control maintenance on San Lorenzo River	Flood	Public Works	ongoing

All of the above mitigations actions identified by the City of Santa Cruz are presented below with initial suggestions for implementation, identification of lead departments in the City, preliminary estimates of resources required and timeline.

#	Very High Priority Actions
A -1	**Hazard event planning**
Proposed Activities	Establish pre-event planning for post-disaster recovery as an integral element of the EMP in all City departments including ongoing training
Hazard	All
Environ Concerns	None
Lead Dept	Emergency Operations Manager (EOM) + Economic Development
Timeline	Ongoing
Resources Required	Unknown staff time
Funding Source	General fund budget
Priority	Very high

A -2	**Emergency preparedness coordination**
Proposed Activities	Coordinate preparedness efforts with Santa Cruz County Office of Emergency Services, UCSC, and other cities and agencies in the region
Hazard	All
Environ Concerns	None
Lead Dept	Emergency Operations Manager (EOM)
Timeline	Ongoing
Resources Required	Unknown staff time
Funding Source	Regular staff salaries
Priority	Very high

A -3	**Community emergency preparation education**
Proposed Activities	Educate and inform the community about emergency preparedness options for hazard events
Hazard	All
Environ Concerns	None
Lead Dept	Emergency Operations Manager (EOM)
Timeline	Ongoing
Resources Required	Staff time, materials production
Funding Source	General fund –staff salary
Priority	Very high

A -4	Emergency supply preparedness
Proposed Activities	Ensure completeness and availability of identified emergency supplies such as water main repair parts, generators, pumps, sandbags, road clearing, medical and communications equipment
Hazard	All
Environ Concerns	None
Lead Dept	Emergency Operations Manager (EOM)
Timeline	Ongoing
Resources Required	Significant funds required to stock supplies
Funding Source	Water fund, general fund, some unidentified outside funding
Priority	Very high

A -5	Cellar services
Proposed Activities	Enhance cellar service to critical facilities
Hazard	All
Environ Concerns	Community concerns re placement of all cell towers
Lead Dept	County Emergency Operations Center Manager (EOC) City liaison on project is EOM
Timeline	Ongoing acquisition as needed
Resources Required	Outside funding –mutual aid during hazard events
Funding Source	General fund – unidentified grants
Priority	Very high

A-6	Encourage disaster resilience
Proposed Activities	Encourage mitigation activities to increase the disaster resilience of institutions, private companies and systems essential to a functioning Santa Cruz through public outreach efforts and regulatory requirements.
Hazard	Multi-Hazard
Environ Concerns	Economic disruption
Lead Dept	Planning & Building
Timeline	Ongoing
Resources Required	Unknown staff time for public outreach
Funding Source	Permit fees and unidentified grant funds
Priority	Very high

A - 7	Maintain cooperative agreements
Proposed Activities	Continue cooperative fire protection agreements with UCSC, the County fire districts and the California Department of Forestry
Hazard	Wildfire
Environ Concerns	None
Lead Dept	Fire
Timeline	Ongoing
Resources Required	Minimal administrative staff time
Funding Source	General fund- regular staff
Priority	Very high

A -8	Vegetation management
Proposed Activities	Increase efforts to reduce fire risk in wildland/urban interface areas particularly steep canyons and arroyos through improved vegetation management and appropriate code enforcement
Hazard	Wildfire
Environ Concerns	Vegetation Management Plan approval
Lead Dept	Fire – Parks & Recreation
Timeline	Ongoing
Resources Required	Staff time Outside consultant services- funding
Funding Source	Staff budget and unidentified outside grants
Priority	Very high

A -9	Open space monitoring
Proposed Activities	Review and revise usage of open space to reduce incidence of human caused wildland fire
Hazard	Fire
Environ Concerns	Vegetation Management Plan approval
Lead Dept	Fire- Parks & Recreation & Police
Timeline	Ongoing
Resources Required	Additional assigned staff in all three departments
Funding Source	Staff budget and unidentified outside funding required
Priority	Very high

A-10	Upgrade infrastructure for seismic shaking
Proposed Activities	Require upgrade of sewer, water and other infrastructure to withstand seismic shaking and differential settlement
Hazard	Earthquake
Environ Concerns	None
Lead Dept	Planning & Building – Public Works
Timeline	Ongoing based on current standards
Resources Required	Staff time and unknown funds
Funding Source	State and federal grants, general fund, building fees
Priority	Very high

A-11	Conservation and Curtailment
Proposed Activities	Reduce near term drought shortages through water conservation and curtailment of water use
Hazard	Drought
Environ Concerns	None
Lead Dept	Water
Timeline	Ongoing through 2010
Resources Required	$500,000 per year
Funding Source	Water fund (711) Water System Development Fees Fund (715)
Priority	Very high

A-12	Desalination facility
Proposed Activities	Provide a reliable water supply that meets long term needs while insuring protection of public health and safety in the form of a seawater desalination facility
Hazard	Drought
Environ Concerns	Marine impacts, energy consumption, growth inducement
Lead Dept	Water – in conjunction with Soquel Creek Water District
Timeline	Estimated time to be operational 2012-2014
Resources Required	$60 Million External funding required, grants and bond financing
Funding Source	Water fund (711), Water System Development Fees Fund (715)' 3-5 FTE plus team of outside technical consultants (engineering & environmental)
Priority	Very high

A-13	Protect water system infrastructure
Proposed Activities	Protect water system infrastructure & reservoirs from landslides & other failure through water system – landslide monitoring and stabilization
Hazard	Landslide-Earthquake-Liquefaction
Environ Concerns	Geologic & hydrologic
Lead Dept	Water
Timeline	Ongoing
Resources Required	External funding required; from $0.5 to $2.0 million per year 1.5 FTE plus outside consultants (geologists, geotechnical and civil engineers)
Funding Source	Grants, water fund (711) and (715)
Priority	Very high

#	High Priority Actions
B- 1	**Bridge integrity check**
Proposed Activities	Periodically review structural integrity of bridges connecting the City's transportation routes
Hazard	Flood-Earthquake-Tsunami-Dam failure-Multi-hazard
Environ Concerns	None
Lead Dept	Public Works _ Inspection done by Caltrans
Timeline	Every two years
Resources Required	Some City staff
Funding Source	Caltrans funding
Priority	High

B-2	**Protect and preserve coastline**
Proposed Activities	Protect and preserve coastline and existing infrastructure through permit review
Hazard	Coastal Erosion
Environ Concerns	Coastal commission review and some community concerns regarding alteration of coastline
Lead Dept	Planning & Building
Timeline	Ongoing
Resources Required	Staff time
Funding Source	Permit fees
Priority	High

B- 3	**Protect coastline and infrastructure**
Proposed Activities	Protect and preserve coastline and infrastructure through coastal restoration efforts
Hazard	Coastal Erosion
Environ Concerns	Coastal commission review and some community concerns regarding alteration of coastline
Lead Dept	Public Works – Parks & Recreation
Timeline	Ongoing and event driven
Resources Required	Staff time
Funding Source	FEMA, Federal Highway Funds, General Fund
Priority	High

B -4	**Tsunami warning system**
Proposed Activities	Ensure early warning system for evacuation of areas at risk for flooding, tsunami inundation, seiches or dam failure
Hazard	Tsunami-Flood-Dam failure-Multi hazard
Environ Concerns	None
Lead Dept	Emergency Operations Manager (EOM)
Timeline	Under development [2007-2008]
Resources Required	Staff time; coordination with county and other municipalities
Funding Source	City and County General Funds; Homeland Security grant funds
Priority	High

B-5	Regulate floodplain development
Proposed Activities	Regulate development in floodplains and increase public awareness of flood hazards
Hazard	Floods
Environ Concerns	Flood inundation resulting in failed building and infrastructure, contamination, loss of businesses, homes and life.
Lead Dept	Planning & Building
Timeline	Ongoing
Resources Required	Staff time – currently monitored between Planning and Building and Economic Development Departments
Funding Source	General fund
Priority	High

B- 6	Federal Flood Insurance Program (FIP) participation
Proposed Activities	Encourage property owner's potential buyers, and residents living in floodplains and coastal inundation areas to participate in the Federal Flood Insurance Program
Hazard	Flood and Tsunami
Environ Concerns	Flood inundation resulting in failed building and infrastructure, contamination, loss of businesses, homes and life.
Lead Dept	Planning & Building
Timeline	Ongoing- current regulations have been updated to bring local ordinances into compliance with federal regulations
Resources Required	Staff time
Funding Source	None
Priority	High

B - 7	Reduce creek flooding
Proposed Activities	Reduce flooding hazard potential along creeks through implementation of City-wide Creeks and Wetlands Management Plan (Feb 2006)
Hazard	Flood
Environ Concerns	Land use issues
Lead Dept	Public Works
Timeline	Ongoing
Resources Required	Staff time and funds
Funding Source	General Fund
Priority	High

B - 8	Storm drain rehabilitation
Proposed Activities	Rehabilitate the City's storm drain system to reduce local flooding caused by inadequate storm drainage
Hazard	Flood
Environ Concerns	None
Lead Dept	Public Works
Timeline	Ongoing
Resources Required	$5-10 Million
Funding Source	Unidentified grant funds, general fund, storm water fund
Priority	High

B -9	Promote early warning systems
Proposed Activities	Promote installation, inspection and testing of built-in fire extinguishing and early warning fire alarm systems
Hazard	Wildfire
Environ Concerns	Addressed when building permit is issued
Lead Dept	Fire & Planning & Building
Timeline	ongoing
Resources Required	Variable staff time
Funding Source	Permit fees
Priority	High

B -10	Wildfire hazard abatement
Proposed Activities	Abate hazardous conditions identified and create programs that are proactive not reactive
Hazard	Wildfire
Environ Concerns	Code compliance and public posting of fire danger
Lead Dept	Fire
Timeline	Ongoing
Resources Required	Staff time and additional unidentified funding
Funding Source	Staff budget and grants
Priority	High

B-11	Minimize Risks from dam failure
Proposed Activities	Monitor dams and infrastructure to preserve water resources and minimize risks to people and property resulting from dam failure
Hazard	Landslide-Earthquake-Liquefaction-Multi-hazard
Environ Concerns	Flooding
Lead Dept	Water, California Department of Water Resources & Division of Safety of Dams
Timeline	Ongoing
Resources Required	.5 FTE plus outside consultants (geologists, geotechnical and civil engineers) $150 /year
Funding Source	Outside funding
Priority	High

#	Important Actions
C-1	**Preserve and protect historic structures**
Proposed Activities	Encourage and support the protection of cultural, historic and architecturally significant structures to preserve neighborhood and community character
Hazard	Multi-hazard
Environ Concerns	Asbestos and lead paint
Lead Dept	Planning & Building – Parks and Recreation
Timeline	3-5 years as funding is available (priorities are Holy Cross High School, UCSC lime kiln buildings and Pogonip Clubhouse)
Resources Required	Four to six million dollars
Funding Source	Unidentified state and federal grants and private funds
Priority	Important

C-2	**Update GIS data systems and mapping**
Proposed Activities	Update and enhance the GIS data systems and mapping for all hazards in the City
Hazard	Multi-Hazard
Environ Concerns	None
Lead Dept	Economic Development and GIS
Timeline	Unknown –based on funding availability
Resources Required	.5 FTE GIS and .1 FTE project manager
Funding Source	Outside funding not yet identified
Priority	Important

C-3	**Critical structure appraisal/estimates**
Proposed Activities	Obtain appraisals or/engineering estimates for City owned critical structures
Hazard	Multi-Hazard
Environ Concerns	None
Lead Dept	Information Technology (GIS) and Economic Development
Timeline	Unknown
Resources Required	Outside consultants (appraisers and engineers)
Funding Source	Outside funding not yet identified
Priority	Important

C-4	Fire protection land use
Proposed Activities	Discourage locating public facilities (other than open space uses) and above ground utilities in high fire hazard areas
Hazard	Wildfire
Environ Concerns	Addressed in Planning and Building process
Lead Dept	Fire & Planning & Building
Timeline	Ongoing
Resources Required	Unknown staff time
Funding Source	Permit fees
Priority	Important

C-5	Adequate Staffing
Proposed Activities	Ensure adequate firefighting and prevention staffing & that programs meet the needs of the City's population and new construction near wildland interface areas
Hazard	Wildfire
Environ Concerns	None
Lead Dept	Fire
Timeline	Ongoing
Resources Required	Additional staff
Funding Source	unknown
Priority	Important

C-6	Fire Safety Prevention Programs
Proposed Activities	Continue fire safety prevention programs for schools, high occupancy uses and commercial & industrial facilities.
Hazard	Wildfire
Environ Concerns	None
Lead Dept	Fire
Timeline	Ongoing
Resources Required	Regular staff time and additional funds required
Funding Source	Staff budget and grant funds
Priority	Important

C-7	Global Warming Policies
Proposed Activities	Address global warming in General Plan Update – implement polices and programs to reduce impacts of global warming
Hazard	Multi-hazard including drought, coastal erosion and flooding
Environ Concerns	Reduce emissions that contribute to global warming
Lead Dept	Planning & Building
Timeline	General Plan Update adoption is scheduled for June 2008 with ongoing implementation
Resources Required	Staff time -
Funding Source	Permit fees, general fund as well as unidentified grants for special studies and implementation
Priority	Important

C-8	Retrofit non-complying unreinforced masonry buildings (URM)
Proposed Activities	Mandatory retrofit of identified structures
Hazard	Earthquake
Environ Concerns	Asbestos and lead exposure-building collapse in earthquake
Lead Dept	Planning & Building
Timeline	Five years for final URMS -Holy Cross High School (discovered 2006) all other known URMS have been retrofitted
Resources Required	Some staff time
Funding Source	Building fees
Priority	Important

C-9	Upgrade structural safety
Proposed Activities	Working with appropriate agencies, upgrade the structural safety of all existing emergency use and critical structures, such as medical facilities, schools, police, fire and emergency response centers as necessary and appropriate
Hazard	Multi-Hazard
Environ Concerns	Building failure/collapse and response disruption
Lead Dept	Planning & Building – Public Works
Timeline	Ongoing (public schools are state responsibility)
Resources Required	unknown
Funding Source	General fund and CIP
Priority	Important Fire stations have recently been upgraded- Police and 911 center are less than ten years old

C-10	Flood control maintenance
Proposed Activities	Annual flood control maintenance on the San Lorenzo River as required by the Army Corps of Engineers consisting primarily of in-stream riparian vegetation management to prevent winter flows from exceeding capacity
Hazard	Flood
Environ Concerns	Habitat and Fish and Game
Lead Dept	Public Works
Timeline	Annual (takes four to five weeks to complete)
Resources Required	Staff
Funding Source	General Fund
Priority	Important

PART 5 — PLAN MAINTENANCE PROCESS

- Monitoring, Evaluating and Updating the Plan
- Incorporation into Existing Planning Mechanisms
- Continued Public Involvement

PART 5 — PLAN MAINTENANCE PROCESS

CHAPTER 14 —PLAN MAINTENANCE PROCESS

14.5.1 Monitoring, Evaluating and Updating the Plan

5.1 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(4)(i): The plan maintenance process **shall** include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Title 44 of the *Code of Federal Regulations* (CFR) Section 201.6(c)(4)(i) requires a hazard mitigation plan to include a plan maintenance process that includes the following:

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.
- A discussion on how the community will continue public participation in the plan maintenance process.

The plan maintenance section of this document details the formal process that will ensure that the City of Santa Cruz hazard mitigation plan (LHMP) remains an active and relevant document. The LHMP maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. This chapter also describes how the City will integrate public participation throughout the plan maintenance and implementation process. Finally, this chapter explains how the City intends to incorporate the mitigation strategies outlined in this LHMP into existing planning mechanisms and programs, such as the City General Plan, Capital Improvement Program, as well as building code enforcement and implementation. The LHMP's format allows the City to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a plan that will remain current and relevant to the City of Santa Cruz.

Evaluation of the Plan

The minimum task of the ongoing annual hazard mitigation planning team meeting will be the evaluation of the progress of the LHMP and incorporating the actions into other plans. This review will include the following:

- Summary of any hazard events that occurred during the prior year and their impact on the community.
- Review of successful mitigation initiatives identified in the LHMP.

- Brief discussion about why targeted strategies were not completed.
- Re-evaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term project because of funding availability).
- Recommendations for new projects.
- Changes in or potential for new funding options (grant opportunities).
- Integration of new data such as GIS data and mapping used to inform the Plan.
- Impact of any other planning programs or initiatives within the City that involve hazard mitigation.

The planning team will create a template to guide the LHMP committee in preparing a progress report.

The planning team will prepare a formal annual report on the progress of the LHMP. This report will be used as follows:

- Distributed to Department Heads for review.
- Posted on the City website on the page dedicated to the LHMP.
- Provided to the local media through a press release.
- Presented in the form of a council report to the Santa Cruz City Council.
- Provided as part of the Community Rating System (CRS) annual re-certification package. *The CRS program requires an annual recertification to be submitted every year*. To meet this recertification timeline, the planning team will strive to complete this progress report prior to the CRS recertification.

Method and Schedule for Updating the Plan within 5 years

Section 201.6.(d)(3) of Title 44 of the *Code of Federal Regulations* requires that local hazard mitigation plans be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under the Disaster Mitigation Act (DMA). The City of Santa Cruz intends to update the LHMP on a five-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than five years based on the following triggers:

- A Presidential Disaster Declaration that impacts the City of Santa Cruz.
- A hazard event that causes loss of life.

It will not be the intent of this update process to start from scratch and develop a new complete hazard mitigation plan for the City of Santa Cruz. Based on needs identified by the planning team, this update will, at a minimum, include the elements below:

- The update process will be convened through a committee appointed by the Planning Director and will consist of at least one member of the General Plan Update committee or staff to insure consistency between plans.
- The hazard risk assessment will be reviewed and updated using best available information and technologies on an annual basis.
- The evaluation of critical structures and mapping will be updated and improved as funding becomes available.

- The action plan will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or new City policies identified under other planning mechanisms, as appropriate (such as the General Plan).
- The draft update will be sent to appropriate agencies for comment.
- The public will be given an opportunity to comment prior to adoption.
- The Santa Cruz City Council will adopt the updated plan.

Implementation Through Existing Programs

The effectiveness of the City's non-regulatory LHMP depends on the implementation of the plan and incorporation of the outlined action items into existing City plans, policies, and programs. The LHMP includes a range of action items that, if implemented, would reduce loss from hazard events in the City of Santa Cruz. Together, the action items in the LHMP provide the framework for activities that the City can choose to implement over the next five years. The planning team has prioritized the plan's goals and identified actions that will be implemented (resources permitting) through existing plans, policies, and programs.

The Planning Department has taken on the responsibility for overseeing the plan's implementation and maintenance through the City's existing programs. The Director of Planning or designated appointee will assume lead responsibility for facilitating LHMP implementation and maintenance meetings. Although the Planning Department will have primary department responsibility for review, coordination, and promotion; plan implementation and evaluation will be a shared responsibility among all departments identified as lead departments in the mitigation action plan. The Planning Department will continue to work closely with the Emergency Operations Manager to insure consistency in Plans.

14.5.2 Incorporation into Existing Planning Mechanisms

5.2 Identification and Analysis of Mitigation Actions – Requirement §201.6(c)(4)(ii): The plan **shall** include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as the comprehensive or capital improvement plans when appropriate.

A. Planning Mechanisms for Incorporating the Requirements of the Plan

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best information and technology available at the time the LHMP was prepared. As previously stated, the City's general plan is considered to be an integral part of this plan. The City, through adoption of its 2007 general plan (safety element) goals, has planned for the impact of natural hazards. The LHMP process provided the City with the opportunity to review and expand on policies contained within the general plan. The City views the General Plan and the LHMP as complementary planning documents that work together to achieve the ultimate goal of the reduction of risk exposure

to the citizens of Santa Cruz. Many of the ongoing recommendations identified in the mitigation strategy are programs recommended by the General Plan, the Urban Water Management Plan, The Capital Improvement Program and other adopted plans.

The City will coordinate the recommendations of the LHMP with other planning processes and programs including the following:

- City Emergency Management Plan
- Capital Improvement Program
- City of Santa Cruz Municipal Code
- Community design guidelines
- Water-conservation guidelines
- Storm Water Management Program

Most action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of educational programs, continued interdepartmental and interagency coordination, or improved public participation.

14.5.3 Continued Public Involvement

5.3 Continued Public Involvement – Requirement §201.6(c)(4)(iii): The plan maintenance process **shall** include a discussion on how the community will continue public participation in the plan maintenance process.

The public will continue to be apprised of LHMP actions through the City website and by providing copies of the annual progress reports to the media. Copies of the LHMP will be distributed to the Santa Cruz Library System. Upon initiation of the LHMP update process, a new public involvement strategy will be initiated based on guidance from the committee. This strategy will be based on the needs and capabilities of the City at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area and the City's website.

ENDNOTES

1 City of Santa Cruz General Plan Safety Element October 25, 1994

2 City of Santa Cruz Downtown Recovery Program- Adopted 1991

3 UCSC LRDP (Long Range Development Plan) 2005-2020

4 UCSC 2005 LRDP Final EIR September 6, 2006.

5 UCSC LRDP 2005-2020

6 Seismicity of the United States, 1568-1989 (Revised) by Carl W. Stover and Jerry L. Coffman, U.S. Geological Survey Professional Paper 1527, US Government Printing Office, Washington: 1993.

7 http://quake.usgs.gov/research/seismology

8 http://www.consrv.ca.gov/CGS/rghm/loss/index.htm May 2006 California Geological Survey Estimation of Future Earthquake Losses in California B. Rowshandel, M. Reichle, C. Wills, T. Cao, M. Petersen(*), D. Branum, and J. Davis

9 http://www.ce.washington.edu/~liquefaction/html/what/what1.html

10 http://www.es.ucsc.edu/~es10/fieldtripEarthQ/Damage1.html

11 http://www.es.ucsc.edu/~es10/fieldtripEarthQ/Damage1.html

12 Estimation of Future Earthquake Losses in California

13 http://www.consrv.ca.gov/CGS/rghm/loss/index.html

14 California Coastal Commission ReCAP Pilot Project Findings and Recommendations: Monterey Bay Region

15 Wildland Pre-Suppression Plan for the Mutual Threat Zone Areas; September 1990 Santa Cruz Fire Department and California Department of Forestry.

16 FEMA Flood Insurance Study Number 06087CV000A; March 2, 2006, Page 15

17 http://nwis.waterdata.usgs.gov/ca/nwis/peak

18 (Stormwater Public Works)

19 California Coastal Commission ReCAP Pilot Project Findings and Recommendations: Monterey Bay Region

20 2005 Urban Water Management Plan, City of Santa Cruz, February 2006 (page5-3)

21 actual recording on the SL River began in 1936 synthesized flow records generated for earlier modeling studies were used to extend the period back to 1921.

22 One acre -feet equals 325,851 gallons; 3.07 acre-feet equals one million gallons.

23 2005 Urban Water Management Plan, City of Santa Cruz, February 2006
Santa Cruz Integrated Water Plan Final Program EIR

24 City of Santa Cruz 2005 Urban Water management Plan, February 2006-Page 2-7

25 Santa Cruz Housing Element Update 2002-2007

26 City of Santa Cruz 2005 Urban Water management Plan, February 2006

27 City of Santa Cruz Water Conservation Plan. Gary Fiske and Associates Feb 2000

28 Tsunamis Affecting the West Coast of the United States 1806-1992 NOAA (Dec 1993)

29 The Tsunami Hazard in California, California Seismic Safety Commission (Dec 2005)

30 Inundation maps for the State of California, Richard K Eisner, Jose C. Borrero, and Costas E. Synolakis (Governor's Office of Emergency Services.

31 Inundation maps for the State of California, Richard K Eisner, Jose C. Borrero, and Costas E. Synolakis (Governor's Office of Emergency Services.

32 San Jose Mercury News Little is known about damage giant wave could cause By Glennda Chui (June 25, 2005)

33 California Coastal Commission ReCAP Pilot Project Findings and Recommendations: Monterey Bay Region

34 Evaluation of Erosion hazards - Heinz Center Coastal Erosion Mapping and Management - Journal of Coastal Research)

35 Draft Review of California Coastal Erosion Planning and Response: A Strategy for Action Gary D. Nichols, California Resources Agency March 2003

36 Living with The Changing California Coast by G.B. Griggs, K, Patsch and L. E. Savoy- University of California Press

37 California Coastal Commission ReCAP Pilot Project Findings and Recommendations: Monterey Bay Region

38 City of Santa Cruz General Plan

39 http://www.fema.gov/hazard/landslide/index.shtm

40 http://www.fema.gov/hazard/landslide/index.shtm

41 USGS OPEN-FILE 97-745 C SHEET 9 OF 11

42 Santa Cruz County Office of Emergency Services

43 City of Santa Cruz 2005 Urban Water management Plan, February 2006

44 City of Santa Cruz 2005 Urban Water management Plan, February 2006

45 http://landslides.usgs.gov/

Appendices

City of Santa Cruz

Local Hazard Mitigation Plan

List of Appendices

	APPENDIX TITLE
A	HAZARDS NOT A RISK TO SANTA CRUZ
B	ACRONYMS AND ABBREVIATIONS
C	GLOSSARY OF TERMS
D	CRITICAL FACILITIES
E	PUBLIC SCHOOLS
F	PRIVATE SCHOOLS
G	DAY CARE FACILITIES
H	SENIOR RESIDENCE AND CARE FACILITIES
I	CITY OF SANTA CRUZ FACILITIES
J	REFERENCES FOR TSUNAMI RUNUP
K	SUCCESSFUL PROGRAMS AND PROJECTS
L	WATER SHORTAGE CONTINENCY PLAN
M	CENSUS CHARACTERISTICS 2000
N	CRITICAL STRUCTURES MAP – LARGER AREA
O	EMERGENCY MANGAGEMENT PLAN (JAN 2007)

HAZARDS THAT ARE DETERMINED NOT A SIGNIFICANT RISK TO SANTA CRUZ

AVALANCHE

An avalanche is defined as a mass of loosened snow, ice, or earth suddenly and swiftly sliding down a mountain. In general practice this is assumed to be a snow avalanche unless another term such as ice, rock, mud, etc, is used. The Sierra Nevada Mountains which are over 200 hundred miles from Santa Cruz are the nearest area with a risk of avalanche. This is not considered a significant hazard risk to Santa Cruz.

www.avalanche-center.org/Bulletins/Calif/

EXPANSIVE SOILS

Expansive soils are the types of soils that swell when wet. Claystone and alluvium are the most common, followed by siltstone. Combined with hilly terrains, expansive soils may contribute to slope creeping, settlement and landslide problems. Site drainage, landscaping and irrigation have a crucial impact on maintenance of properties on expansive soils. Santa Cruz is not subject to expansive soils.

Soils Survey of Santa Cruz County
www.ca.nrcs.usda.gov/mmlra02/stcruz/document/tables.html

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration Geodetic Bench Marks

www.geo-one-stop.gov/
www.ngs.noaa.gov/PUBS_LIB/GeodeticBMs/

EXTREME HEAT

Exposure to excessive heat can cause illness, injury and death. Approximately 400 people die each year in the United States from exposure to heat due to weather conditions, and many more people die from health conditions that are exacerbated by exposure to excess heat. Most heat-related deaths occur during the summer months. The elderly, very young, and people with chronic health problems are most at risk. Air conditioning is the leading protective factor against heat-related illness and death.

On the coast, the small range in temperature from day to night and from winter to summer produces an unusually equable regime. Santa Cruz, Santa Cruz County is at about 36.98˚N 122.01˚W. Santa Cruz is a coastal city with a mild year-round climate. Average maximum temperatures range from 75ºF to 77º F in August and September, the hottest months of the year. The highest temperature ever recorded in Santa Cruz was 108 in 1900 and 1904. The most recent high was 107 in September 1971. No deaths were attributed to heat.

Sources:
www.worldclimate.com/cgi-bin/
www.hurricane.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals
www.nws.noaa.gov
www.ncdc.noaa.gov/oa/climate/extremes/2000/august/augustext2000.html
Department of Health and Human Services Center for Disease Control and Prevention

HURRICANES, TYPHOONS AND COASTAL STORMS

A hurricane is a severe tropical storm that forms in the North Atlantic Ocean, the Northeast Pacific Ocean east of the dateline, or the South Pacific Ocean east of 160º. Hurricanes need warm tropical oceans, moisture and light winds above them. If the right conditions last long enough, a hurricane can produce violent winds, incredible waves, torrential rains and floods. In other regions of the world, these types of storms have different names. This is called a typhoon when they occur in the Northwest Pacific. A tropical storm becomes a hurricane when winds reach 74 mph. When hurricanes move onto land, the heavy rain, strong winds and heavy waves can damage buildings, trees and cars. The heavy waves are called a storm surge. Storm surges are very dangerous as they threaten low lying coastal lands with inundation.

Coastal storms in Santa Cruz consist of precipitation, occasional high winds and heavy waves. Because the City is not in an area subject to hurricanes, the risks from coastal storms are generally limited to flooding and coastal erosion which are discussed separately.

Source:
National Oceanic & Atmospheric Administration U.S. Department of Commerce
http://hurricanes.noaa.gov/
NOAA Coastal Storm events www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms
www.nsc.org/ehc/ew/disaster/hurrican.htm

LAND SUBSIDENCE

Land subsidence is defined as a settling, compaction, or caving in of land caused by subsurface mining, ground-water withdrawal, or pumping of oil and gas. Land subsidence occurs in Santa Cruz only in conjunction with severe coastal storms and earthquake and is addressed under those topics.

USGS Science Topics Land Subsidence
NNOAA Satellite & Information Service National Geophysical Data Center
U.S. Geological Survey (USGS)

WINTER STORMS and HAILSTORMS

Severe winter storms and weather include extreme cold, heavy snowfall, ice storms, winter storms, and/or strong winds. In addition, winter storms may result in other hazards such as flooding, severe thunderstorms, tornadoes or extreme winds.

Snow has been reported in nearly every part of California, but it is very infrequent west of the Sierra Nevada except at high elevations of the Coast Range and the Cascades. The City of Santa Cruz is in a mild coastal area without risk of heavy snowfall or ice storms.

Source: U.S. Climate Normal's at National Climatic Data Center
NOAA Satellite and Information Service
www.hurricane.ncdc.noaa.gov/cgi- bin

TORNADOS

A tornado is a violently rotating column of air extending between, and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as a funnel cloud. On a local-scale, tornadoes are the most intense of all atmospheric circulations with wind that can reach destructive speeds of more than 300 mph.

Since 1950, 292 tornadoes have occurred in 42 counties throughout California resulting in 103 injuries. However, since 1950, no deaths caused by tornadoes have been recorded in California. A search of NOAA Satellite and Information Service shows three minor tornadoes in Santa Cruz on record since 1965. There were no deaths and only minor property damage.

Source:
NOAA Satellite and Information Service National Climatic Data Center
www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html

VOLCANOES

Volcanoes are described as a vent in the Earth's crust through which molten or hot rock, steam, and ash reach the surface, including the cone built by the eruptions. According to the NOAA the only two volcanoes in California which have erupted in the last six hundred years are Mono Lake and Mt. Lassen.* Santa Cruz is over 300 miles from either of these volcanic sites. While there is always a possibility that as a result of an eruption some ash might drift as far as Santa Cruz. At this distance and given the history of eruption, the risk appears to be negligible for Santa Cruz.

Volcano Title	Volcano Type	Eruption Code
Lassen Volcanic Center	Stratovolcano Historical	D2
Mono Craters	Lava Domes Radiocarbon	D6
Mono Lake Volcanic Field	Cinder Cones	D4

The Last Known Eruption Codes:
D1 = Last known eruption 1964 or later
D2 = Last known eruption 1900-1963
D3 = Last known eruption 1800-1899
D4 = Last known eruption 1700-1799
D5 = Last known eruption 1500-1699
D6 = Last known eruption A.D. 1-1499

Source: www.noaa.gov/volcanoes.html
www.ngdc.noaa.gov/seg/hazard/stratoguide/glossary.html

ACRONYMS AND ABBREVIATIONS

BFE	Base flood elevation
CAGS	California Geological Survey
CBC	California Building Code
CCR	California Code of Regulations
CDF	California Department of Forestry
CERT	Community Emergency Response Team
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	Cubic feet per second
CIP	Capital improvement Program
CRS	Community Rating System
DHS	U.S. Department of Homeland Security
DMA	Disaster Mitigation Act (Public Law 106-390)
DOF	Depth of flooding
EIR	Environmental impact report
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FIS	Flood Insurance Study
ft	Feet
GIS	Geographical information system
HMGP	Hazard Mitigation Grant Program
IBC	International Building Code
km	Kilometer
M	Magnitude
MCE	Maximum credible earthquake
MH	Multi-hazard
ML	Local magnitude
mph	Miles per hour
NA	Not applicable
NCDC	National Climatic Data Center
NFIP	National Flood Insurance Program
NFIRS	National Fire Incident Reporting System
NOAA	National Oceanic and Atmospheric Administration
OES	California Governor's Office of Emergency Services
PDM	Pre-Disaster Mitigation Grant Program
RCRA	Resource Conservation and Recovery Act
SEMS	Standardized Emergency Management System
SFHA	Special flood hazard area
SHELDUS	Spatial Hazard Events and Losses Database for U.S.
UBC	Uniform Building Code

GLOSSARY OF TERMS

100-Year Flood The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1 percent annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Action Program, project or specific act taken to promote goal, in this case the goal of hazard mitigation.

Asset An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood Elevation (BFE): The BFE is the water surface elevation of a 100-year flood event (a flood that has a 1 percent chance of occurring in any given year as defined by the NFIP). The base flood is a statistical concept used to ensure that all properties subject to NFIP are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water – whether from rainfall, snowmelt, springs, or other sources – flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally above the ground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified.

Community Rating System (CRS) The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Facility A critical facility is vital to the City's ability to provide essential services and protect life and property. Loss of a critical facility would result in a severe economic or catastrophic impact; Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers needed for disaster response before, during, and after hazard events; Public and private utilities and infrastructure vital to maintaining or restoring normal services to areas damaged by hazard events; Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event

Dam A dam is any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, earthquakes, and intentional destruction.

Debris Debris refers to the scattered remains of assets broken or destroyed during the occurrence of a hazard. Debris caused by wind or water hazards can cause additional damage to other assets.

Depth of Flooding (DOF) The DOF is the difference between regulatory flood elevation (RFE) and the elevation of the lowest grade adjacent to a structure.

Disaster Mitigation Act of 2000 (DMA) The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster hazard mitigation grant program (HMGP) were established.

Drought Drought is a period of time without substantial rainfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Duration Duration is defined as the length of time that a hazard occurs. For example, the duration of a tornado can be minutes, but release of a chemical warfare agent such as mustard gas can persist for hours or weeks if unremediated.

Earthquake An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Exposure Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

(FEMA) An independent agency (now part of the Department of Homeland Security) created in 1978 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Fire Behavior Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Flash Flood A flash flood occurs with little or no warning when water levels rise at an extremely fast rate.

Flooding Flooding is a general and temporary condition of rising and overflowing water resulting in partial or complete inundation of normally dry land areas. Floods result from: (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation of runoff of surface water from any source, and (3) mudflows or the sudden collapse of shoreline land.

Flood Depth
Flood Elevation Flood depth is the height of the flood water surface above the ground surface.
Flood elevation is the height of water surface above an established datum (for example, the National Geodetic Vertical Datum of 1929 [NGVD], North American Vertical Datum of 1988, or mean sea level).

Flood Insurance Rate Map (FIRM) FIRM is the official map of a community for which FEMA has delineated the special flood hazard area (SFHA) and the risk premium zones applicable to the community.

Flood Insurance Study A flood insurance study is published for a community by the Federal Insurance and Mitigation Administration in conjunction with the community's FIRM. The study contains background data such as base flood discharges and water surface elevations that were used to prepare the study.

Floodplain A floodplain is any land area that becomes inundated with water during a flood or from any other source. Floodplain can be defined in different ways but is commonly defined as the area that is also called the 100-year floodplain.

Floodway A floodway is an area within a floodplain reserved for the purpose of conveying flood discharge without increasing the BFE by more that 1 foot. Generally speaking, no development is allowed in floodways because any structures there would block the flow of floodwater.

Frequency For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

General Plan California state law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for community development. The plan must consist of an integrated and internally consistent set of goals, policies, and implementation measures. In addition, the plan must focus on issues of the greatest concern to the community and be written in a clear and concise manner. City actions, such as those relating to land-use allocation, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with such a plan. The City of Santa Cruz's general plan serves these purposes. The General Plan Advisory Committee is now in the process of reviewing this plan and will submit its recommendations to the City Council in 2007.

Goal A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of the RHMP, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

GIS GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage. Natural hazards include floods, tsunamis, and earthquakes. Man-made hazards include acts of terrorism and hazardous material spills.

Hazard Mitigation Hazard mitigation refers to reduction or alleviation of the loss of life, personal injury and property damage that could result from a disaster through long- and short-term strategies. Hazard mitigation involves strategies such as planning, policy changes, programs, projects, and other activities that could mitigate the impacts of hazards.

HMGP **Hazard Mitigation Grant Program** Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard Mitigation Plan A hazard mitigation plan is a collaborative document that identifies hazards that could affect a community, assesses vulnerability to hazards, and represents consensus decisions reached on how to minimize or eliminate the effects of hazards.

HAZUS-MH — **Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program** is a GIS-based program used to support the development of risk assessments as required under the DMA. The HAZUSMH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards.

Hydraulics — Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology — Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity — Intensity refers to the measure of the effects of a hazard.

Inventory — The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other community resources.

Landslide — A landslide refers to the sliding movement of masses of loosened rock and soil down a hillside or slope under the force of gravity. Fundamentally, slope failure occurs when the strength of soils forming the slope is exceeded by pressure acting upon the soils (caused by factors such as weight or saturation).

Liquefaction — Liquefaction is the failure of soils when soils lose shear strength and flow horizontally during earthquakes. Liquefaction is most likely to occur in fine-grained sands and silts with high water content. Liquefaction undermines the ground's ability to solidly support building structures. Foundations on liquefiable soils can lose their ability to support load and can experience settlement on the order of several inches or more. This situation is extremely hazardous and may result in extreme property damage and threats to life and safety. Differential settlement can cause significant damage to buildings, lifelines, and transportation structures with partial or total collapse.

Magnitude — Magnitude is the measure of the strength of an earthquake, typically measured by the Richter Scale. Magnitude is most commonly measured by local magnitude (ML) used by the Richter Scale or by Mercalli Intensity. In the Richter Scale, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mitigation Actions — Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

NFIP — **National Flood Insurance Program (NFIP)**: In 1968, Congress created the NFIP in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. The Mitigation Division is the FEMA section that manages the NFIP and oversees the floodplain management and mapping components of the program. Nearly 20,000 communities across the United States and its territories participate in NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities.

Objective — An objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Peak Ground Acceleration Peak ground acceleration is a measure of the highest amplitude of ground shaking that accompanies an earthquake based on a percentage of the force of gravity.

Preparedness Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Recovery Recovery refers to actions taken by an individual or community after a catastrophic event to restore order and community lifelines.

Repetitive Loss Property A repetitive loss property is any NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced any of the following:

- Four or more paid flood losses exceeding $1,000 each
- Two paid flood losses exceeding $1,000 each within any 10-year period since 1978
- Three or more paid losses that equal or exceed the current value of the insured property

Risk Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment Risk assessment is the process of measuring potential loss of life, personal injury, economic injury and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on

1. hazard identification;
2. impacts of hazards on physical, social, and economic assets;
3. vulnerability identification; and
4. estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on the people, property, and economy of Santa Cruz. Risk estimates for the City are based on the methodology that the City used to prepare the risk assessment for this plan. The following equation shows the risk ranking calculation:

Risk Ranking = Probability + Impact (people + property + economy)

Riverine Riverine refers to anything of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Stafford Act The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Tornado A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. Tornadoes are the most intense of all atmospheric circulations. Winds can reach speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed A watershed is an area that drains down gradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire or Wildland Fire These terms refer to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage.

Zoning Ordinance The zoning ordinance designates allowable land use and intensities for the City. Zoning ordinances consist of two components: a zoning text and a zoning map.

CRITICAL FACILITIES

Critical Facility: A critical facility is vital to a community's ability to provide essential services and protect life and property. Loss of a critical facility would result in a severe economic or catastrophic impact. Under the Santa Cruz Local Hazard Mitigation Plan (Santa Cruz LHMP) definition, critical facilities include the following: Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers needed for disaster response before, during, and after hazard events.

FACILITY	LOCATION	
Police Station	155 Center Street	Police HQ is also primary EOC for all Emergency Management Incidents
Fire Station No 1	711 Center Street	
Fire Station No 2	1103 Soquel Avenue	Backup EOC
Fire Station No 3	335 Younglove Avenue	
UCSC Fire Station	1156 High Street	
City Hall	809 Center Street	
Corp Yard	1125 River Street	
Marine Safety & Lifeguard HQ	#1 Municipal Wharf	
County Government Building		
ES Building (County)	Park Drive	
Jail		
County Mental Health	1400 Emeline	
Harbor Master HQ		
Post Office -HQ	850 Front Street	
Post Office	120 Morrissey Avenue	
Wastewater Facility	California Street	
Water Treatment –	Graham Hill Road	
Bay Street Reservoir	High Street	
Loch Lomond Reservoir		
Refuse Disposal	Dimeo Lane	
PG & E Substation	Blaine Street	

I addition to the above facilities there are public and private utilities and infrastructure vital to maintaining services to areas impacted by hazard events as well as facilities that serve populations requiring special services during hazard events including hospitals, nursing homes, senior and disabled housing and facilities likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event. There are no hospitals within the City limits. The following facilities may require special services:

- Family Shelter on Water Street
- Senior Center
- Hope Services
- Dorian Center for the Blind
- Cabrillo Stroke Center

PUBLIC SCHOOLS

Elementary Schools (K-5)

Bay View Elementary	1231 Bay St.
DeLaveaga Elementary	1145 Morrissey Blvd
Gault Elementary	1320 Seabright Ave.
Westlake Elementary	1000 High St.

Middle Schools (6-8)

Branciforte Middle School	315 Poplar Ave
Mission Hill Middle School	425 King St.

Senior High Schools

Harbor High School	300 La Fonda
Santa Cruz High School	415 Walnut Ave

Branciforte Small School Campus 840 N Branciforte Ave

Monarch Community (K-6)
ARK - Independent Studies
Costanoa High School

Santa Cruz City Schools HQ 429-3410

http://www.sccs.santacruz.k12.ca.us/html/Boundaries.html

University of California at Santa Cruz

Main Campus	High and Bay Streets
Marine Lab Campus	Delaware (end of road at cliff – 100 Shaffer Rd)
2300 Delaware	2300 Delaware

PRIVATE SCHOOLS

School	Grade	Students	Phone	Address
Carden El Encanto	K-8th	95	460-2600	319 La Fonda
Empire Academy	7 -12th	50	458-4200	1025 Center Street
Georgiana Bruce Kirby	6-12th	190	423-0658	117 Union Street
Gateway School	K -8th	275	423-0341	126 Eucalyptus
Holy Cross	K-8th	230	423-4447	150 Emmet
SC Children's School	K- 6th	48	429-8444	366 Gault
Spring Hill	K - 6	112	427-2641	250 California
SC Waldorf School	K - 11	205	425-0519	1190 Empire Grade 111 Errett Circle

DAY CARE FACILITIES

Facility	Phone	Address
A Child's Reflection	426-3655	327 Church St
A Child's View	427-9959 427-9035	
Calvary Childcare Center	425-1332	532 Center Street
Campus Kids Connection, Inc DeLaveaga, Gault, Branciforte & Westlake	462-9822	1000 High
Children's Alley Preschool	476-4398	7th Avenue
Common Threads Montessori	427-1316	208 Rankin
Community Children's Center	425-8668	301 Center
Delaveaga Child Care Center	426-7402	1145 Morrissey Blvd.
Downtown Children's Center	427-0900	303 Walnut
Emeline Child Care Center	459-8866	1030 Emeline Ave
Friends Forever Family Day Care	26-8878	Lee St
Gault Child Care Center	457-1229	1320 Seabright
Head Start	457-8506	255 Swift St.
Happy Days Children's	423-8581 469-9338	Morrissey Blvd. 191 Harvey West Blvd.
Holy Cross Preschool	425-1782	150 Emmet
Johnny Crow's Garden	426-7620	548 Highland Ave
Kids Klub	469-0403	1114 Water
Magic Garden Preschool	476-1870	Checola Court
Messiah Lutheran Preschool	458-1498	801 High St.
Neighborhood Childcare Center	423-9073	904 Western Dr.
North County Early Head Start	420-1800	214 Kaye St.
Nuevo Dia Child Dev Center	426-1236	135 Leibrandt
Penny's Playhouse	26-6275	S. Branciforte Ave
SC Comm Children's Center	425-8668	Center Street
SC Parent Ed. Nursery School	425-4495	411 Roxas St.
Sonrise Academy	469-8576	Frederick St
Sunflower Kids	462-4152	call for info
Sycamore Street Child Dev Center	454-9920	121 Sycamore St
Swift Street Child Dev. Center	454-9920	Swift St
Trinity Learning Center	425-7580	420 Melrose Avenue
The Village School	423-3588	California Ave
Westside Parent Coop	425-5789	Bay View Elementary

SENIOR RESIDENCE AND CARE FACILITIES

Facility	Address	Phone
Dominican Hospital-Rehab - Restorative Care Unit	610 Frederick	457-7160
Heartland Home Health Care And Hospice		423-4679
The Maple House	410 Pennsylvania	423-6347
Comfortcare Senior Service	100 Doyle -Suite F	427-1553
Alexandria Victoria Ret Assisted Living	226 Morrissey	429-9137
La Posada	609 Frederick	429-9230
Villa Cruz Guest Home	127 Laurent	429-0126
Palomar Inn	1344 Pacific	423-7000
Sunshine Villa	80 Front	459-8400
Arbor Cove Senior Commons	84 Blackburn	454 9548

CITY OF SANTA CRUZ FACILITIES

Cultural Facilities

Civic Auditorium

Dedicated in 1940 in downtown Santa Cruz, the Civic Auditorium is classic California. Arched granite pillars cover the brick entryway and warm pastel colors fill the hallways to create an inviting, slightly deco atmosphere. Hosting concerts, expos, meetings and private parties, the Civic has something for everyone.

Louden Nelson Center

The Center's mission is to seek a balance between social, recreational and cultural services to the diverse communities of Santa Cruz. The Center strives to create a space that feels welcoming, comfortable, safe and accessible to all who use it.

Museums

Natural History Museum

The City's Museum of Natural History is in Tyrell Park above Seabright State Beach. Museum exhibits and programs are displayed in the modified 1915 Carnegie Library that sits on the park's southern edge, overlooking Monterey Bay. The Museum provides interesting exhibits and programs on the diverse cultural and natural history of the Santa Cruz region.

Surfing Museum

The Santa Cruz Surfing Museum is housed in the Mark Abbott Memorial Lighthouse at Lighthouse Point on West Cliff Drive. Overlooking internationally renowned surfing hot spot Steamer Lane, this little gem of a museum has photographs, surfboards, and other interesting items tracing over 100 years of surfing history in Santa Cruz.

Libraries

Santa Cruz Public Library

The Santa Cruz Public Libraries is a city-county library system with libraries throughout the County of Santa Cruz, California. System Headquarters: 1543 Pacific Avenue, Santa Cruz, California 95060. (831) 420-5600.

Central Branch 224 Church Street
Garfield Park 705 Woodrow Avenue
Branciforte 230 Gault Avenue

Parks and Open Spaces

DeLaveaga Golf Course

Carved in the hills overlooking Santa Cruz and the Monterey Bay, DeLaveaga Golf Course is a championship par 72 course known for its natural beauty, challenging layout and full range of services. DeLaveaga offers a lighted driving range, a comprehensive lesson program, men's and women's playing clubs and year-round tournaments.

Loch Lomond Recreational Area

Loch Lomond Recreation Area offers fishing, boating, picnicking, and hiking. As a City of Santa Cruz drinking water reservoir, swimming and other body-contact water sports are not permitted.

Harvey West Park

Harvey West Park is a 50-acre municipal park. Located just off the intersection of Highways 1, 9, and 17 and is truly Santa Cruz' most complete central park complex. The park includes hiking trails, swimming pools, ball fields, play equipment, clubhouses, barbecue pits, and picnic areas.

Lighthouse Field

Point Santa Cruz, locally known as Lighthouse Field State Park, forms the northern boundary of Monterey Bay. It is one of the last open headlands in any California urban area.

Neary Lagoon

Neary Lagoon is an important part of the urban watershed for the west side of the city of Santa Cruz. A drainage area of approximately 850 acres empties into the lagoon, and from there, out to the ocean.

Pogonip

A scenic 640-acre expanse of open meadows, woodlands and creeks, Pogonip features over nine miles of trails open to hikers.

Arana Gulch

Arana Gulch is a 63-acre greenbelt land, featuring open meadows, oak woodland, and Arana Creek.

Neighborhood Parks Around Santa Cruz

There are over 25 parks around Santa Cruz.

Waterfront and Beaches

Santa Cruz Beaches

Santa Cruz Wharf

Situated on the pristine Monterey Bay National Marine Sanctuary, the Santa Cruz Wharf combines the natural splendor of the sanctuary with the fun and recreation of the largest working wharf on the West Coast. Marine Safety and Lifeguard Headquarters are located on the Wharf.

Municipal Facilities

Landfill and Recycling Center

The City of Santa Cruz Resource Recovery Facility and Recycling Center is owned and operated by the City of Santa Cruz. It is located at 605 Dimeo Lane which intersects Highway 1 about 3 miles north of the City limits.

Wastewater Pollution Control Facility

The City of Santa Cruz has been treating sewage at the wastewater treatment facility near Neary Lagoon and disposing of the effluent in the ocean since 1928.

Water Treatment – Graham Hill

REFERENCES FOR TSUNAMI RUN-UP

***Tsunamis affecting the West Coast of the United States**, 1806-1992*, KGRD No. 29, National Oceanic and Atmospheric Administration, National Geophysical Data Center, Boulder, Colorado, USA, September, 242 p.
1993 Lander, James F., Patricia A. Lockridge, and Michael J. Kozuch (237)

Santa Cruz Mountains (Loma Prieta) Earthquake, EOS, Transactions, American Geophysical Union, Vol. 70, No. 45, November 7, p. 1463-1467.
1989 McNally, Karen G., Thorne Lay, Marino Protti-Quesada, Gianluca Valensise, Dan Orange, and Robert S. Orange (264)

Earthquake and bay response of to the Loma Prieta Earthquake, EOS, Transactions, American Geophysical Union, February 6
1990 Schwing, F.B., J.G. Norton, and C.H. Philskaln (384)

DATE			LOCATION = SANTA CRUZ						
Year	Mo	Dy			Latitude	Longitude	Type	Max Height in Meters	Deaths at Runup Location
1840	1	16			36.970	-122.020	1		
1865	10	4			36.970	-122.020			
1865	10	8			36.970	-122.020	1		
1868	10	21			36.970	-122.020	1		
1877	5	10			36.970	-122.020	1	1.37	
1896	6	15			36.970	-122.020		1.50	
1922	11	11			36.970	-122.020			
1923	2	3			36.970	-122.020			
1946	4	1			36.970	-122.020	1	1.52	1
1952	11	4			36.970	-122.020			
1960	5	22			36.970	-122.020	2	.90	
1964	3	27			36.970	-122.020		1.5	
1965	2	4			36.970	-122.020	2	.61	
1989	10	18			36.970	-122.020			
2006	11	15			36.970	-122.020			

Run Up Run up is height of the largest tsunami wave above sea level at the furthest inland point.
Inundation The maximum horizontal distance inland that a tsunami penetrates.
Wave Period The Wave Period is the time between waves which can typically vary from five minutes to two hours.

SUCCESSFUL PROGRAMS AND PROJECTS

Program/Project	Description	Hazard	Department
Updated Emergency Operations Plan	Emergency Operations Plan is reviewed and updated annually (current Feb 2007)	Multi-hazard	EOM
Emergency staff training	City staff is assigned, trained and regularly participates in Emergency Operations drills		EOM
Ongoing coordination with other agencies	City of Santa Cruz EOM meets with SC County office of Emergency Services, UCSC and other cities and agencies in the region to share information and coordinate preparedness efforts.	Multi-hazard	EOM
Ongoing Warning System	The City of Santa Cruz EOM works with the SC Office of Emergency Services to manage the early warning system for evacuation of areas susceptible to flooding, tsunami inundation, seiches or dam failure.	Flood Tsunami Dam failure	EOM
Ongoing promotion of fire protection systems	The Santa Cruz Fire Dept promotes installation, inspection, and testing of built-in fire extinguishing and early warning fire alarm systems	Fire	Fire
Delaveaga	The Santa Cruz Fire Department successfully completed the DeLaveaga Vegetation Management project protecting wildland and park facilities.	Wildfire	Fire
Meder Canyon	The Santa Cruz Fire Department successfully completed the Arroyo Secco Canyon Vegetation Management project, a vegetation management program in the wildland/urban interface area	Wildfire	Fire
Ongoing Cooperative agreements	The Santa Cruz Fire Department maintains cooperative fire protection agreements with UCSC, the County fire districts and the California Department of Forestry	Wildfire	Fire
Ongoing design review	Working together, the Fire and Planning & Building Departments review new development design, circulation & access to ensure that development provides for minimum emergency response times and that emergency vehicles have safe & expedient passage at all times	Muli-hazard Fire	Fire Planning & Building

Ongoing UBC requirement	The Planning & Building Dept requires that all new construction conform with the latest edition of UBC	Earthquake	Planning & Building
Ongoing Geologic requirement	The Planning & Building Department requires geologic investigations by qualified professionals	Earthquake	Planning & Building
Completed after 1989 Loma Prieta Earthquake	A seismic retrofit program was completed after the Loma Prieta Earthquake that strengthened or replaced city owned and used buildings that were known to have structural weaknesses	Earthquake	Planning & Building
Public Buildings completed-residential is ongoing	Planning and Building continue with ongoing efforts to require retrofit of all remaining non-complying Unreinforced Masonry (URM) buildings during repair or alteration including risk reduction from lateral spreading including Wharf and Natural History Museum	Earthquake Multi-Hazard	Planning & Building Parks & Rec
Coastal protection permit review	The Planning and Building Dept continues to protect & preserve the coastline and City infrastructure through the permit review process		Planning & Building
Ongoing historic preservation	The Planning & Building Department encourage and support the protection of cultural, historic and architecturally significant structures to preserve neighborhood and community character as defined in the General Plan.		Planning & Building
Market St. bridge seismic retrofit	Public Works Dept completed the Market Street Bridge Seismic Retrofit and Barrier Rail	Earthquake	Public Works
Tressel bridge reconstruction	Public Works Department completed the West Cliff Drive Bridge Reconstruction	Earthquake	Public Works
Storm drain improvement	Public Works completed the Center Street Storm Drain & Paving Project	Flood	Public Works
Storm drain improvement	Public Works completed the Beach Flats Storm Drain Project	Flood	Public Works
Seismic safety	Public Works (with review by the Building Department) completed the City Hall Renovation: Phase 1 and 2 and 3	Earthquake	Public Works
Floodplain management-Limit alteration	Public Works continues with a program to minimize the alteration of floodplains, stream channels and natural protective barriers that accommodate overflow	Flood	Public Works
Ongoing creek flooding reduction	Public Works with the assistance of Planning & Building endeavors to reduce flooding hazards in potential flood areas along Branciforte and Carbonera Creeks.	Flood	Public Works

NFIP compliance monitoring	The State of California Department of Water Resources monitors compliance for FEMA for cities to confirm compliance with NFIP	Flood	Public Works Redevelopment
CRS compliance	The City of Santa Cruz annually certifies compliance with the CRS program as a part of that certification NFIP compliance components are included	Flood	Public Works Redevelopment
Floodplain management-Encourage FIP participation	The City of Santa Cruz encourages property owners, potential buyers & residents living in floodplains and coastal inundation areas to participate in Federal Flood Insurance Program	Flood	Public Works Redevelopment Planning & Building
Floodplain management-Public awareness	Public Works (in conjunction with Planning and Building) continues to regulate development in floodplains and strives to increase public awareness of flood hazards	Flood	Public Works Planning & Building Redevelopment
Completed San Lorenzo Levee Project	The City has recently completed the San Lorenzo River Levee Project which brings the City of Santa Cruz FEMA Community Rating System to a class seven rating which further reduces the NFIP A-99 flood insurance rates by 5%.	Flood	Public Works & Redevelopment
Bay St reservoir transmission project	The Water Department is in the final stages of the Bay Street Reservoir Transmission Project which includes a new treated water transmission main from Ocean Street to the Bay Street Reservoir and pump station. The Project also includes the installation of a segment of 24-inch water transmission main for raw water from the North Coast to the treatment plant as well as replacement of existing undersized and old distribution mains in Hunolt, High, Laurent and Moore Streets, and Cardiff Place.	Multi-hazard drought	Water
Water storage seismic retrofit	Water Department completed seismic retrofit of storage tanks .	Earthquake	Water
Wharf Sprinklers	Installation of under wharf fire sprinkler system	Fire	Parks & Rec Fire

WATER SHORTAGE CONTINGENCY PLAN

This chapter presents information about how the City of Santa Cruz manages the water system during a water shortage emergency that arises as a result of drought. It also describes actions that would be undertaken in response to a catastrophic interruption of water supplies, including a regional power outage, earthquake, or other emergency situation.

The rules and regulations governing the use of water during a water supply shortage are contained in the City's Drought Emergency Ordinance (Appendix E). This ordinance is put into effect when Water Department staff determines that available supplies will be inadequate due to the lack of sufficient rainfall, runoff, and reservoir storage to support the community's normal water needs.

This ordinance was last adopted in 1992. Since that time, many things have changed including:

- Population
- Customer consumption patterns
- Per capita water use
- New water rates and rate structure
- Monthly billing inside City limits
- Completion of the Water Curtailment Study, which generated considerable insight and information about how the hardships of water shortage vary among different customer groups.
- Adoption of the Integrated Water Plan, which includes use curtailment as a planned component of the City's overall water management strategy.

As a result of all these changes, the Water Department recognizes the need to review and update its water shortage contingency plan and the accompanying drought emergency ordinance. Such an update is scheduled for later in 2006.

The following is a summary of the ordinance in its current form.

The need to adopt the ordinance is first discussed at the City's Water Commission, where a report on the City's water supply status is made and a recommended plan of action is discussed. The matter is then brought before the City Council for consideration at a public hearing, typically during the month of April. In adopting the ordinance, the Council makes a formal declaration of a water supply emergency. The ordinance remains in effect until October 31 of that year, unless the Council takes action before then to rescind it. The general timeline for declaring a water shortage and determining the drought response plan is presented in Table 8-1.

Determination of Shortfall

When a lack of supply appears imminent, such as after an unusually dry winter or period of consecutive dry years, it becomes necessary to calculate the degree to which water supplies will be deficient relative to estimated water needs.

For the Santa Cruz water system, supplies are generally adequate to meet demand

during the months from November through March, even in drought years. During this time, water consumption is at a seasonal low and production from the river, wells and coastal sources is usually sufficient to meet demands without having to draw water from Loch Lomond. The peak season from April 1 through October 31 is considered the critical period for the purpose of defining the degree of water supply shortfall, and for selecting the appropriate conservation goal.

To determine the potential shortfall, the Department follows a three-step process, described below:

1. Develop a forecast of supply available from surface diversions and wells.

2. Calculate the allocation available for use from Loch Lomond reservoir.

3. Compare the total available water supply against expected water demand.

Forecasting the supply expected from coastal streams, wells, and the San Lorenzo River involves both professional judgment and correlating runoff with the amount of rainfall received to determine the yield that can be obtained from each specific source. The Department uses a conservative estimate of yield to avoid the situation of overestimating supply and having to upgrade the emergency later in the year.

The amount of water available from Loch Lomond is then calculated, based on the level of storage at the beginning of the dry season and consideration of the reserve needed at the end of the dry season if drought conditions were to carry over into the following year.

In comparing the supply situation against demand, the Department used 1987 consumption levels during the 1987-92 drought as the reference point for “normal” water demand. Because customer demand patterns and per capita use levels have changed since the late 1980’s, the Department will need to establish a new baseline for demand in future droughts.

This process of defining the deficit condition is conducted toward the end of the winter season, when the status of the water supply situation becomes certain. The public is then immediately notified through the news media and informed of the severity of the situation.

Response to Water Supply Shortage

The Department’s response to inadequate water supply varies depending on the magnitude of the shortfall. The existing drought emergency ordinance has been designed using a phased approach that includes four stages ranging from a minimal to a severe shortage. The response varies from voluntary use restrictions to mandatory rationing. Table 8-2 summarizes the type of actions that are required of customers and activities undertaken by the Department corresponding with each stage of shortfall listed in the ordinance.

The Water Department coordinates its response to the water shortage through a rationing task force, which meets on a weekly basis when rationing is in effect. The task force consists of key staff members including the Director and the Water Conservation Manager. Public input and participation in drought contingency planning and management

Table 8-1. Calendar for Declaring Water Shortage

Target Date	Action
Months of Oct-Dec	Monitor rainfall, reservoir level, and runoff amounts
Late January	Prepare written status report on water supply conditions
Early February	Present initial estimate of water supply availability for year ahead
Early March	Present revised estimate of water supply availability for year ahead
Mid-March	SCWD announces existence of water shortage (if applicable)
Mid to late March	SCWD determines monthly water production budget and need for voluntary or mandatory response.
Early April	Present shortage response recommendation to Water Commission
Mid-April	City Council formally declares water supply emergency, adopts emergency ordinance
Beginning of May	Water shortage regulations become effective

Table 8-2. Water Shortage Contingency Plan

Drought Stage/ Shortage Condition	Customer Requirements	Water Department Activities	Penalties
I. Conservation Alert: Minimal Shortage (5-12%)	• Time of day restrictions on residential irrigation • Prohibition on outdoor washing of surfaces	• Initiate public information campaign, media outreach • Request voluntary conservation • Step up enforcement of prohibition on water waste	• Educational letter, visit by service representative • Warnings • Excess water use limit
II. Mandatory Restrictions: Moderate Shortage (13-19%)	• Designated irrigation days/times • Large turf rationing • Additional prohibitions on outdoor washing / swimming pool filling • Display of conservation information by hotels and restaurants	• Request voluntary % reduction • Intensify media outreach and information campaign • Monitor customer use • Suspend main flushing • Mobilize Drought Appeals Board • Mobilize Drought Patrol	• Warnings • Excess water use limit • Rationing for repeat violations • Aggravated use fees
III. Limited Rationing: Serious Shortage (20-38%)	• Residential usage allotments • % reduction for non-residential customers • Large agricultural irrigation audit • Large turf irrigation audit • Large commercial use survey/audit	• Institute rationing program for residential accounts • Implement customer meter reading program • Establish rationing taskforce • Intensify public relations • Monitor customer use • Step up leak detection/repair	• Warnings • Excess water use fee • Aggravated use fees • Flow restrictions / disconnections
IV. Full Rationing: Severe Shortage (39% and greater)	• Rationing for all customers • No turf watering by public agencies	• Institute rationing program for business, industry, agriculture and municipal customers • Intensify all stage III actions	• Warnings • Excess water use fee • Aggravated use fees • Flow restrictions / disconnections

is accomplished primarily through monthly meetings of the City's Water Commission. During a drought emergency, Commission meetings serve as a public forum for discussing the status of water conditions and issues associated with implementation of the drought ordinance.

Mandatory Prohibitions Against Water Waste

As mentioned in Chapter 6, the City adopted an ordinance prohibiting water waste in 1981. The uses of water that are considered to be wasteful or without reasonable purpose include the following:

- Unauthorized use of water from a fire hydrant
- Watering of landscaping in a manner that allows excess water to run to waste
- Uncorrected plumbing leaks
- Outdoor washing without the use of a positive shut-off nozzle
- Other indiscriminate uses of water

These regulations against water waste are in effect in Santa Cruz on a permanent basis. During a drought emergency, however, the number of reports of water waste received from the general public and from field staff increase dramatically. These cases are acted upon, first through attempts to educate the customer, and then through appropriate enforcement by field service representatives, conservation staff, or by a temporary drought patrol.

Priority-Based Water Allocation System

The City has established an allocation system for individual customers and for customer categories as a whole when rationing is necessary. Allocations are based on priority of use and economic considerations, and are applied as equitably as possible in the various customer categories.

The overall intent of the drought emergency ordinance is to minimize non-essential uses of water and to conserve remaining supplies for the greatest public benefit, with particular regard to domestic use, sanitation, and fire protection. Accordingly, top priority is given to meeting minimum health and safety requirements for indoor residential needs and for public safety/fire protection purposes at all times, in accordance with the legal requirements of the California Water Code, Section 350, et seq.

The next highest priority is usage related to commercial and industrial activity. A deliberate effort is made to avoid rationing water to business, industrial, and institutional/public customers to preserve jobs and minimize economic harm unless it is absolutely necessary. These customers are required to reduce their consumption as a group based on a percentage of their previous use. If these customers fail to meet water use reduction goals, rationing of individual accounts can be instituted. Included in this category is all usage by agriculture, and by golf courses.

Water used for outdoor irrigation is given a low priority during a water shortage emergency. All irrigation becomes subject to limitations with respect to the time of day when irrigation is allowed

in Stage I and the day of week when irrigation is allowed in Stage II. Residential and commercial irrigation accounts and large turf customers are subject to further reductions during Stage III ranging between 12 and 50 percent. In addition, many residential customers choose to cut back or eliminate outdoor watering altogether when rationing is implemented during a severe drought.

Lowest in priority under the drought emergency ordinance is outdoor washing (including cars, sidewalks and buildings), swimming pool filling, operation of fountains, and other nonessential outdoor water uses.

Consumption Reduction Methods

The consumption reduction methods used in the City's water shortage contingency plan are summarized in Table 8-3. There are no specific allocations implemented in Stages I and II when the deficit is less than 20 percent. Instead, the approach taken by the City is to appeal for the voluntary cooperation of all customers to conserve water, to impose restrictions on low priority uses, to enforce prohibitions on nonessential uses, and to initiate a public information and education campaign to achieve the specified conservation goal.

Rationing for residential customers and certain irrigation accounts begins in Stage III, when the shortfall is 20 percent or greater. Business, industrial and other nonresidential customer categories are required to reduce water consumption by a certain percentage as a group, but are not rationed individually as are residential customers in Stage III.

In Stage IV, when the deficit approaches 40 percent, all customers are rationed, and turf watering by public agencies is prohibited.

Use allocations in Stages III and IV are calculated for each type of customer using the methods listed in Table 8-4.

Penalties or Charges for Excessive Use

There are three types of penalties that apply to noncompliance with regulations and overuse of water during a declared water supply emergency: excess use limits and fees, aggravated use fees, and disconnection of service.

Table 8-3. Consumption Reduction Methods

Consumption Reduction Methods	Stage When Method Takes Effect
Reduce pressure in water lines	
Flow restriction	III, IV
Restrict building permits	
Restrict for only priority uses	All stages
Use prohibitions	All stages
Water shortage pricing/penalties	All stages
Per capita allotment by customer type	III, IV
Plumbing fixture replacement	Ongoing programs
Voluntary restrictions	I
Mandatory restrictions	II
Incentives to reduce water consumption	Ongoing programs
Information and education campaign	All stages
Percentage reduction by customer type	II. III, IV

Excess use fees are imposed on single family residential customers who use more than a specifies amount, called an “excess use limit”, beginning in Stage II. The limit varies depending on the number of persons per household, starting at 55 CCF per bimonthly billing period. This penalty discourages excessive consumption by high-end customers as a way of forestalling water rationing, and functions like an additional price tier above normal water rates while restrictions are in effect.

In Stages III and IV, when rationing is in effect, excess use fees are imposed for customers who use more than their allocation. Customers are charged $5.00 per billing unit (hundred cubic feet) in addition to the basic rate for the first 10 percent of water over their limit/allocation and $25.00 per unit for each additional unit thereafter. The ordinance allows a customer to use a portion of the fee, on a one-time only basis, toward the installation of water conservation equipment in lieu of paying the penalty to the Water Department.

Aggravated use fees of up to $50.00 per day may be imposed on any customer who has been issued several notices of violation of water use regulations.

Table 8-4. Water Allocation Methods

Customer Class	Allocation Method
Single Family Residential	Persons per household
Multi-Family Residential	Option of: 1. Number of dwelling units 2. Persons per household 3. Hybrid of persons per household and percent reduction
Business	Percentage reduction
Industrial	Percentage reduction
Municipal	Percentage reduction
Irrigation	Percentage reduction
Coast Irrigation	Limit based on Prior Use

For customers who knowingly and willfully violate rationing rules and restrictions, the Department may install a device to restrict flow or discontinue service altogether. The fee for installing a flow restrictor is $ 35.00 and another $35.00 is charged for removal when the matter has been resolved. Reconnection charges are determined by the size of the meter and range in price from $50.00 for a 5/8 x 3/4 inch meter to $1,250.00 for a 6 inch meter.

The City's ordinance includes a provision for variances on restrictions and usage allotments. Decisions are made on a case-by-case basis by the Water Director, and, under certain circumstances, may be appealed to a City Council-appointed Drought Appeals Board. The Appeals Board hears both requests for variances as well as petitions from customers for relief from penalties arising from violations of the drought ordinance. It has the authority to make final decision in such cases.

Tracking Reductions in Water Use

Under normal water supply conditions, water production and gross consumption is recorded daily and monthly by treatment plant operators and reported to the Production Superintendent. Metered water consumption is reported on a monthly basis though automated sales reports generated by the utility billing system.

During a water shortage emergency, a monthly production budget is developed for each source of supply. Actual production and the lake level are closely monitored on a daily and weekly basis to verify that the budgeted goals are being met. Consumption by large users is monitored on a frequent basis. If the trend in consumption is such that the rate of drawdown at Loch Lomond is greater than anticipated, the City Manager and Council are notified so that corrective action can be taken.

In serious or severe stages of a drought, production and consumption data are evaluated daily and the status reported to the Water Director's office.

Estimate of Minimum Supply for Next Three Years

Water Code section 10632 (b) requires water suppliers to estimate the minimum water supply available during each of the next three years based on the driest three-year historic sequence for the agency's water supply.

The hypothetical scenario that follows for calendar years 2006 through 2008 is based on the following assumptions:

- As of January 1, 2006, Loch Lomond Reservoir is at full capacity (which reflects actual conditions), but the remainder of the 2005-06 water year is dry.
- Hydrologic conditions for 2007 and 2008 are similar to those experienced in the 1976-77 drought, which is the driest historic sequence on record.
- Annual water production from each major source is similar to that estimated in Table 5-2 for multiple dry years.
- Net increase in storage at Loch Lomond Reservoir over the next two winter seasons is estimated to be 100 million gallons each year.
- Unrestricted system demand is estimated to be 4.0 billion gallons per year with 2.7 billion gallons used during the peak season from April to October.
- The City's planned desalination plant is not available to increase supplies during the next three years.

The results are presented in Table 8-5. In 2006, no water shortage is expected to occur. In 2007, available water supplies would be reduced by 500 million gallons, resulting in peak season shortage of 18 percent compared to normal use of 2.7 billion gallons, which would trigger a Stage II response with mandatory water restrictions. In 2008, available water supplies would be reduced by 1.3 billion gallons, resulting in a severe peak season shortfall of 48 percent, and would require full water rationing for all customers. This scenario ends with a reserve supply in Loch Lomond Reservoir of slightly over one billion gallons, which would be retained as a safeguard against a subsequent dry year.

Table 8-5. Three-Year Estimated Minimum Water Supply (mgy)

Source/Condition		2006	2007	2008
North Coast		1,077	400	300
San Lorenzo River		2,008	2,100	1,800
Live Oak Wells		187	300	400
Loch Lomond Reservoir		728	700	200
Total Production		4,000	3,500	2,700
Peak Season Supply Deficit		0%	18%	48%
Condition of Loch Lomond Reservoir at end of season:	Elevation	563.6	549.4	539.9
	Capacity (% full)	74%	54%	42%
	Volume (bil gal)	2.1	1.5	1.2

Analysis of Revenue Impacts of Reduced Sales During Shortages

One of the consequences of drought is the decline in revenues that accompanies voluntary or mandatory reduction in customer water use. After the last drought ended in 1993, the City established a water rate stabilization fund. The primary purpose of the rate stabilization fund is to provide a financial reserve to help protect the City's Water Fund from short-term losses in revenue and to alleviate the need for rate increases under such circumstances. The fund is managed as a restricted account and can only be used with the approval of City Council under certain extraordinary circumstances, such as an emergency water shortage or other natural disaster. The fund balance currently is $2.4 million.

An analysis of the potential revenue impacts that would result if a worst-case situation like the scenario described above is summarized in Table 8-6. The total loss of revenue that would be experienced spanning the three fiscal years from FY 07 through FY 09 is estimated to be about $9.7 million. The rate stabilization fund would cover the loss of revenue in FY 07, but the fund balance would be exhausted early in FY 08. Such an event would likely force the Water Department to cut operating expenses and to defer several capital improvement projects planned in FY 08 and FY 09 in order to balance the budget.

Table 8-6. Analysis of Revenue Impacts

	FY 06	FY 07	FY 08	FY 09
Projected Normal Year Revenue	$19,695,701	$22,599,177	$25,246,724	$27,293,878
Drought Revenue	$19,695,701	$21,780,740	$21,203,970	$22,543,116
Loss of Revenue		$(818,437)	$(4,042,754)	$(4,750,762)
Rate Stabilization Fund Balance	$2,400,000	$1,581,563	$0	$0
Deficit after RSF Depletion	$0	$0	$(2,461,191)	$(4,736,952)
Postponed CIP Projects:				
- Water treatment upgrades			$0	$2,500,000
- Meter retrofit program			$400,000	$0
- City Initiated Main Replacement			$400,000	$400,000
- County/Redevelopment Work			$50,000	$50,000
- Beltz Treatment Plant Upgrade			$0	$800,000
- Power Management Study/ Electric Upgrade			$1,300,000	$0
- North Coast System Rehabilitation			$0	$500,000
- Transmission System Improvements			$200,000	$200,000
Total			$2,350,000	$4,450,000
Reduction in Operating Expense			$125,000	$325,000
Deficit/Surplus after postponing CIP and operating expense savings:			$13,809	$38,048

The analysis suggests that the rate stabilization fund balance may need to be increased over time to keep pace with the Department's budget and recent changes in water rates and rate structure.

In future years, the level of customer curtailment and impact on water revenues for a similar drought event should be less severe, assuming that additional supply becomes available from the planned desalination facility. When that happens though, the City will face increased operating expenses of about $1.7 million per year related to running the desalination facility.

Catastrophic Interruption of Water Supplies

Water Code section 10632 (c) requires water suppliers to describe the actions to be undertaken to prepare for, and implement during, a catastrophic interruption of water supplies.

The City plans for and responds to emergency incidents, including floods, earthquakes, fires, and hazardous materials incidents in accordance with the Santa Cruz County Operational Area

Memorandum of Understanding (MOU). The MOU ratifies local government agreements to follow the Standardized Emergency Management System or SEMS, as mandated under California law. The City maintains an Emergency Management Plan, which defines and describes the emergency management organization and guides the response of appropriate personnel to a major emergency. The City Manager, functioning as the City's Director of Emergency Services, would coordinate the emergency response to maintain water delivery and/or restore service as necessary.

The Water Department maintains a mutual assistance agreement with other water agencies through the Water/Wastewater Agency Response Network (WARN) to share equipment, personnel, and supplies in times of an emergency. The City is a within the California Office of Emergency Services Coastal Region II, which includes the counties in the San Francisco Bay region and northern California coast.

The Water Department has a **General Emergency Plan and Emergency Response Plan for Terrorist Activity and Natural Disasters.** This document sets forth the primary objectives of the Department in an emergency as follows:

- Maintain water service for domestic and firefighting purposes,
- Protect the water supply form possible contamination,
- Control the loss of water, and
- Keep the public informed

The plan outlines the roles responsibilities of key Departmental personnel during an emergency at both the City Emergency Operations Center and Water Department Operations Center. It also describes general actions to be taken to 1) assess situation status and extent of damage to the water system, 2) prevent contamination and loss of water, and 3) restore water service in response to the following types of emergencies:

- Earthquake
- Tsunami
- Flood
- Fire
- Suspected Contamination of Water Supply
- Civil Disorder
- Power Outage
- Treatment Plant Failure
- Damage to Distribution Storage Reservoirs or Booster Pumping Station
- Telecommunications Failure

The plan contains an emergency water rationing plan intended to preserve treated water supplies in the event a catastrophe results in impairment of the water system. The emergency rationing plan has two stages, which are defined as follows:

Serious shortage: This condition exists when the system is unable to meet normal demand, but can supply enough water for basic public health and safely needs. In this situation, not taking swift action to ration water could jeopardize available water in storage, or could leave the City vulnerable in the event of further outages.

Critical shortage: This condition exists when production facilities are rendered incapable of meeting 50% or less of normal daily production levels and the current rate of consumption poses an immediate threat of draining Bay Street reservoir or other storage tank.

The restrictions that would be instituted in a serious or critical shortage are summarized in Table 8-7.
The City has four portable auxiliary generators to run booster pumps in case of an extended power outage. In addition, the treatment plant and major pump stations (not including the coast pump station) have stationary electrical generators as a stand-by source of power in case of a local or regional power outage.

Finally, Water Department has separate earthquake response procedures that outline responsibilities for inspection and reporting the status of critical structures, including Newell Creek Dam, Bay Street Reservoir, and other major water production facilities following an earthquake.

Table 8-7. Emergency Water Rationing Plan

Serious Shortage	
Prohibited Uses: 1. Watering lawns, gardens or landscaping 2. Washing cars, boats, building exteriors 3. Washing sidewalks, driveways, or any exterior surfaces 4. No outdoor use for any reason 5. Car washes closed 6. Watering plants at nurseries, garden centers 7. Filling of swimming pools, hot tubs, decorative pools, or fountains (must be turned off) 8. Public showers closed	*Permitted Uses:* 1. Normal domestic uses: drinking, cooking (paper plates and plastic utensils requested) 2. Toilet flushing, only when necessary 3. Limit showers to three minutes 4. Bathing only if absolutely necessary (no more than half full) 5. Minimize clothes and dish washing
Critical Shortage	
Prohibited Uses: 1. Outdoor water use for any reason (garden, landscape, car washing, cleaning, maintenance) 2. Clothes washing and commercial laundering, except for health reasons 3. Janitorial cleaning 4. Businesses and institutions that use water in their operations may be forced to close or restrict operations: - Restaurants, bars, and coffee shops - Laundromats - Public and Private Schools - Manufacturing - Gyms and health spas - Beauty salons and barber shops 5. No water for construction 6. No water for crop irrigation	*Permitted Uses:* 1. Water limited to health and safety only: drinking and cooking (paper plates and plastic utensils required) 2. Toilet flushing for solid waste only 3. Shower/bathing should be limited to every other day 4. Use water only when absolutely necessary

CENSUS CHARACTERISTICS 2000

Table DP-1. Profile of General Demographic Characteristics: 2000

Geographic Area: Santa Cruz city, California

[For information on confidentiality protection, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total population	**54,593**	**100.0**
SEX AND AGE		
Male	27,180	49.8
Female	27,413	50.2
Under 5 years	2,664	4.9
5 to 9 years	2,563	4.7
10 to 14 years	2,619	4.8
15 to 19 years	5,054	9.3
20 to 24 years	7,751	14.2
25 to 34 years	9,343	17.1
35 to 44 years	8,458	15.5
45 to 54 years	8,028	14.7
55 to 59 years	2,067	3.8
60 to 64 years	1,383	2.5
65 to 74 years	2,196	4.0
75 to 84 years	1,764	3.2
85 years and over	703	1.3
Median age (years)	31.7	(X)
18 years and over	45,130	82.7
Male	22,328	40.9
Female	22,802	41.8
21 years and over	39,715	72.7
62 years and over	5,432	9.9
65 years and over	4,663	8.5
Male	1,839	3.4
Female	2,824	5.2
RACE		
One race	52,137	95.5
White	42,984	78.7
Black or African American	945	1.7
American Indian and Alaska Native	469	0.9
Asian	2,677	4.9
Asian Indian	344	0.6
Chinese	858	1.6
Filipino	507	0.9
Japanese	402	0.7
Korean	205	0.4
Vietnamese	119	0.2
Other Asian [1]	242	0.4
Native Hawaiian and Other Pacific Islander	72	0.1
Native Hawaiian	34	0.1
Guamanian or Chamorro	8	-
Samoan	10	-
Other Pacific Islander [2]	20	-
Some other race	4,990	9.1
Two or more races	2,456	4.5
Race alone or in combination with one or more other races: [3]		
White	45,123	82.7
Black or African American	1,383	2.5
American Indian and Alaska Native	1,130	2.1
Asian	3,593	6.6
Native Hawaiian and Other Pacific Islander	227	0.4
Some other race	5,877	10.8

Subject	Number	Percent
HISPANIC OR LATINO AND RACE		
Total population	**54,593**	**100.0**
Hispanic or Latino (of any race)	9,491	17.4
Mexican	7,184	13.2
Puerto Rican	170	0.3
Cuban	77	0.1
Other Hispanic or Latino	2,060	3.8
Not Hispanic or Latino	45,102	82.6
White alone	39,304	72.0
RELATIONSHIP		
Total population	**54,593**	**100.0**
In households	49,959	91.5
Householder	20,442	37.4
Spouse	7,562	13.9
Child	10,841	19.9
Own child under 18 years	8,554	15.7
Other relatives	2,193	4.0
Under 18 years	583	1.1
Nonrelatives	8,921	16.3
Unmarried partner	1,954	3.6
In group quarters	4,634	8.5
Institutionalized population	373	0.7
Noninstitutionalized population	4,261	7.8
HOUSEHOLD BY TYPE		
Total households	**20,442**	**100.0**
Family households (families)	10,401	50.9
With own children under 18 years	5,141	25.1
Married-couple family	7,562	37.0
With own children under 18 years	3,460	16.9
Female householder, no husband present	1,962	9.6
With own children under 18 years	1,205	5.9
Nonfamily households	10,041	49.1
Householder living alone	5,986	29.3
Householder 65 years and over	1,556	7.6
Households with individuals under 18 years	5,513	27.0
Households with individuals 65 years and over	3,433	16.8
Average household size	2.44	(X)
Average family size	2.98	(X)
HOUSING OCCUPANCY		
Total housing units	**21,504**	**100.0**
Occupied housing units	20,442	95.1
Vacant housing units	1,062	4.9
For seasonal, recreational, or occasional use	508	2.4
Homeowner vacancy rate (percent)	0.7	(X)
Rental vacancy rate (percent)	1.4	(X)
HOUSING TENURE		
Occupied housing units	**20,442**	**100.0**
Owner-occupied housing units	9,528	46.6
Renter-occupied housing units	10,914	53.4
Average household size of owner-occupied units	2.51	(X)
Average household size of renter-occupied units	2.39	(X)

- Represents zero or rounds to zero. (X) Not applicable.

[1] Other Asian alone, or two or more Asian categories.

[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.

[3] In combination with one or more of the other races listed. The six numbers may add to more than the total population and the six percentages may add to more than 100 percent because individuals may report more than one race.

Source: U.S. Census Bureau, Census 2000.

1

U.S. Census Bureau

Table DP-2. Profile of Selected Social Characteristics: 2000

Geographic area: Santa Cruz city, California

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
SCHOOL ENROLLMENT		
Population 3 years and over enrolled in school	**19,089**	**100.0**
Nursery school, preschool	743	3.9
Kindergarten	462	2.4
Elementary school (grades 1-8)	4,198	22.0
High school (grades 9-12)	2,258	11.8
College or graduate school	11,428	59.9
EDUCATIONAL ATTAINMENT		
Population 25 years and over	**33,896**	**100.0**
Less than 9th grade	1,868	5.5
9th to 12th grade, no diploma	1,825	5.4
High school graduate (includes equivalency)	4,913	14.5
Some college, no degree	7,791	23.0
Associate degree	2,453	7.2
Bachelor's degree	9,116	26.9
Graduate or professional degree	5,930	17.5
Percent high school graduate or higher	89.1	(X)
Percent bachelor's degree or higher	44.4	(X)
MARITAL STATUS		
Population 15 years and over	**46,537**	**100.0**
Never married	21,012	45.2
Now married, except separated	17,635	37.9
Separated	814	1.7
Widowed	1,900	4.1
Female	1,568	3.4
Divorced	5,176	11.1
Female	2,980	6.4
GRANDPARENTS AS CAREGIVERS		
Grandparent living in household with one or more own grandchildren under 18 years	**526**	**100.0**
Grandparent responsible for grandchildren	144	27.4
VETERAN STATUS		
Civilian population 18 years and over	**44,950**	**100.0**
Civilian veterans	3,667	8.2
DISABILITY STATUS OF THE CIVILIAN NONINSTITUTIONALIZED POPULATION		
Population 5 to 20 years	**12,236**	**100.0**
With a disability	1,074	8.8
Population 21 to 64 years	**34,510**	**100.0**
With a disability	4,965	14.4
Percent employed	54.6	(X)
No disability	29,545	85.6
Percent employed	79.4	(X)
Population 65 years and over	**4,555**	**100.0**
With a disability	1,775	39.0
RESIDENCE IN 1995		
Population 5 years and over	**51,678**	**100.0**
Same house in 1995	20,942	40.5
Different house in the U.S. in 1995	28,610	55.4
Same county	13,453	26.0
Different county	15,157	29.3
Same state	11,389	22.0
Different state	3,768	7.3
Elsewhere in 1995	2,126	4.1

Subject	Number	Percent
NATIVITY AND PLACE OF BIRTH		
Total population	**54,364**	**100.0**
Native	46,139	84.9
Born in United States	45,286	83.3
State of residence	30,138	55.4
Different state	15,148	27.9
Born outside United States	853	1.6
Foreign born	8,225	15.1
Entered 1990 to March 2000	3,575	6.6
Naturalized citizen	2,518	4.6
Not a citizen	5,707	10.5
REGION OF BIRTH OF FOREIGN BORN		
Total (excluding born at sea)	**8,225**	**100.0**
Europe	1,756	21.3
Asia	1,773	21.6
Africa	84	1.0
Oceania	77	0.9
Latin America	4,266	51.9
Northern America	269	3.3
LANGUAGE SPOKEN AT HOME		
Population 5 years and over	**51,678**	**100.0**
English only	40,149	77.7
Language other than English	11,529	22.3
Speak English less than "very well"	4,721	9.1
Spanish	7,336	14.2
Speak English less than "very well"	3,732	7.2
Other Indo-European languages	2,466	4.8
Speak English less than "very well"	415	0.8
Asian and Pacific Island languages	1,446	2.8
Speak English less than "very well"	537	1.0
ANCESTRY (single or multiple)		
Total population	**54,364**	**100.0**
Total ancestries reported	*64,159*	*118.0*
Arab	304	0.6
Czech[1]	250	0.5
Danish	726	1.3
Dutch	1,017	1.9
English	6,461	11.9
French (except Basque)[1]	1,953	3.6
French Canadian[1]	392	0.7
German	7,708	14.2
Greek	348	0.6
Hungarian	354	0.7
Irish[1]	7,038	12.9
Italian	4,764	8.8
Lithuanian	155	0.3
Norwegian	1,145	2.1
Polish	1,570	2.9
Portuguese	1,126	2.1
Russian	1,471	2.7
Scotch-Irish	1,084	2.0
Scottish	1,956	3.6
Slovak	46	0.1
Subsaharan African	199	0.4
Swedish	1,132	2.1
Swiss	394	0.7
Ukrainian	176	0.3
United States or American	1,414	2.6
Welsh	661	1.2
West Indian (excluding Hispanic groups)	125	0.2
Other ancestries	20,190	37.1

-Represents zero or rounds to zero. (X) Not applicable.

[1]The data represent a combination of two ancestries shown separately in Summary File 3. Czech includes Czechoslovakian. French includes Alsatian. French Canadian includes Acadian/Cajun. Irish includes Celtic.

Source: U.S. Bureau of the Census, Census 2000.

2

U.S. Census Bureau

Table DP-3. Profile of Selected Economic Characteristics: 2000

Geographic area: Santa Cruz city, California

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	**45,984**	**100.0**
In labor force	31,578	68.7
Civilian labor force	31,578	68.7
Employed	29,644	64.5
Unemployed	1,934	4.2
Percent of civilian labor force	6.1	(X)
Armed Forces	-	-
Not in labor force	14,406	31.3
Females 16 years and over	**23,260**	**100.0**
In labor force	14,811	63.7
Civilian labor force	14,811	63.7
Employed	14,018	60.3
Own children under 6 years	**2,898**	**100.0**
All parents in family in labor force	1,492	51.5
COMMUTING TO WORK		
Workers 16 years and over	**28,971**	**100.0**
Car, truck, or van - - drove alone	17,644	60.9
Car, truck, or van - - carpooled	3,645	12.6
Public transportation (including taxicab)	2,119	7.3
Walked	2,343	8.1
Other means	1,567	5.4
Worked at home	1,653	5.7
Mean travel time to work (minutes)[1]	23.3	(X)
Employed civilian population 16 years and over	**29,644**	**100.0**
OCCUPATION		
Management, professional, and related occupations	13,381	45.1
Service occupations	4,782	16.1
Sales and office occupations	6,983	23.6
Farming, fishing, and forestry occupations	250	0.8
Construction, extraction, and maintenance occupations	2,257	7.6
Production, transportation, and material moving occupations	1,991	6.7
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	296	1.0
Construction	2,027	6.8
Manufacturing	2,797	9.4
Wholesale trade	790	2.7
Retail trade	3,167	10.7
Transportation and warehousing, and utilities	542	1.8
Information	1,273	4.3
Finance, insurance, real estate, and rental and leasing	1,296	4.4
Professional, scientific, management, administrative, and waste management services	3,829	12.9
Educational, health and social services	8,040	27.1
Arts, entertainment, recreation, accommodation and food services	3,481	11.7
Other services (except public administration)	1,163	3.9
Public administration	943	3.2
CLASS OF WORKER		
Private wage and salary workers	19,794	66.8
Government workers	6,168	20.8
Self-employed workers in own not incorporated business	3,605	12.2
Unpaid family workers	77	0.3

Subject	Number	Percent
INCOME IN 1999		
Households	**20,368**	**100.0**
Less than $10,000	1,839	9.0
$10,000 to $14,999	1,121	5.5
$15,000 to $24,999	2,148	10.5
$25,000 to $34,999	2,053	10.1
$35,000 to $49,999	2,903	14.3
$50,000 to $74,999	3,855	18.9
$75,000 to $99,999	2,492	12.2
$100,000 to $149,999	2,406	11.8
$150,000 to $199,999	853	4.2
$200,000 or more	698	3.4
Median household income (dollars)	50,605	(X)
With earnings	17,273	84.8
Mean earnings (dollars)[1]	64,369	(X)
With Social Security income	3,746	18.4
Mean Social Security income (dollars)[1]	11,349	(X)
With Supplemental Security Income	765	3.8
Mean Supplemental Security Income (dollars)[1]	6,261	(X)
With public assistance income	550	2.7
Mean public assistance income (dollars)[1]	3,788	(X)
With retirement income	2,506	12.3
Mean retirement income (dollars)[1]	20,132	(X)
Families	**10,664**	**100.0**
Less than $10,000	441	4.1
$10,000 to $14,999	419	3.9
$15,000 to $24,999	705	6.6
$25,000 to $34,999	1,065	10.0
$35,000 to $49,999	1,415	13.3
$50,000 to $74,999	2,289	21.5
$75,000 to $99,999	1,616	15.2
$100,000 to $149,999	1,700	15.9
$150,000 to $199,999	514	4.8
$200,000 or more	500	4.7
Median family income (dollars)	62,231	(X)
Per capita income (dollars)[1]	25,758	(X)
Median earnings (dollars):		
Male full-time, year-round workers	44,751	(X)
Female full-time, year-round workers	32,699	(X)

Subject	Number below poverty level	Percent below poverty level
POVERTY STATUS IN 1999		
Families	**704**	**6.6**
With related children under 18 years	595	10.6
With related children under 5 years	334	15.0
Families with female householder, no husband present	**353**	**16.8**
With related children under 18 years	330	23.5
With related children under 5 years	185	44.5
Individuals	**8,350**	**16.5**
18 years and over	7,104	17.1
65 years and over	218	4.8
Related children under 18 years	1,148	12.5
Related children 5 to 17 years	724	11.1
Unrelated individuals 15 years and over	6,031	31.1

-Represents zero or rounds to zero. (X) Not applicable.

[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator. See text.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-4. Profile of Selected Housing Characteristics: 2000

Geographic area: Santa Cruz city, California

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total housing units	**21,460**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	12,086	56.3
1-unit, attached	1,893	8.8
2 units	946	4.4
3 or 4 units	1,617	7.5
5 to 9 units	1,571	7.3
10 to 19 units	1,114	5.2
20 or more units	1,794	8.4
Mobile home	406	1.9
Boat, RV, van, etc	33	0.2
YEAR STRUCTURE BUILT		
1999 to March 2000	233	1.1
1995 to 1998	892	4.2
1990 to 1994	892	4.2
1980 to 1989	2,181	10.2
1970 to 1979	4,276	19.9
1960 to 1969	2,958	13.8
1940 to 1959	5,260	24.5
1939 or earlier	4,768	22.2
ROOMS		
1 room	1,538	7.2
2 rooms	2,169	10.1
3 rooms	2,905	13.5
4 rooms	4,400	20.5
5 rooms	4,091	19.1
6 rooms	3,044	14.2
7 rooms	1,683	7.8
8 rooms	908	4.2
9 or more rooms	722	3.4
Median (rooms)	4.4	(X)
Occupied housing units	**20,395**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	5,112	25.1
1995 to 1998	6,561	32.2
1990 to 1994	2,908	14.3
1980 to 1989	2,987	14.6
1970 to 1979	1,647	8.1
1969 or earlier	1,180	5.8
VEHICLES AVAILABLE		
None	1,885	9.2
1	7,308	35.8
2	7,663	37.6
3 or more	3,539	17.4
HOUSE HEATING FUEL		
Utility gas	15,591	76.4
Bottled, tank, or LP gas	243	1.2
Electricity	3,971	19.5
Fuel oil, kerosene, etc	20	0.1
Coal or coke	-	-
Wood	354	1.7
Solar energy	15	0.1
Other fuel	39	0.2
No fuel used	162	0.8
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	204	1.0
Lacking complete kitchen facilities	280	1.4
No telephone service	207	1.0

Subject	Number	Percent
OCCUPANTS PER ROOM		
Occupied housing units	**20,395**	**100.0**
1.00 or less	18,727	91.8
1.01 to 1.50	649	3.2
1.51 or more	1,019	5.0
Specified owner-occupied units	**8,238**	**100.0**
VALUE		
Less than $50,000	24	0.3
$50,000 to $99,999	20	0.2
$100,000 to $149,999	71	0.9
$150,000 to $199,999	190	2.3
$200,000 to $299,999	1,199	14.6
$300,000 to $499,999	4,415	53.6
$500,000 to $999,999	2,144	26.0
$1,000,000 or more	175	2.1
Median (dollars)	411,900	(X)
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
With a mortgage	6,163	74.8
Less than $300	-	-
$300 to $499	64	0.8
$500 to $699	136	1.7
$700 to $999	479	5.8
$1,000 to $1,499	1,242	15.1
$1,500 to $1,999	1,781	21.6
$2,000 or more	2,461	29.9
Median (dollars)	1,663	(X)
Not mortgaged	2,075	25.2
Median (dollars)	364	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15.0 percent	2,464	29.9
15.0 to 19.9 percent	962	11.7
20.0 to 24.9 percent	1,051	12.8
25.0 to 29.9 percent	872	10.6
30.0 to 34.9 percent	644	7.8
35.0 percent or more	2,215	26.9
Not computed	30	0.4
Specified renter-occupied units	**10,915**	**100.0**
GROSS RENT		
Less than $200	253	2.3
$200 to $299	209	1.9
$300 to $499	966	8.9
$500 to $749	1,877	17.2
$750 to $999	2,615	24.0
$1,000 to $1,499	3,088	28.3
$1,500 or more	1,665	15.3
No cash rent	242	2.2
Median (dollars)	941	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15.0 percent	1,416	13.0
15.0 to 19.9 percent	1,177	10.8
20.0 to 24.9 percent	1,280	11.7
25.0 to 29.9 percent	1,131	10.4
30.0 to 34.9 percent	955	8.7
35.0 percent or more	4,499	41.2
Not computed	457	4.2

-Represents zero or rounds to zero. (X) Not applicable.

Source: U.S. Bureau of the Census, Census 2000.

4

U.S. Census Bureau

Critical structures overview indicating figure 4 inset location within larger area

City of Santa Cruz
Emergency Operations Plan
2007

INTRODUCTION

The City of Santa Cruz Emergency Operations Plan (EOP) describes the roles and operations of the departments and personnel of the City of Santa Cruz during a major emergency. The plan sets forth standard operating procedures for managing public emergencies resulting from floods, storms, earthquakes, tsunami, hazardous material incidents and other natural or man-made disasters. The EOP defines and describes the emergency management organization which shall be used during emergencies. The plan also addresses the integration and coordination with other governmental levels when required.

The EOP is based on the functional elements of California's Standardized Emergency Management Systems (SEMS). It outlines and uses the Firefighting Resources of California Organized for Potential Emergencies (FIRESCOPE) Incident Command System (ICS). The EOP identifies how the City fits into local, regional, state, and federal emergency response structures. This framework conforms to the requirements of the National Incident Management System (NIMS) as mandated by the Federal Department of Homeland Security (DHS).

PURPOSE

The City of Santa Cruz plans for and responds to emergency events in accordance with the Santa Cruz County Operational Area Memorandum of Understanding (MOU). This MOU ratifies local government agreements to follow the SEMS as mandated under California law.

SEMS is comprised of the emergency management organizations of cities, operational areas, OES regions, and state agencies. Within this context, local jurisdictions are responsible for directing and coordinating emergency response and recovery operations within their respective jurisdictions, while the other agencies serve primarily as support elements.

Scope

The EOP is a department-level plan which focuses the response of appropriate personnel resources of the City of Santa Cruz to a major emergency. The intent of the EOP is to provide guidance for extraordinary emergency situations. Departmental responsibilities are identified where appropriate, based on the hazard or threat. In particular, see the Departmental Functional Responsibilities Matrix, for primary departmental response areas (Appendix A4). The EOP and organization shall be subordinate to the Operational Area (County).

Special Districts serving the City of Santa Cruz are responsible for following the plan and developing plans and standard operating procedures to fulfill their responsibilities.

Mission

It shall be the mission of the City of Santa Cruz Emergency Management Organization to respond to an emergency situation in a safe and timely manner. The protection of lives, preservation of property, and protection of the environment shall be the principal goals which underscore each activity undertaken in the name of the Emergency Operations Plan.

AUTHORITY AND PROMULGATION

This shall be the official Emergency Operations Plan for the City of Santa Cruz and shall supersede previous plans and shall preclude employee actions not in concert with the intent of this plan, or the emergency organization created by it. Nothing in this plan shall be construed in a manner that limits the use of good judgment and common sense in matters not foreseen or covered by the elements of the plan or any appendices hereto.

The plan is promulgated under the authority of the City Council, City Manager, the Director of Public Works, and/or the Disaster Coordinator and is an official publication and directive of the City of Santa Cruz under provisions of applicable law.

Employees as Disaster Service Workers

By State law (Government Code Section 3100), government employees are Disaster Service Workers. When a disaster occurs, each employee will be expected to perform certain duties to assist the community in returning to normal as soon as possible. This plan shall be read and its stipulations considered binding upon all City employees.

CONCEPT OF OPERATIONS: THE INCIDENT COMMAND SYSTEM

The Emergency Operations Plan uses a management system widely known as the Incident Command System (ICS). The ICS delegates functions (or tasks) to subordinates of an Incident Commander (field response) and/or an EOC Director and promotes proper span of control and unity of command, and is implemented in accordance with SEMS mandates and incorporates the National Incident Management System (NIMS).

The purpose of the ICS is to assign employees with reasonable expertise and training to a function critical to emergency management during the course of emergencies without loss of precious time.

Another important feature of the ICS is that only those positions needed to manage a particular incident are activated. As the severity of the incident increases, assignments may change in the Emergency Operations Plan command structure commensurate with that shift. Realizing that during the course of an emergency the EOP identifies employees by titles that are different from their usual designations, the EOP includes Section, Branch, Unit and Leadership checklists for each position. Additionally, an organizational transition matrix is provided in the Appendices.

Emergency Declarations

A local emergency may be proclaimed only by the governing body of a city, county, or city and county, or by an official designated by ordinance adopted by that governing body (*see* Government Code Sections 8630-8634).

If a local government (as described above), determines that effects of an emergency are beyond the capability of local resources, the next step is to issue a declaration of local emergency. Declarations must be made within ten (10) days of occurrence to qualify for assistance under the State Natural Disaster Assistance Act and must be renewed every 14 days.

(*Source*: OES, Disaster Assistance Branch [http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/Proclamation/$file/Proc.pdf]

RESPONSE TO EMERGENCIES AND DISASTERS: FOUR PHASES

- **Increased Readiness** ..... Level 1
- **Initial Response Operations** .....Levels 2 and 3
- **Extended Response Operations**.....Levels 2 and 3
- **Recovery Operations**.....Levels 2 and 3

Increased Readiness

Upon receipt of a warning or the observation that an emergency situation is imminent or likely to occur soon, the city initiates actions to increase its readiness. A Level One alert may be issued to Emergency Management staff and field crews. During this phase, the following actions should be accomplished: Standard Operating Procedures (SOPs)and the EOP are reviewed; emergency public information is disseminated; critical facilities inspected and readied; resources mobilized.

Initial Response Operations

The city's initial response activities are primarily performed at the field response level. Emphasis is placed on minimizing the effects of the emergency or disaster. Other actions at this level include: evacuation, if necessary; notifications to the Operational Area (County) and state; identification of the need for mutual aid; mutual aid requests through appropriate channels; local emergency declaration if warranted.

Extended Response Operations

The city's extended response activities are conducted in the field and in the City's Emergency Operations Center (EOC). Extended operations involve the coordination of personnel and resources to mitigate an emergency and facilitate the transition to recovery operations.

Recovery Operations

As the immediate threat to life, property and the environment subsides, recovery activities involving the restoration of services to the public and rebuilding the affected areas are initiated or extended. Recovery activities may be both short-term and long-term, ranging from restoration of essential utilities such as water and power, to mitigation measures designed to prevent future occurrences of a given threat facing the city.

INCIDENT COMMAND SYSTEM: MOBILIZATION PROCEDURES

Level 1 — Standby/Alert

Level 1 is characterized as a minor or moderate incident. Local resources are considered adequate at this level in order to resolve the situation. The City Manager and/or designee initiates the Emergency Operations Plan for impending problems such as storms, National Weather Service (NWS) alerts or other potential emergency. Level 1 activation initiates necessary briefings of key departments, confirms employee and City operational status and readiness and authorizes the Public Information Officer to begin preparations for internal and external communications.

Level 2 — Partial Activation

Level 2 indicates a moderate to severe emergency situation that may require Mutual Aid. A local emergency may be declared at this level. The Incident Command System goes into effect. Positions on the Emergency Operations Center (EOC) staffing roster are filled by the EOC Director under the general direction of the City Manager / Director of Emergency Services; the EOC is activated at the direction of the EOC Director;

liaison with the Operational Area Coordinator (County) is established; certain EOC Section level activities are commenced in accordance with the Emergency Operations Plan. This may include Operations, Planning/Intelligence, Finance/Administration, and/or Logistics.
At the direction of the EOC Director, personnel perform the following:

1. Mobilize for activation of EOC if so ordered.
   • Level 2 EOC Director takes command of EOC.
2. Begin recall of EOC staff – *see* Emergency Operations Center Staffing and Contact Numbers (Appendix A1) and make necessary notifications.
3. EOC Director obtains status briefing from Operations, Planning, Logistics, Finance, Public Information Officer Sections, and lead personnel, and reviews the EOC Director's checklist.
4. Operations Section leads personnel assembly and reports to EOC Director.
5. Planning, Finance, and Logistics Sections meet with department-level operations sections (who serve as deputies to the Operations Section Chief) to develop a system for communication, information exchange and information posting.
6. EOC Director periodically advises the City Manager and Director of Public Works of incident status. Ongoing communications between the City Manager / Director of Emergency Services and the EOC Director will be maintained and facilitated by the EOC Manager.
7. EOC Director may authorize the opening of the Department Operating Centers (DOCs) at the City's Corporation Yard and Harvey West Maintenance Yard.

Level 3 — Full Activation

Level 3 signifies a major disaster requiring area-wide mutual aid and state and/or federal assistance. The EOC is automatically activated and the EOC Director fills positions as needed.

Escalating incident criteria will indicate a declaration of a Level 3 response as determined by the Level 2 EOC Director. The EOC Director advises the City Manager, Director of Public Works, and the Operational Area Coordinator (County). Personnel perform the following:

1. Mobilize for automatic activation of EOC (disregard if EOC is already active).
   • Level 3 EOC Director takes command of the EOC.
2. Begin additional recall of EOC staff using mobilization list – *see* Emergency Operations Center Staffing and Contact Numbers (Appendix A1) and make necessary notifications.
3. EOC Director obtains status briefing from Operations, Planning, Logistics, Finance, Public Information Officer Sections, and lead personnel, and reviews the EOC Director's checklist.
4. Operations Section leads personnel assembly and reports to EOC Director.
5. Planning, Finance and Logistics Sections meet with department-level operations sections (who serve as deputies to the Operations Section Chief) to develop a system for communication and information exchange.
6. EOC Director periodically advises the City Manager / Director of Emergency Services (directly, or through the Government Operations Assistant) and County Disaster Coordinator of incident status.
7. EOC Director may authorize the opening of the Department Operating Centers (DOCs) at the City's Corporation Yard and Harvey West Maintenance Yard.

The transition of key Emergency Management personnel from Level 1 through Level 3 is shown on the organization chart in the Activation Guide (Appendix A2). The flow chart illustrates how the chain of command develops to address the increasing level of complexity represented by each level of emergency.

ORGANIZATION OF THE SEMS SYSTEM

Under the Standardized Emergency Management System, the Incident Command System (ICS) response modes are divided into functions within the following Sections. General tasks are identified, for the field response level and the EOC level, as follows:

SEMS Function	Response Priorities/Tasks	
SECTION	**FIELD RESPONSE**	**EOC**
COMMAND MANAGEMENT	**Command**: Responsible for the directing, ordering, and/or controlling of resources.	**Management (Policy Group)**: Responsible for overall emergency policy and coordination through joint efforts of government agencies and private organizations.
OPERATIONS	The coordinated tactical response of all field operations in accordance with the Incident Action Plan.	The coordination of all jurisdictional operations in support of the response to the emergency in accordance with EOC Action Plan.
PLANNING/INTELLIGENCE	Collecting, evaluating, documenting, and using information related to the incident.	Collecting, evaluating, disseminating information; maintaining documentation relative to jurisdictional activities and the status of resources.
LOGISTICS	Providing facilities, services, personnel, equipment and materials in support of the incident.	Providing facilities, services, personnel, equipment and materials in support of all jurisdictional activities as required.
FINANCE/ADMINISTRATION	Financial and cost analysis and administrative aspects not handled by the other functions.	Broad fiscal and recovery responsibility as well as overall fiscal accountability.
PUBLIC INFORMATION	Coordination for all media releases; represent the city as lead Public Information Officer; coordinate with other PIOs from affected emergency response agencies	Gathering, formulating and disseminating information about the incident to news media, the public, and other appropriate agencies as approved by the EOC Director.

SEMS FUNCTIONS: DUTY STATEMENTS

The following Duty Statements briefly describe the key personnel in the Emergency Management Organization. Each position will be directed to report to the EOC or DOC as they are called to service under the Incident Command System. Upon reporting, each person will be assigned a duty position and will proceed to a duty station as directed and commence duties until demobilized by the EOC Director.

Management • Policy Group

City Manager/Director of Emergency Services • City Attorney • Fire Chief • Police Chief • Mayor • EOC Director
Overall authority and responsibility for the emergency response effort and operation of city services not related to the emergency response. Advises and coordinates with elected leaders and heads of local, state and federal assistance providers.

The Management/Policy Group is responsible for advising the EOC Director on matters where no policy exists. They assist the EOC Director in the development of overall strategy and tactics to mitigate the incident and formulate rules, regulations, proclamations and orders.

Government Operations Assistant / Emergency Services Assistant
The Emergency Services Assistant is responsible for maintaining City services and activities at such level of effort as is deemed appropriate.

Incident Commander
Overall management of incident activities in the field, including development, implementation and review of strategic decisions. Incident Commanders generally retain the flexibility to modify procedures or organizational structures to align as necessary with the operating characteristics of their specific jurisdictions or to accomplish the mission in the context of a particular scenario.

EOC Director
Overall management of incident activities in the EOC, including development, implementation and review of strategic decisions.

EOC Manager
Responsible for effective and efficient Emergency Operations Center activities and serves as the point of contact for Agency Representatives from assisting organizations and agencies outside the City government structure.

Operational Area Liaison
Coordinates the City's emergency response priorities with the County Operational Area; typically located at the County EOC site.

Safety Officer
Assure safety of all emergency personnel through monitoring and assessing hazardous and unsafe situations.

Operations Section

Operations Section Chief
Management of all tactical incident operations consistent with the Incident Action Plan.

Department Operating Center (DOC) Manager
Establishes and maintains resources, directs operations of Public Works, Water and Parks & Recreation field personnel and manages staging areas for holding resources until they are given an assignment or are demobilized by the EOC Director.

Law Enforcement Branch Leader
Mobilize and deploy law enforcement and traffic control operations. Alert and warn the public and conduct evacuations.

Fire and Rescue Branch Leader
Mobilize and deploy fire resources for the protection of life, property and the environment. Prevent and suppress fires, mitigate hazardous materials incidents, conduct rescue operations and provide medical aid.

Public Works / Engineering Branch Leader
Coordinates all infrastructure related activities during an emergency. Reports to the Operations Section Chief. Often called Construction/Engineering Branch, includes coordination of utility services, public works, engineering, and damage and safety inspections and assessments; provides damage/safety assessment information. Maintains detailed records on damaged areas and structures. Initiates requests for engineers to inspect structures and facilities.

Water Branch Leader
Oversee activities and resources, under the direction of the Operations Section Chief, related to water system and related infrastructure; maintenance of water services.

Staging Branch Manager
Establish and maintain staging areas for holding resources until they are assigned or demobilized by the Incident Commander.

Planning/Intelligence Section

Planning Section Chief
Collect, evaluate, and disseminate information about the incident situation and status of resources; understand the current situation; predict possible course of incident events; and prepare primary and alternative strategies in Action Plan for EOC Director review, ratification and implementation.

Advance Planning Branch Leader
Predict possible course of incident events and primary and alternative strategies in the Action Plan for review, ratification and implementation.

Documentation Branch Leader
Capture and organize information relating to the emergency such as message forms, journals, logs, status boards and any other critical information relating to the disaster.

Resources Unit Leader
Collect and display status of resources, including personnel, equipment, apparatus, etc.

Situation Unit Leader
Collect, evaluate and display current situation status information regarding the emergency.

Technical Data Unit Leader

Collect, evaluate, disseminate and advise the Section Chief(s) on all information of a technical nature regarding the emergency. Supervise, organize and coordinate all agencies within the Technical Specialist Unit.

Logistics Section

Logistics Section Chief
Contact, communication and coordination with assisting and cooperating agencies and jurisdictions. Coordinate and manage volunteers and shelter for evacuees.

Communication Unit Leader
Install, test, distribute, maintain, repair and plan for effective use of incident communication equipment. Establish and supervise a Communications Center.

Dependent Care Officer
Provides communications between dependents and families of essential emergency personnel.

EOC Set-up Team
Mobilize all equipment utilized in the EOC including; tables, partitions, chairs, desks, computers, faxes, copy machines, equipment footlockers, telephones and any other equipment deemed necessary for the efficient functioning of the EOC.

Evacuee Shelter Unit Leader
Provide temporary relief and support to displaced evacuees, including relocation shelters, food, bedding, first-aid, registration service and counseling assistance.

Housing Unit Leader
Provide temporary housing and housing-related support to workers responding to the request of the Incident Commander for emergency assistance, mutual aid responders, and specialists secured from the private or public sector.

Procurement Unit Leader
Order contract personnel, equipment and supplies; receive and store all supplies for the incident; maintain an inventory of supplies; and service non-expandable supplies and equipment. Responsible for supplying the food needs for the entire incident, including all remote locations, as well as for personnel unable to leave tactical field assignments. Responsible for ordering, receiving, processing and storing all incident related resources.

Commissary Manager
Responsible for determining feeding requirements at all incident facilities; menu planning; providing potable water; and general maintenance of the food services areas.

Transportation Unit Leader
Procure and manage transportation equipment needed to support emergency response personnel.

Volunteer Unit Leader

Coordinate volunteer services provided by individuals and other agencies with those of the City and keeps the Logistics and Planning Section Leaders advised of the size, availability, and significant specialties of members of the volunteer work force.

Finance Section

Finance Section Chief
Manage resources which provide support for personnel, equipment, facilities, services and supplies in pursuance of incident activities.

Cost Analysis Unit Leader
The Cost Analysis Unit Leader is responsible for collecting all cost data, performing cost effectiveness analyses and providing cost estimates and cost-saving recommendations for the incident.

Time Unit Leader
Responsible for equipment and personnel time recording and for managing the commissary operations.

Public Information

Public Information Officer
Serve as the coordination point for all media releases. Ensure that the public receives accurate and consistent information about the incident. Develop the format for press conferences and releases. Formulate and release information about the incident to news media, the public, and other appropriate agencies as approved by the EOC Director.

MAINTAINING CITY SERVICES

During the course of the emergency response the City Manager/Director of Emergency Services, having assumed management of the City's disaster response effort, may direct a Government Operations Assistant to absorb the responsibility of maintaining City services and activities at such level of effort as is deemed appropriate.

Department heads (or their designees, should the Department heads be mobilized in the emergency response), will be responsible for providing the Government Operations Assistant with status reports and for communicating information about the status of departmental service levels. Every effort shall be made to provide high levels of service to the citizens of the City of Santa Cruz insofar as there remains a practical inventory of resources to do so.

Upon **Level 2** or **Level 3** mobilization the Government Operations Assistant/ Emergency Services Assistant, under the direction of the City Manager/Director of Emergency Services, shall meet with the Department heads (or their designees), to identify City and department needs during the response including, but not limited to:

1. Incident status reporting
2. Determining operational work periods
3. Release of non-essential employees/alternate assignments
4. Public notification of facility closures

PROTECTION MEASURES FOR CITY FACILITIES

Emergency Operations Center (EOC)

Location: The EOC for all emergency management incidents will be located at the Police Headquarters Building, 155 Center Street. The backup EOC is Fire Station No. 2 located at 1103 Soquel Avenue.

Function: The EOC is the centralized location where Management activities will occur. It will be continuously maintained in a state of readiness. Upon being activated by the Incident Commander, City Manager/Director of Emergency Services or EOC Director, the EOC becomes the central command facility for emergency management activities.

Primary management and control of EOC systems is the responsibility of the EOC Manager before and during mobilization events. During the declaration of an emergency all responsible key administration personnel shall report to the EOC (or DOC as directed) rather than their home department until the EOC is demobilized.

A floor plan of the primary EOC with space allocations for each activity and phone numbers assigned to each appears in the Floor Plan Layout and Telecommunications Guide (Appendix A5).

Department Operating Centers (DOC)

At the direction of the EOC Director and under the management control of the Operations Section, a DOC may be established at the City Corporation Yard at 1125 River Street or at the Parks and Recreation Department Harvey West Maintenance Facility, or both. All SEMS functions are to be provided for at the DOC (Management, Finance/Administration, Planning/Intelligence, Operations, Logistics). These functions may be performed by one or a few persons.

The purpose of the DOC is to provide a centralized, well-supported location at which to gather, log in, and direct field operations staff from the Public Works, Water, and the Parks and Recreation Departments. Staff and equipment awaiting work assignments shall stage at the Corporation Yard and will be managed by the DOC Manager who will coordinate with the Operations Section Staging Manager in assigning personnel to teams set up to provide field support.

The DOC Manager shall keep a record of personnel reporting to work and assignments given. S/he shall also keep a record of vehicle and equipment assignments. This information shall be regularly transmitted to the EOC Planning/Intelligence Section for status reporting and resource tracking.

EMERGENCY OPERATIONS AND MOBILIZATION OF EMPLOYEES

The success of the Incident Command System in meeting the needs of emergency management situations is a direct consequence of the speed and efficiency with which the City shifts from its regular organizational structure to its Incident Command structure.

Mobilization of Identified Employees

Upon declaration of a **Level 2** or **Level 3** emergency and the activation of the EOC, the EOC Director shall direct and oversee activities that call Section Chiefs into action. Each Section Chief in turn calls their

branch, division leaders, or deputies who in turn direct and oversee mobilization of their respective units by a systematic calling of personnel listed in the mobilization roster (*see* Appendix A1).

Employees called to respond will be given the name of the staff person and the location where they are to report. Upon arrival at their assigned place of assembly, employees will be given assignments as prescribed within the scope of the duty statements.

Each ICS position has an identification vest. The vests shall be kept at the EOC. Applicable Emergency Operations Checklist(s) shall be kept in the lockers assigned to each section.

Mobilization of Non-Identified Employees

Once the Incident Command System employees are mobilized, unit leaders will begin to identify and mobilize support employees as distinct operational needs are identified. These operational needs may dictate the immediate recall of support employees for flood control activities, street repairs or water line repairs only as dictated by the nature of the emergency. The ICS provides that only those employees needed to handle operational problems be called to duty.

Employees not named as key personnel in this plan, but mobilized for duty, are directed to report to the Corporation Yard or other identified area. They will be advised to whom they must report and will be given other instructions as deemed necessary. Upon reporting to the staging area the employee signs in and is assigned to an operational team by the unit leader manager.

Demobilization

At the direction of the EOC Director, employees may be demobilized and returned to routine duty. Typically, demobilization will occur when a level of control has been restored and the conditions of the emergency are at a level where property and lives are not significantly at risk. Demobilization is managed by the Planning/Intelligence Section under the guidance of the Demobilization Unit.

Demobilization will generally occur in reverse order of mobilization and may continue until all operations are routine and normal. Selective demobilization may be pursued if found necessary to restore the day-to-day operational needs of the City while at the same time maintaining a standby capability for emergency management.

At the close of the operations of the emergency management system, the EOC Director will officially deactivate the EOC and be demobilized by the City Manager.

LOGISTICS AND MATERIAL

During the course of emergency management situations the need for coordination of non-typical activities will arise. Among these activities may be the need to establish contact with family members, establishing emergency meals for staff called to duty after-hours, or coordination of volunteer labor. The following sets forth information related to these logistical and material questions. The EOC Director will be called upon for guidance in matters not addressed here and will utilize existing City policy, common sense and good judgment in formulating procedures to address those situations not covered.

Dependent Care Plan: Contacting Family in Emergencies

The Dependent Care Plan provides for locating City employees and their immediate family during major emergencies and catastrophes. Dependent Care procedures should provide a reasonable level of assurance on the part of employees as well as their family members that their personal welfare is being looked after.

For personnel on duty at the time of such an occurrence, all possible efforts will be exercised to determine the whereabouts and condition of family members. Prior to emergency operations, these procedures are implemented and managed by the Human Resources Department.

Employee Responsibilities: Each employee will have the responsibility of completing the Dependent Care Form — a confidential emergency contact information document. Employees should check with Human Resources if they have not completed this form. Employees are responsible to update this information on an as-needed basis by informing HR of changes.

Additionally, it is the employee's responsibility to establish a pre-plan with their respective family members to educate them as to the procedures to follow as may be dictated by their particular situation and emergency response tasks. As a guideline, plan elements should at least contain the following:

1. It will be the responsibility of the employee and the family members of the employee to make every effort to contact the Human Resources Department using the identified telephone number. Each employee should discuss with their families a pre-plan for reaching the employee based upon their own situation and disaster responsibilities.
2. In the event of a major emergency or catastrophe, City services will be overloaded for a period of time. *Family members should not phone the EOC*. Family members should be instructed to phone the identified telephone line provided for dependent contact. They should leave the following information: name, employee's name, their location and phone number(s) where they can be reached
3. Once the employee has completed the Dependent Care Form, it will be filed in two (2) locations:
    - One copy will be filed in the Dependent Care Officer Emergency Preparedness Plan.
    - One copy will be filed in the Logistics Section files.
4. This procedure is the same for off-duty personnel as well as on-duty personnel. Off-duty personnel will automatically communicate with their respective supervisors in the event of a major emergency.
5. The first individuals contacted should be the family of those employees who are on duty, with the remainder contacted thereafter.
6. A log of those people contacted, showing the time of contact and the location of the individuals, and a re-contact point, if possible, shall be kept.

Emergency Response Purchases

The Finance Section Chief will utilize current City vendor lists to the maximum extent possible to secure resources for emergency management purposes. In order to account for emergency-related expenses, an employee making an Emergency Management-related purchase will mark "Emergency Response" on the invoice or receipt. The employee preparing the pay voucher or petty cash reimbursement will indicate "Emergency Response" prominently on the face of the voucher or reimbursement slip.

The Planning Section's Resources Unit shall monitor existing City resources in order to prepare for impending needs.

The Logistics Section is responsible for the development of resources and needs for procurement.

The Finance Section is responsible for procurement and financial purchase of resources. All incoming resources shall be received at the City Corporation Yard unless directed elsewhere.

Meals

The EOC Director will authorize provision of meals for employees after working hours under conditions prescribed in the City's current Memorandums of Understanding with employee bargaining groups. The City maintains blanket purchase orders for emergency meals with several sources in the Santa Cruz area. The Finance Section Chief will direct the Commissary Manager to provide meals and refreshments as needed.

The Incident Commander, or Finance Section staff, will determine the most appropriate way for employees to receive meals. During a **Level 2** or **Level 3** emergency, concern for situation and command coverage must be followed when personnel are rotated for meals.

Coordination of Volunteers

All volunteer workers will be assigned to a Volunteer Reception Center for assignments. Volunteers shall be coordinated and managed by the Volunteers Unit Leader who shall be subordinate to the Logistics Section Chief.

The Volunteers Unit Leader shall direct volunteers to a Volunteer Staging Area to await work assignments. The Volunteers Unit Leader shall keep the Logistics Section Chief and the DOC Manager advised at all times of the number, availability, and significant specialties of members of the volunteer work force.

Loyalty Oath: Volunteers who will be working as Disaster Service Workers must be registered per state laws, and shall have taken the appropriate loyalty oath as prescribed by law. (Reference: Title 19. Public Safety Division 2. Office of Emergency Services. Chapter 2. Emergencies and Major Disasters. Subchapter 3. Disaster Service Worker Volunteer Program.)

PLAN DEVELOPMENT AND MAINTENANCE

Training: Understanding the Emergency Operations Plan

Training will be provided annually on the utilization of the Emergency Operations Plan and the duties and responsibilities of persons eligible for mobilization under the provisions of the Plan. The EOC Manager, in consultation with Section Chiefs, will determine which type of training is needed by each of the various levels of EOP respondents and may elect to combine classroom with field instruction or simulations.

Training will include familiarization with the EOC, individual staff training based upon the staff member's potential assignment during an emergency response including specialized training essential to the effective use of the Standardized Emergency Management System, the Incident Command System and the National Incident Management System.

Emergency Operations Plan: Maintenance • Updates • Revisions

The EOP as a whole is reviewed and updated once per year. In the intervening months, Section Chiefs and Team Leaders (IT; EOC Set-Up), are tasked with providing updates to the EOC Manager regarding reorganization of their staffing. This task includes notifying the EOC manager with staff additions, deletions and/or other changes to the call out roster (*see* Appendix A1).

AFTER ACTION REVIEWS • REPORTS • CORRECTIVE ACTIONS

"Hotwashes"

At the conclusion of emergency response activates and related training exercises, there will be a "hotwash" — a discussion to identify critical issues and problems resulting from or occurring during participation in the incident-related operations and/or exercises or training events. The EOC Director or Incident Commander (or designees) are responsible for conducting hotwashes, which shall be as inclusive as practicable. The goal of the hotwash is to capture critical issues that may be addressed and resolved.

After Action Reviews

After Action Reviews (AARs) are to be conducted following any significant incident and/or emergency in which this Emergency Operations Plan is employed. The AAR shall identify those areas requiring attention, corrective action, or plan revisions. After Action Review should be held as soon as practicable following an incident and demobilization from that incident or emergency. Outside agencies that were involved in the emergency response to the incident shall be invited to participate in the review process. An After Action Report will be distributed to all agencies involved in the response effort.

The completion of an After Action Report is part of the required SEMS reporting process. The Emergency Services Act, [Section 8607 (f)] mandates that the Office of Emergency Services in cooperation with involved state and local agencies, complete an after action report within 120 days after each declared disaster. Section 2450 (a) of the SEMS Regulations states: "Any city, city and county, or county declaring a local emergency for which the governor proclaims a state of emergency, and any state agency responding to that emergency shall complete and transmit an after action report to OES within ninety (90) days of the close of the incident period…"

The After Action Report shall document the City of Santa Cruz' emergency response actions and will identify areas of concern as well as successes. The After Action Report will be used to develop a work plan for enhancing emergency response capabilities. Responsibility for initiating the After Action Report process is assigned to the Documentation Unit within the Planning Section.

Remedial Action Issues

Issues identified during the incident or exercise that could not be resolved and that may require higher level remediation may be forwarded directly to the EOC Manager. Those remedial actions should describe, for each recommendation:

- Description of actions to be taken
- Assignments
- Associated costs and budget
- Timetable for completion
- Follow up responsibility

Acronyms

List of commonly used acronyms found in federal, state and local emergency operations plans.

A

AC .....Area Command
ADA .....Americans with Disabilities Act
ARC.....American Red Cross
ARES.....Amateur Radio Emergency Services

C

CALTRANS .....California Department of Transportation
CALWAS.....California Warning System
CAO.....Chief Administrative Officer
CBO.....Community Based Organization
CBRNE.....Chemical, Biological, Radiological, Nuclear and Explosive
CCC.....California Conservation Corps
CD .....Civil Defense
CDC.....Centers for Disease Control
CDF .....California Department of Forestry
CERT .....Community Emergency Response Team
CESA.....California Emergency Services Association
CESFRS.....California Emergency Service Fire Radio System
CESRS.....California Emergency Services Radio System
CFR .....Code of Federal Regulations
CHP .....California Highway Patrol
CLEMARS .....California Law Enforcement Mutual Aid Radio System
CLERS.....California Law Enforcement Radio System
CLETS.....California Law Enforcement Telecommunications System
COE.....Corps of Engineers / US Army

D

DA .....Damage Assessment
DAC.....Disaster Application Center
DAP .....Disaster Assistance Programs
DCS .....Disaster Communications Service
DEST .....Disaster Emergency Support Team
DFCO .....Deputy Federal Coordinating Officer
DFO .....Disaster Field Office
DHA .....Disaster Housing Assistance
DHS .....Department of Homeland Security
DMAT.....Disaster Medical Assistance Team
DMORT.....Disaster Mortuary Operational Response Team
DMIS .....Disaster Management Information System
DOC.....Department Operations Center
DRC.....Disaster Recovery Center
DRM.....Disaster Recovery Manager
DRO.....Disaster Recovery Operations
DSA .....Disaster Support Area
DSR .....Damage Survey Report
DWR.....Department of Water Resources / California

E

EAS .....Emergency Alert System
EDIS .....Emergency Digital Information System
EMAC .....Emergency Management Assistance Compact
EMIS .....Emergency Management Information System
EMMA.....Emergency Managers Mutual Aid
EMSA.....Emergency Medical Services Authority
EMS.....Emergency Medical Services
EMT.....Emergency Medical Technician
EOC.....Emergency Operations Center
EOP .....Emergency Operations Plan
EPA.....Environmental Protection Agency
EPI.....Emergency Public Information
ERT.....Emergency Response Team
ESA .....Emergency Services Act / California
ESC.....Emergency Services Coordinator
ESF .....Emergency Support Functions
EST.....Emergency Support Team

F

FAA .....Federal Aviation Administration
FCO .....Federal Coordinating Officer
FEMA.....Federal Emergency Management Agency
FIRESCOPE.....Firefighting Resources of California Organized for Potential Emergencies

G

GAR.....Governor's Authorized Representative
GIS.....Geographic Information System
GSA .....General Services Administration

H

HAZMAT .....Hazardous Materials
HSPD.....Homeland Security Presidential Directive

I

IACG .....Inter Agency Coordinating Group
IAP.....Incident Action Plan
IC.....Incident Commander
ICP.....Incident Command Post
ICS.....Incident Command System
IDE .....Initial Damage Estimate
IIMG.....Interagency Incident Management Group
IMT.....Incident Management Team
IRMS .....Information Resources Management Service

J

JIC .....Joint Information Center
JIS .....Joint Information System
JFO .....Joint Field Office
JOC.....Joint Operations Center
JPIC .....Joint Public Information Center

L

LFA.....Lead Federal Agency

M

MACS.....Multi-Agency Coordination System
MARAC .....Mutual Aid Regional Advisory Committee
MHFP .....Multi-Hazard Functional Planning
MSA .....Multi-Purpose Staging Area

N

NAWAS .....National Warning System
NCS .....National Communications System
NDAA .....California Natural Disaster Assistance Act
NDMS .....National Disaster Medical System
NEP .....National Exercise Program
NFIP .....National Flood Insurance Program
NGO .....Non-Government Organization
NIMS .....National Incident Management System
NMRT.....National Medical Response Team
NOAA .....National Oceanic and Atmospheric Administration
NOC.....National Operations Center
NRCS.....Natural Resources Conservation Service
NRP .....National Response Plan
NRT .....National Response Team
NWS .....National Weather Service

O

OA .....Operational Area
OASIS .....Operational Area Satellite Information System
OEM .....Office of Emergency Management
OES .....Office of Emergency Services
OMB.....Office of Management and Budget (Federal)
OSC .....On-Scene Coordinator
OSHA .....Occupational Safety and Health Administration

P

PA .....Public Affairs
PA .....Public Assistance
PAO .....Public Affairs Officer
PA/O .....Public Assistance Officer
PA# .....Project Application Number
PBX .....Private Branch Exchange
PDA .....Preliminary Damage Assessment
PDD .....Presidential Decision Directive
PFO.....Principal Federal Officer
PIO.....Public Information Officer
PL .....Public Law - U.S. Public Law 93-288, Federal Disaster Relief Act of 1974
POC .....Point of Contact
PNP.....Private Nonprofit Organization
PUC .....Public Utilities Commission / California
PW .....Project Worksheet

R

RACES .....Radio Amateur Civil Emergency Services
RADEF .....Radiological Defense
RAP .....Radiological Assistance Program
RCP .....Regional Oil and Hazardous Substances Pollution Contingency Plan
RD .....Regional Director (FEMA)
REACT.....Radio Emergency Associated Communication Team

REC .....Regional Emergency Coordinator
REOC .....Regional Emergency Operations Center
RIMS .....Response Information Management System
ROC.....Regional Operations Center
RRCC .....Regional Response Coordinating Center
RRT .....Regional Response Team
RTOS .....Rail Transit Operations Supervisor

S

SA.....Salvation Army
SAC .....Special Agent in Charge
SAP.....State Assistance Program
SAR .....Search and Rescue
SAST .....State Agency Support Team / California
SCO .....State Coordinating Officer
SEMO.....State Emergency Management Office
SEMS.....Standardized Emergency Management System
SFLEO.....Senior Federal Law Enforcement Officer
SFO.....Senior Federal Officer
SHMO .....State Hazard Mitigation Officer
SHPO.....State Historic Preservation Officer
SIOC.....Strategic Information and Operations Center
SITREP.....Situation Report
SLPS.....State and Local Programs and Support Directorate (FEMA)
SOC .....State Operations Center
SOP.....Standard Operating Procedure
STO.....State Training Officer

T

TEWG .....Terrorism Early Warning Group
TH.....Temporary Housing
TSCA.....Toxic Substances Control Act
TWG.....Terrorism Working Group

U

UASI.....Urban Areas Security Initiative
USACE.....United States Army Corps of Engineers
USAR .....Urban Search and Rescue
USDA .....United States Department of Agriculture
USFA .....United States Fire Administration
USGS.....United States Geological Survey

V

VA.....Veterans Administration
VOAD .....Volunteer Organizations Active in Disaster

W

WMD.....Weapons of Mass Destruction

GLOSSARY OF KEY TERMS

For the purposes of the National Incident Management System (NIMS), the following terms and definitions apply:

Agency: A division of government with a specific function offering a particular kind of assistance. In ICS, agencies are defined either as jurisdictional (having statutory responsibility for incident management) or as assisting or cooperating (providing resources or other assistance).

Agency Representative: A person assigned by a primary, assisting, or cooperating state, local, or tribal government agency or private entity that has been delegated authority to make decisions affecting that agency's or organization's participation in incident management activities following appropriate consultation with the leadership of that agency.

Area Command (Unified Area Command): An organization established to: (1) oversee the management of multiple incidents that are each being handled by an ICS organization or, (2) oversee the management of large or multiple incidents to which several Incident Management Teams (IMTs) have been assigned. Area Command has the responsibility to set overall strategy and priorities, allocate critical resources according to priorities, ensure that incidents are properly managed, and ensure that objectives are met and strategies followed. Area Command becomes Unified Area Command when incidents are multijurisdictional. Area Command may be established at an emergency operations center facility or at some location other than an incident command post.

Assessment: The evaluation and interpretation of measurements and other information to provide a basis for decision-making.

Assignments: Tasks given to resources to perform within a given operational period that are based on operational objectives defined in the Incident Action Plan (IAP).

Assistant: Title for subordinates of principal Command Staff positions. The title indicates a level of technical capability, qualifications, and responsibility subordinate to the primary positions. Assistants may also be assigned to unit leaders.

Assisting Agency: An agency or organization providing personnel, services, or other resources to the agency with direct responsibility for incident management. *See also* Supporting Agency.

Available Resources: Resources assigned to an incident, checked in, and available for a mission assignment, normally located in a Staging Area.

Branch: The organizational level having functional or geographical responsibility for major aspects of incident operations. A Branch is organizationally situated between the Section and the Division or Group in the Operations Section, and between the Section and Units in the Logistics Section.

Chain of Command: A series of command, control, executive, or management positions in hierarchical order of authority.

Check-In: The process through which resources first report to an incident. Check-in locations include the incident command post, Resources Unit, incident base, camps, staging areas, or directly on the site.

Chief: The ICS title for individuals responsible for management of functional sections: Operations, Planning, Logistics, Finance/Administration, and Intelligence (if established as a separate section).

Command: The act of directing, ordering, or controlling by virtue of explicit statutory, regulatory, or delegated authority.

Command Staff: In an incident management organization, the Command Staff consists of the Incident Command and the special staff positions of Public Information Officer, Safety Officer, Liaison Officer, and other positions as required, who report directly to the Incident Commander. They may have an assistant or assistants, as needed.

Common Operating Picture: A broad view of the overall situation as reflected by situation reports, aerial photography, and other information or intelligence.

Communications Unit: An organizational unit in the Logistics Section responsible for providing communication services at an incident or an EOC. A Communications Unit may also be a facility (e.g., a trailer or mobile van) used to support an Incident Communications Center.

Cooperating Agency: An agency supplying assistance other than direct operational or support functions or resources to the incident management effort.

Coordinate: To advance systematically an analysis and exchange of information among principals who have or may have a need to know certain information to carry out specific incident management responsibilities.

Deputy: A fully qualified individual who, in the absence of a superior, can be delegated the authority to manage a functional operation or perform a specific task. In some cases, a deputy can act as relief for a superior and, therefore, must be fully qualified in the position. Deputies can be assigned to the Incident Commander, General Staff, and Branch Directors.

Dispatch: The ordered movement of a resource or resources to an assigned operational mission or an administrative move from one location to another.

Division: The partition of an incident into geographical areas of operation. Divisions are established when the number of resources exceeds the manageable span of control of the Operations Chief. A Division is located within the ICS organization between the Branch and Resources in the Operations Section.

Emergency: Absent a Presidentially declared emergency, any incident(s), human-caused or natural, that requires responsive action to protect life or property. Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, an emergency means any occasion or instance for which, in the determination of the President, Federal assistance is needed to supplement State and local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States.

Emergency Operations Centers (EOCs): The physical location at which the coordination of information and resources to support domestic incident management activities normally takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility, perhaps at a higher level of organization within a jurisdiction. EOCs may be organized by major functional disciplines (e.g., fire, law enforcement, and medical services), by jurisdiction (e.g., Federal, State, regional, county, city, tribal), or some combination thereof.

Emergency Operations Plan (EOP): The "steady-state" plan maintained by various jurisdictional levels for responding to a wide variety of potential hazards.

Emergency Public Information: Information that is disseminated primarily in anticipation of an emergency or during an emergency. In addition to providing situational information to the public, it also frequently provides directive actions required to be taken by the general public.

Emergency Response Provider: Includes state, local, and tribal emergency public safety, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities. *See* Section 2 (6), Homeland Security Act of 2002, Pub. L. 107-296, 116 Stat. 2135 (2002). Also known as Emergency Responder.

Evacuation: Organized, phased, and supervised withdrawal, dispersal, or removal of civilians from dangerous or potentially dangerous areas, and their reception and care in safe areas.

Event: A planned, nonemergency activity. ICS can be used as the management system for a wide range of events, e.g., parades, concerts, or sporting events.

Function: Function refers to the five major activities in ICS: Command, Operations, Planning, Logistics, and Finance/Administration. The term "function" is also used when describing the activity involved, e.g., the planning function. A sixth function, Intelligence, may be established, if required, to meet incident management needs.

General Staff: A group of incident management personnel organized according to function and reporting to the Incident Commander. The General Staff normally consists of the Operations Section Chief, Planning Section Chief, Logistics Section Chief, and Finance/Administration Section Chief.

Group: Established to divide the incident management structure into functional areas of operation. Groups are composed of resources assembled to perform a special function not necessarily within a single geographic division. Groups, when activated, are located between Branches and Resources in the Operations Section. (*see* Division.)

Hazard: Something that is potentially dangerous or harmful, often the root cause of an unwanted outcome.

Incident: An occurrence or event, natural or human-caused, that requires an emergency response to protect life or property. Incidents can, for example, include major disasters, emergencies, terrorist attacks, terrorist threats, wildland and urban fires, floods, hazardous materials spills, nuclear accidents, aircraft accidents, earthquakes, hurricanes, tornadoes, tropical storms, war-related disasters, public health and medical emergencies, and other occurrences requiring an emergency response.

Incident Action Plan: An oral or written plan containing general objectives reflecting the overall strategy for managing an incident. It may include the identification of operational resources and assignments. It may also include attachments that provide direction and important information for management of the incident during one or more operational periods.

Incident Command Post (ICP): The field location at which the primary tactical-level, on-scene incident command functions are performed. The ICP may be collocated with the incident base or other incident facilities and is normally identified by a green rotating or flashing light.

Incident Command System (ICS): A standardized on-scene emergency management construct specifically designed to provide for the adoption of an integrated organizational structure that reflects the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries. ICS is the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure, designed to aid in the management of resources during incidents. It is used for all kinds of emergencies and is applicable to small as well as large and complex incidents. ICS is used by various jurisdictions and functional agencies to organize field-level incident management operations.

Incident Commander (IC): The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

Incident Management Team (IMT): The IC and appropriate Command and General Staff personnel assigned to an incident.

Incident Objectives: Statements of guidance and direction necessary for selecting appropriate strategy(s) and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed. Incident objectives must be achievable and measurable, yet flexible enough to allow strategic and tactical alternatives.

Initial Action: The actions taken by those responders first to arrive at an incident site.

Initial Response: Resources initially committed to an incident.

Intelligence Officer: The intelligence officer is responsible for managing internal information, intelligence, and operational security requirements supporting incident management activities. These may include information security and operational security activities, as well as the complex task of ensuring that sensitive information of all types (e.g., classified information, law enforcement sensitive information, proprietary information, or export-controlled information) is handled in a way that not only safeguards the information, but also ensures that it gets to those who need access to it to perform their missions effectively and safely.

Joint Information Center (JIC): A facility established to coordinate all incident-related public information activities. It is the central point of contact for all news media at the scene of the incident. Public information officials from all participating agencies should collocate at the JIC.

Joint Information System (JIS): Integrates incident information and public affairs into a cohesive organization designed to provide consistent, coordinated, timely information during crisis or incident operations. The mission of the JIS is to provide a structure and system for developing and delivering coordinated interagency messages; developing, recommending, and executing public information plans and strategies on behalf of the IC; advising the IC concerning public affairs issues that could affect a response effort; and controlling rumors and inaccurate information that could undermine public confidence in the emergency response effort.

Jurisdiction: A range or sphere of authority. Public agencies have jurisdiction at an incident related to their legal responsibilities and authority. Jurisdictional authority at an incident can be political or geographical (e.g., city, county, tribal, State, or Federal boundary lines) or functional (e.g., law enforcement, public health).

Liaison: A form of communication for establishing and maintaining mutual understanding and cooperation.

Liaison Officer: A member of the Command Staff responsible for coordinating with representatives from cooperating and assisting agencies.

Local Government: A county, municipality, city, town, township, local public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; an Indian tribe or authorized tribal organization, or in Alaska a Native village or Alaska Regional Native Corporation; a rural community, unincorporated town or village, or other public entity.

Logistics: Providing resources and other services to support incident management.

Logistics Section: The section responsible for providing facilities, services, and material support for the incident.

Major Disaster: As defined under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5122), a "major disaster" is any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of States, tribes, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

Management by Objective: A management approach that involves a four-step process for achieving the incident goal. The Management by Objectives approach includes the following: establishing overarching objectives; developing and issuing assignments, plans, procedures, and protocols; establishing specific, measurable objectives for various incident management functional activities and directing efforts to fulfill them, in support of defined strategic objectives; and documenting results to measure performance and facilitate corrective action.

Mitigation: The activities designed to reduce or eliminate risks to persons or property or to lessen the actual or potential effects or consequences of an incident. Mitigation measures may be implemented prior to, during, or after an incident. Mitigation measures are often informed by lessons learned from prior incidents. Mitigation involves ongoing actions to reduce exposure to, probability of, or potential loss from hazards. Measures may include zoning and building codes, floodplain buyouts, and analysis of hazard-related data to determine where it is safe to build or locate temporary facilities. Mitigation can include efforts to educate governments, businesses, and the public on measures they can take to reduce loss and injury.

Mobilization: The process and procedures used by all organizations — state, local, and tribal — for activating, assembling, and transporting all resources that have been requested to respond to or support an incident.

Multiagency Coordination Entity: A multiagency coordination entity functions within a broader multiagency coordination system. It may establish the priorities among incidents and associated resource allocations, deconflict agency policies, and provide strategic guidance and direction to support incident management activities.

Multiagency Coordination Systems: Multiagency coordination systems provide the architecture to support coordination for incident prioritization, critical resource allocation, communications systems integration, and information coordination. The components of multiagency coordination systems include facilities, equipment, emergency operation centers, specific multiagency coordination entities, personnel, procedures, and communications. These systems assist agencies and organizations to fully integrate the subsystems of the NIMS.

Multijurisdictional Incident: An incident requiring action from multiple agencies that each have jurisdiction to manage certain aspects of an incident. In ICS, these incidents will be managed under Unified Command.

Mutual-Aid Agreement: Written agreement between agencies and/or jurisdictions that they will assist one another on request, by furnishing personnel, equipment, and/or expertise in a specified manner.

National: Of a nationwide character, including the state, local, and tribal aspects of governance and policy.

National Disaster Medical System: A cooperative, asset-sharing partnership between the Department of Health and Human Services, the Department of Veterans Affairs, the Department of Homeland Security, and the Department of Defense. NDMS provides resources for meeting the continuity of care and mental health services requirements of the Emergency Support Function 8 in the Federal Response Plan.

National Incident Management System: A system mandated by HSPD-5 that provides a consistent nationwide approach for state, local, and tribal governments; the private-sector, and nongovernmental organizations to

work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. To provide for interoperability and compatibility among state, local, and tribal capabilities, the NIMS includes a core set of concepts, principles, and terminology. HSPD-5 identifies these as the ICS; multiagency coordination systems; training; identification and management of resources (including systems for classifying types of resources); qualification and certification; and the collection, tracking, and reporting of incident information and incident resources.

National Response Plan: A plan mandated by HSPD-5 that integrates Federal domestic prevention, preparedness, response, and recovery plans into one all-discipline, all-hazards plan.

Nongovernmental Organization (NGO): An entity with an association that is based on interests of its members, individuals, or institutions and that is not created by a government, but may work cooperatively with government. Such organizations serve a public purpose, not a private benefit. Examples of NGOs include faith-based charity organizations and the American Red Cross.

Operational Period: The time scheduled for executing a given set of operation actions, as specified in the Incident Action Plan. Operational periods can be of various lengths, although usually not over 24 hours.

Operations Section: The Section responsible for all tactical incident operations. In ICS, it normally includes subordinate Branches, Divisions, and/or Groups.

Personnel Accountability: The ability to account for the location and welfare of incident personnel. It is accomplished when supervisors ensure that ICS principles and processes are functional and that personnel are working within established incident management guidelines.

Planning Meeting: A meeting held as needed prior to and throughout the duration of an incident to select specific strategies and tactics for incident control operations and for service and support planning. For larger incidents, the planning meeting is a major element in the development of the Incident Action Plan.

Planning Section: Responsible for the collection, evaluation, and dissemination of operational information related to the incident, and for the preparation and documentation of the IAP. This Section also maintains information on the current and forecasted situation and on the status of resources assigned to the incident.

Preparedness: The range of deliberate, critical tasks and activities necessary to build, sustain, and improve the operational capability to prevent, protect against, respond to, and recover from domestic incidents. Preparedness is a continuous process. Preparedness involves efforts at all levels of government and between government and private-sector and nongovernmental organizations to identify threats, determine vulnerabilities, and identify required resources. Within the NIMS, preparedness is operationally focused on establishing guidelines, protocols, and standards for planning, training and exercises, personnel qualification and certification, equipment certification, and publication management.

Preparedness Organizations: The groups that provide interagency coordination for domestic incident management activities in a nonemergency context. Preparedness organizations can include all agencies with a role in incident management, for prevention, preparedness, response, or recovery activities. They represent a wide variety of committees, planning groups, and other organizations that meet and coordinate to ensure the proper level of planning, training, equipping, and other preparedness requirements within a jurisdiction or area.

Prevention: Actions to avoid an incident or to intervene to stop an incident from occurring. Prevention involves actions to protect lives and property. It involves applying intelligence and other information to a range of activities that may include such countermeasures as deterrence operations; heightened inspections; improved surveillance and security operations; investigations to determine the full nature and source of the threat; public health and agricultural surveillance and testing processes; immunizations, isolation, or quarantine; and, as appropriate, specific law enforcement operations aimed at deterring, preempting, interdicting, or disrupting illegal activity and apprehending potential perpetrators and bringing them to justice.

Private Sector: Organizations and entities that are not part of any governmental structure. It includes for-profit and not-for-profit organizations, formal and informal structures, commerce and industry, and private voluntary organizations (PVO).

Processes: Systems of operations that incorporate standardized procedures, methodologies, and functions necessary to provide resources effectively and efficiently. These include resource typing, resource ordering and tracking, and coordination.

Public Information Officer: A member of the Command Staff responsible for interfacing with the public and media or with other agencies with incident-related information requirements.

Publications Management: The publications management subsystem includes materials development, publication control, publication supply, and distribution. Consistent documentation is critical to success, because it ensures that all responders are familiar with the documentation used in a particular incident regardless of the location or the responding agencies involved.

Qualification and Certification: This subsystem provides recommended qualification and certification standards for emergency responder and incident management personnel. It also allows the development of minimum standards for resources expected to have an interstate application. Standards typically include training, currency, experience, and physical and medical fitness.

Reception Area: This refers to a location separate from staging areas, where resources report in for processing and out-processing. Reception Areas provide accountability, security, situational awareness briefings, safety awareness, distribution of IAPs, supplies and equipment, feeding, and bed down.

Recovery: The development, coordination, and execution of service- and site-restoration plans; the reconstitution of government operations and services; individual, private-sector, nongovernmental, and public-assistance programs to provide housing and to promote restoration; long-term care and treatment of affected persons; additional measures for social, political, environmental, and economic restoration; evaluation of the incident to identify lessons learned; postincident reporting; and development of initiatives to mitigate the effects of future incidents.

Recovery Plan: A plan developed by a State, local, or tribal jurisdiction with assistance from responding Federal agencies to restore the affected area.

Resources: Personnel and major items of equipment, supplies, and facilities available or potentially available for assignment to incident operations and for which status is maintained. Resources are described by kind and type and may be used in operational support or supervisory capacities at an incident or at an EOC.

Resource Management: Efficient incident management requires a system for identifying available resources at all jurisdictional levels to enable timely and unimpeded access to resources needed to prepare for, respond to, or recover from an incident. Resource management under the NIMS includes mutual-aid agreements; the use of special state, local, and tribal teams; and resource mobilization protocols.

Resources Unit: Functional unit within the Planning Section responsible for recording the status of resources committed to the incident. This unit also evaluates resources currently committed to the incident, the effects additional responding resources will have on the incident, and anticipated resource needs.

Response: Activities that address the short-term, direct effects of an incident. Response includes immediate actions to save lives, protect property, and meet basic human needs. Response also includes the execution of emergency operations plans and of mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes. As indicated by the situation, response activities include applying intelligence and other information to lessen the effects or consequences of an incident; increased security operations; continuing investigations into nature and source of the threat; ongoing public health and agricultural surveillance and testing processes; immunizations, isolation, or quarantine; and specific law enforcement operations aimed at preempting, interdicting, or disrupting illegal activity, and apprehending actual perpetrators and bringing them to justice.

Safety Officer: A member of the Command Staff responsible for monitoring and assessing safety hazards or unsafe situations and for developing measures for ensuring personnel safety.

Section: The organizational level having responsibility for a major functional area of incident management, e.g., Operations, Planning, Logistics, Finance/Administration, and Intelligence (if established). The Section is organizationally situated between the Branch and the Incident Command.

Span of Control: The number of individuals a supervisor is responsible for, usually expressed as the ratio of supervisors to individuals. An appropriate span of control is between 1:3 and 1:7.

Staging Area: Location established where resources can be placed while awaiting a tactical assignment. The Operations Section manages Staging Areas.

State: When capitalized, refers to any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and any possession of the United States.

Strategic: Strategic elements of incident management are characterized by continuous long-term, high-level planning by organizations headed by elected or other senior officials. These elements involve the adoption of long-range goals and objectives, the setting of priorities; the establishment of budgets and other fiscal decisions, policy development, and the application of measures of performance or effectiveness.

Strike Team: A set number of resources of the same kind and type that have an established minimum number of personnel.

Strategy: The general direction selected to accomplish incident objectives set by the Incident Commander.

Supporting Technologies: Any technology that may be used to support the NIMS is included in this subsystem. These technologies include orthophoto mapping, remote automatic weather stations, infrared technology, and communications, among various others.

Task Force: Any combination of resources assembled to support a specific mission or operational need. All resource elements within a Task Force must have common communications and a designated leader.

Technical Assistance: Support provided to State, local, and tribal jurisdictions when they have the resources but lack the complete knowledge and skills needed to perform a required activity (such as mobile-home park design and hazardous material assessments).

Terrorism: Under the Homeland Security Act of 2002, terrorism is defined as activity that involves an act dangerous to human life or potentially destructive of critical infrastructure or key resources and is a violation of the criminal laws of the United States or of any State or other subdivision of the United States in which it occurs and is intended to intimidate or coerce the civilian population or influence a government or affect the conduct of a government by mass destruction, assassination, or kidnapping.

Threat: An indication of possible violence, harm, or danger.

Tools: Those instruments and capabilities that allow for the professional performance of tasks, such as information systems, agreements, doctrine, capabilities, and legislative authorities.

Tribal: Any Indian tribe, band, nation, or other organized group or community, including any Alaskan Native Village as defined in or established pursuant to the Alaskan Native Claims Settlement Act (85 stat. 688) [43 U.S.C.A. and 1601 et seq.], that is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

Type: A classification of resources in the ICS that refers to capability. Type 1 is generally considered to be more capable than Types 2, 3, or 4, respectively, because of size; power; capacity; or, in the case of incident management teams, experience and qualifications.

Unified Area Command: A Unified Area Command is established when incidents under an Area Command are multijurisdictional. (*See* Area Command.)

Unified Command: An application of ICS used when there is more than one agency with incident jurisdiction or when incidents cross political jurisdictions. Agencies work together through the designated members of the UC, often the senior person from agencies and/or disciplines participating in the UC, to establish a common set of objectives and strategies and a single IAP.

Unit: The organizational element having functional responsibility for a specific incident planning, logistics, or finance/administration activity.

Unity of Command: The concept by which each person within an organization reports to one and only one designated person. The purpose of unity of command is to ensure unity of effort under one responsible commander for every objective.

Volunteer: For purposes of the NIMS, a volunteer is any individual accepted to perform services by the lead agency, which has authority to accept volunteer services, when the individual performs services without promise, expectation, or receipt of compensation for services performed.

APPENDICES

Appendices A:
Emergency Incident Command System Organization Guides

A1. Emergency Operations Center Staffing and Contact Numbers
A2. Emergency Operations Plan Activation Guide
A3. Emergency Operations Duty Checklists
A4. Emergency Management Functional Responsibilities Matrix
A5. Emergency Operations Center Floor Plan Layout Guide
A6. Emergency Operations Center Telephone Numbers
A7. Incident Level Activation Matrix
A8. Santa Cruz County Emergency Management MOU
A9. Emergency Operations Center Radio Call Numbers

Appendices B:
Hazard Analysis Summaries for the City of Santa Cruz

B1. City of Santa Cruz Hazard Analysis Summary
B2. Wharf Hazard Plan
B3. Flood Hazard
B4. Earthquake
B5. Dam Inundation
B6. Wildland Fire
B7. Tsunami
B8. Oil Spill
B9. Hazardous Materials Incident
B10. Airplane Crash

Section/Unit Operations Plans ('Under Construction')

1. Command/Management
2. Operations
3. Planning
4. Logistics
5. Finance
6. PIO