POMONA
NATURAL HAZARDS MITIGATION PLAN

November 1, 2004

POMONA
NATURAL HAZARDS MITIGATION PLAN

Prepared for City of Pomona

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NHMP Document Organization

POMONA NATURAL HAZARDS MITIGATION PLAN

The Pomona *Natural Hazards Mitigation Plan* (NHMP) establishes the City's strategy to implement improvements and programs to reduce community impacts in the event of natural hazards. Prepared pursuant to the federal Disaster Mitigation Act of 2000, the NHMP comprehensively identifies potential natural hazards, the extent of the risks posed by the hazards, the vulnerabilities of the City to these hazards, and actions the City will take to mitigate or reduce the potential impact of the hazards.

While the frequency of disaster occurrence is low, Pomona is susceptible to major natural hazards with potential for catastrophic consequences. The ensuing devastation could tremendously disrupt daily activities, commerce, and economic development as well as the functions of the City and other public agencies, in addition to causing untold tragedy in life loss and widespread injuries. Earthquakes top the list of natural hazards with potential widespread impacts in Pomona, with wildfire, landslides, flooding, and windstorm following.

The NHMP builds upon preparedness and hazard reduction programs currently employed by the City. There are, however, a variety of risks with potential for considerable community impacts that require commitment of additional City resources and staff. By partnering with emergency response providers and community members in the implementation of the actions outlined in this document, the City can achieve a greater level of resiliency and will avoid major disruptions and upheaval associated with a natural disaster.

ORGANIZATION

The NHMP is organized into Part I: Mitigation Strategy Plan and Part II: Natural Hazard Risk Assessment. Part I is a comprehensive planning document, complete with an explanation of the NHMP process, risks and vulnerabilities overview, goals and objectives, and mitigation actions. Part II documents in greater depth the analysis of natural hazard extents, potential intensity, occurrences, and risk assessment including estimated financial vulnerabilities for each category of hazard. Appendices A through E provide various materials supporting the discussions and recommendations of Parts I and II.

The structure of the NHMP document is outlined below.

Part I: Mitigation Strategy Plan

- 1: Introduction
- 2: Community Profile
- 3: Risk Assessment
- 4: Goals and Objectives
- 5: Mitigation Action Plan

Part II: Natural Hazard and Risk Assessment

- 6: Earthquake
- 7: Landslide
- 8: Wildfire
- 9: Flooding
- 10: Windstorm

Appendices

- A: Public Participation Process
- B: Master Resource Directory
- C: Economic Analysis Guidelines for Natural Hazard Mitigation Projects
- D: List of Acronyms
- E: Glossary

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PART I:
MITIGATION STRATEGY PLAN

1 Introduction

1.1 BACKGROUND

The City of Pomona is a desirable place to live with many attractive features: a favorable climate, diverse employment opportunities, historic downtown and neighborhoods, and more affordable housing than many of its neighboring communities. This quality of life attracts many new residents each year, resulting in a growth rate of 61% in the last twenty years, significantly higher than the growth rate of Los Angeles County region as a whole.[1] Along with this growth, however, comes numerous challenges, one of which is how to effectively manage threats to the City in the event of a natural disaster. Southern California is home to a host of potential natural hazards that could cause significant injury, loss of life, and property damage.

LOCAL HAZARDS

In Pomona, the greatest hazard threats are ground shaking and liquefaction from a major earthquake, although landslide, wildfire, flooding, and windstorm events also have potential to endanger people and property. As the City continues to grow, the exposure to these hazards increases, and the accompanying potential for negative impacts becomes even greater. Pomona's status as a nearly built-out city with limited natural open spaces affects the types of hazards and potential consequences of concern.

Pomona has been impacted by natural hazards—namely earthquake and flooding—in prior years. One of the most memorable disasters was a train wreck known to have occurred about 1900. The possible cause was a major earthquake registering approximately 6.5 on the Richter scale along the San Jacinto Fault on December 25, 1899. Over one hundred passengers were seriously injured. Because Pomona had no medical facility, injured passengers were taken into private homes and cared for by Pomona residents. This incident was the catalyst for Pomona to build a hospital, which today is Pomona Valley Hospital Medical Center. The Whittier-Narrows Earthquake of 1987 resulted in damage to many valued historic buildings, and several damaged unreinforced masonry buildings in the downtown area required demolition. Pomona has also had a long history of significant flooding in the eastern portions. Drainage improvements in the 1950s and 1960s and the construction of the San Antonio Dam have alleviated this hazard, although some localized flooding still occasionally occurs during heavy rainstorms.[2]

Above. The derailment of a train in 1899 in Central Pomona prompted the construction of the City's hospital - Pomona Valley Hospital Medical Center. Traveling at high speeds, the train jumped track, potentially due to track damage caused by a large earthquake that occurred in the region on the same day.

[1] U.S. Census Bureau: United States Population and Housing Counts, 1980 and 2000.

The City of Pomona has not to date experienced disasters requiring a request for a Presidential Disaster Declaration and associated emergency assistance funds. The fact that a catastrophic situation requiring this request has not occurred to date should not in any way be interpreted as prediction of low hazard risk for the future. An event like the 1994 Northridge Earthquake, with damage totaling nearly 50 billion dollars, could realistically occur in Pomona.

HAZARD MITIGATION PLANNING

Exact prediction of disasters and the extent of impact on the City is impossible. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazard events. Mitigation planning is an effective method of reducing risk from such natural disasters. It is defined as "sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects."[3] This *Natural Hazards Mitigation Plan* is the culmination of extensive research, analysis, and community outreach undertaken by the City of Pomona to identify potential natural hazard risks and establish appropriate and effective mitigation to reduce the risks.

1.2 PURPOSE OF THE NHMP

In response to a series of costly and damaging disasters, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000), which establishes a framework for proactive local planning for natural hazard mitigation. This law requires that every local, county, and state government:

- Conduct an assessment of the natural hazards that pose a threat to the jurisdiction;
- Determine the potential financial impact of these hazards;
- Create a plan to mitigate these hazards; and
- Implement the plan to reduce the impacts of natural disasters.

The preparation and adoption of such a plan is required in order to be eligible for funding from the Federal Emergency Management Agency (FEMA). The *Natural Hazards Mitigation Plan* for Pomona will ensure that the City is in compliance with this law, and will be able to receive funding for mitigation projects and other assistance under DMA 2000.

As the costs of damage from natural disasters continue to increase, the community realizes the importance of identifying effective ways to reduce vulnerability to disasters. Natural Hazard Mitigation Plans assist communities in reducing risk from natural hazards by identifying resources, information, and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the City. The NHMP establishes a set of action items to reduce risk from natural hazards through education and outreach programs and to foster the development of partnerships, improvements to maximize emergency service response capabilities, and implementation of preventative activities such as land use programs that restrict and control development in areas subject to damage from natural hazards.

1.3 RELATED MITIGATION PLANNING EFFORTS

The Pomona NHMP addresses natural hazards, risks, and mitigation actions for the entire City. However, a variety of agencies and organizations have facilities in the City and take the lead on mitigation planning efforts for their facilities. NHMPs are under preparation by the following for facilities that include Pomona:

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[2] Gallivan, Mickey. President, Pomona Historical Society. Written Communication. June 22, 2004.

[3] Federal Emergency Management Agency, website: www.fema.gov

- State of California, for State-owned facilities such as freeways and Lanterman Developmental Center;
- County of Los Angeles, for County-owned facilities such as the courts;
- Pomona Unified School District and Claremont Unified School District, for schools and other facilities and property owned by the districts; and
- Pomona Valley Hospital Medical Center.

Major utility infrastructure in Pomona is owned, operated, and managed by entities other than the City, such as Southern California Edison, Union Pacific Railroad, Southern California Gas Company, and the Los Angeles County Metropolitan Transportation Authority (MTA). Maintenance and emergency preparedness of these types of facilities are not under the City's jurisdiction, although the City has a responsibility to coordinate with these infrastructure providers on emergency preparedness and risk reduction strategies, and advocate safety for Pomona residents, business, and property.

Partners and resources exist at the regional, State and federal levels. Numerous State agencies have a role in natural hazards and natural hazard mitigation. Some of the key agencies include:

- The Governor's Office of Emergency Services (OES) is responsible for disaster mitigation, preparedness, response, recovery, and the administration of federal funds after a major disaster declaration;
- The Southern California Earthquake Center (SCEC), gathers information about earthquakes, integrates this information on earthquake phenomena, and communicates this to end-users and the general public to increase earthquake awareness, reduce economic losses, and save lives;
- The California Division of Forestry (CDF) is responsible for all aspects of wildland fire protection on private, state, and administers forest practices regulations, including landslide mitigation, on non-federal lands;
- The California Division of Mines and Geology (DMG) is responsible for geologic hazard characterization, public education, the development of partnerships aimed at reducing risk, and exceptions (based on science-based refinement of tsunami inundation zone delineation) to state mandated tsunami zone restrictions; and
- The California Division of Water Resources (DWR) plans, designs, constructs, operates, and maintains the State Water Project; regulates dams; provides flood protection and assists in emergency management. It also educates the public and serves local water needs by providing technical assistance.

1.4 RELATED CITY PLANS AND DOCUMENTS

The NHMP works in conjunction with other City plans and documents, specifically the General Plan, Development Code, and the Multi-Hazard Function Plan. The status of these documents is described below. The planning mechanisms in these documents will be amended to incorporate the NHMP mitigation actions.

POMONA GENERAL PLAN

The *Pomona General Plan* establishes a city-wide development plan and policies to help achieve the community's vision and goals for the City. Topics addressed in the *General Plan* include land use, circulation, economic development, urban design, historic and natural resources, open spaces, noise, as well as public safety. The City is currently conducting a comprehensive update of the 1976 *General Plan*, by working with community members and stakeholders in a process of:

- Issue identification;
- Opportunities and challenges documentation in the 2004 *Existing Conditions, Opportunities, and Challenges Report* with in-depth analysis of development, environmental, infrastructure, and economic planning issues;
- Delineation of Focus Areas with potential for redevelopment, reuse, and/or intensification;
- Alternative development concepts for the Focus Areas for formulation of a Preferred Plan; and
- Preparation of the new General Plan and Environmental Impact Report.

Due to overlap in research and recommendations, the NHMP has been prepared in tandem with the General Plan Update process.

DEVELOPMENT CODE

The *Pomona Development Code* establishes regulations for development in the City, thereby implementing the General Plan policy framework. The Development Code is currently being updated, and will be revised to reflect the directives in the new General Plan.

STANDARDIZED EMERGENCY MANAGEMENT SYSTEM PLAN

The *Standardized Emergency Management System Plan (SEMS)* last updated in 1999—establishes the emergency organization, task assignments, policies and general procedures, and coordination of the various emergency staff and service elements utilizing the Standardized Emergency Management Systems (SEMS). The objective is to incorporate and coordinate all the facilities and personnel of the City into an efficient organization capable of responding to any emergency, as an extension of the California Emergency Plan. In the event of a natural disaster, the City would employ the communication protocols and systems for emergency response established in the *Standardized Emergency Management System Plan*.

1.5 PLANNING PROCESS

In preparing the NHMP, the City utilized a step-by-step planning process incorporating thorough research, analysis, and participation by stakeholders and community members. This planning process consisted of six major steps:

- Identification of issues pertaining to natural hazards, community risks and vulnerabilities, preparedness, and awareness;
- Intensive research and mapping of hazards, critical facilities, and vulnerabilities to identify potential risks in Pomona;
- Rating of risks according to potential extent of damage, injury and life loss, and severity of service disruptions impairing community functioning;
- Formulation of mission, goals, and objectives;
- Evaluation of mitigation actions to reduce risks and improve preparedness; and
- Plan preparation.

Community members, stakeholders, and partners in emergency preparedness were involved in each step—providing input and assistance—as described in Chapter 3: Risk Assessment.

1.6 PUBLIC PARTICIPATION

Emergency preparedness and response in a city like Pomona depends on the coordinated efforts of emergency service providers, infrastructure partners, community leaders, and residents themselves. To be comprehensive, feasible, and effective, mitigation planning for natural hazards must proceed in coordination with these entities. For these reasons, a multi-component public participation program was integrated with the

planning process for the NHMP. The public participation program included:

- Technical Advisory Committee (TAC) comprised of approximately 20 members representing City departments, school district, surrounding cities, utility and emergency service providers, who provided input at each of the planning steps;
- Public workshops in each City Council district to identify hazard planning and preparedness issues, held as part of the General Plan Update;
- Public scoping meeting;
- Informational newsletter distributed at the workshops, scooping meeting, additional community meetings conducted for the General Plan Update, and at City Hall and Library;
- Project website providing information on how to participate and access to the Draft NHMP;
- Extensive list of community stakeholders and partners that received notices about meetings and document review opportunities; and
- Communications with stakeholders and partners to acquire data and planning information.

Appendix A contains additional documentation of the public participation process.

1.7 NHMP IMPLEMENTATION AND MAINTENANCE

Implementation of the NHMP will involve the coordinated efforts and commitment of City officials, City staff, emergency preparedness partners, and community leaders and residents. The timetable for implementation of the mitigation actions is five years, although a variety of actions will be ongoing once initiated. Other actions may take several years to complete.

PLAN ADOPTION

The NHMP is intended to be adopted by the City Council, following review and comment by the State Hazard Mitigation Officer in the Governor's Office of Emergency Services, FEMA, and the public. Once adopted, the NHMP will be submitted again to the State Hazard Mitigation Officer, who will then submit the plan to FEMA for final review and acceptance. Upon acceptance by FEMA, the City will gain eligibility for Hazard Mitigation Grant Program funds.

IMPLEMENTATION STRUCTURE

The Community Development Department will take the lead in supervising implementation, working closely with the City's Emergency Preparedness Coordinator and the Natural Hazards Action Committee. Each year in an Annual Report, priorities will be established for mitigation implementation, with consideration of cost-effectiveness per FEMA-approved techniques.

The City will update the NHMP every five years—in coordination with the Natural Hazards Action Committee and with public input—by evaluating the effectiveness of mitigation implementation, addressing changes in critical facilities and vulnerabilities, incorporating advancements in emergency response and post-disaster services, and updating hazard and risk assessments as new information becomes available. This includes incorporating new data from federal, State, or regional hazard mapping and delineation efforts.

The NHMP implementation structure is established in Mitigation Action 1.1 in Chapter 5, which should be referred to for more detail.

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2 Community Profile

This Community Profile provides background information on Pomona's geography, environment, population, and economy. This context description helps to better understand natural hazards and vulnerabilities of the City. The 2004 *Existing Conditions, Opportunities, and Challenges Report* is the source for much of the discussion in this chapter, and should be referred to for greater detail on conditions, trends, and planning issues.

2.1 INTRODUCTION

Located in the highly urbanized Los Angeles metropolitan area, the City of Pomona shares many attributes with its neighbors. This includes a vulnerability to the volatile natural systems and features that distinguish the area. The semi-arid climate that attracts many people to the region also creates the conditions for fast-spreading wildfires. The infrequent but intense winter rain storms can create the potential for flooding, should the flood prevention infrastructure ever fail. The hillsides that frame the Pomona Valley and that are home to well-established neighborhoods are also subject to destructive landslide conditions. And perhaps most dramatically, Pomona is located in one of the most earthquake prone urbanized areas in the United States.

Although situated in a high-risk metropolitan region, Pomona has been fortunate to avoid catastrophic natural disasters since its development from orchards to city. Since urbanization of Pomona, there have been no recorded states of emergency due to natural hazards. Southern California earthquakes have impacted Pomona, although major damage has been limited. Fire has also impacted Pomona, although wildfires such as the kind seen in the 2003 Southern California fires have not spread into Pomona. Large scale flooding has not been a threat since the channelization of local creeks, and significant landslides have not caused widespread damage. Nevertheless, the threat of natural disaster is always present. The potential for property loss and personal injury is particularly profound in Pomona due to its nearly built-out status. As the City continues to intensify with infill development, the risks, as well as the opportunity to build in mitigation, increases.

The inevitability of natural hazards, and the growing population and activity within the City, create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future natural hazard events. Identifying the risks posed by natural hazards, and developing strategies to reduce the impact of a hazard event, can assist in protecting life and property of citizens and communities. Local residents and businesses can work together with the City to create a *Natural Hazards Mitigation Plan* that addresses the potential impacts of hazard events.

2.2 GEOGRAPHY AND THE ENVIRONMENT

The City of Pomona occupies 22.8 square miles in eastern Los Angeles County. To the west are the cities of the San Gabriel Valley and to the east is the fast-growing San Bernardino-Riverside region, as shown in Figure 2-1: Regional Location. The majority of the City is situated on the low-lying floor of the Pomona Valley and is bisected by major transportation corridors – freeways, rail corridors, and arterial roads. The San Jose and Puente Hills provide distinct edges to the northwest and southern boundaries, respectively, of Pomona see Figure 2-2: Topography.

Pomona is located on a gently sloping alluvial fan, which originates at the mouth of the San Antonio Canyon and slopes gradually to the south and southwest. Pomona is mostly characterized by flat topography (average slope in the valley floor area is a little under one percent) and there are only minor topographic variations except for the hillside areas to the northwest and south. Elevations in the City range from 1,100 to 1,300 feet in the San Jose and Puente Hills to 800 to 900 feet on the valley floor.

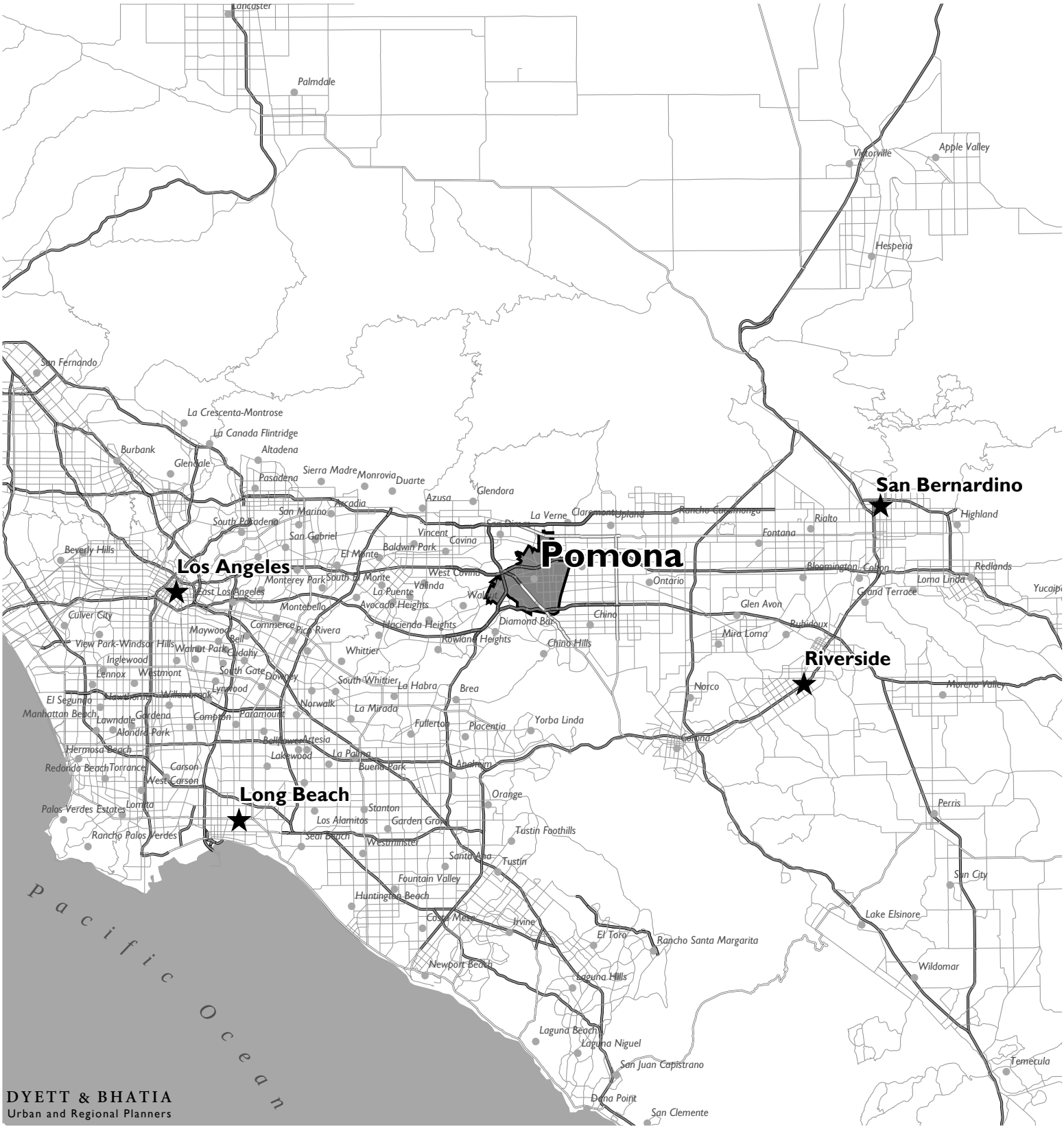


Figure 2-1

Regional Location

City Boundary

Source:
City Boundary: City of Pomona, September 2003; Street Network and other City Locations: US Census TIGER data, 2000.

POMONA NATURAL HAZARDS MITIGATION PLAN

0 2.5 5 10
Miles

In general, the City is primarily urbanized, with limited open space and parks (864 acres, or 7.7% of total), and vacant areas (597 acres, or 5.3% of total). The City has no major water features, such as rivers or lakes, but rather the City form has been defined in the early years by the railroad and later by the freeways. Creeks have been channelized and do not create significant physical boundaries.

2.3 HISTORICAL DEVELOPMENT

The City of Pomona is one of the most well established cities in the San Gabriel Valley. The City of Pomona was initially plotted out in 1876 as a one square-mile townsite built around the Southern Pacific railroad station and the City itself was later incorporated in 1888, the fifth chartered City in Los Angeles County. Pomona started as a major center for citrus orchards, but also developed a well-defined town area. Residential neighborhoods soon developed, some of which are highly regarded for their exceptional architecture and style. These neighborhoods, along with the unique downtown core, give Pomona a historic character that is a source of community pride and an asset to be protected.

Today, Pomona is the 12th most populous city in the greater Los Angeles metropolitan area and the fifth most populous in Los Angeles County. It is a City with a diverse mix of people, neighborhoods, and business opportunities. Pomona has also developed into a very urban place. The City has a well-developed mixed-use downtown that is a center for arts and culture, and the site of substantial redevelopment and infill development.

Large scale industrial districts are in place in both the east and the west of the City, offering substantial opportunities for business and employment growth with direct connections to major transportation corridors (freeways and rail). There are numerous educational opportunities from K-12 education to colleges and universities including DeVry, Western University, and the adjacent Cal Poly Pomona. The expansive Fairplex facilities are home to the Los Angeles County Fair as well as numerous recreation, convention, and exhibit activities. The City's major transportation arterials are also major commercial corridors. And, of course, the City has a wide range of housing options and diverse neighborhoods, both on the valley floor and in the hillside areas.

2.4 CLIMATE

One of the City's great assets is its spectacular Southern California climate. Average temperatures range from 41 degrees in the winter months to 89 degrees in the summer months. However, the temperatures can vary over a wide range, particularly when the Santa Ana winds blow from October to March, bringing higher temperatures and very low humidity. Temperatures rarely exceed 100 degrees in the summer months (June-September), nor drop below 30 degrees in the winter months (November-March).

Rainfall in the city averages 19.37 inches of rain per year. However the term "average rainfall" is misleading. Over the recorded history of rainfall in the City of Pomona, amounts have ranged from lows of seven inches in some years to 46 inches of rain in very wet years.

Furthermore, actual rainfall in Southern California tends to fall in large amounts during sporadic and often heavy storms rather than consistently over storms at somewhat regular intervals. Because the metropolitan basin is largely built out, water originating in higher elevation communities can have a sudden impact on adjoining communities that have a lower elevation.

2.5 GEOLOGIC CONDITIONS

REGIONAL GEOLOGIC SETTING

The City of Pomona lies within the western portion of the Transverse Ranges geomorphic province, characterized by numerous earthquake faults. The Transverse Ranges consist of a distinct group of east-west trending ranges and valley that truncate the prevailing north-northwest trend of

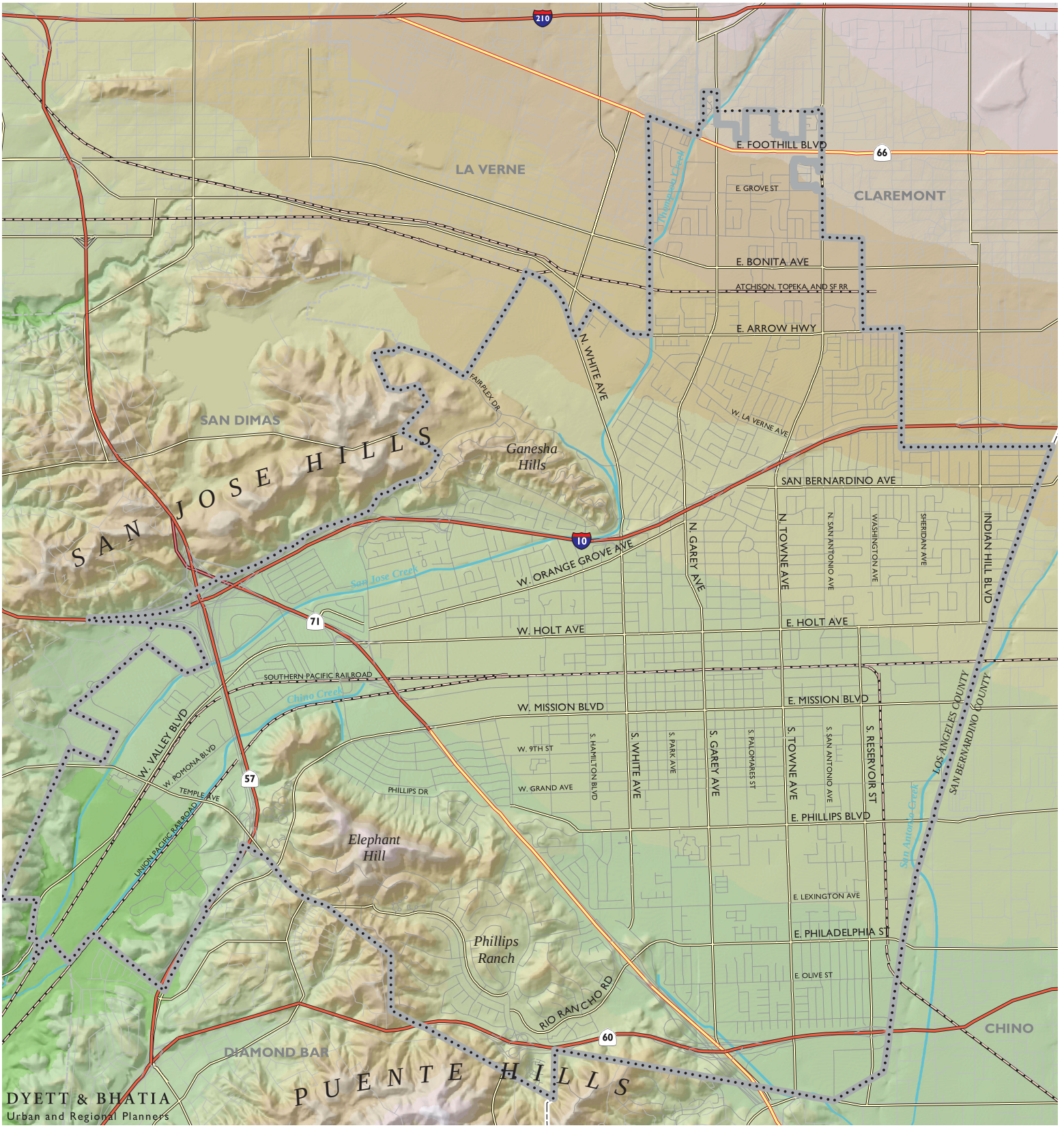


Figure 2-2

Topography (in feet)

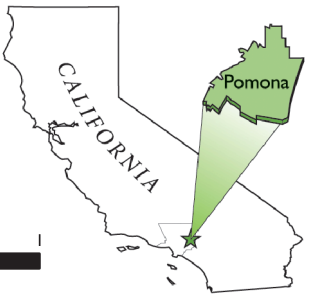
- Under 700
- 700 - 800
- 801 - 900
- 901 - 1,000
- 1,001 - 1,100
- 1,101 - 1,200
- 1,201 - 1,300
- 1,301 - 1,400
- 1,401 - 1,500
- Greater than 1,500
- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona 2003; Topography: United States Geological Survey (USGS) 30-meter digital elevation models (DEMs), Ontario and San Dimas quadrangles, 1999.

POMONA NATURAL HAZARDS MITIGATION PLAN

10 Acres

0 0.25 0.5 1
Miles



the southern Coast Ranges and Peninsular Ranges. This province encompasses approximately 325 miles, and extends from Point Aguello, located along the western coast of California, eastward to Joshua Tree National Park, where it merges with the Mojave and Colorado Deserts.

Within the Transverse Ranges there are abundant compressional reverse and thrust normal faults, and curvilinear strike-slip faults that generally trend in an east-west direction. The foremost structural feature that has affected the geologic evolution of the province is the San Andreas fault. This fault has a northwest strike, located both to the north and south of the Transverse Ranges, but changes to a west-northwest strike within the Transverse Ranges, thus forming a bend in the fault. Many of these normal faults break the ground surface south of the San Andreas fault along the southern flank of the San Gabriel and Santa Monica Mountains. The thrust faults that break the surface south of the San Andreas fault dip southward and merge with the broad, buried fold and thrust belts that underlie the Los Angeles basin and the southern margin of the Transverse Ranges.

LOCAL GEOLOGIC SETTING

The City is underlain by alluvium within the valley area and underlain by bedrock on the San Jose Hills on the northwest and the Puente Hills on the southwest. The unconsolidated alluvial soils of the San Bernardino Valley came from the transport of soils from the San Gabriel Mountains to the north, as well as soils that washed out of nearby foothills and the San Antonio canyon area. The alluvial soils are underlain by igneous-metamorphic rock, as seen in outcrops in the Puente Hills and San Jose Hills. Soils on the western valley area are made up of unconsolidated coarse sands and gravel near the San Jose Creek, and very fine grain unconsolidated silty sands along the foothills.

The Puente Hills are made up of marine sandstones and siltstones of the Puente formation, with a mixture of volcanic rock and outcrops. The Ganesha Hills are made of igneous metamorphic outcrops, as found on the San Jose Hills. The rocks are as much as 24,000 feet thick and consist of fine to course-grained marine clastic sedimentary rocks of the Cenozoic era (12 million years to 10,000 years ago). These rocks also include volcanic rocks and some non-marine sedimentary rocks.

REGIONAL FAULTS

The major faults that have the potential to affect the greater Los Angeles Basin, and therefore the City of Pomona are the San Andreas Fault Zone, Sierra Madre Fault System, Whittier-Elsinore Fault Zone, Verdugo Fault, Norwalk Fault, Santa Monica Fault, San Fernando Fault Zone, and the Newport-Inglewood Fault Zone. These faults are described in greater detail in Chapter 6: Earthquakes.

LOCAL FAULTS

In addition to the regional faults, there are several local faults located within the city that are considered potentially active. No recent seismic activity has been recorded along these faults in the last 10,000 years. However, a major earthquake occurring along any of these faults would be capable of generating seismic hazards and strong groundshaking effects within the City. These local faults include the Indian Hill, Chino, Central Avenue, and San Jose Faults. These faults are described in greater detail in Chapter 6: Earthquakes.

MINERALS AND SOILS

The characteristics of the minerals and soils present in the City of Pomona indicate the potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether or not an area will be prone to geologic hazards such as earthquake–induced ground shaking, liquefaction and landslides.

Within the Pomona area, various soil associations are identified by the Natural Resources Conservation Service (NRCS), formerly known as

the U.S. Soil Conservation Service. These soil associations consist of one or more soil types that have similar characteristics, and each is named for the predominant soil series it contains. According to the 2004 City Existing Conditions, Opportunities, and Challenges Report, soil series within the City include Tununga-Sobada, Hanford, Cropley, Foster-Grangeville, Chino, Diablo-Altamont, Altamont-Diablo, San Andreas-San Benito, San Benito-Soper, and Yolo. Generally, soils located in the western valley area comprise unconsolidated coarse sands and gravel, with very fine grain unconsolidated silty sands along the foothills.

The City is not located within a Significant Mineral Aggregate Resource Area (SMARA), as designated by the State Department of Conservation, nor is it located in an area with active mineral extraction activities.

2.6 POPULATION AND DEMOGRAPHICS

The City of Pomona has a population of about 149,473 people in an area of 22.8 square miles. The population has steadily increased from the late 1800's through 2000, and increased 13.5 percent from 1990 to 2000 according to the 2000 Census. This rate of increase is greater than the rate of increase for Los Angeles County as a whole over the same time period (7.4 percent). Over the same period of time, the number of households grew at a slower rate (3.9 percent), leading to an increasing person per household average (3.82 in 2000, 3.52 in 1990) and denser neighborhoods.

Considering the historic trends, population growth is expected to continue in the City of Pomona. This increase of people creates more community exposure, and changes how agencies prepare for and respond to natural hazards. For example, more people living in crowded neighborhoods can increase the risks associated with hazard events.

Furthermore, the City is experiencing a great deal of in-fill building, which is increasing the population density and creating greater service loads on the built infrastructure, including roads, water supply, sewer services, and storm drains.

Natural hazards do not discriminate, but the impacts in terms of vulnerability and the ability to recover vary greatly among the population. According to Peggy Stahl of the Federal Emergency Management Agency (FEMA) Preparedness, Training, and Exercise Directorate, 80% of the disaster burden falls on the public, and within that number, a disproportionate burden is placed upon special needs groups: women, children, minorities, and the poor. The ethnic and cultural diversity in Pomona suggests a need to address multi-cultural needs and services as described below.

According the latest census figures, (2000) the demographic make up of the City is as follows:

Table 2-1: Race and Ethnic Composition of Pomona

Race	*Percent of Total Population*
Hispanic	64.5
White	17.0
Black	9.3
Asian	7.0
2 or more races	1.7

Source: 2000 U.S. Census

Census data also indicates that the number of Pomona residents in poverty increased dramatically from 1990 to 2000, by 31.7 percent. About 20.8 percent of the population in Pomona was determined to have poverty status in 2000, more than the County at 17.5 percent of the population.

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, may be disproportionately impacted by natural hazards. In Pomona, the percentage of the population over 65 has decreased slightly from 7.0 percent in 1990 to 6.4 percent in 2000. However, the percentage of

residents under 18 years of age has increased from 32.8 percent in 1990 to 34.6 percent in 2000.

Examining the reach of hazard mitigation policies to special needs populations may assist in increasing access to services and programs. FEMA's Office of Equal Rights addresses this need by suggesting that agencies and organizations planning for natural disasters identify special needs populations, make recovery centers more accessible, and review practices and procedures to remedy any discrimination in relief application or assistance.

The cost of natural hazards recovery can place an unequal financial responsibility on the general population when only a small proportion may benefit from governmental funds used to rebuild private structures. Discussions about natural hazards that include local citizen groups, insurance companies, and other public and private sector organizations can help ensure that all members of the population are a part of the decision-making processes.

2.7 LAND USE PATTERNS

Pomona is a highly urbanized city with a rich history that is reflected in its current development pattern and diverse mix of land uses, building types and styles, and neighborhoods. The City is almost entirely built-out with only 5.3 percent of land vacant and 7.7 percent of land in parks or open space uses (see Table 2-2). The distribution of existing land uses is shown in Figure 2-3: Existing Land Use.

Table 2-2: Summary of Major Land Uses

Land Use	*Acres*	*Percent of Total*
Low-Density Residential	4,310	38.6%
Medium-Density Residential	591	5.3%
High-Density Residential	294	2.6%
Residential Total	*5,195*	*46.5%*
Retail Commercial	355	3.2%
Service Commercial	182	1.6%
Commercial Total	*537*	*4.8%*
Office	114	1.0%
Light Industrial	797	7.1%
Heavy Industrial	413	3.6%
Industrial Total	*1,210*	*10.8%*
Parks & Open Space	864	7.7%
Public, Civic & Institutional	2,254	20.2%
Schools	396	3.5%
Public Land Total	*3,514*	*31.5%*
Vacant Land	597	5.3%
Total	**11,165**	**100%**

Source: LA County Assessor Parcel Data, 2003; City of Pomona GIS, 2003; Dyett & Bhatia, 2004.

Note: the City boundary for Pomona encompasses 14,703 acres. The remaining 3,538 acres are taken up by streets, drainages, rights-of-way, and similar public lands and easements.

Overall, the City's development pattern is typical of a city of its age, topography, and western U.S. location. Even in the City Center, topography and lack of physical constraints has allowed for a relatively uniform street grid with residential neighborhoods and commercial corridors radiating outwards from the traditional mixed-use downtown core. Residential neighborhoods located further away from the downtown and along the hillsides to the north and south were built later in the 20th century and are more uniformly residential in use. At the western and eastern edges of the City, large industrial areas have developed with access to the railway and major transportation arteries.

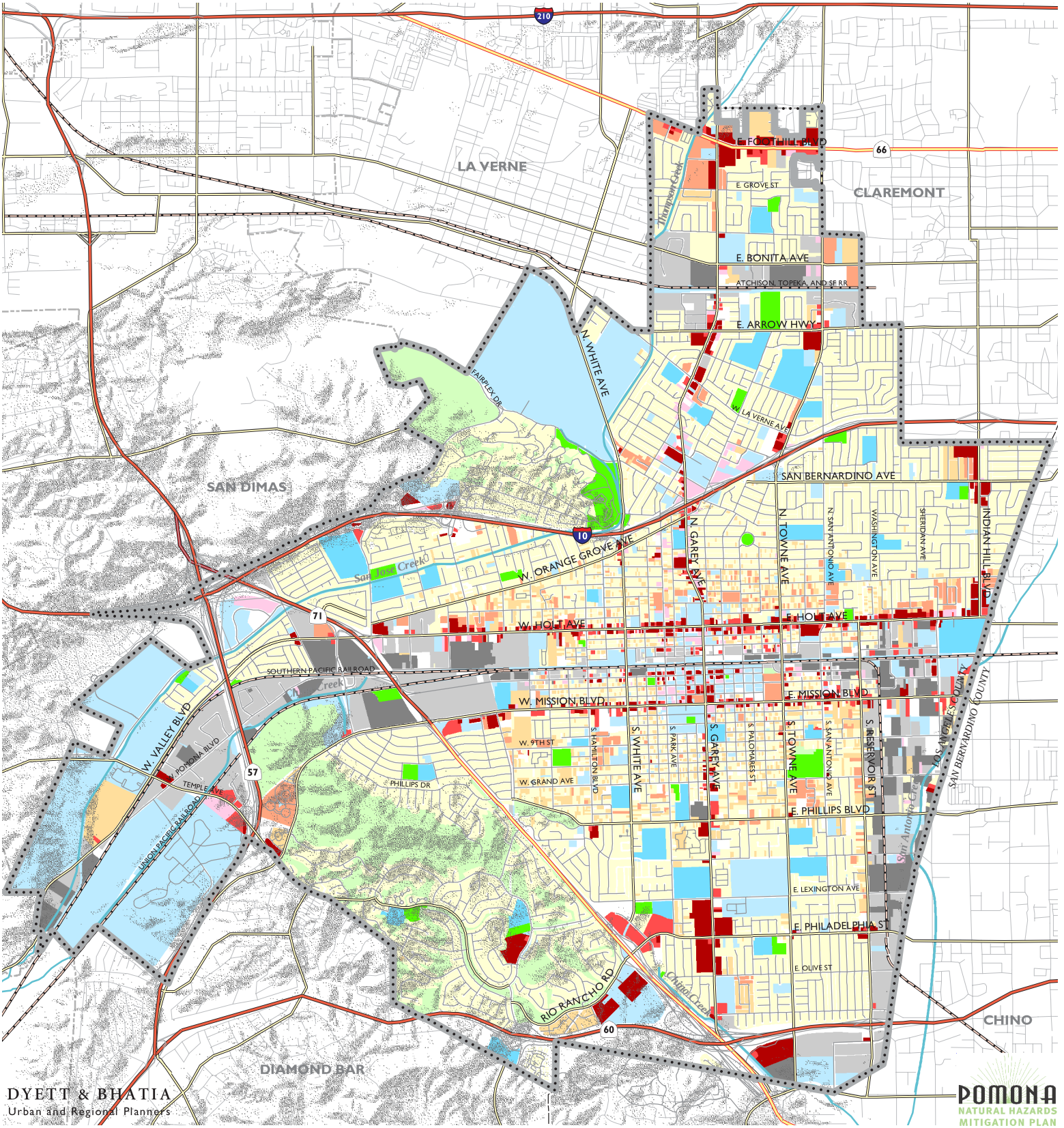


Figure 2-3

Existing Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Auto, Motels, and Service Commercial
- Retail Commercial and Shopping Centers
- Office
- Light Industrial
- Heavy Industrial and Outdoor Storage
- Parks
- Open Space
- Vacant Land
- Education
- Public, Civic, and Institutional
- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona, 2003.
Land Use Data: Los Angeles County Assessor Parcel Data, 2003.

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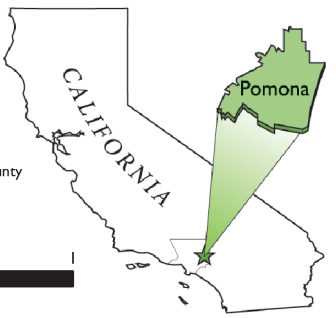


2.8 HOUSING AND COMMUNITY DEVELOPMENT

In Pomona, the demand for housing outstrips the available supply, and the recent low interest rates have further fueled a pent up demand. This has been a concern in recent years as growth in housing (3.9 percent from 1990 to 2000) has been outpaced by growth in population (13.5 percent). This discrepancy is also reflected in growing household sizes and a decreased vacancy rate. It also contributes to a growing housing affordability problem as the average sales price for new construction homes is between $350,000 and $400,000.

Although the cost of housing is increasing and there is a lack of vacant land for new single-family residential homes, the mix of housing types has remained relatively consistent in recent years. Single-family residential is the primary housing type (69.5 percent of the total), with the remainder consisting of multi-family (26.2 percent) and mobile homes or other (4.3 percent).

The majority of homes in the City are owner-occupied (57.4 percent of non-vacant units). The remaining 42.6 percent are renter-occupied. The vacancy rate in 2000 was four percent.

The age of Pomona's housing stock is detailed in Table 2-3. However, what is not as readily apparent in the housing age statistics is the disparity of maintenance in many Pomona neighborhoods. While some of Pomona's older neighborhoods are remarkable for their largely uniformly excellent condition, there are also many areas where careful upkeep is not the norm. The condition of many of the City's older homes requires significant investment in renovation to bring them up to meet contemporary standards. While these older homes can create affordable housing options, the cumulative effect of substandard housing stock on a neighborhood can be a sense of blight and negative effect on community identity, pride, housing value, as well as the city's ability to attract new business investment. The risk of property damage and injury is heightened in areas of older homes.

To address housing issues, the City's Housing Division provides a number of programs including rental assistance, homebuyer mortgage assistance, housing rehabilitation, and façade improvement programs.

For non-residential uses, the City of Pomona's Business Development Division is a body that helps to promote economic prosperity throughout the City. The Business Development Division's goals are to attract new and highly desirable businesses to the community, assist businesses experiencing growth with their expansion needs, and assist in the efforts to retain existing local businesses requiring access to business resources. To achieve these goals, the Division sponsors a variety of services and programs, including business assistance, façade improvement programs, and marketing.

Overall, the City's annual average household income (2000) of $53,073 was about 18.7 percent less than the countywide average. About one-third of Pomona households earned an average annual income of less than $25,000.

Table 2-3: Age of Housing Stock

Year Built	*Units*	*Percent of Total*
1990 to 2000	2,401	6.1
1980 to 1989	6,882	17.4
1970 to 1979	5,908	14.9
1960 to 1969	7,320	18.5
1950 to 1959	9,940	25.1
1940 to 1949	3,540	8.9%
1939 or earlier	3,629	9.2
Total Units	*39,620*	*100.0*

Source: L.A. County Assessor Parcel data, 2003.

2.9 EMPLOYMENT AND INDUSTRY

Pomona's job base is undergoing changes initiated by the closure of aerospace and manufacturing facilities in the late 1980s and early 1990s. Although the loss of large employers such as General Dynamics has been a negative impact, Pomona is a resilient city and has seen an increase in employment of 25.4 percent from 1992 to 2000.

The largest increases have been in the services category (49.7 percent), followed by the government (51.0 percent), wholesale trade (45.7 percent), and construction (25.3 percent) categories.

Overall, however, although employment growth has been positive, there have been other impacts from the job base changes. With the loss of major employers, Pomona has seen an increase in the diversity of job types and a shift to a wider range of smaller enterprises. This presents a challenge in coordinating with major employers to ensure the safety and welfare of workers and limit damage to industrial infrastructure. There is also need to increase jobs with greater pay.

2.10 GROWTH AND DEVELOPMENT

As discussed in Section 2.1: Introduction, the City of Pomona is located at the boundary of the highly urbanized metropolitan counties of Los Angeles and San Bernardino. It is surrounded and contained by the cities of Claremont, La Verne, San Dimas, Walnut, Diamond Bar, Chino, and Montclair. Within Pomona, all of the large land areas are developed, including most of the more remote hillsides. The remaining undeveloped land is either not suitable for development, or has been set aside to remain as open space.

Although the City is considered built-out, development continues and is expected to continue to meet market demand created by population growth. Because of the lack of available land suitable for development, new development will be primarily infill, reuse, and intensification. Addressing the challenge of accommodating projected growth within the urban fabric of the City is a major goal of the ongoing *General Plan Update*. As part of this effort, a comprehensive assessment of areas in the City with potential for infill development, redevelopment, land use change, and/or development intensification has been conducted. The results of this assessment have resulted in the formulation of Focus Areas, which are depicted in Figure 2-4.

The Focus Areas are those areas that have the highest potential for change over the next 10 to 20 years, provided with the right land use incentives. They may also be areas that serve as important landmarks or focal points within the city and therefore may act as valuable catalysts for further development or economic activity in Pomona. Criteria for identifying the focus areas is summarized below, but not all criteria necessarily apply to all identified focus areas:

- Contains significant vacant or underutilized lands or buildings;
- Contains obsolete or incompatible land uses;
- Is appropriate for further intensification of use;
- Contains uses that are not expected to remain through the life of the plan;
- Contains significant blight;
- Is consistent with redevelopment planning efforts; and
- Can serve as a catalyst for development in surrounding areas or as a model for a particular type of development.

Addressing the natural hazard mitigation issues in an urbanized City like Pomona are different from those encountered in a community with room to expand outward. Due to its built-out status, future growth in Pomona will not stretch into undeveloped areas that could present additional natural hazard risks; rather, development will be integrated into the existing urban fabric, and affected by the same natural hazards that face the

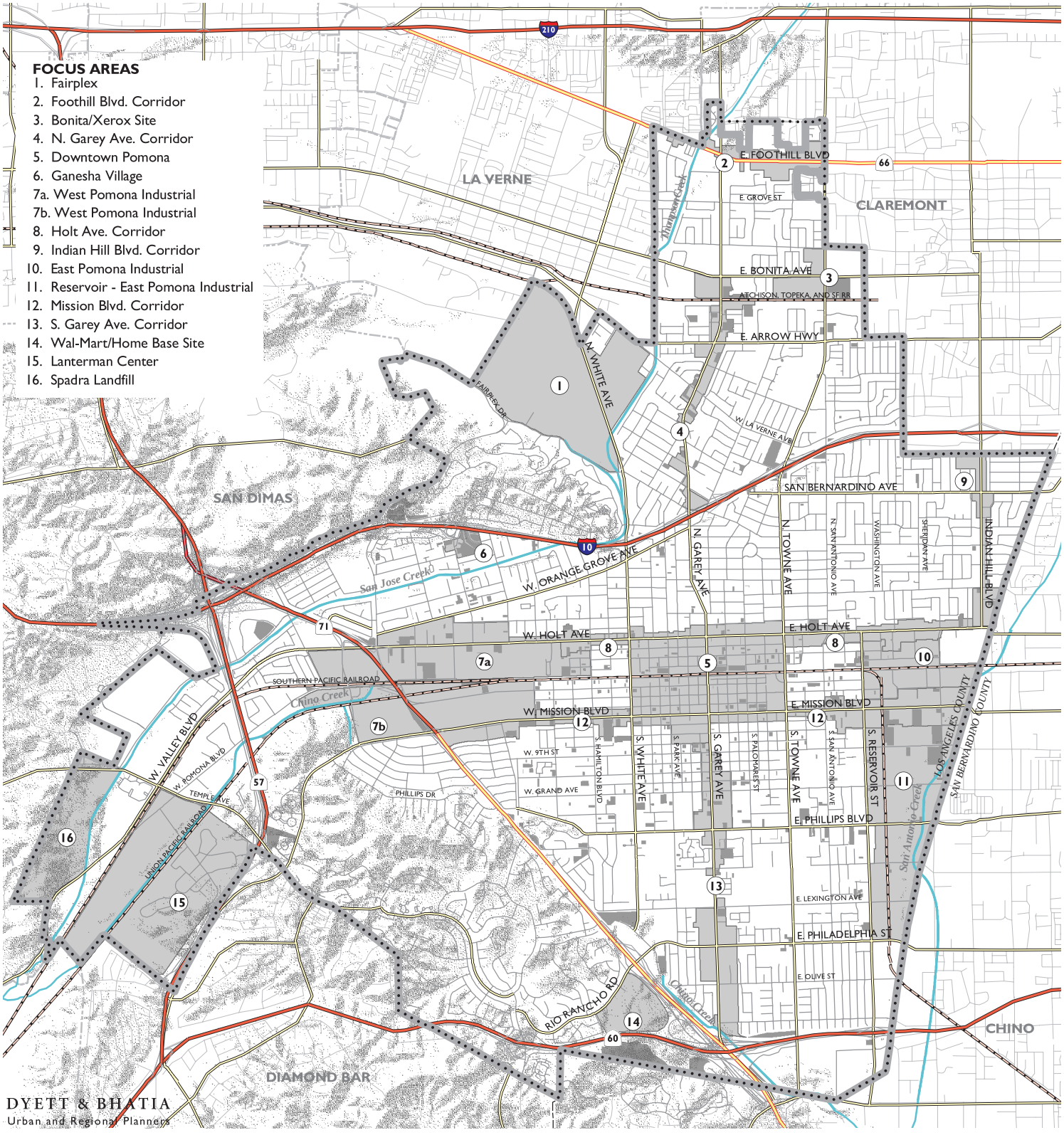


Figure 2-4

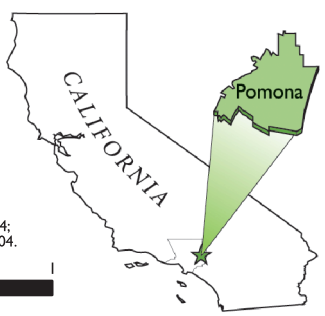
Focus Areas

Focus Areas

Vacant Land

City Limits

Sphere of Influence



Source:
City of Pomona, 2004;
Dyett and Bhatia, 2004.

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POMONA
NATURAL HAZARDS
MITIGATION PLAN

community in its present state. Challenges involved in involved in mitigating risks associated with infill development primarily include concerns about the increase of risk from increased densities, some in already overcrowded neighborhoods. However, redevelopment also creates the opportunity to upgrade or replace older building stock with new construction that conforms to modern building codes. These include regulations for structural resistance to earthquakes, landslide mitigation efforts, fire-resistant materials, and elevation above flood levels. From a hazard mitigation perspective, through the replacement or renovation of older structures and infrastructure, infill and redevelopment can increase the City's safety significantly.

The primary way to mitigate hazard impacts on future development is to create hazard-resilient development and infrastructure. Policies formulated in this document address this need, and are discussed in detail in Chapter 5: Mitigation Action Plan. Additionally, the update of Pomona's *General Plan* provides the ideal opportunity to incorporate hazard mitigation measures into this long-term, comprehensive planning document.

2.11 TRANSPORTATION AND COMMUTING PATTERNS

TRANSPORTATION INFRASTRUCTURE

Pomona is centrally located within the greater Los Angeles-San Bernardino-Riverside region. As such, the City is traversed by a number of key regional transportation routes, notably the five major freeways and two rail lines that provide passenger and freight access and connect Pomona with the Inland Empire, Los Angeles and Orange County (see Figure 2-5: Transportation Network). In addition, Ontario International Airport, located just ten miles to the east, has established itself as a major gateway to the region, serving approximately six million passengers annually.

The well developed street system in the City provides access to and from the regional facilities described above and accommodates travel for various modes of transportation (automobiles, trucks, buses, bicycles and walking). The local system combined with superb regional access provides many opportunities for Pomona residents to travel within their city and region, and well beyond. The road system is also complimented with service from three transit agencies (Los Angeles County MTA, Foothill Transit, and OmniTrans) and two lines of the Metrolink commuter rail system.

The five major freeways provide east-west and north-south access as follows:

- The San Bernardino Freeway (I-10) and the Pomona Freeway (SR-60) provide east-west access to Pomona from Santa Monica and Los Angeles to the west, and Ontario, San Bernardino and Riverside to the east. The Foothill Freeway (I-210) provides an additional east-west connection to the north of Pomona, extending west to Pasadena and the San Fernando Valley.
- The Corona Expressway (SR-71) and Orange Freeway (SR-57) provide connections with Corona and Orange County.

The City's 296-mile road system includes 28.2 miles of major arterials, 45.8 miles of minor arterials, 36.7 miles of collector roads, and 184.4 miles of local roads. Figure 2-5 shows the local network of arterial collector, and local streets, which is generally organized as a traditional grid.

Overall, traffic volumes are quite high in the City. In places, Holt Avenue carries close to 40,000 vehicles per day, while seven other arterials carry in excess of 20,000 vehicles per day. Most other arterials carry between 10,000 and 20,000 vehicles per day, while all collectors for which data is available, carry less than 10,000 vehicles per day. As traffic volumes rise, there is an increased risk that a natural hazard event will disrupt the travel plans of residents across the region, as well as local, regional and national commercial traffic.

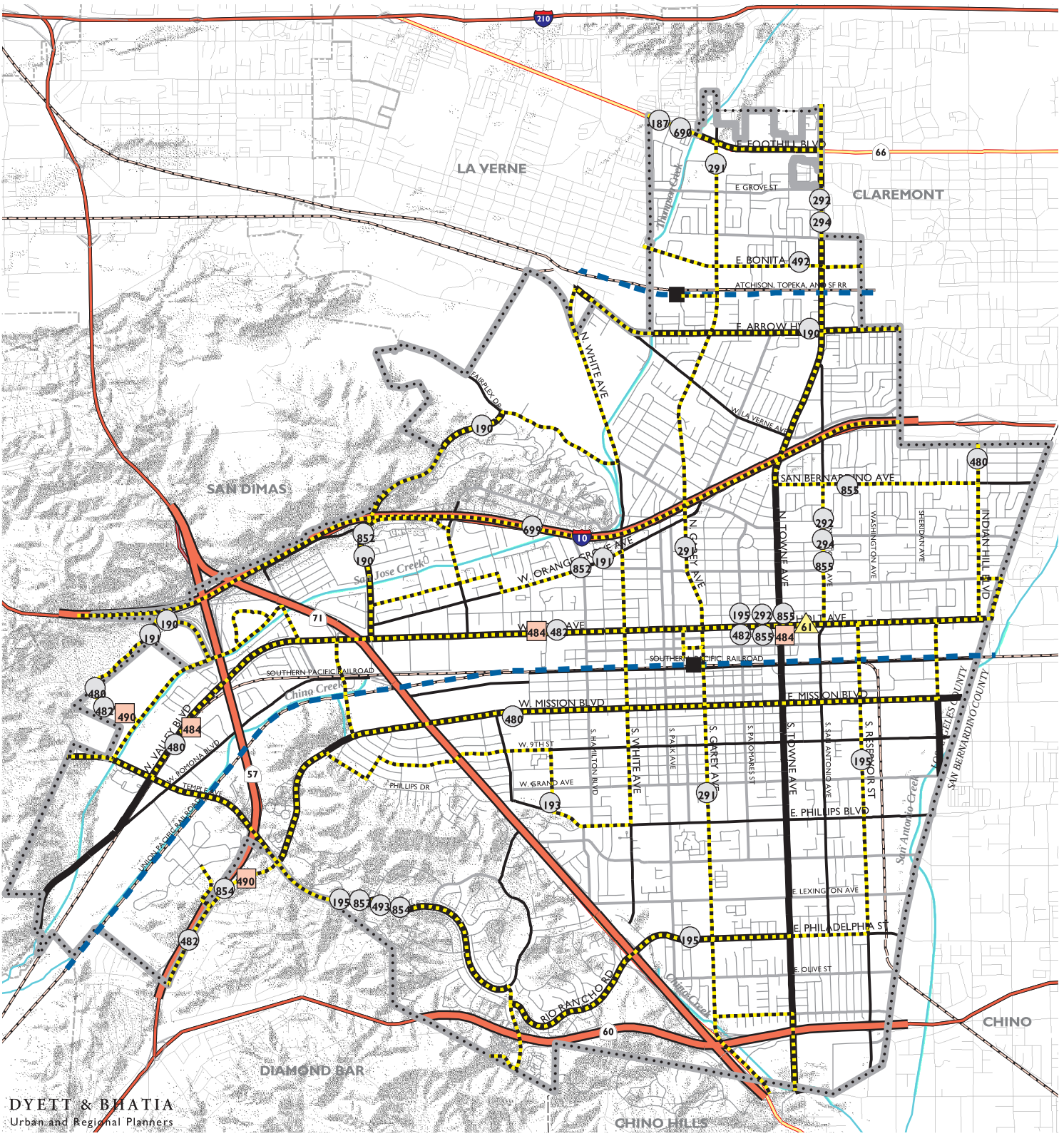
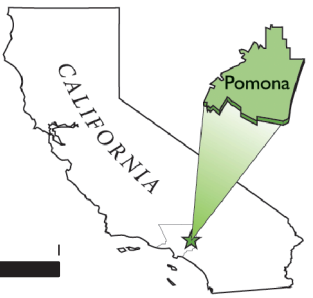


Figure 2-5

Transportation Network

- Freeway
- Major Arterial
- Minor Arterial
- Collector
- Local Street
- Bus Route
- Metrolink Line
- Metrolink Station
- Foothill Transit
- MTA
- Omni Trans
- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona, 2003;
Transportation Information: Fehr & Peers, 2004.



POMONA NATURAL HAZARDS MITIGATION PLAN

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In addition to the transportation access for residents, Pomona is well located for goods transportation. In addition to the freeways, two major rail lines traverse the city, including the Alameda Corridor East, which links Pomona to the Ports of Los Angeles and Long Beach, and the rest of U.S. market.

TRENDS AND ISSUES

Although there are many routes traveling through or near Pomona, population growth in the region, particularly in the fast-growing Inland Empire area, has put a considerable strain on the regional freeways serving the City. As well, transportation patterns have become more complex, as the traditional "suburb to central city" journey to work has been replaced by multi-directional travel patterns due to job growth in dispersed locations.

Overall, vehicle and rail volumes are increasing in the area. Freeway congestion has become an acute problem in the region. In Pomona, there are significant level of service deficiencies along I-10, at the interchange of I-10, SR-57, and SR-71, and particularly along SR-71 at the Mission Boulevard intersection. Also the amount of rail traffic through Pomona is substantial, roughly 50 to 60 freight trains per day. This number is expected to increase following improvements to the Alameda Corridor, which includes the Union Pacific Railroad, potentially up to 150 trains per day. This is a serious concern for the hazards mitigation planning effort in that only three grade separated crossings are in place for local traffic and emergency vehicles to cross the Alameda Corridor. However, the Alameda Corridor East project does provide for improvements in Pomona including median improvements, traffic signal improvements, construction of new sidewalks and construction for two new grade separations, one at East End Avenue and one at Temple Avenue.

The *Existing Conditions Opportunities and Challenges Report* contains detailed documentation of transportation infrastructure, conditions, and planning issues.

3 Risk Assessment

3.1 INTRODUCTION

The critical step in hazard mitigation planning is comprehensive risk assessment. This involves first understanding the types of natural hazards that could occur in the City, and then determining the range of risks to the community from each of the hazards. Mitigation is then formulated to avoid or reduce the identified risks, thereby facilitating a safer and more resilient environment for residents and business when implemented. This chapter overviews the risk assessment process, including documentation of the approach employed in the NHMP planning process in Pomona, description of critical facilities and vulnerable populations, and summary of the identified risks.

3.2 APPROACH

The approach employed for risk assessment for the Pomona NHMP was designed to identify all possible risk scenarios, determine the potential impact to the community associated with each risk, and then accordingly prioritize risks having greater potential impacts to be targeted in the mitigation actions. The steps in this process—conducted in coordination with the Technical Advisory Committee and with input from community members—included:

- Determination of hazard threats in Pomona by way of researching existing data bases and discussions with the TAC, a process that resulted in focusing the Pomona NHMP on earthquake-induced ground shaking, liquefaction, and landslide; wildfire; flooding; and windstorm (see Section 3.2 below and Chapters 6 to 10);
- Hazard identification and profiling, including documentation of the geographic extent, potential intensity, and the probability of occurrence of the natural hazard with potential to affect Pomona, using the best available data (see Chapters 6 to 10);
- Inventory of critical facilities, defined as services and infrastructure that are essential to emergency response and community function—examples include fire and police services, hospitals, circulation, and water and sewer systems (see Section 3.3);
- Inventory of vulnerable populations, defined as people who are particularly susceptible to impacts of a natural disaster and may have special post-disaster needs—examples include populations in schools, child care facilities, and overcrowded neighborhoods (see Section 3.4);
- Consideration of risk scenarios for critical facilities and vulnerable populations utilizing the hazard information on extent, intensity, and probability;
- Rating risk scenarios according to potential impact on the community, with consideration of geographic extent, potential for disruption of emergency and essential services, duration, and potential for population injuries, fatalities, and/or dislocation (see Chapters 6 to 10); and
- Risk analysis, involving quantification of vulnerabilities in terms of dollar losses, where appropriate data was available (see Chapters 6 to 10).

3.3 NATURAL HAZARDS ANALYSIS

Pomona is potentially subject to risks associated with earthquakes, landslide, wildfire, flooding, and windstorm. The greatest natural hazard threats with potential for widespread injury, life loss, property damage, and prolonged disruption in Pomona are ground shaking and liquefaction associated with a major earthquake. Pomona is located in a seismically active region of Southern California, with several damaging earthquakes having occurred just in the past twenty years.

Important but potentially less destructive hazard threats—due to more limited geographic extent—include landslide associated with steeper slopes

and wildfire associated with the remaining open spaces. Flooding occurs in some limited areas occasionally disrupting circulation arterials, and there is a risk albeit very low of flooding from dam inundation. Windstorm conditions resulting from strong seasonal Santa Ana winds occur, but the impact to the community is low relative to the potential impacts of other natural hazard events.

Complete natural hazard descriptions—which include hazard identification and profiles, maps, and potential risks—are set out in separate chapters as follows:

- Chapter 6: Earthquake
- Chapter 7: Landslide
- Chapter 8: Wildfire
- Chapter 9: Flooding
- Chapter 10: Windstorm

3.4 CRITICAL FACILITIES

In the event of a natural disaster, the primary goals of the City emphasize maintaining services that are key to the functioning of Pomona. By identifying critical facilities that lie within potentially hazardous areas, the City can help to prepare for and minimize debilitating impacts on these services. The following is an overview of the critical facilities in Pomona. With the exception of utilities, which have been omitted for security purposes, the critical facilities are mapped in Figure 3-1.

GOVERNMENT EMERGENCY OPERATIONS FACILITIES

Maintaining the continuity of government during a natural disaster is essential in order to respond to emergencies, protect life and property, and recover in the aftermath of an event. The City of Pomona has formulated a comprehensive strategy to ensure proper functioning of the government during a crisis. This strategy is laid out in the City's *SEMS Plan*. As part of this plan, several sites are designated as centers of emergency operation, communication, and governance during an emergency. Alternates for these facilities are also designated, in the event that the original facility is not operational. As shown in Figure 3-1, the majority of these facilities are centrally located in downtown Pomona, which is the "hub" of government emergency operations. Also located in close proximity, and in some instances serving as government operations facilities, are the headquarters of the Police and Fire Departments that serve the City.

EMERGENCY SERVICES

Police Services

The Pomona Police Department provides local police services for the City of Pomona. The department operates 11 facilities, three of which are first-response facilities. The Police Department also maintains an aero bureau and training facilities. Pomona Police Department headquarters are located at 490 W. Mission Boulevard.

Fire Services

The Los Angeles County Fire Department (LACoFD) serves the City of Pomona. Pomona is part of the LACoFD Division VIII, located on the eastern boundary of the Department's jurisdiction. In addition to the City of Pomona, Division VIII includes the neighboring cities of Diamond Bar and Walnut. Eight of 13 fire stations in Division VIII are located in Pomona. If necessary, resources in the City's adjacent jurisdictions provide additional support.

Fire stations are strategically located throughout the City to provide prompt assistance to area residents. Each fire station operates within a specific district that comprises the immediate geographical area around the station. Approximately 83% of the City is located within a one-mile radius of a fire station in Pomona. The division and battalion headquarters in Pomona are located at 590 S. Park Avenue, at Station 181.

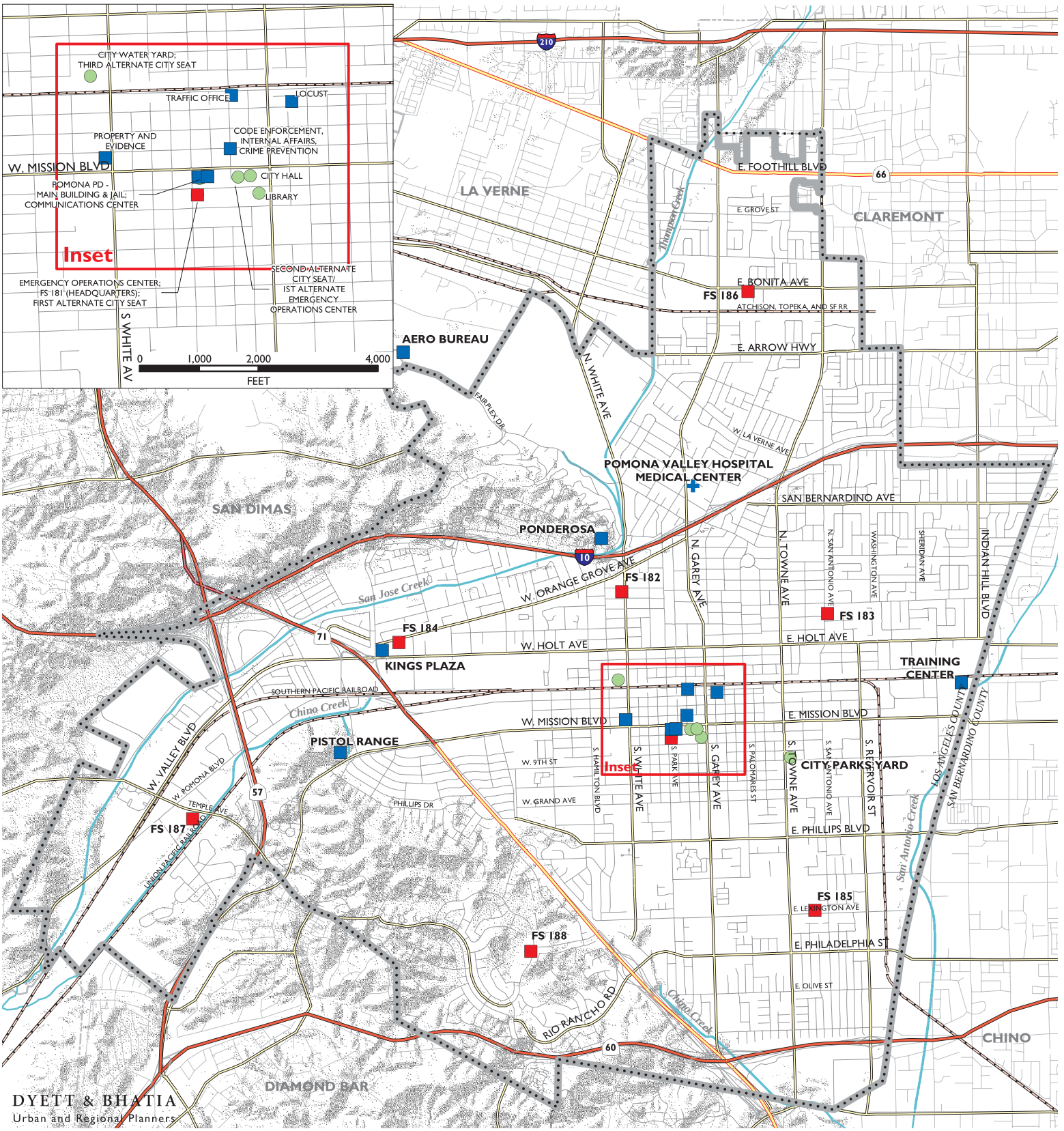
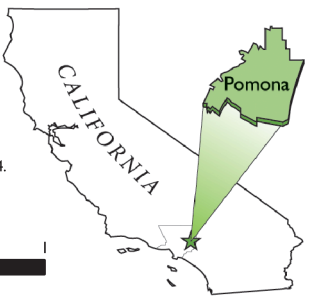


Figure 3-1

Critical Facilities

- Hospital
- Emergency Government Facility
- Fire Stations
- Police Facility
- City Limits
- Sphere of Influence

Source:
Basedata and Critical Facilities: City of Pomona, 2003-2004.



POMONA NATURAL HAZARDS MITIGATION PLAN

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Miles

HOSPITALS

There is one major critical health care facility in Pomona, the Pomona Valley Hospital Medical Center. This facility is located at 1798 N. Garey Avenue. In addition to Pomona, it serves Eastern Los Angeles and Western San Bernardino Counties. It contains 436 beds, 30 emergency beds, and offers a complete range of medical facilities including general medical and surgical care, general intensive care, cardiac intensive care, open heart surgery, neurology, pediatrics, and obstetrics. A staff of 630 physicians, 2,300 employees and more than 1,000 volunteers manage over 100,000 inpatient days, 6,000 newborn deliveries, and more than 55,000 ER patient visits.[1]

Three other hospitals serve the City of Pomona: Casa Colina Hospital for Rehabilitative Medicine, American Recovery Center, and Lanterman Developmental Center. However, these facilities provide specialized care to treat specific illnesses, and would not be primary providers of emergency medical aid in the event of a disaster. A further discussion of these hospitals is presented in the following section on vulnerabilities. Other facilities, such as the county-operated Pomona District Health Center and the East Valley Community Health Center, provide important primary care services, but due to their limited size and services are not considered critical or vulnerable facilities for the purposes of this plan.

TRANSPORTATION

There are five major freeways serving Pomona that provide primary regional access to and from the City. The I-10 and SR- 60 freeways provide east-west access to Pomona from Santa Monica and Los Angeles to the west, and Ontario, San Bernardino and Riverside to the east. The I-210 freeway provides an additional east-west connection to the north of Pomona, extending west to Pasadena and the San Fernando Valley. The SR-71 and SR-57 freeways provide connections with Corona and Orange County.

In addition to the five freeways passing through the City, Pomona has an extensive street network. Classified as arterials, collectors, and local roads, Pomona's roads carry many thousands of vehicle and transit trips daily. Pomona's street network is primarily based on a grid, with several major north-south and east-west roadways interlaced with a system of intersecting minor streets.

Three railroads cross Pomona, which generally run east-west. Two railroad lines, located in the center of the City, are operated by Union Pacific Railroad (UPR) and are part of the Alameda Corridor. One of these lines was formerly the Southern Pacific Line (SPL) and is still marked as and commonly referred to under that name. The UPR tracks carry both freight and passenger trains. The northernmost railroad tracks were formerly operated by Atchison Topeka and Santa Fe Railroad (ATSFR). They are currently owned by the Los Angeles County Metropolitan Transportation Authority, which operates passenger trains on the line (Metrolink).[2]

The UPR, located roughly between Holt Ave. and Mission Boulevard, bisects the center of the City and could be a significant impediment to north-south transportation if a train derailed within the City. Damage to the UPR tracks would also have far-reaching economic effects; the line is a major regional freight transportation artery. The location in Pomona is one through which all eastbound and westbound rail traffic must pass in Southern California. As part of the Alameda Corridor, the UPR will experience substantial structural improvements and increases of train traffic in the future.

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[1] Pomona Valley Hospital Medical Center website. 2002 Annual Report, http://www.pvhmc.org/Docs/AnReport2002_low.pdf, accessed 03/01/04; Van Lul, Kenneth. Written communication, June 10, 2004.

[2] City of Pomona. *Materials Recovery Facility Draft Environmental Impact Report*. April 1996.

Each of the highways, freeways, and railroads are considered critical facilities in Pomona. A hazard that rendered these routes impassible would pose a significant challenge to the City in responding to and recovering from the event.

UTILITIES

Pomona is a large city, 23 square miles in size, and it is traversed by hundreds of miles of streets, transmission lines, pipelines, and other facilities that enable proper functioning of the utility systems that serve Pomona. Although each of the parts contribute to the health of these systems, it is impossible to detail every component involved in Pomona's utility networks. This section, therefore, provides a brief description of utility services in the City, then summarizes the few critical facilities that contribute most to proper system functioning.

Water

Potable water is delivered via facilities that consist of reservoirs, booster pumps, transmission and distribution pipelines, pressure reducing valves, service connections, meters, and other facilities. Transmission and distribution pipelines total approximately 400 miles in length.[3]

The City's Water master Plan is currently subject to a comprehensive update. In the update, capacity, maintenance, and projected growth will be addressed. Mitigation measures from the NHMP should be integrated into the update.

Sewer

Wastewater service within Pomona is provided by the City's Utility Service Department, and the Los Angeles County Sanitation District (LACSD) treats wastewater from the City's system. A majority of the City's wastewater is treated and disposed of at the LACSD's Pomona Water Reclamation Plant (PWRP). The plant occupies approximately 14 acres northeast of the intersection of the SR-57 and SR-60 Freeways. Sewage effluent from the neighboring cities of La Verne and Claremont is also treated at the PWRP. The City may also divert flows to the Water Pollution Control Plant (JWPCP) in the City of Carson.

The City's existing sewer system consists of interceptors and lift stations for the conveyance of wastewater within the City. Specifically, the collection system consists of over 275 miles of pipeline ranging from eight inches to 42-inches in diameter. In addition, there are four sewer lift stations, with facilities for emergency power and odor control, and three onsite stationary backup generators.[4]

The City of Pomona is also currently updating their Sewer System Master Plan, which was last revised in 1990. The Sewer System Master Plan will identify existing deficiencies. This is noteworthy, as it provides a good opportunity to incorporate any needed mitigation measures from the NHMP into the Master Plan update.

Solid Waste

The City of Pomona Utility Services Department provides trash, recycling, and special pickup services for single-family residences, duplexes, triplexes, and some fourplexes. Franchise commercial waste haulers provide trash and recycling service for most fourplexes, all apartments with five or more units, as well as all commercial, governmental, and industrial facilities. Solid waste is transported to transfer stations for sorting and shipping to landfills; no transfer stations serving Pomona are located in the City.

Electricity

Southern California Edison Company is the primary distribution provider for electricity in the

[3] City of Pomona, *Water System Master Plan*, 1992: pp. 4-6.

[4] City of Pomona, Purchasing Specification No. 1030. 9, Request for Proposals for Water and Sewer System Master Plan, June 10, 2003.

City. The power received by the City's residents is produced at the various generation plants located throughout the region. Upon leaving the plant, electricity is distributed to individual users via local distributing stations, located within and around the City. The four substations and two primary transmission lines in Pomona are considered critical facilities.

Natural Gas

Currently, Southern California Gas Company maintains transmission and distribution lines throughout the City. Most lines operate at a medium pressure of approximately 30 to 60 pounds per square inch (psi), except for those located in the industrial areas that require higher pressures.

3.5 VULNERABLE FACILITIES

Natural hazards will not equally affect all areas and population of Pomona. Identifying the vulnerable populations and facilities in the City will help to avert damage, and prepare the City to provide extra assistance to those who will need it. Facilities with vulnerable populations are described below and depicted geographically in Figure 3-2. Facilities that have particular vulnerabilities to specific hazards are discussed in further detail in the relevant hazard chapters (Chapters 6 to 10).

SCHOOLS AND DAY CARE CENTERS

Children are the primary vulnerable group in Pomona. Minimizing damage to schools and daycare facilities will help ensure their safety during a natural disaster. Preparing schools for natural hazards not only helps prevent harm from coming to the children of Pomona; the schools can also be used as critical facilities in the event of a natural disaster. During and after times of crisis, schools can be utilized to serve as mass care facilities and important centers of information and communication.

Public Schools

The Pomona Unified School District (PUSD) operates 40 schools within the City, which are mapped on Figure 3-2. Two of PUSD's schools are located in Diamond Bar and, thus, serves a portion of that City's population. There are currently 27 elementary schools (grades K-6), six middle schools (grades 7-8), five high schools (grades 9-12), one continuation high school (grades 9-12), two all-ages alternative schools, and one adult school within the PUSD. Approximately 35,000 students attend PUSD schools, and the district is one of Pomona's largest employers.[5] The PUSD is currently developing its own Natural Hazards Mitigation Plan for school facilities and other properties.

Private Schools

The City of Pomona has 16 private schools, with an enrollment of approximately 1,900 students ranging from kindergarten through grade 13. The largest of these schools includes Mt. Calvary Lutheran School (K-8) and St. Joseph Elementary (K-8). Locations of private schools are depicted in Figure 3-2.

Childcare Centers

According to the PUSD, which keeps an inventory of all childcare providers in the City, there are currently more than 1,400 licensed providers in Pomona.[6] The majority of these are small, in-home residential childcare services with fewer than 8 children. There are twelve commercial day care providers in Pomona, which are considered greater vulnerabilities due to the larger number of children

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[5] Pomona Unified School District, website: http://www.pusd.org/public_index.asp, accessed November 20, 2003; Pomona Unified School District, Capital Facilities Department, written communication, March 22, 2004; California Department of Education, Educational Demographics Unit, website: http://data1.cde.ca.gov, accessed November 19, 2003.

[6] Pomona Unified School District. Verbal Communication, May 2004.

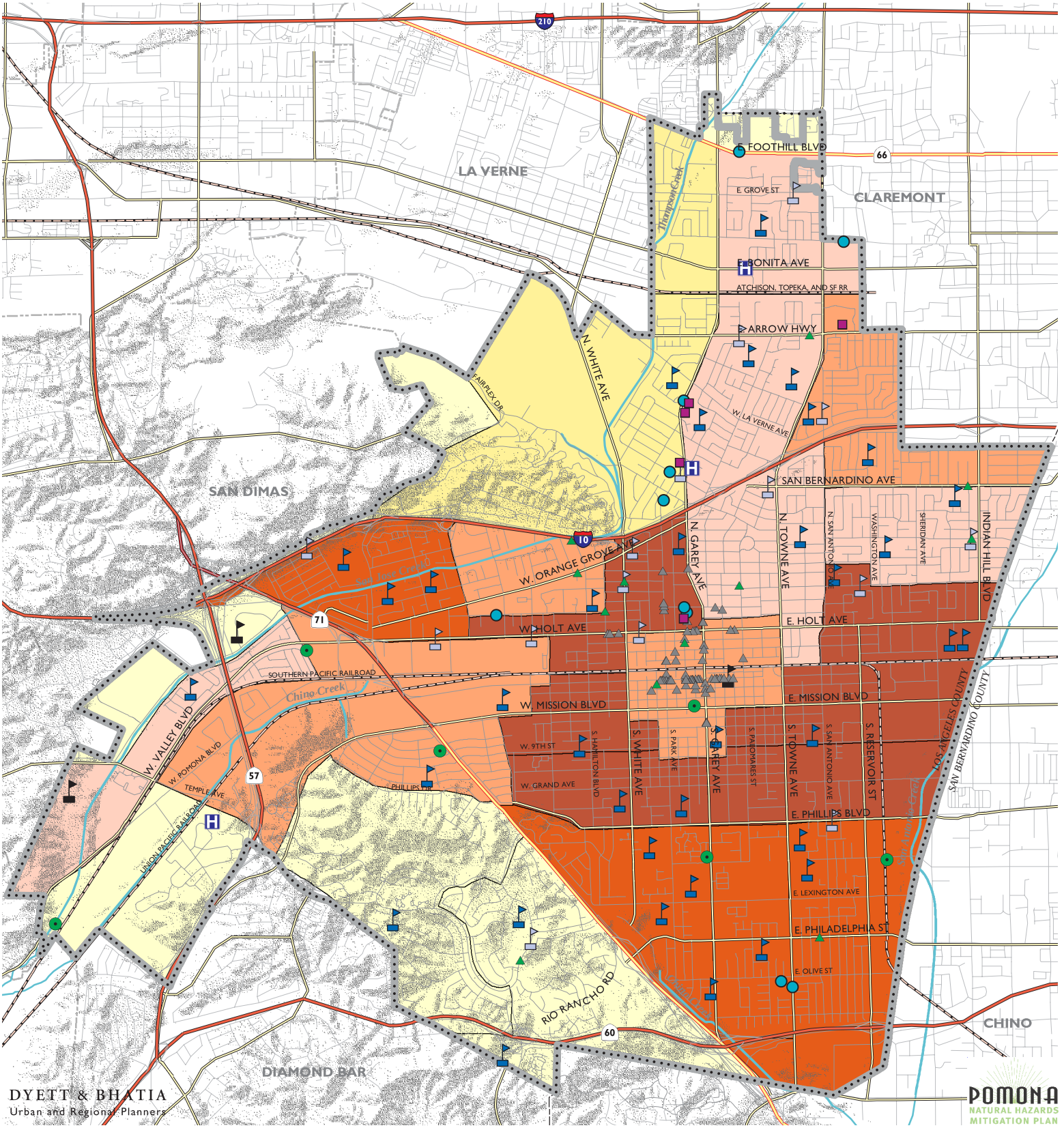


Figure 3-2

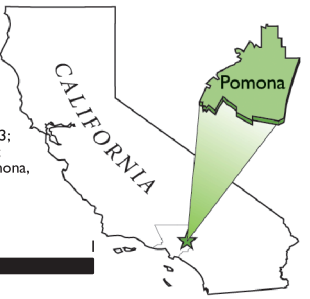
Vulnerable Facilities

Percent of Overcrowded Units

- 0 % - 10%
- 11% - 20%
- 21% - 30%
- 31% - 40%
- 41% - 50%
- > 50%

- Hospital/Medical Facility
- Senior Care Facility
- Private School
- Public School
- Higher Eduation Facility
- Unreinforced Masonry Building
- Commercial Childcare Facility
- Shelter
- Hazardous Materials Site
- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona, 2003;
Census data: US Census, 2000;
Vulnerability Data: City of Pomona, 2004 and HAZUS-MH, 2004.



0 0.25 0.5 1
Miles

present at their facilities.[7] The locations of the commercial childcare centers are mapped in Figure 3-2.

Universities

There are several institutions providing higher education in Pomona. The largest of these is the California State Polytechnic University (Cal Poly Pomona). This University is located adjacent to the City's western border, in unincorporated lands, but owns some land within city limits. Cal Poly Pomona employs more than 2,300 people, and has an approximate enrollment of more than 19,000 graduate and undergraduate students.[8]

Western University of Health Sciences is located in downtown Pomona. Its main campus is at 309 E. 2nd Street. The University employs roughly 500 people, and current enrollment is approximately 1,400 students.[9]

DeVry University in Pomona is one of twenty DeVry campuses located throughout the United States. The Pomona facility is located at 901 Corporate Center Drive. The current enrollment at DeVry is approximately 3,000 students.[10]

RECREATION AND COMMUNITY CENTERS

Approximately 35% of Pomona's population is younger than 18 years of age. There are several recreation and community centers in the City that help to provide services to its young residents. These facilities also provide important services to seniors as well. Especially during after-school hours, these centers can become crowded with youth. The City operates community centers at six of its parks, as well as the Pomona Boys and Girls Club. There is also a YMCA in Pomona, which has served the community since 1884. The original YMCA building, completed in 1922, is also listed in the National Register of Historic Placed and Pomona's Local Landmark Register.

SENIOR CARE FACILITIES

In addition to the care available at hospital facilities, ten senior care centers are located in Pomona. The residents of these facilities may require additional medical attention, transportation assistance, emergency housing, or other assistance in the event of a natural disaster. Most senior fare facilities in Pomona are located in the north of Holt Avenue, and several are clustered along the Garey Avenue corridor.

HOSPITALS

Hospital facilities house large numbers of vulnerable patients who may need additional assistance in the event of an emergency. All of the hospitals in Pomona, including PVHMC, are considered assets with vulnerabilities. In addition, there are two other hospitals that serve as specialized treatment centers in Pomona: Casa Colina Hospital for Rehabilitative Medicine and Lanterman Developmental Center. Information on PVHMC is provided in Section 3-3; Critical Facilities, and information about the remaining two hospitals is supplied below.

Casa Colina Hospital for Rehabilitative Medicine

Casa Colina Hospital is an acute and sub-acute care hospital providing medical rehabilitation services. The hospital serves children and adults who have been disabled by spinal cord injury, brain injury, stroke, chronic lung disease, back injury, chronic pain, orthopedic conditions, neurological and neuromuscular disorders, developmental disorders, and other illnesses or injuries. The facility is located at 255 East Bonita

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[7] Hurst, Jean. City of Pomona Business License Specialist. Written Communication, June 2004.

[8] California State Polytechnic University, Pomona, website: http://www.csupomona.edu/. Accessed November 23, 2003.

[9] Western University of Health Sciences, website: http://www.wesernu.edu. Accessed February 23, 2004.

[10] DeVry University, Pomona, website: http://www.pom.dvry.edu/. Accessed November 23, 2003.

Avenue and has 64 beds, a staff of 184 physicians, and 27 full-time staff nurses.

Lanterman Developmental Center

Lanterman Developmental Center, on Pomona Boulevard in the western corner of the City, is a state-run, live-in facility with services for adults with developmental disabilities. The hospital has 660 patients currently living on-site, and has approximately 15 full-time physicians.[11] There are a total of 718 beds.

SHELTERS

There are five shelters and transitional living facilities in Pomona identified by the City's department of Community Services.[12] Such group living quarters are considered vulnerabilities because of their concentrations of people with special needs and limited resources. The potential for loss of life is much higher in the event of structural failure/building collapse. In addition, due to the limited financial resources of the inhabitants in these shelters, the residents may require special post-disaster assistance, in particular relocation assistance.

HAZARDOUS MATERIALS

In the event of a natural hazard, hazardous materials could potentially harm Pomona residents by exposing them to chemicals that may be poisonous, irritating, suffocating, or cause burns. The severity of hazardous materials impacts depends on many factors such as amount of chemical released, location, and rate and direction of dispersion. Identifying vulnerable toxic sites and preventing hazardous materials spills before they occur is fundamental to mitigating the myriad unpredictable impacts that such spills may have on the community.

Over 200 sites with exposed hazardous materials are located within the City of Pomona. These sites include leaking underground storage tanks (USTs), leaking underground fuel tanks (LUFT), and other hazardous materials sites that are listed by the California Department of Toxic Substances Control (DTSC).[13] In order to most efficiently address the primary hazardous waste vulnerabilities, only the most acutely hazardous materials were mapped in Figure 3-2. There are six locations listed by the Environmental Protection Agency (EPA), under the Superfund Amendments and Reauthorization Act (SARA), Title III. Of the many hazardous materials sites in the City, these represent the greatest threat to human and environmental health in the City if released. The distribution of the sites indicates that hazardous materials are predominantly located along major industrial and commercial corridors in Pomona.

In addition to stationary hazardous materials sites, hazardous material that is en-route to other locations via truck or train may also be present in Pomona at any given time. Restrictions placed on transporters of hazardous materials include the avoidance of heavily populated areas, unless no other satisfactory route exists; limitations on access to bridges and tunnels; and a one-mile wide zone limitation along freeways for access to fuel and services. Railroad regulations stipulate that explosive materials are controlled within the train, but there are no controls regarding train routes. The only restriction is that potential flammable or explosive materials cannot be any closer than six rail cars from the train locomotive. This exposes neighborhoods near railway tracks in Pomona to

[11] Lanterman Developmental Center, Office of the Director. Personal Communication, November 10, 2003

[12] City of Pomona website: http://www.ci.pomona.ca.us/city_departments/community_development/community_services_listing.php. Accessed May 10, 2004.

[13] Department of Toxic Substances Control, website: http://www.dtsc.ca.gov/HazardousWaste/#Hazardous%20Waste%20Facilities. Accessed April 10, 2004.

potential hazards due to rail car derailment and hazardous spills.[14]

UTILITIES

Critical facilities of the utility systems in Pomona are discussed in the previous section, but it is important to note that there are specific vulnerabilities associated with them as well. Undergrounded utilities may be subject to rupture during an earthquake, creating the potential for fire or releasing hazardous chemicals. Additionally, strong winds are capable of downing tree branches that can fall on power lines, and fires can damage aboveground utility lines. Depending on the event, impacts can remain localized or affect the entire City. Specific utility vulnerabilities are discussed further in the relevant hazard chapters, when appropriate (see Chapters 6 to 10).

VULNERABLE DEVELOPMENT PATTERNS

Overcrowded Communities

The U.S. Census collects information about the density and level of crowding in housing units. A unit is considered overcrowded if it has more than one occupant per room. The percent of housing units that are overcrowded, per census tract, is displayed in Figure 3-2. Areas with a large percent of overcrowded units may experience greater impact during natural disasters due to their higher population densities. Because overcrowding is closely correlated with lower income levels and housing values, it is reasonable to assume that overcrowded neighborhoods may contain greater numbers of deteriorated buildings prone to damage than in other parts of the City. Emergency responders should be prepared to spend relatively greater amounts of time in the overcrowded neighborhoods when responding to the effects of a major disaster. Furthermore, there may be needs for higher levels of post-disaster assistance, such as short-term housing.

[14] City of Pomona, *Master Environmental Assessment,* April 1994.

Unreinforced Masonry (URM) Buildings

Unreinforced masonry buildings (URMs) are structures that are particularly vulnerable to damage during an earthquake. These buildings—generally constructed prior to 1933—predate modern earthquake-resistant design standards. URM buildings are made of brick and have not been reinforced with strengthening steel bars in the structure. The walls of these buildings are more likely to disconnect from the foundation and fall during ground shaking, creating debris hazards and sometimes total collapse of the structure.[15] URM buildings in Pomona are depicted on Figure 3-2.

Historic Properties

First incorporated in 1888 as the fifth city in Los Angeles County, Pomona has an impressive inventory of historic properties. It includes eight properties listed on the National Register of Historic Places, three properties designated as California Historic Landmarks, and thirteen properties designated locally on Pomona's Landmark Register, as well as three historic districts. There are several additional districts with potential historic significance and more than 500 potential historic properties under consideration for local, state, or national historic designation.[16]

Many of these structures are particularly vulnerable to damage from hazards due to their age, construction methods, and materials. Many historic buildings were heavily damaged in the last major hazard event to affect Pomona, the Whittier Narrows earthquake.[17] The City of Pomona owns three of the most historic properties, which date back to the first modern settlement of the site that

[15] "Unreinforced Masonry Buildings Fact Sheet," Historic Buildings Committee, February 2004.

[16] City of Pomona. *Existing Conditions, Challenges, and Opportunities Report.* May 2004.

[17] Gallivan, Mickey. President, Pomona Historical Society. Written Communication. June 2004.

later became Pomona. These three properties are displayed in Figure 3-2.

Pre-1976 Structures

Seismic safety standards were first incorporated into Pomona's building code in 1976. Due to the considerable age of the City, however, the majority of the structures were constructed before such standards were in place. The age of City structures, when available, has been mapped in Figure 3-3. The distribution of structures by age clearly displays the evolution of Pomona: the oldest buildings are clustered downtown—including the URM buildings discussed above and mapped in Figure 3-2—and development radiates outward over time from this core. In the vast majority of cases, pre-1976 buildings are not required to conform to seismic safety requirements and have an elevated risk to damage due to earthquake. Older structures are also more prone to wind damage.

Hazard-Specific Land Uses and Construction

In addition to other types of vulnerable development patterns discussed in this section, there are specific land uses and construction types that are more susceptible to particular natural hazards. For example, soft-story and tilt-up construction tends to be more vulnerable to ground shaking. Development in the wildland-urban interface increases the risk of damage due to wildfire. These types of hazard-specific developments are discussed in further detail in Chapters 6 – 10.

3.6 RISK IDENTIFICATION AND VULNERABILITIES SUMMARY

Identified risks and vulnerabilities associated with natural hazards in Pomona are summarized below. Chapters 6 – 10 document the analyses yielding these conclusions.

EARTHQUAKE

The following risks and vulnerabilities associated with ground shaking, liquefaction, and earthquake-induced landslides have been prioritized for mitigation actions:

- Many of the buildings in Pomona were constructed before seismic safety standards were implemented in 1976; this includes a majority of the facilities that house emergency services and government operations.
- There are 94 unreinforced masonry buildings, which are well-known for their poor ability to withstand earthquakes. They are especially prone to collapse and pose subtantial risks to life and property .
- Pomona has an impressive inventory of historic properties, which are a unique source of civic pride. They are also more prone to sustain damage and collapse during an earthquake.
- Much of the utility infrastructure in Pomona is aging and will need maintenance or replacement. Critical components of the utility systems, such as water reservoirs, have partial seismic safety features in place but completion of retrofit programs has been deferred.
- Targetted transportation corridors have been identified as crucial and vulnerable lifelines, essential for emergency vehicle traffic. Collapse of underpasses or train derailment would impair proper provision of emergency services in the aftermath of an earthquake.
- Particular neighborhoods in Pomona have an elevated vulnerability to earthquake hazards due to the age of the structures, or due to a high percentage of overcrowding. Often these characteristics coincide; damage in these neighborhoods is expected to be relatively greater than the rest of the City, and will require concomitant emergency response.

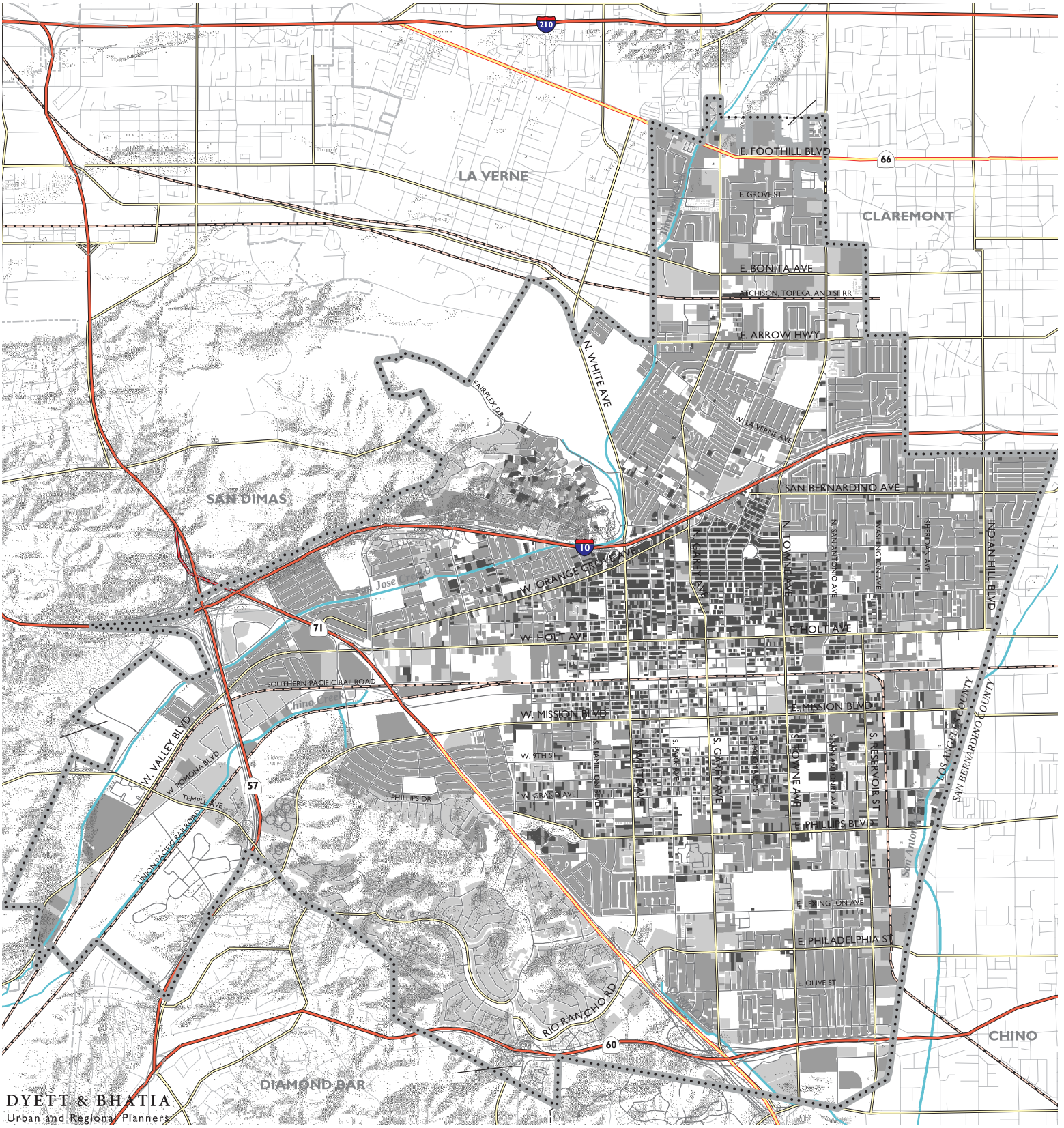

Figure 3-3

Age of City Structures

1933 and Earlier

1934-1976

Post-1976

City Limits

Sphere of Influence

Source:
City of Pomona, 2003; Structure Data: L.A. County Assessor Parcel Data, 2003.

POMONA NATURAL HAZARDS MITIGATION PLAN

10 Acres

0 0.25 0.5 Miles

LANDSLIDE

The following risks and vulnerabilities associated with landslides have been prioritized for mitigation.

- Residential developments in the hills of Pomona are at risk to landslide. Not only are they built on areas that are historically prone to landslides due to topography and soil conditions, but road development, grading, excavation and other forms of development increase landslide risk.

WILDFIRE

The following risks and vulnerabilities associated with wildfire have been prioritized for mitigation.

- Development in the urban/wildland interface is epecially vulnerable to wildfire damage. Communities such as Phillips Ranch and Ganesha Hills were built in these areas and require more stringent wildfire mitigation measures. Aging infrastructure in the City is vulnerable to damage from earthquake, which could affect the City's water supply in the event of a wildfire.

FLOODING

The following risks and vulnerabilities associated with flooding have been prioritized for mitigation.

- A small number of locations in Pomona are prone to flooding due to storm drain deficiencies. The flooding that occurs seasonally at the railroad underpasses is of particular concern, as it has the potential to block routes that are considered key transportation lifelines.
- A significant portion of the City could be subject to flooding in the event of dam failure. However, due to the distance of the City from the reservoirs, the minimal amount of water that is stored at the relevant impoundments, and the very low probability of occurrence, this risk is not considered to have significant potential for widespread community impacts.

WINDSTORM

The following risks and vulnerabilities associated with windstorm have been prioritized for mitigation.

- Santa Ana winds, which occur between October and March, can damage or dislodge roofs, and topple trees and power lines. These wind storms can affect the entire city but potential damage is not widespread and there are no high risks to critical facilities or city infrastructure.

3.7 POTENTIAL FINANCIAL LOSSES

POTENTIAL DAMAGE ESTIMATES

A comprehensive assessment of the potential risks faced by a community involves understanding financial vulnerabilities in addition to prospects for injury, life loss, and property damage. Estimates of financial costs help to underscore the cost effectiveness of emergency preparedness and hazard mitigation actions and improvements. In addition, cost estimates calculated for separate hazard scenarios—earthquake, flooding, landslide, etc.—provide a quantitative tool for comparing hazard effects and prioritizing mitigation.

For each hazard where data were available, cost estimates of potential damage have been calculated. The primary tool available to estimate the potential losses of natural hazards is the GIS-based software HAZUS. A HAZUS scenario was constructed to estimate losses due to earthquake damage in the City; total potential losses exceeded 750 million dollars. While these estimates are highly hypothetical, they nevertheless provide a sense of the magnitude of potential financial impacts. At this time, HAZUS scenarios for other natural hazards are not available. In order to provide a baseline for the potential damage estimates of the other natural hazards, the number and value of structures within the scope of each of the hazards is provided whenever possible.

COST-EFFECTIVENESS ANALYSIS FOR MITIGATION

Cost effectiveness analysis is an important tool that the City will use to help prioritize mitigation actions. This process will assist in identifying those actions that maximize risk reduction with efficient expenditure of public funds. Appendix C contains the guidelines for cost effectiveness analysis that the City will follow.

4 Goals and Objectives

4.1 INTRODUCTION

One of the steps in preparing the *Natural Hazards Mitigation Plan* pursuant to the Disaster Management Act of 2000 is consideration of the City's mission in hazard planning and related goals and objectives. The mission establishes the overarching guiding principle, whereas goals are broad statements of intent and objectives provide direction on actions to achieve the goal. The mission, goals, and objectives were based on the hazard and risk analysis along with input from the Technical Advisory Committee (TAC) and community members.

4.2 MISSION STATEMENT

The City of Pomona's mission for the NHMP is to:

> *Establish a comprehensive strategy of programs, development regulations, and cost-effective improvement projects to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards.*

The goals and objectives specified below together serve as the framework for formulating the NHMP mitigation strategy, thereby linking the mission statement to the action plan.

4.3 GOALS AND OBJECTIVES FRAMEWORK

PROTECT LIFE AND PROPERTY

***Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses.**

- *Objective 1.1.1:* Increase the resilience of institutions, services, and lifeline systems that are essential to Pomona's functioning.
- *Objective 1.1.2:* Increase the ability of the City government to serve the community during and after hazard events through response, recovery and rebuilding.
- *Objective 1.1.3:* Recognize the potential for greater impacts to vulnerable populations and overcrowded neighborhoods in emergency response and mitigation planning.
- *Objective 1.1.4:* Continue to utilize the emergency management system to provide early warning of and response to all life-threatening hazards that can be predicted, such as earthquakes, floods, landslides, severe storms, wildfires, and hazardous materials incidents.

***Goal 1.2:* Protect Pomona's unique character and values from being compromised by hazard events.**

- *Objective 1.2.1:* Encourage and support the long-term protection of historic and architecturally significant structures to preserve neighborhood and community character.
- *Objective 1.2.2*: Implement mitigation that effectively addresses the hazard potential while preserving unique historical values.
- *Objective 1.2.3:* Support the long-term protection of Pomona's neighborhoods by reducing the potential impact to structures from hazard events.

***Goal 1.3:* Minimize losses to existing property and reduce potential for damage to future development.**

- *Objective 1.3.1:* Coordinate land use plans and regulations to direct development away, or buffer development from, area and site-specific natural hazards.
- *Objective 1.3.2:* Continue maintenance programs, such as site inspection and trash/debris removal, to reduce the potential for wildfire and other problems.
- *Objective 1.3.3:* Encourage insurance coverage for earthquake events.

- *Objective 1.3.4:* Ensure that new buildings and substantial improvements to existing buildings are governed by and incorporate all appropriate building codes and construction measures to protect them against failure of damage.

- *Objective 1.3.5:* Implement a program to mitigate the hazards posed by older unreinforced masonry buildings largely clustered in the downtown area.

- *Objective 1.3.6:* Avoid localized hazards and associated risks to property and people by implementing appropriate improvements, such as construction of stormwater drainage improvements for localized flooding and slope stabilization measures for localized landslide conditions.

- *Objective 1.3.7:* Avoid localized flooding problems by construction of appropriate stormwater drainage improvements.

PUBLIC AWARENESS

***Goal 2.1:* Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.**

- *Objective 2.1.1:* Prioritize community education and outreach in natural hazard mitigation planning.

- *Objective 2.1.2:* Develop targeted education and outreach programs to segments of the community that are most at-risk to hazards events.

- *Objective 2.1.3:* Encourage the distribution of information to residents, businesses, and public employees on safety and health precautions to take in advance of and during a disaster.

- *Objective 2.1.4:* Utilize local organizations and community partners in preparedness training and post-disaster assistance.

- *Objective 2.1.5:* Advise and assist residents and businesses in taking appropriate mitigation steps to protect their properties.

- *Objective 2.1.6:* Aid both the private and public sectors in understanding the risks they may be exposed to and finding mitigation strategies to reduce those risks.

NATURAL SYSTEMS

***Goal 3.1:* Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment.**

- *Objective 3.1.1:* Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions where possible, recognizing the built-out character of the City.

- *Objective 3.1.2:* Minimize potential negative environmental impacts from mitigation efforts.

PARTNERSHIPS AND IMPLEMENTATION

***Goal 4.1:* Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities.**

- *Objective 4.1.1:* Strengthen communication and coordination with public agencies, citizens, non-profit organizations, business, and industry to ensure support for implementation.

- *Objective 4.1.2:* Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

- *Objective 4.1.3:* Continue developing and strengthening inter-jurisdictional coordination and cooperation in the area of emergency services and post-disaster response programs.

- *Objective 4.1.4*: Maintain partnerships with facilities and institutions with populations that are particularly vulnerable to risks associated with natural hazards, including emergency planning and post-disaster contingency plans.

- *Objective 4.1.5:* Coordinate with utility and transportation providers to establish and maintain early warning systems.

- *Objective 4.1.6:* Periodically review and update the Natural Hazards Mitigation Plan, taking into consideration new hazard information, changes in vulnerabilities and critical facilities, and advancements in emergency response and post-disaster services.

EMERGENCY SERVICES

***Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events.**

- *Objective 5.1.1:* Prioritize funding and implementation schedules for improvements needed to ensure continuous and extensive emergency response capabilities.

- *Objective 5.1.2:* Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.

- *Objective 5.1.3:* Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

- *Objective 5.1.4:* Continue providing emergency services with training and equipment to address all identified hazards.

- *Objective 5.1.5:* Distribute resources for emergency response around the City to ensure accessibility.

- *Objective 5.1.6:* Conduct periodic emergency preparedness drills involving City staff and emergency services, other emergency service providers, critical facilities, utility operators, community partners, and institutions with vulnerable populations.

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5 Mitigation Action Plan

5.1 INTRODUCTION

Risks associated with natural hazards in Pomona are reduced through a variety of programs implemented by the federal and State governments and local agencies and government, including the City of Pomona. This chapter sets forth the mitigation action plan that the City is committed to implementing to reduce the potential for risks in the event of earthquake, wildfire, flooding, or windstorm, and to maximize the effectiveness of the emergency response system to avoid injury, life loss, and property damage.

The mitigation actions represent the culmination of the research, mapping, analysis, and community outreach conducted for the NHMP. More specifically, the mitigation considers:

- Risks associated with critical facilities and community vulnerabilities that have been rated as having medium and high community impact potential;
- NHMP mission, goals and objectives;
- Input from City staff and stakeholders and additional research conducted by the project team.

In the process of formulating the mitigation action plan, the Technical Advisory Committee reviewed a series of draft mitigation measures and provided feedback on cost-effectiveness, political will, technical feasibility, and environmental soundness. During this process the TAC helped to identify additional mitigation as well as improve the feasibility and effectiveness of the proposed mitigation given Pomona's unique needs.

For each mitigation action, the following are documented:

- Natural hazards addressed;
- Goals and objectives implemented—it should be noted that many of the mitigation actions are designed to achieve multiple goals and objectives;
- Lead Department; and
- Implementation Schedule, whereby "Short-term" denotes anticipated implementation within two years of NHMP adoption, "Mid-term" denotes anticipated implementation within five years of NHMP adoptions; and "On-going" denotes continuous implementation from year to year. Mitigation actions currently underway are noted as appropriate. Due to significant budget restrictions, the City will continue to seek assistance through federal, State, and regional funding programs.

Programs implemented by other agencies to reduce risks associated with natural hazards are described in Chapters 6 to 10.

5.2 MITIGATION ACTION ITEMS

NHMP IMPLEMENTATION STRUCTURE

***Mitigation Action 1.1:* Coordinator and Action Committee**

Designate a Hazard Mitigation Coordinator and a Natural Hazards Action Committee to steer NHMP implementation. The Coordinator will be responsible for:

- Overseeing implementation of the NHMP.
- Preparing an Annual Report to the City Council—in coordination with the Natural Hazards Action Committee—that details mitigation action items to implement in the upcoming year, including cost estimates, cost/benefit or cost-effectiveness analyses (see Appendix C), and recommendations for items to include in the City's Capital Improvement Program.

- Updating the NHMP every five years—in coordination with the Natural Hazards Action Committee— by evaluating the cost-effectiveness of mitigation implementation (see Appendix C), addressing changes in critical facilities and vulnerabilities, incorporating advancements in emergency response and post-disaster services, and updating hazard and risk assessments as new information becomes available. This includes incorporating new data from federal, State, or regional hazard mapping and delineation efforts.

- Establishing and maintaining the roster for the Action Committee, calling meetings, and preparing agendas and necessary information materials for meetings.

The Natural Hazards Action Committee will be comprised of representatives of City departments involved in NHMP implementation; representatives of critical and vulnerable facilities; community stakeholders involved in emergency preparedness and response; and representatives of the CERT and CAEP programs (see Mitigation Actions 4.2 and 4.3). In addition to the roles in the Annual Report and NHMP Five-year Updates noted above, the Action Committee will provide input on community education efforts.

Lead Department: Community Development

Implementation Schedule: On-going

Hazards Addressed: All

Goals and Objectives Implemented: All

Mitigation Action 1.2: **Implementation Options for Hazard Mitigation**

Secure necessary funding for implementation of hazard mitigation actions as follows:

- Allocate City resources and assistance for hazard mitigation projects, using available City resources efficiently and with consideration of cost-effectiveness analysis;

- Identify and seek grant programs and foundations that may support mitigation activities; and

- Partner with other government agencies, special districts, utility providers, and organizations involved in hazard mitigation and emergency preparedness and response to pursue grants and special funding programs.

In addition, utilize incentive programs for local community members and businesses to pursue hazard mitigation projects.

Lead Department: Community Development, Public Works, or Utility Services, depending on the project

Implementation Schedule: On-going

Hazards Addressed: All

Goals and Objectives Implemented: All

READY CRITICAL FACILITIES AND EMERGENCY SERVICES

Mitigation Action 2.1: **Integrity of Emergency Operation Center System**

Maintain the system of the Emergency Operation Center (Central Fire Station) with alternative back-up facilities to be activated in the event the central facility is impaired. Because emergency service response times will decrease if back-up locations must be activated, maximize resiliency of the Central Emergency Operations Facility. This likely involves structural improvements needed to withstand ground shaking.

The existing Emergency Operation Center's location in the basement of the Central Fire Station is undesirable. Access, structural, and capacity limitations could significantly impair coordination activities necessary to save lives and property in the event of a major disaster such as an earthquake. Relocate the Emergency Operations Center to a more appropriate facility, and prioritize integration of the Emergency Operations Center in the planned police headquarters facility. Evaluate the

structural soundness of the City Council Chambers as a potential location for the Emergency Operations Center, and prioritize any upgrades necessary to use the facility in an emergency situation.

Lead Departments: Police Department, Redevelopment

Implementation Schedule: Short-term and long-term

Hazards Addressed: All

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.4).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objectives 5.1.1, 5.1.3, 5.1.4).

***Mitigation Action 2.2:* Back-up Emergency Operations Center**

Because the Emergency Operations Center and back-up locations are all clustered in the City center, activating the emergency response system could be impeded if the City center experienced extensive damage during a major earthquake. To ensure response capabilities, designate and equip a back-up facility outside of the City center, preferably south of the I-10 freeway and outside of liquefaction zones. This facility should meet all current seismic safety standards.

Lead Department: Police Department

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.4).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objectives 5.1.1, 5.1.3, 5.1.4, 5.1.5).

***Mitigation Action 2.3:* Reinforcement of Other City Facilities**

Conduct a structural assessment of City-owned properties constructed prior to the 1976 Building Code—which contain the latest seismic safety structural requirements—to identify buildings needing seismic safety improvements. This assessment should include City Hall, the Pomona Library, fire and police facilities, and community/recreation centers (particularly the Ganesha Hills Center). Prioritize improvements according to 1) minimizing injury and life loss, 2) ensuring emergency services and response, 3) ensuring distribution of hazard-resistant emergency facilities across the City to maximize emergency response and accessibility. Also consider cost-effectiveness in the prioritization ranking.

Lead Department: Redevelopment

Implementation Schedule: Mid-term

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.3).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

***Mitigation Action 2.4:* Establish "Life-line" Circulation System**

North-south circulation in Pomona could be significantly diminished in the event a long freight train is stranded on the Southern Pacific Railroad

due to an earthquake or other hazard event. North-south circulation could also be impaired by significant flooding in the railroad underpasses at White, Towne, and Garey Avenues or the associated bridge collapses due to an earthquake. These scenarios are of particular concern given the location of the City's only hospital north of these potential obstructions and the majority of City population to the south, and require the following actions:

- In the update of the General Plan Circulation Element and the next update of the *SEMS Plan*, establish "Life-line" circulation system whereby special protocols are enacted to manage traffic flows on White, Towne, and Garey Avenues to ensure adequate north-south access for emergency vehicles. Establish alternative Life-line streets in the event these streets are obstructed;

- Continue prioritizing maintenance of the pumps in the underpasses;

- As prescribed in Mitigation Action 3.1, coordinate with the Union Pacific Railroad to advocate the importance of maintaining the structural integrity of the underpass structures; and

- Conduct engineering evaluations of the City's under/overpasses for structural soundness. Request any evaluations that have been performed by the Union Pacific Railroad.

Three projects are underway that will contribute significantly to the Life-line circulation system:

- Railroad underpasses at East End Avenue and Reservoir Streets are currently under construction, and should serve to enhance north-south circulation in Pomona. Consider these improvements in planning for the Life-line system.

- The Transit Management Action Center (TMAC), to be installed at the Fairplex or the TransCenter in downtown, will provide citywide traffic monitoring capabilities that can be used for traffic management in the aftermath of a disaster.

- The Intelligent Railroad Integrated System (IRIS), funded with federal grants, includes sixteen message signs distributed around the City. Life-line circulation planning and the *SEMS Plan* should consider the location of the message signs and establish protocol directives for use of the signs for traffic management and other community communications after a major hazard event.

Lead Department: Community Development, Public Works

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.4).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.3).

***Mitigation Action 2.5:* Water Reservoir Seismic Retrofit Completion**

Complete the program to retrofit the City's reservoirs to withstand strong ground shaking during earthquake events. While six of the City's 22 reservoirs have been improved, a number remain vulnerable and need seismic safety valves. Reservoir damage could result in widespread water service disruptions and diminished fire fighting capabilities.

Lead Department: Utility Services

Implementation Schedule: Short-term

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

***Mitigation Action 2.6:* Aging Water and Sewer Infrastructure Replacement**

As an older City with the development in the City center dating back to the late 1800s —including the system of water wells and pipelines— portions of the City's water and sewer infrastructure are in need of extensive maintenance and/or replacement. Older infrastructure is more prone to damage and service disruptions during earthquake, with potential ramifications for public safety and fire fighting capabilities. Continue to fund and prioritize water and sewer infrastructure improvements to reduce the potential for these hazard-related risks. Use the Sewer and Water Master Plans currently under preparation as the basis for the improvement schedule.

Lead Department: Utility Services

Implementation Schedule: On-going

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

***Mitigation Action 2.7:* Localized Flood Control Improvements**

While the City has an effective flood control system, several localized areas continue to be subject to storm-related flooding. These include underpasses at the intersections of Garey, Towne, and White Avenues and the Union Pacific Railroad tracks; East End Avenue, between Mission Boulevard and Grand Avenue; Ninth Street, between the Union Pacific Railroad tracks and East End Avenue; and cul-de-sacs bounded by SR-60, County Road, Garey Boulevard, and Reservoir Street. In addition, five claims for National Flood Insurance Program assistance were filed between 1978 to 2003, indicating the need for improvements.

Conduct a study of these localized flooding hazards and identify needed improvements. Determine priority for implementation in part with cost-effectiveness analysis. Once the improvements are identified, consider options for requiring construction of the improvements as part of development projects if appropriate and feasible.

Lead Department: Public Works

Implementation Schedule: Mid-term

Hazards Addressed: Flooding

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

***Mitigation Action 2.8:* Back-up Medical Services**

Establish communication with Pomona Valley Hospital Medical Center regarding established agreements for back-up services and participation

in the regional Medical Alert Center. Identify the emergency medical facilities in the surrounding areas that would provide care in the event of service limitations at Pomona Valley Hospital Medical Center, due to patient overload, facility damage, or access problems from failure of major arterials. Integrate this information into the *SEMS Plan.*

Lead Department: Police Department

Implementation Schedule: On-going

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.3).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (4.1.3, 4.1.4).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.2, 5.1.3, 5.1.4).

COORDINATION AND COMMUNICATION WITH OTHER UTILITY PROVIDERS AND RAILROADS

***Mitigation Action 3.1:* Early Warning Systems and Local Consideration**

Review the disaster preparation, response, and early warning programs of relevant jurisdictions, agencies, utilities, and private companies (including railroads) to ensure that the needs of Pomona are addressed in planning and infrastructure improvement initiatives. Of particular import in Pomona due to the age of many neighborhoods is coordinating with utility providers to determine that infrastructure is maintained in condition that can resist hazard events. Advocate making the City a primary recipient of any early hazard warning, and establish communication protocols.

Lead Department: Police

Implementation Schedule: Ongoing

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.4).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objectives 4.1.1, 4.1.3, 4.1.5).

COMMUNITY PREPAREDNESS AND EDUCATION

***Mitigation Action 4.1:* Emergency Preparedness Campaigns**

Continue implementing customized campaigns to educate residents and businesses about appropriate emergency preparedness measures and what to do in the event of a disaster, using the following means of communication:

- Incorporation of special publications and inserts in the City's newsletter and other mailings such as utility bills;
- Traveling booths to set up in shopping centers, community centers, popular athletic fields, schools, and other activity centers;
- Information posted on website;
- Media releases;
- Reports to City Council and City Commissions;

- Presentations to community organizations, and dissemination of literature through organizations' membership networks—Pomona's strong community networks are one of the best mechanisms for reaching residents and small business owners;

- Events such as the Police Department Open House, Child Safety Fair, and National Night Out; and

- Coordination with Pomona Unified School District to distribute information to families with children and to conduct preparedness activities.

When designing and developing campaigns, give special attention to language, demographic, and cultural characteristics of the Pomona population to maximize effectiveness. Target vulnerable populations such as the elderly, poor, disabled, and non-English speakers.

Given the age of many Pomona homes and commercial structures, there should be frequent emphasis on insurance coverage and techniques to secure buildings to avoid seismically induced damage, including information on available assistance programs. Information should be periodically distributed about non-structural improvements to mitigate hazard risks, such as securing bookcases, filing cabinets, light fixtures, and similar objects that can cause injuries and block exits.

Lead Department: Police

Implementation Schedule: On-going

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.1 – 2.1.6).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objectives 4.1.1, 4.1.2, 4.1.4).

***Mitigation Action 4.2:* Community Emergency Volunteers**

Through organizations like Community Emergency Response Team program (CERT), build and train teams of community residents, business owners, leaders, and stakeholders to assist with emergency response and first aid. Make use of existing community networks to enlist participants, and include the team in the City's emergency response system and communications network established in the *SEMS Plan.* Use the CERT structure to disseminate hazard mitigation information to residents and businesses.

Lead Department: Police

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.2, 1.1.3).

Goal 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.1 – 2.1.6).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objectives 4.1.1, 4.1.4).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objectives 5.1.4, 5.1.6)

Mitigation Action 4.3: **Hazard Mitigation Partners**

Through the Communication Action for Emergency Preparedness Program (CAEP), organize partners in community response and recovery, such as utility providers, the railroad operators, Pomona Valley Hospital Medical Center, the Red Cross, and faith-based institutions. Use the CAEP platform to coordinate and prioritize hazard mitigation efforts. Include the CAEP organization in the City's emergency response system and communications network established in the *SEMS Plan.*

Lead Department: Police

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1 – 1.1.4).
>
> *Goal 2.1*: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.1 – 2.1.6).
>
> *Goal 4.1*: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objectives 4.1.1 – 4.1.5).
>
> *Goal 5.1*: Ensure continued operations when the City is impacted by natural hazard events (Objectives 5.1.2, 5.1.6)

RESILIENT HOUSING, NEIGHBORHOODS AND COMMERCIAL DISTRICTS

Mitigation Action 5.1: **Unreinforced Masonry Buildings**

Continue requiring improvements to meet seismic safety standards for unreinforced masonry buildings when a change in use is proposed. Revise the development code to include incentives to increase the number of retrofit projects, such as relief from selected non-conforming use provisions, to offset the costs of retrofits.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: Earthquake

Goals and Objectives Implemented:

> *Goal 1.2:* Protect Pomona's unique character and values from being compromised by hazard events (Objectives 1.2.1, 1.2.2, 1.2.3).
>
> *Goal 1.3:* Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.4, 1.3.5).

Mitigation Action 5.2: **Vulnerable Building Reinforcement**

As shown in Figure 3-3, much of the City was developed prior to current seismic standards. Older homes and buildings may require structural intervention to avoid significant damage in the event of a major earthquake. In addition, the clusters of mobile homes in the City may need reinforcements such as foundation strappings. Structural interventions are often straightforward and cost-effective, such as bolting structures to foundations. Through the community education campaigns, educate property owners about areas with structures potentially needing reinforcement, and provide technical assistance to property owners with vulnerable buildings to implement retrofit standards.

This action will be most effective when City building inspection staff are directed to prioritize identification and reinforcement of vulnerable buildings, are appropriately trained to detect vulnerable buildings and make reasonable, cost-efficient recommendations, and are consulted during formulation of community education campaigns.

The City currently offers a program for substantial rehabilitation of residential properties for low and moderate income households, funded with tax increment income from the redevelopment project areas. Expand the improvements eligible for funding to include seismic safety and windstorm structural reinforcements. Pursue grant funds for improvements benefiting special need population.

Lead Department: Community Development, Redevelopment

Implementation Schedule: Short-term

Hazards Addressed: Earthquake, Windstorm

Goals and Objectives Implemented:

> *Goal 1.3:* Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.3, 1.3.4).
>
> *Goal 2.1:* Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.5, 2.1.6).

***Mitigation Action 5.3:* Valuing Heritage**

Many of Pomona's designated historic buildings, as well as homes within the designated historic districts, do not meet seismic safety codes. Pomona's historic resources contribute greatly to local environment and culture, and are tremendously valued by the community. Prioritize retrofitting historic structures and avoid demolition for the purpose of public safety. Provide technical assistance to property owners, and explore opportunities for federal and state grants for structural improvements to make buildings safer in lieu of demolition.

Lead Department: Community Development, Redevelopment

Priority: On-going

Hazards Addressed: Earthquake

Goals and Objectives Implemented:

> *Goal 1.2:* Protect Pomona's unique character and values from being compromised by hazard events (Objectives 1.2.1, 1.2.2, 1.2.3).

***Mitigation Action 5.4:* Reduced Wildfire Threat**

Continue existing programs to reduce risk of property damage and injury from wildfire, including:

- Citywide prohibition of new wood and wood shake roofing materials, and requirement of fire-resistant materials for re-roofing projects;
- Requirement of tile roofs in Phillips Ranch;
- Development of fire-resistant landscape program in coordination with Ganesha Hills homeowners; and
- County Fire Department weed abatement and brush clearance program.

Further measures to reduce the risks of wildfire include:

- Exploring options for further decreasing fire hazards through requirements established by ordinance in Ganesha Hills; and
- Limiting any increases in residential densities in wildfire hazard areas through appropriate land use policy applications in the General Plan Update.

Lead Department: Community Development, Fire

Implementation Schedule: Ongoing

Hazards Addressed: Wildfire

Goals and Objectives Implemented:

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objective 1.3.1).

Goal 3.1: Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

***Mitigation Action 5.5:* Expanded Code Enforcement in Overcrowded Neighborhoods**

In Pomona's overcrowded neighborhoods (see Figure 3-2):

- Step up code enforcement efforts, with particular emphasis on remediation of illegally inhabited building spaces that increase risks of injury or life loss in the event of a major earthquake.
- Significantly increase fees for code violations pertinent to public health and safety, so that the fees serve as a deterrent; and
- Continue enforcing stiff fines imposed on homeowners and contractors implementing structural modifications without appropriate permits.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: Earthquakes

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.3).

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objective 1.3.4).

***Mitigation Action 5.6:* Landslide Prevention**

Prioritize routine maintenance and repairs of water, sewer, and irrigation lines in and around landslide prone areas (see Figure 7-1), to avoid long-term leaks that saturate and de-stabilize earth materials to point of dangerous and destructive landslides.

Lead Department: Utility Services, Parks and Recreation

Implementation Schedule: On-going

Hazards Addressed: Landslide

Goals and Objectives Implemented:

Goal 3.1: Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

***Mitigation Action 5.7:* Landslide Prevention Development Standards**

Revise the City Grading Ordinance and development standards for hillside properties implemented through the "H" Overlay Zone to include best management practices for landslide prevention. Review the extent of property subject to the "H" overlay to ensure that all landslide potential areas are included, and also continue applying the standards to all property meeting the requirements of "Hillside Area" as defined in Development Code Section 58010.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: Landslide

Goals and Objectives Implemented:

Goal 1.2: Protect Pomona's unique character and values from being compromised by hazard events (Objective 1.2.3).

Goal 3.1: Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

***Mitigation Action 5.8:* Stabilizing Ganesha Park Slopes**

Develop and implement a program to stabilize the Ganesha Park slopes, in order to avoid landslides such as the 2003 event. Review the cost-effectiveness of the alternative strategies—including construction of a retaining wall—that were studied in the 2003 follow-up report commissioned by the City. Continue efforts to implement the recommendations of this report, and evaluate the application of these measures to other areas in Ganesha Park that are subject to similar conditions. Prioritize this mitigation action to avoid landslide recurrence and potential life loss, injury, and facility damage in this highly popular and treasured recreation center.

Lead Department: Parks and Recreation

Implementation Schedule: Short-term

Hazards Addressed: Landslide

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses (Objective 1.1.3).

*Goal 1.*3: Minimize losses to existing property and reduce potential for damage to future development (Objective 1.3.6).

RISK REDUCTION FOR COMMUNITY VULNERABILITIES

***Mitigation Action 6.1:* Accelerated Emergency Response for Vulnerable Populations**

Many of the mitigation actions established in the NHMP will act to reduce risks associated with the vulnerable populations in the City, including people in child care and senior care facilities, hospitals, public and private schools, and overcrowded neighborhoods, as well as people with disabilities. However, focused response efforts may be needed in the event of a disaster to ensure the safety of vulnerable populations. As part of the plan to step up emergency response efforts for vulnerable facilities:

- Maintain updated inventory and map of vulnerable facilities in the *SEMS Plan* to help identify facilities that may need special response service, and integrate vulnerable facilities into the communication protocol;
- Request representatives from vulnerable facilities to participate in emergency preparedness drills; and
- Request representatives from vulnerable facilities to participate in the CAEP and CERT program described in Mitigation Action 4.2 and 4.3.

Lead Department: Police

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.3).

Goal 2.1: Develop and implement education and outreach programs to increase public

awareness of the risks associated with natural hazards (Objective 2.1.2).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objective 4.1.4).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.6).

DEVELOPMENT PLANNING AND REGULATORY FRAMEWORK

***Mitigation Action 7.1:* General Plan and Development Code Update**

In the *General Plan Update* and associated *Development Code* amendments, integrate the hazards and risk assessment and mitigation in the new policy framework, with special attention to avoidance of new risks from proposed development, protection of environmental resources, appropriate level of public services and facilities, and circulation system effectiveness. Establish development policies that encourage and support redevelopment of aging building stock, consistent with community vision and goals.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.2, 1.1.3).

Goal 1.2: Protect Pomona's unique character and values from being compromised by hazard events (Objectives 1.2.1, 1.2.2, 1.2.3).

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.1, 1.3.4, 1.3.5, 1.3.6).

Goal 3.1: Balance natural resource management and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

***Mitigation Action 7.2:* Development Project Review for Natural Hazards Risks**

When reviewing proposals for new development and infrastructure improvement projects, identify any natural hazards that have the potential to impact the property. If current building and development codes do not adequately address identified natural hazard impacts associated with a specific project, require additional mitigation to be incorporated into the project. Include this requirement in all project review procedures.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1).

Goal 1.2: Protect Pomona's unique character and values from being compromised by hazard events (Objectives 1.2.2, 1.2.3).

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.1, 1.3.4, 1.3.6).

Goal 3.1: Balance natural resource management and land use planning with

natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

CITY SEMS PLANNING AND TRAINING

Mitigation Action 8.1:* Pomona *SEMS Plan

Continue to implement the Pomona *SEMS Plan*, which functions as the City's manual for communications protocol in the event of a disaster. Update as needed for consistency with the *State SEMS Plan,* evolving inter-agency communication protocols, and the NHMP.

Lead Department: Police

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.2, 1.1.3, 1.1.4).

Goal 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.1, 2.1.2, 2.1.3, 2.1.4).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objectives 4.1.1, 4.1.3, 4.1.4, 4.1.5).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objectives 5.1.2, 5.1.3).

***Mitigation Action 8.2:* Emergency Preparedness Drills**

Pursuant to the City's *SEMS Plan*, conduct emergency preparedness and response drills for mock major earthquake events, the natural hazard with the greatest potential for injury, loss life, property damage, and service interruptions. Drills should test disaster response systems and communication protocols, and include activation of the TMAC and IRIS systems (see Mitigation Action 2.3). When preparing the drills, consider the wide range of potential risks associated with critical facilities and vulnerabilities, such as interrupted service at Pomona Valley Hospital Medical Center, street blockages from paused trains, major power service disruption, etc. Include representatives of City officials and staff, utility providers and the railroad operators, as well as trained community emergency response volunteers and emergency response stakeholders, and representatives of vulnerable facilities.

After the drill, analyze the strengths and weaknesses of the response effort and identify facility and infrastructure deficiencies contributing to response concerns. Use this information to inform priorities established in the NHMP Annual Report (see Mitigation Measure 1.1).

Lead Department: Police

Implementation Schedule: On-going, on annual basis

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.3, 1.1.4).

Goal 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.1, 2.1.2, 2.1.3, 2.1.4).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement

local hazard mitigation activities (Objectives 4.1.1, 4.1.3, 4.1.4, 4.1.5).

Goal 4.1: Encourage and support leadership within Pomona to promote and implement local hazard mitigation activities (Objectives 5.1.2, 5.1.3, 5.1.4, 5.1.6).

***Mitigation Action 8.3*: Decentralized Emergency Supplies and Equipment**

Distribute stores of emergency supplies and equipment in at least two locations at disparate points in the City, to avoid access issues in the event of road closures or facility damage.

After the drill, analyze the strengths and weaknesses of the response effort and identify facility and infrastructure deficiencies contributing to response concerns. Use this information to inform priorities established in the NHMP Annual Report (see Mitigation Measure 1.1).

Lead Department: Police

Implementation Schedule: Long-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.5).

***Mitigation Action 8.4:* City Hall Life Safety Planning**

Immediately following a disaster, community members will rely on City staff for assistance and direction. Part of the City's plan for maximizing emergency services must include taking care of staff's emergency needs so that they can function and serve the community. Without the ready services of City staff, the likelihood of hazard impacts to the community could increase.

Update City Hall life safety preparedness plan, conduct employee training, ensure that each department has complete first-aid kit, and hold emergency evacuation drills at City Hall on an annual basis. In addition, help staff establish reserve of personal emergency supplies, by buying kits at discounted prices and selling at-cost to staff or designating a team captain in each department to help individuals bring in appropriate kit.

Lead Department: Police

Implementation Schedule: Short-term

Hazards Addressed: All

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objectives 5.1.4, 5.1.6).

PART II:

NATURAL HAZARD AND RISK ASSESSMENT

6 Earthquakes

6.1 INTRODUCTION

California is home to the most intense and greatest number of earthquakes in the contiguous United States: of the 15 largest earthquakes in the contiguous United States, seven have occurred in California.[1] The State also ranks number one in the nation in the amount of damage caused by earthquakes, in large part due to its high population and degree of urbanization.[2] The City of Pomona is no exception to the rest of the State, and the threat posed by an earthquake is considered the most significant natural hazard facing Pomona. This chapter provides information about the earthquake hazard in Pomona, beginning with an overview of historic events and the probability of future earthquakes in Southern California, and then identifies specific areas of hazards and risks within the City.

6.2 HAZARD PROFILE

HAZARD DESCRIPTION

Generally defined, an earthquake is an abrupt release of accumulated energy in the form of seismic waves when movement occurs along a fault. The City of Pomona lies in a seismically active region of Southern California, with several major active faults in the area, including the San Andreas, Sierra Madre, and Whittier-Elsinore fault zones. However, in addition to these known faults, movement along buried blind thrust faults that have no obvious surface features can also occur.

Faulting and Seismicity

Earth scientists use the angle of the fault with respect to the surface (known as the dip) and the direction of slip along the fault to classify faults. Faults that move along the direction of the dip plane are dip-slip faults and described as either normal or reverse, depending on their motion. Faults that move horizontally are known as strike-slip faults and are classified as either right-lateral or left-lateral. Faults that show both dip-slip and strike-slip motion are known as oblique-slip faults. The types of faults are described below and illustrated in Figure 6-1:

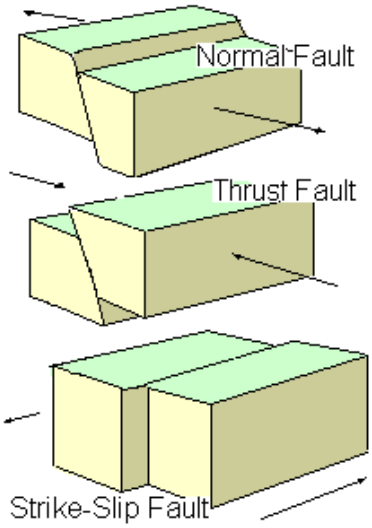
- *Normal Fault.* A dip-slip fault in which the block above the fault has moved downward relative to the block below. This type of faulting occurs in response to extension and is often observed in the Western United States Basin and Range Province and along oceanic ridge systems.
- *Thrust Fault.* A dip-slip fault in which the upper block, above the fault plane, moves up and over the lower block. This type of faulting is common in areas of compression, such as regions where one plate is being subducted under another. When the dip angle is shallow, a reverse fault is often described as a thrust fault.
- *Strike-Slip Fault.* A fault on which the two blocks slide past one another. A left lateral strike-slip fault is one on which the displacement of the far block is to the left when viewed from either side. A right lateral strike-slip fault is one on which the displacement of the far block is to the right when viewed from either side. The San Andreas Fault is an example of a right lateral strike-slip fault.[3]

[1] National Earthquake Information Center website: http://neic.usgs.gov/neis/eqlists/10maps_usa.html Accessed July 1, 2004.

[2] USGS Earthquake Hazards Program website: http://earthquake.usgs.gov/faq/hist.html#5: Accessed July 1, 2004.

[3] USGS Earthquake Hazards Program website: http://earthquake.usgs.gov/faq/plates.html, Accessed Jun 30, 2004.

Figure 6-1: Types of Faults



HISTORIC EVENTS

Although damaging earthquakes have occurred numerous times in Southern California, the City of Pomona has never declared a state of emergency due to an earthquake.[4] During the 1987 Whittier Narrows earthquake, several historic buildings were damaged, but the City did not sustain any deaths or serious injuries; relatively speaking, Pomona has been able to avoid many of the dire effects of earthquakes experienced by other Southern California communities. However, the risk to the City from an earthquake is still great, given the history of earthquakes in the Southern California and the probability of future occurrence in the region. In order to examine the earthquake threat to Pomona, it is useful to review experiences of other Southern California cities in profiling earthquake hazards.

Historical earthquake records can generally be divided into records of the pre-instrumental period and the instrumental period. In the absence of instrumentation, the detection of earthquakes is based on observations and witness reports, and is dependent upon population density and distribution. Since California was sparsely populated in the 1800s, the detection of pre-instrumental earthquakes is relatively difficult. However, two very large earthquakes, the Fort Tejon in 1857 (7.9) and the Owens Valley in 1872 (7.6) are evidence of the tremendously damaging potential of earthquakes in Southern California. In more recent times, two 7.3 earthquakes struck Southern California: in Kern County (1952) and Landers (1992). Table 6-1 lists historic earthquakes in Southern California of a magnitude 5.0 or greater.

Table 6-1: Southern California Earthquakes with Magnitude 5.0 or Greater

Year	*Geographic Area*
1769	Los Angeles Basin
1800	San Diego Region
1812	Wrightwood
1812	Santa Barbara Channel
1827	Los Angeles Region
1855	Los Angeles Region
1857	Great Fort Tejon Earthquake
1858	San Bernardino Region
1862	San Diego Region
1892	San Jacinto or Elsinore Fault
1893	Pico Canyon
1894	Lytle Creek Region
1894	E. of San Diego
1899	Lytle Creek Region
1899	San Jacinto and Hemet
1907	San Bernardino Region
1910	Glen Ivy Hot Springs
1916	Tejon Pass Region
1918	San Jacinto
1923	San Bernardino Region
1925	Santa Barbara
1933	Long Beach
1941	Carpenteria
1952	Kern County
1954	W. of Wheeler Ridge
1971	San Fernando
1973	Point Mugu
1986	North Palm Springs
1987	Whittier Narrows
1992	Landers
1992	Big Bear
1994	Northridge
1999	Hector Mine

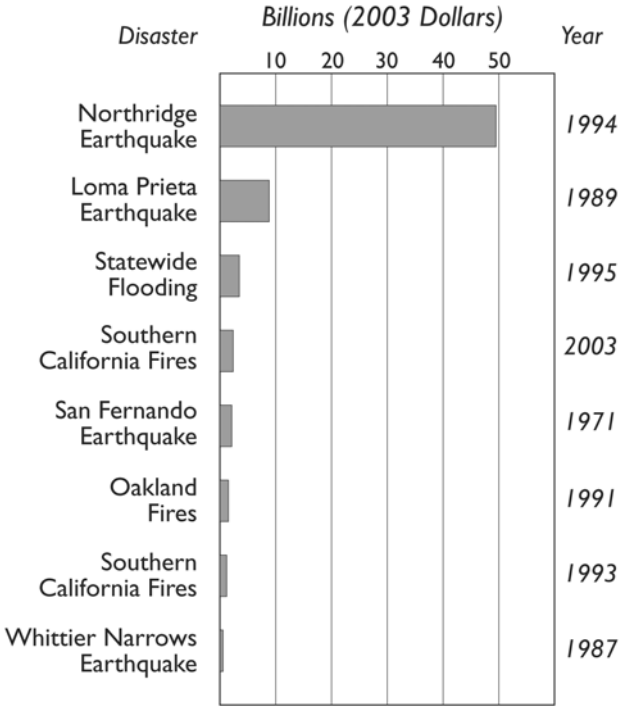
Source: http://geology.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fpasadena.wr.usgs.gov%2Finfo%2Fcahist_eqs.html

[4] Cruz, Carrie. Verbal Communication, June 8, 2004.

The damage from these four large earthquakes was limited because they occurred in areas that were sparsely populated at the time. The seismic risk is much more severe today because of widespread growth throughout Southern California, with the population at risk in the millions, rather than a few hundred or a few thousand persons. This is evidenced by the Northridge earthquake of 1994. Although the magnitude of the earthquake (6.7) was smaller than the aforementioned events, the Northridge earthquake became the costliest disaster in California history (see Figure 6-2). 57 people were killed and more than 1,500 people were seriously injured.

For days afterward, thousands of homes and businesses were without electricity, tens of thousands had no gas, and nearly 50,000 had little or no water. Approximately 15,000 structures were moderately to severely damaged, which left thousands of people temporarily homeless. The total cost of the damage caused by the Northridge earthquake approached 50 billion dollars.

Figure 6-2: California's Costliest Disasters



Source: Southern California Earthquake Center, et al. "Putting Down Roots in Earthquake Country." 2004.

HAZARD LOCATION AND EXTENT

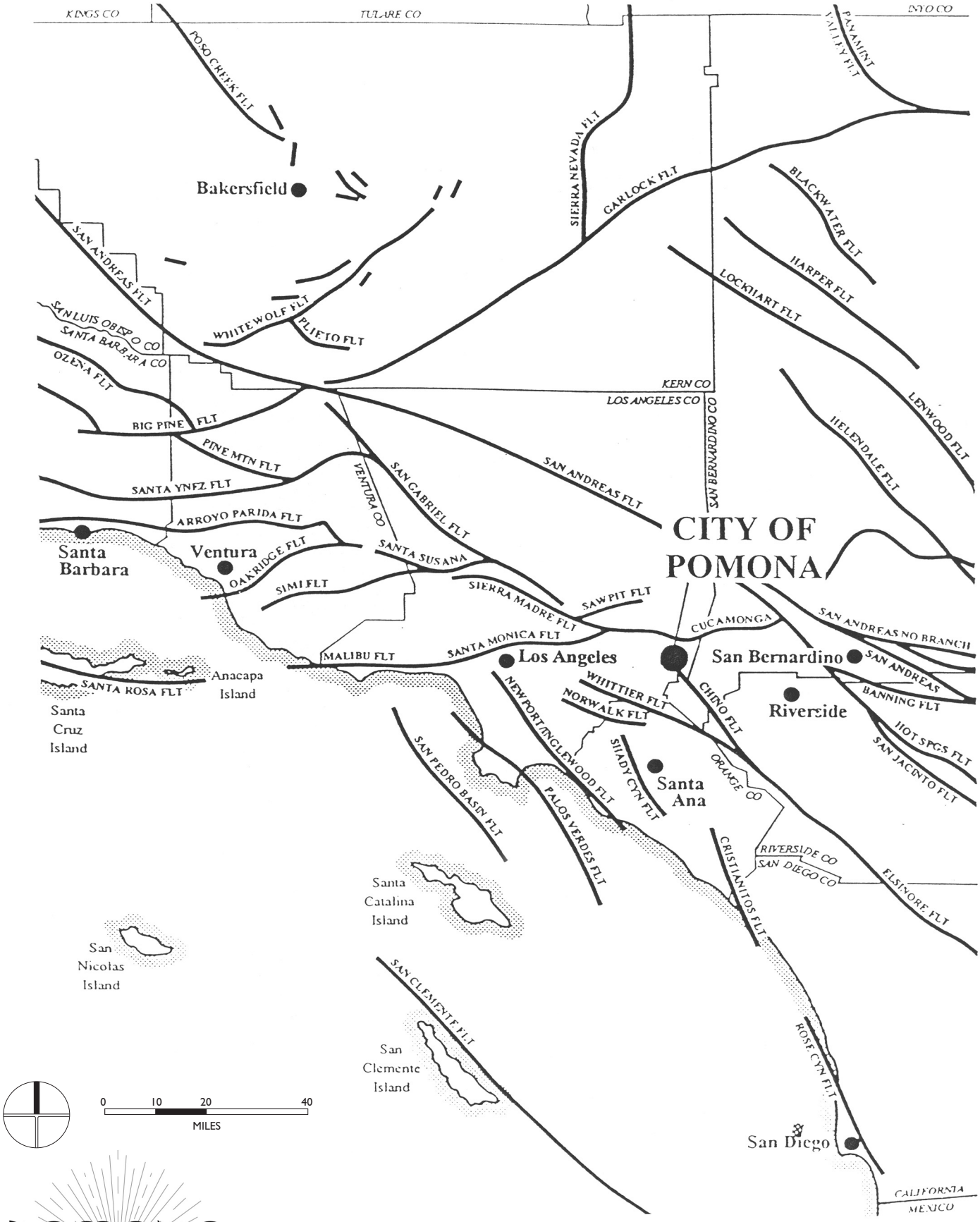
There are numerous faults in the Los Angeles area that are categorized as active, potentially active, and inactive. A fault is classified as *active* if it has either moved during the Holocene time (during the last 11,000 years) or is included in an Alquist-Priolo Earthquake Fault zone (as established by the California Division of Mines and Geology). A fault is classified as *potentially active* if it has experienced movement within Quaternary time (during the last 1.8 million years). Faults that have not moved in the last 1.8 million years are generally considered *inactive*. Surface displacement can be recognized by the existence of cliffs in alluvium, terraces, offset stream courses, fault troughs and saddles, the alignment of depressions, sag ponds, and the existence of steep mountain fronts.

Regional Faults

Earthquakes from several active and potentially active faults in the Southern California region could affect future development within the City of Pomona; although no known regional faults directly traverse the city. It should be noted, however, that the Northridge Earthquake occurred on a previously undetected active fault, and more faults may exists than are discussed here. The nearest identified regional faults are summarized below and presented in Figure 6-3.

Active Faults

- *San Andreas Fault Zone.* Located approximately 20 miles to the northeast of the City, this fault zone extends from the Gulf of California northward to the Cape Mendocino area where it continues northward along the ocean floor. The length of the fault and its active seismic history indicates that it has a very high potential for large-scale movement in the near future (magnitude 8.0+ on Richter scale), and should be considered important in land use planning for most cities in California.



POMONA
NATURAL HAZARDS
MITIGATION PLAN

Source:
Master Environmental Assessment for City of Pomona
David Evans and Associates, Inc., April 1994.

Figure 6-3

Regional Faults

- *Sierra Madre Fault System.* Located approximately one mile north of the City, at the base of the San Gabriel Mountains, this fault system forms a prominent 50-mile long east-west structural zone on the south side of the San Gabriel Mountains. It consists of a complex system of dips and slips and has a left lateral reverse component. The Sierra Madre fault system has been responsible for uplift of the San Gabriel Mountains by faulting in response to tectonic compression. In many places, the faults have placed basement bedrock over alluvium where they dip northerly below the steep topographic front of the San Gabriel Mountains.
- *Whittier-Elsinore Fault Zone.* This fault zone is located along the southern base of the Puente Hills, approximately 9 miles to the southwest of the City. This northwest-trending fault trends from Whittier Narrows southeast across the Santa Ana River, past Lake Elsinore, into western Imperial County and then into Mexico. This fault zone has the expected maximum capability of a magnitude 6.6 earthquake.
- *San Fernando Fault Zone.* This fault is located approximately 30 miles northwest of the City. Generally, fault segments are east-west trending thrust faults with associated left lateral movement.
- *Newport-Inglewood Fault Zone.* Located approximately 35 miles southwest of the City, this fault zone could generate a 7.0+ magnitude earthquake within the next 50 to 100 years.
- *Norwalk Fault.* Located approximately 25 miles southwest of the City, this fault strikes 65 to 85 degrees to the northwest and dips steeply to the northeast. The fault is approximately 16 miles long and has an accurate trace between Buena Park and Tustin. Microseismic activity along the Norwalk Fault is high and it may be capable of generating a magnitude 6.3 earthquake.

Potentially Active Faults

- *San Gabriel Fault.* Labeled as potentially active, this fault is located approximately 20 miles northwest of the City. This fault extends from Frazier Park to Mount Baldy Village, a distance of approximately 84 miles. Because of its length and its ancestral relationship with the San Andreas Fault System, its potential future activity must be realized. Due to the length of its surface trace, the San Gabriel Fault is believed capable of generating a magnitude 7.8 earthquake.
- *Verdugo Fault.* Located approximately 22 miles west of the City, this potentially active fault bounds the south flank of the Verdugo Mountains, and appears to merge with the Eagle Rock-San Rafael Fault System in the vicinity of the Verdugo Wash. Low magnitude earthquakes (less than 3.0) which have been attributed to activity along the Verdugo Fault are occasionally recorded in the Burbank-Glendale area. No direct evidence of ground displacement has been observed as associated with these low-magnitude earthquakes. The Verdugo Fault has a high potential for future activity and is capable of generating a magnitude 6.4 earthquake.
- *Santa Monica Fault.* This fault is located approximately 25 miles west of the City. No detailed information is available on the exact location of this southwest-northeast trending fault at the ground surface (fault trace), or on its geometric orientation. This fault, the Malibu Coast Fault, and the Raymond Fault belong to one large fault system. Classified as a potentially active fault, this fault could generate a moderate seismic event (magnitude 6.6).

Local Faults

In addition to the regional faults, there are several local faults located within the city that are considered potentially active. No recent seismic activity has been recorded along these faults in the last 10,000 years. However, a major earthquake occurring along any of these faults would be capable of generating seismic hazards and strong

groundshaking effects within the City. These local faults include the San Jose, Indian Hill, Chino, and Central Avenue Faults. Of the local faults, the probability of earthquake activity is considered the highest along the San Jose Fault, with possible ground rupture. Neither the Indian Hills Fault, Chino Fault, nor the Central Avenue Fault have a high probability of seismic activity, and their precise locations are currently not well defined. None of the local faults have been placed in an Alquist Priolo Special Studies Zone. Thus, no fault rupture hazard is anticipated along the fault traces that pass through the City. These local faults are further described below and are illustrated in Figure 6-4.

- *San Jose Fault.* This fault is classified as potentially active and is located in the San Jose Hills, on the western edge of the City. The fault is approximately 13 kilometers long and runs in a northeast/southwest direction, approximately parallel to the I-10 freeway. The fault has an 80 to 85 degree upward dip and has a reverse movement with the north side up. The fault displaces upper Miocene sedimentary and volcanic rocks as much as 2,700 feet vertically, with a 100-meter vertical offset in older subsurface alluvium. Some geologists consider this fault as seismically active and the origin of the L.A. County earthquakes in 1988 and 1990[5].
- *Indian Hill Fault.* This fault is located along the northern section of the city and runs in an east/west direction for approximately 9 kilometers. It is believed to be a single strand and is considered potentially active. This fault serves as a barrier to groundwater movement and offsets soils of Late Pleistocene age, which is the reason it is considered potentially active.
- *Chino Fault.* Considered to be a part of the Whittier-Elsinore fault system, this fault borders the Puente Hills to the northeast and is buried along most of its length. It is approximately 28 kilometers long from the Santa Ana Mountains to the City of Pomona in a northwest-southeast direction, as it joins the San Jose Fault, near the I-10. Based on geomorphic evidence, it does not appear to have as great a potential for seismic activity as does the Whittier-Elsinore fault. Where exposed in the Puente Hills area, the Chino fault is not as well-expressed as the Elsinore fault. The fault has an estimated slip rate of 0.2 mm/year. It should be noted that some geologists have questioned whether the Chino fault is in reality an earthquake fault, since recent evidence indicates that it is not a fault but the contact point between bedrock and less consolidated alluvium.
- *Central Avenue Fault.* Considered a potentially active fault and located in the City of Chino, this fault extends into the southern portion of the City of Pomona. This fault is approximately 8 kilometers long and believed to be a single strand that is subparallel to the Chino fault. The fault exhibits displacement on Quaternary and Holocene age deposits but has no surface expression.

Earthquake Hazards

Several hazards can be produced by a single earthquake event. Ground shaking, landslides, and liquefaction are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake. A discussion of these hazards is presented below, and areas affected by each of these hazards are mapped in Figure 6-4.

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter.

[5] David Evans and Associates, Inc. "Master Environmental Assessment for the City of Pomona." April 1994.

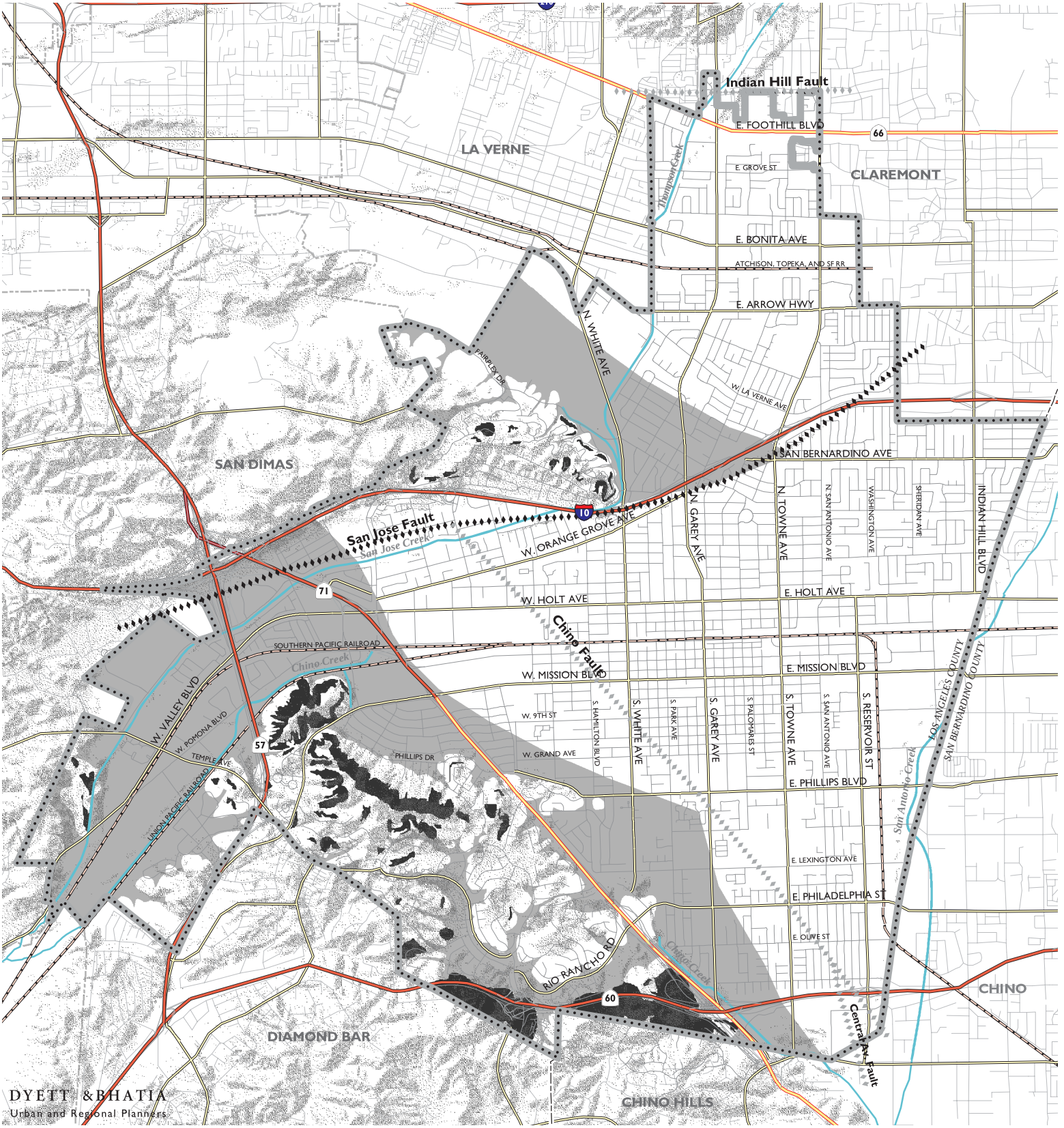


Figure 6-4

Seismic Hazards

Liquefaction (Area of Required Investigation)

Earthquake-Induced Landslide (Area of Required Investigation)

City Limits

Sphere of Influence

Faults Covered by Alluvium

Potentially Active/Active

Potentially Active

Source:
Liquefaction and Landslides data: CA Division of Mines and Geology, March 1999; Basedata, City of Pomona, 2003; Faults Data: City of Pomona Master Environmental Assessment, April 1994.

POMONA NATURAL HAZARDS MITIGATION PLAN

10 Acres

0 0.25 0.5 1 Miles

Although the entire City is susceptible to damage from ground shaking, geological conditions can greatly influence the amount of shaking experienced throughout the City. The majority of Pomona is underlain by alluvial soils, transported from the San Gabriel Mountains the north, which are less resistant to shaking than other soil types. However, portions of the City situated on bedrock such as San Jose (Ganesha Hills) and Puente (Elephant Hill, Phillips Ranch) would likely experience less ground shaking and associated damage.

Landslides

Landslides are secondary earthquake hazards that can occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake.

The Northridge earthquake of 1994 provides an example of the serious and damaging effects of landslides. As a result of the magnitude 6.7 earthquake, more than 11,000 landslides occurred over an area of almost 400 square miles. The landslides destroyed dozens of homes, blocked roads, and damaged oil-field infrastructure. They indirectly caused deaths from Coccidioidomycosis (valley fever), the spore of which was released from the soil during landslide activity and blown towards populated coastal areas.[6]

Many communities in Southern California have a high likelihood of encountering such risks, especially in areas with steep slopes. In Pomona, the risk of damage due to landslides is confined to parts of Phillips Ranch and Ganesha Hills. These areas are delineated by the USGS, and depicted in Figure 6-4. Although some of the susceptible areas have residential development, most of them are located in designated open space.

In the landslide-prone areas that are developed, the risk of a damaging flow is even greater. Although landslides are a natural geologic process in the hills around Pomona, residential developments in these areas exacerbate the risk of landslide hazards. Grading for road construction and development can increase slope steepness and contribute to the speed and severity of landslides. Grading and construction can also decrease the stability of a hill slope by adding weight to it top, removing support at the base of the slope, and increasing water content. Other human activities effecting landslides include: excavation, drainage and groundwater alterations, and changes in vegetation.[7]

Liquefaction

The phenomenon of liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these structures. Pomona is one of many communities in Southern California that is built on an ancient river bottom and has sandy soil. In some cases this ground may be subject to liquefaction, depending on the depth of the water table.

The California Geological Survey identifies and maps areas susceptible to liquefaction, based on groundwater levels and geologic materials. Pomona has 4,025 acres—or 27 percent of the City area—that fall within these zones and are susceptible to liquefaction. These areas generally occur at the base of the hills in the southern and western portions of the City. Liquefaction areas are presented in Figure 6-4.

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[6] Highland, L.M. and R.L. Schuster, Significant Landslide Events in the United States. Accessed via website at: http://landslides.usgs.gov.html_files/pubs/report1/Landslides_pass_508.pdf

[7] Planning For Natural Hazards: The Oregon Technical Resource Guide, Department of Land Conservation and Development, 2000: Chapter 5.

PROBABILITY OF FUTURE OCCURRENCE

The USGS estimates that within the next 30 years the probability is 60% that an earthquake measuring greater than magnitude 6.7 will occur in Southern California.[8] It is impossible to predict exactly where it will take place; however there are fault segments that are considered more likely than others to produce such an earthquake. Along the Earth's plate boundaries, segments exist where no large earthquakes have occurred for long intervals of time. Scientists term these segments "seismic gaps" and, in general, have been successful in forecasting the time when some of the seismic gaps will produce large earthquakes. Geologic studies show that over the past 1,400 to 1,500 years large earthquakes have occurred at about 150-year intervals on the southern San Andreas fault. As the last large earthquake on the southern San Andreas occurred in 1857, that section of the fault is considered a likely location for an earthquake within the next few decades.[9] However, the San Andreas fault is just one of many faults capable of producing large earthquakes in the region. Recently, researchers at UCLA predicted a magnitude 6.4 or greater earthquake to occur on or before September 5, 2004. The area of prediction includes not only the San Andreas fault, but portions of the San Jacinto, Imperial, and Elsinore faults as well. This stretch encompasses 12,440 square miles from southeastern San Diego County to central San Bernardino County.[10]

Although the science of earthquakes is not exact, these predictions are persuasive reminders of the constant risk of earthquakes to Southern California communities. The focus of the research on estimating the timeframe and location of earthquakes is itself a reminder that when discussing earthquakes, it is not a matter of "if" one will occur, it is a matter or when and where.

[8] http://earthquake.usgs.gov/faq/hazard.html#10

[5] USGS Publications website: http://pubs.usgs.gov/gip/earthq3/when.html

[6] Report to the Director, Governor's Office of Emergency Services by the California Earthquake Prediction Evaluation Council. March 2, 2004.

6.3 VULNERABILITY ASSESSMENT

OVERVIEW

The effects of earthquakes span a large area, and large earthquakes occurring in many parts of the Southern California region would probably be felt throughout the region. However, the degree to which the earthquakes are felt, and the damages associated with them may vary. At risk from earthquake damage are large stocks of old buildings and bridges; many high tech and hazardous materials facilities; extensive sewer, water, and natural gas pipelines; earth dams; petroleum pipelines; and other critical facilities and private property located in the City. Identifying these vulnerabilities and estimating potential losses that could occur due to an earthquake event are crucial steps in the process of formulating effective, efficient mitigation measures.

IDENTIFYING VULNERABILITIES

Chapter 3: Risk Assessment details the various types of critical and vulnerable facilities within Pomona. Each of these types of facilities is vulnerable to damage by an earthquake and its associated hazards of liquefaction and landslides. Of these facilities, the Technical Advisory Committee—drawing upon available scientific research, building structural information, historical experience, and community knowledge—identified specific vulnerabilities to target in the earthquake hazard mitigation process. The following sections identify those facilities that are considered the most vulnerable portions of the City to earthquake damage and are specific targets of earthquake mitigation action items.

Emergency Services

As previously discussed in Chapter 3: Risk Assessment, much of Pomona was built before seismic safety standards were implemented in

1976. Many of the City's critical facilities were also built before 1976, and could be more vulnerable to the hazards associated with earthquakes. Detailed studies will have to be conducted in order to determine which, if any, of the City's buildings have the potential to suffer serious damage during an earthquake. However, identifying those that predate seismic safety standards will help to prioritize the inventory process.

- *Emergency Government Operations.* All of the buildings that are designated as facilities for use during an emergency were built before 1976. The only location identified in the City's *SEMS Plan* that is not inside a potentially vulnerable structure is located in the west parking lot of City Hall. However, this location lacks many of the amenities of an operational building, such as shelter, electricity, restrooms, and additional assets that would be significant in the operation of the Emergency Operation Center (EOC).
- *Police and Fire Facilities.* The majority of police and fire facilities in Pomona were built before 1976. These building include the main building, jail, and property/evidence storage structures of the Pomona Police Department and five of the City's eight fire stations (an additional fire station was built in 1952, however it has been retrofitted to conform to 2003 building code standards). These five stations are have not been seismically retrofitted, although they were evaluated in 2003 for seismic safety each rated "better than average" for seismic performance relative to buildings of the same general type (see Table 6-2).

Table 6-2: Details on Fire Stations Built Before 1976

Fire Station	*Year Built*	*Construction Materials*	*Retrofit?*
181	Unknown: Pre-1976	Reinforced Concrete; Reinforced Masonry	No
182	1963	Reinforced Masonry	No
183	1952	Reinforced Masonry	Yes (2003)
184	Unknown: 1959-1974	Tilt-up precast concrete	No
185	1962	Reinforced Masonry	No
186	1963	Reinforced Masonry	No

Source: City of Pomona. Seismic Reports of Fire Stations, July, 2003.

Hospitals

All of the three major medical facilities in Pomona house vulnerable patient populations who would require substantial assistance in the event of damage to any of the hospital. Additionally, damage that incapacitated Pomona Valley Hospital Medical Center, which is the only provider of emergency medical services in the City, would detrimentally affect Pomona's ability to care for people injured in a large earthquake. In accordance with the Hospital Seismic Safety Act (see Section 7.4 for details), a number of structures at these facilities are being retrofitted or replaced. The statuses of each of the hospitals seismic preparations are:

- *Pomona Valley Hospital Medical Center.* The hospital celebrated its 100-year anniversary in 2003; five of its seven buildings were built before seismic building codes were developed. The hospital has plans to replace all of these five buildings by 2013.[11] PVHMC is also in the process of developing its own Natural Hazards Mitigation Plan to address risks associated with the hospital, and officials at the hospital have expressed a desire to work closely with the City of Pomona to effectively coordinate the development of both entities' mitigation plans.
- *Casa Colina Center for Rehabilitative Medicine.* Casa Colina is in the process of building a new facility, scheduled to open in the fall of 2004. Upon completion of the new hospital, which will be fully compliant with the safety standards of SB 1953, the current hospital facility will be demolished. The existing hospital has been updated for compliance in

[11] VanLul, Kenneth. Vice President of General Services, Pomona Valley Hospital Medical Center. Verbal Communication, June 4, 2004.

interim to ensure patient and staff safety. All outpatient facilities were built between 2001 and the present, and comply with either the 1999 or 2000 building code.[12]

- *Lanterman Developmental Center.* Approximately ten years ago, the California State Department of General Services (specifically Real Estate Services Division) performed an evaluation of all State facilities. Some of the oldest Lanterman buildings were declared unfit for 24-hour occupancy. In response to this, several buildings were retrofitted and upgraded to be used for day-use only. The main facility was retrofitted to be fully compliant with the seismic safety standards of SB 1953.[13]

Although these private facilities are privately- and state-owned and will be responsible for mitigating hazards on their property, increased preparedness and communication between them and City officials will help to coordinate emergency efforts in the event of an earthquake.

Utilities

Each of the components of Pomona's utility systems contributes to its overall operation and efficiency. However, some components are more critical to system operation and have been targeted as specific vulnerabilities to be addressed during earthquake mitigation.

Water

Maintaining water quality and distribution are crucially important during and after hazard events. The following critical components of the City's water service system are vulnerable to earthquake damage:

- *Water Reservoirs.* Six of the City's 22 water reservoirs have been upgraded with seismic safety valves which cwould shut off the reservoir in the event of a rupture, preventing drainage of the reservoir and potential for flooding. Currently, there are no plans to upgrade the remaining 16. The reservoirs could be subject to rupture during strong ground shaking. A report was conducted in 2003 to determine the structural stability of the reservoirs in response to an earthquake. All of the reservoirs performed well in the test with the exception of reservoir 4B, which ruptured. A follow-up report is currently being conducted to determine the nature of the reservoir rupture, and implement appropriate improvements.
- *Groundwater Wells.* A majority of Pomona's water supply is provded by local groundwater wells. The City has 37 groundwater wells, three of which are located immediately outside City limits in Claremont. The structural stability of these facilities is unknown, and would have to be evaluated through further technical studies to assess vulnerability to ground shaking and liquefaction. None of the groundwater wells are located in areas subject to earthquake-induced landslides. If a well(s) were to experience earthquake-related damage, local water supplies would only be incrementally affected and the overall community impact is considered low.
- *Water Treatment.* The City's Anion Exchange Plant removes nitrates from the water supply for a significant portion of the City. Failure of this plant has the potential to substantially limit potable water supply. The structural stability of the plant is unknown; however, it was completed in 1992, and is assumed to have a high level of resistance to ground shaking due to its modern construction standards.

Undergrounded Utility Lines

Undergrounded utilities—such as natural gas and petroleum—may be subject to rupture during an earthquake, creating the potential for fire or the release of hazardous chemicals. Specifically, the two petroleum pipelines and seven primary natural

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[12] Bender, Scentha. Administrative Assistant to Rob Barnes, Director of Project Development. Verbal Communication, June 4, 2004.

[13] Parks, Arthur. Assistant Planner of Operations. Verbal Communication, June 4, 2004.

gas distribution pipelines could pose significant fire and hazardous materials risks if ruptured. In addition to these main lines, the aging underground utility network in Pomona may experience any number of ruptures along its lines, resulting in localized service disruptions or release of materials.

Schools

In increasing Pomona's resilience to earthquakes, prioritizing the safety of the community's children is a primary concern. The many schools within the City house thousands of students during school hours are considered a substantial vulnerability. Many of Pomona's children attend school at private facilities, but the vast majority attend school at one of Pomona Unified School District's (PUSD) facilities. The PUSD is concurrently developing its own Natural Hazards Mitigation Plan to evaluate and mitigate potential hazards at its facilities. The PUSD and the City of Pomona have been working closely in the development of their concurrent NHMPs.

Recreation and Community Centers

In addition to schools, recreation and community centers also house a large number of children. As discussed in Chapter 3: Risk Assessment, the City of Pomona operates six community centers. Three of these facilities were constructed before seismic safety codes were established. Currently, no other information about the potential structural vulnerability to earthquake damage is available, and further studies would need to be conducted to determine their level of vulnerability. Two of the community centers are also in areas subject to liquefaction. The Ganesha Park Community Center—one of the City's most popular recreation facilities—is the most potentially vulnerable. It was constructed in 1950, and located in an area subject to strong ground shaking, liquefaction, and earthquake-induced landslides.

Unreinforced Masonry Buildings

The City of Pomona has 94 unreinforced masonry (URM) buildings. These buildings are especially vulnerable to damage and collapse during earthquakes. Their potential for collapse poses hazards to life and property loss. Also, many of these buildings are valuable assets to the City's rich historical heritage. The URM buildings in Pomona are clustered in the oldest and most central portion of the City, largely located along 2nd Street in Downtown.

Vulnerable Development Patterns

Central Pomona has a number of vulnerable development characteristics that could potentially result in more damage due to an earthquake when compared to other areas of the City. In general, census tracts with the highest percentages of overcrowded units are located in central Pomona; these high densities increase the potential number of people per neighborhood who would be impacted by an earthquake. Additionally, many of these overcrowded areas are located in neighborhoods with older structures, which pre-date seismic safety standards. Finally, large numbers of multi-family units are located in Central Pomona, of which a number are likely "soft story" apartment buildings. This type of construction is characterized by multi-storied structures that have an opening on the ground floor, such as a garage, that is less sturdy than the floors above it. These buildings are particularly vulnerable to earthquake damage, as the weakened first story may sustain damage, shift, or collapse. The combination of these development characteristics creates an area of the City with elevated susceptibility to the hazardous effects of earthquakes.

Railroads

The Union Pacific Railroad (UPR) line that is located in the center of the City is a primary east-west freight corridor. Trains on the tracks also carry passengers, on a much more limited basis. An earthquake that caused derailment, damage to

the tracks by liquefaction, or obstruction on the tracks due to landslides would be a tremendous vulnerability to the City. A train present on the tracks would seriously hamper the ability of emergency vehicles to traverse the City, especially if the crucial underpasses at Garey, White, and Towne Avenues were blocked. Although the possibility of a train derailment in the City seems remote, it was just such an event that prompted the construction of Pomona Valley Hospital Medical Center, as mentioned in Chapter 1: Introduction. The City does not have jurisdiction over the UPR tracks; hazard planning and mitigation is the responsibility of the Union Pacific Railroad. However, the City can coordinate with UPR on mitigation planning and work to maximize local emergency facility resiliency to help reduce risks associated with the railroad.

ESTIMATING POTENTIAL LOSSES

Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time.[14] Factors included in assessing earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the region due to an earthquake event in a specific location. FEMA's software program, HAZUS, uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information to estimate losses from a potential earthquake.[15]

HAZUS Earthquake Scenario

To perform the risk analysis for this NHMP, a magnitude 7.0 earthquake was simulated using HAZUS. The earthquake scenario was based on ground shaking data derived from USGS probabilistic seismic hazard curves, assuming a 100-year return period. The intensity of ground shaking per census tract is depicted in Figure 6-5. It is impossible to exactly predict the circumstances of the next earthquake to affect the City, and the data provided by the HAZUS simulation will surely differ from the actual losses experienced due to such an event. However, the use of HAZUS allows the City to view reasonable potential losses from a modeled earthquake, and make appropriate mitigation and emergency preparedness decisions.

It is noteworthy that this model assumes that the entire City is underlain by alluvial site conditions; although the majority of the City is located on an alluvial fan, portions on the western boundaries are underlain by bedrock, which is more resistant to ground shaking. Additionally, the secondary earthquake hazards of liquefaction and seismically-induced landslides were not simulated in this scenario. A discussion of the risks associated with these hazards follows the summary of HAZUS results.

Structural Damage

In this HAZUS scenario, 29 percent of buildings in Pomona experienced at least moderate damage. Approximately 340 structures were completely destroyed, and the vast majority of these were residential uses. Single-family homes accounted for almost half of the total number of affected structures. Overall, buildings that sustained the most damage were manufactured housing or structures with wood construction.

Displaced Persons

This model estimated that the earthquake displaced 920 households, or approximately 3,500 people. Although some of these people would be able to seek shelter with relatives, friends, or alternative means, many would require accommodation in temporary public shelters.

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[14] Burby, R. (Ed.) Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities (1998), Washington D.C., Joseph Henry Press.

[15] FEMA HAZUS http://www.fema.gov/hazus (May 2003).

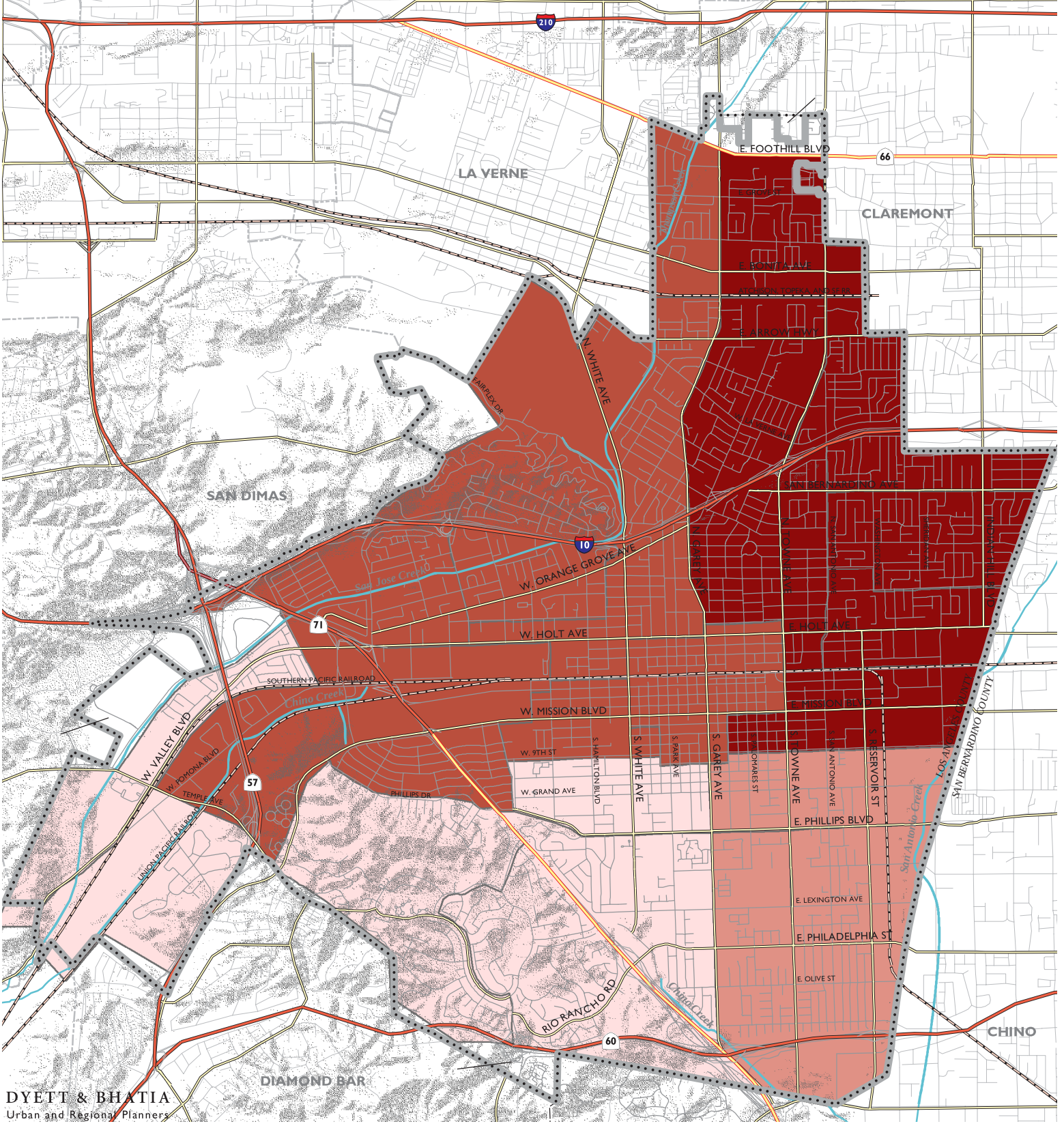

Figure 6-5

Peak Ground Acceleration (g) of HAZUS Scenario

- Less than 0.33
- 0.33 - 0.34
- 0.34 - 0.35
- 0.35 - 0.36

- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona, 2003;
PGA: HAZUS-MH, 2004.

POMONA
NATURAL HAZARDS
MITIGATION PLAN

0 0.25 0.5 1
Miles

Casualties

Approximately 1,300 people were injured or killed during this earthquake scenario. The majority of these casualties, roughly 1,000, were due to minor injuries requiring medical attention but not hospitalization. The remaining number includes more serious injuries requiring hospitalization and approximately 60 deaths.

Fire Damage

Fires often occur following an earthquake, due to downed power lines, ruptured fuel lines or other flammable materials becoming exposed and ignited. In the wake of an earthquake, water may not be immediately available or may be available in limited quantities. Additionally, emergency personnel may be stretched thin and responding to other emergency situations. These factors increase the hazard that such fire pose to Pomona. This HAZUS scenario modeled four fire ignitions in the City, resulting in the displacement of an additional 100 people and five million dollars of property damage.

Debris

The HAZUS-MH scenario produced an estimated 290 tons of debris. Following an earthquake, the City would need to devote resources to cleaning up brick, glass, wood, steel or concrete building elements, office and home contents, and other materials. This challenge includes disposing of or recycling the waste in compliance with the regulations of AB 939: The Integrated Waste Management Act. For these reasons, developing a strong debris management strategy is essential in post-disaster recovery.

Direct Economic Impacts

The total estimated economic loss to the City in this scenario was 757 million dollars. The economic losses calculated by HAZUS-MH include both income (wage, capital-related, rental, relocation) and capital (structural, non-structural, content, inventory) losses incurred by earthquake damage, as well as damage to transportation and utility lifelines. The majority of losses were caused by building-related losses, which totaled 750 million dollars. Within that category, residential losses comprise the largest portion—63%—primarily due to damage of single family homes.

The aforementioned economic impacts do not include indirect impacts, long-term changes that occur as a result of direct impacts. Such impacts include losses due to business closures, employment changes, loss of tourism revenues, changes in sales tax revenues, or other long-term consequences of earthquake damage.

Additional Risk Analysis Factors

As previously mentioned, this HAZUS scenario did not model the potential effects of liquefaction or earthquake-induced landslides, which are important secondary hazards associated with earthquakes. Of the two hazards, liquefaction presents a more serious risk to the City. It covers a widespread area, unlike the localized hazard of landslides, and includes many important lifelines that could be damaged due to liquefaction. At this time, insufficient resources are available to conduct a more advanced HAZUS analysis that would include both liquefaction and earthquake-induced landslides effects. In lieu of this analysis, Table 6-3, on the following page, lists the total structural assets that are located within these secondary earthquake hazards areas.

6.4 EXISTING EARTHQUAKE MITIGATION ACTIVITIES

Existing mitigation activities include current mitigation programs and activities that are being implemented by various levels of government, as well as private and educational organizations.

City of Pomona Codes

Implementation of earthquake mitigation policy most often takes place at the local government level. The City of Pomona Department of Building and Safety enforces building codes pertaining to

Table 6-3: Structures within Liquefaction and Landslide Zones

	Liquefaction			Landslide		
Land Use	*Units*	*Structure Value (in millions)*	*Acres*	*Units*	*Structure Value (in millions)*	*Acres*
Low Density Residential	5,437	402.3	924.3	144	24.1	32.8
Medium Density Residential	988	47.4	121.4	17	1.3	3.8
High Density Residential	595	19.8	21.1	-	-	-
Automotive, Motel, and Service Commercial	129	12.4	33.6	-	-	-
Retail Commercial and Shop Centers	28	46.0	109.6	-	-	-
Office	15	38.8	38.4	-	-	-
Light Industrial	65	128.7	243.7	-	-	-
Heavy Industrial and Outdoor Storage	99	30.8	143.7	-	-	-
Parks and Open Space	N/A	N/A	86.0	N/A	-	253.8
Education	3	0.1	509.7	-	-	-
Public, Civic, and Institutional	4	120.1	718.4	-	-	-
Vacant Land	1	N/A	61.1	N/A	-	35.1
Total	**7,364**	**846.6**	**3,011.1**	**161**	**25.4**	**325.3**

Source: L.A. County Assessor Parcel Data, 2004.

earthquake hazards. Currently, the City of Pomona uses the California Building Code (CBC) of 2001 as its standard for minimum design and constructions standards of new buildings. This most recent code was adopted in 2002, and included the adopted of updated seismic safety standards.[16]

The following sections of the CBC (based on the 1997 Uniform Building Code) address the earthquake hazard:

- 1605.1: Distribution of Horizontal Sheer;
- 1605. 2: Stability against Overturning;
- 1626: Seismic;
- 1605. 3: Anchorage;
- 1632 , 1633, 1633 ; 1649, 1650, 1651, 1652, (Volume 2) deal with specific earthquake hazards;
- 1610 Earthquake Loads

The City of Pomona Planning Department enforces the zoning and land use regulations relating to earthquake hazards. The policy of the City is to reduce unacceptable levels of seismic risk by controlling land use and building design in known fault zones and upon soils that may fail under seismic activity. This policy does not directly regulate specific land uses, but leaves final approval of projects to the proper decision making body, based on information from recommended geologic studies, and environmental impact reports, when required.[17]

California Earthquake Mitigation Legislation

California is painfully aware of the threats it faces from earthquakes. Dating back to the 19th century,

[16] Montero, Cynthia. City of Pomona, Department of Building and Safety. Written Communication, July 2004.

[17] City of Pomona. "Comprehensive General Plan." March 1976.

Californians have been killed, injured, and lost property as a result of earthquakes. As the State's population continues to grow, and urban areas become even more densely built up, the risk will continue to increase. For decades the Legislature has passed laws to strengthen the built environment and protect the citizens. Table 6-4 provides a sampling of some of the 200 plus laws in the State's codes.

Hospitals

The Alfred E. Alquist Hospital Seismic Safety Act (Hospital Act) was enacted in 1973 in response to the magnitude 6.6 Sylmar Earthquake in 1971, when four major hospital campuses were severely damaged and evacuated. Two hospital buildings collapsed killing 47 people. Three others were killed in another hospital that nearly collapsed.

In approving the Act, the Legislature noted that:

"Hospitals, that house patients who have less than the capacity of normally healthy persons to protect themselves, and that must be reasonably capable of providing services to the public after a disaster, shall be designed and constructed to resist, insofar as practical, the forces generated by earthquakes, gravity and winds (Health and Safety Code Section 129680)."

When the Hospital Act was passed in 1973, the State anticipated that, based on the regular and timely replacement of aging hospital facilities, the

Table 6-4: Partial List of California Laws on Earthquake Safety

Government Code Section 8870-8870.95	Creates Seismic Safety Commission.
Government Code Section 8876.1-8876.10	Established the California Center for Earthquake Engineering Research.
Public Resources Code Section 2800-2804.6	Authorized a prototype earthquake prediction system along the central San Andreas fault near the City of Parkfield.
Public Resources Code Section 2810-2815	Continued the Southern California Earthquake Preparedness Project and the Bay Area Regional Earthquake Preparedness Project.
Health and Safety Code Section 16100-16110	The Seismic Safety Commission and State Architect will develop a state policy on acceptable levels of earthquake risk for new and existing state-owned buildings.
Government Code Section 8871-8871.5	Established the California Earthquake Hazards Reduction Act of 1986.
Health and Safety Code Section 130000-130025	Defined earthquake performance standards for hospitals.
Public Resources Code Section 2805-2808	Established the California Earthquake Education Project.
Government Code Section 8899.10-8899.16	Established the Earthquake Research Evaluation Conference.
Public Resources Code Section 2621-2630 2621.	Established the Alquist-Priolo Earthquake Fault Zoning Act.
Government Code Section 8878.50-8878.52 8878.50.	Created the Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990.
Education Code Section 35295-35297 35295.	Established emergency procedure systems in kindergarten through grade 12 in all the public or private schools.
Health and Safety Code Section 19160-19169	Established standards for seismic retrofitting of unreinforced masonry buildings.
Health and Safety Code Section 1596.80-1596.879	Required all child day care facilities to include an Earthquake Preparedness Checklist as an attachment to their disaster plan.

Source: http://www.leginfo.ca.gov/calaw.html

majority of hospital buildings would be in compliance with the Act's standards within 25 years. However, hospital buildings were not, and are not, being replaced at that anticipated rate. In fact, the great majority of the State's urgent care facilities are now more than 40 years old.

The magnitude 6.7 Northridge Earthquake in 1994 caused $3 billion in hospital-related damage and evacuations. Twelve hospital buildings constructed before the Act were cited (red tagged) as unsafe for occupancy after the earthquake. Those hospitals that had been built in accordance with the 1973 Hospital Act were very successful in resisting structural damage. However, nonstructural damage (for example, plumbing and ceiling systems) was still extensive in those post-1973 buildings.

Senate Bill 1953 ("SB 1953"), enacted in 1994 after the Northridge Earthquake, expanded the scope of the 1973 Hospital Act. Under SB 1953, all hospitals are required, as of January 1, 2008, to survive earthquakes without collapsing or posing the threat of significant loss of life. The 1994 Act further mandates that all existing hospitals be seismically evaluated, and retrofitted, if needed, by 2030, so that they are in substantial compliance with the Act (which requires that the hospital buildings be reasonably capable of providing services to the public after disasters). SB 1953 applies to all urgent care facilities (including those built prior to the 1973 Hospital Act) and affects approximately 2,500 buildings on 475 campuses.

Businesses/Private Sector

Natural hazards have a devastating impact on businesses. In fact, of all businesses which close following a disaster, more than forty-three percent never reopen, and an additional twenty-nine percent close for good within the next two years.[18] The Institute of Business and Home Safety has developed "Open for Business", which is a disaster planning toolkit to help guide businesses in preparing for and dealing with the adverse affects natural hazards. The kit integrates protection from natural disasters into the company's risk reduction measures to safeguard employees, customers, and the investment itself. The guide helps businesses secure human and physical resources during disasters, and helps to develop strategies to maintain business continuity before, during, and after a disaster occurs.

Earthquake Education

Earthquake research and education activities are conducted at several major universities in the Southern California region, including Cal Tech, USC, UCLA, UCSB, UCI, and UCSB. The local clearinghouse for earthquake information is the Southern California Earthquake Center (SCEC), located at the University of Southern California, Los Angeles, CA 90089, Telephone: (213) 740-5843, Fax: (213) 740-0011, Email: SCEinfo@usc.edu, Website: http://www.scec.org. The SCEC is a community of scientists and specialists who actively coordinate research on earthquake hazards at nine core institutions, and communicate earthquake information to the public. The SCEC is a National Science Foundation (NSF) Science and Technology Center and is co-funded by the United States Geological Survey (USGS).

In addition, Los Angeles County along with other Southern California counties sponsors the Emergency Survival Program (ESP), an educational program for learning how to prepare for earthquakes and other disasters. Many school districts have very active emergency preparedness programs that include earthquake drills and periodic disaster response team exercises.

[18] Institute for Business and Home Safety Resources, April 2001.

6.5 PROPOSED EARTHQUAKE MITIGATION ACTION ITEMS

The earthquake mitigation action items provide guidance on suggesting specific activities that agencies, organizations, and residents in the City of Pomona can undertake to reduce risk and prevent loss from earthquake events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

Mitigation Action 2.3: **Reinforcement of Other City Facilities**

Conduct a structural assessment of City-owned properties constructed prior to the 1976 Building Code—which contain the latest seismic safety structural requirements—to identify buildings needing seismic safety improvements. This assessment should include City Hall, the Pomona Library, fire and police facilities, and community/recreation centers (particularly the Ganesha Hills Center). Prioritize improvements according to 1) minimizing injury and life loss, 2) ensuring emergency services and response, 3) ensuring distribution of hazard-resistant emergency facilities across the City to maximize emergency response and accessibility. Also consider cost-effectiveness in the prioritization ranking.

Lead Department: Redevelopment

Implementation Schedule: Mid-term

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.3).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

Mitigation Action 2.5: **Water Reservoir Seismic Retrofit Completion**

Complete the program to retrofit the City's reservoirs to withstand strong ground shaking during earthquake events. While six of the City's 22 reservoirs have been improved, a number remain vulnerable and need seismic safety valves. Reservoir damage could result in widespread water service disruptions and diminished fire fighting capabilities.

Lead Department: Utility Services

Implementation Schedule: Short-term

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

Mitigation Action 2.6: **Aging Water and Sewer Infrastructure Replacement**

As an older City with the development in the City center dating back to the late 1800s —including the system of water wells and pipelines— portions of the City's water and sewer infrastructure are in need of extensive maintenance and/or replacement. Older infrastructure is more prone to damage and service disruptions during earthquake, with potential ramifications for public safety and fire fighting capabilities. Continue to fund and prioritize water and sewer infrastructure improvements to reduce the potential for these haz-

ard-related risks. Use the Sewer and Water Master Plans currently under preparation as the basis for the improvement schedule.

Lead Department: Utility Services

Implementation Schedule: On-going

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

Mitigation Action 5.1: **Unreinforced Masonry Buildings**

Continue requiring improvements to meet seismic safety standards for unreinforced masonry buildings when a change in use is proposed. Revise the development code to include incentives to increase the number of retrofit projects, such as relief from selected non-conforming use provisions, to offset the costs of retrofits.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: Earthquake

Goals and Objectives Implemented:

> *Goal 1.2:* Protect Pomona's unique character and values from being compromised by hazard events (Objectives 1.2.1, 1.2.2, 1.2.3).
>
> *Goal 1.3:* Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.4, 1.3.5).

Mitigation Action 5.2: **Vulnerable Building Reinforcement**

As shown in Figure 3-3, much of the City was developed prior to current seismic standards. Older homes and buildings may require structural intervention to avoid significant damage in the event of a major earthquake. In addition, the clusters of mobile homes in the City may need reinforcements such as foundation strappings. Structural interventions are often straightforward and cost-effective, such as bolting structures to foundations. Through the community education campaigns, educate property owners about areas with structures potentially needing reinforcement, and provide technical assistance to property owners with vulnerable buildings to implement retrofit standards.

This action will be most effective when City building inspection staff are directed to prioritize identification and reinforcement of vulnerable buildings, are appropriately trained to detect vulnerable buildings and make reasonable, cost-efficient recommendations, and are consulted during formulation of community education campaigns.

The City currently offers a program for substantial rehabilitation of residential properties for low and moderate income households, funded with tax increment income from the redevelopment project areas. Expand the improvements eligible for funding to include seismic safety and windstorm structural reinforcements. Pursue grant funds for improvements benefiting special need population.

Lead Department: Community Development, Redevelopment

Implementation Schedule: Short-term

Hazards Addressed: Earthquake, Windstorm

Goals and Objectives Implemented:

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.3, 1.3.4).

Goal 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.5, 2.1.6).

Mitigation Action 5.3: **Valuing Heritage**

Many of Pomona's designated historic buildings, as well as homes within the designated historic districts, do not meet seismic safety codes. Pomona's historic resources contribute greatly to local environment and culture, and are tremendously valued by the community. Prioritize retrofitting historic structures and avoid demolition for the purpose of public safety. Provide technical assistance to property owners, and explore opportunities for federal and state grants for structural improvements to make buildings safer in lieu of demolition.

Lead Department: Community Development, Redevelopment

Priority: On-going

Hazards Addressed: Earthquake

Goals and Objectives Implemented:

Goal 1.2: Protect Pomona's unique character and values from being compromised by hazard events (Objectives 1.2.1, 1.2.2, 1.2.3).

Mitigation Action 5.5: **Expanded Code Enforcement in Overcrowded Neighborhoods**

In Pomona's overcrowded neighborhoods (see Figure 3-2):

- Step up code enforcement efforts, with particular emphasis on remediation of illegally inhabited building spaces that increase risks of injury or life loss in the event of a major earthquake.
- Significantly increase fees for code violations pertinent to public health and safety, so that the fees serve as a deterrent; and
- Continue enforcing stiff imposed on homeowners and contractors implementing structural modifications without appropriate permits.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: Earthquakes

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.3).

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objective 1.3.4).

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7 Landslides

7.1 INTRODUCTION

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year.[1] The best estimate of direct and indirect costs of landslide damage in the United States range between $1 and $2 billion annually.[2] Some landslides result in private property damage, while other landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life. California has had a significant number of locations impacted by landslides, attributable to a variety of conditions present in the state: seismic activity, heavy seasonal participation, rapid development, and varied topography. Landslides resulting from these types of conditions are discussed in this chapter, while earthquakes-induced landslides are addressed in Chapter 6: Earthquakes.

7.2 HAZARD PROFILE

HAZARD DESCRIPTION

A landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting" which denotes any downslope movement of soil and rock under the direct influence of gravity. Failure of a slope occurs when the force that is pulling the slope downward (gravity) exceeds the strength of the earth materials that compose the slope. They can move slowly, (millimeters per year) or quickly and disastrously, as is the case with debris flows.

The term "landslide" encompasses events such as rock falls, topples, slides, spreads, and flows. Landslides can be initiated by rainfall, earthquakes, volcanic activity, changes in groundwater, disturbance and change of a slope by man-made construction activities, or any combination of these factors. Landslides can also occur underwater, causing tidal waves and damage to coastal areas. These landslides are called submarine landslides.[3]

The size of a landslide usually depends on the geology and the initial cause of the landslide. Landslides vary greatly in their volume of rock and soil, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names, depending on the type of failure and their composition and characteristics.

Landslides can be broken down into two categories: (1) rapidly moving—generally known as debris flows—and (2) slow moving. Rapidly moving debris flows present the greatest risk to human life, and people living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Due to their sluggish rate of movement, slow moving landslides typically do not result in loss of life, but can cause widespread property damage over time.

Debris Flows

A debris flow – also known as a mud flow – is a semi-fluid mass of rock, earth, vegetation, and other materials that is saturated with water. This high percentage of water gives the debris flow a very rapid rate of movement down a slope. Although debris flows can travel down a hillside of

[1] Mileti, Dennis, Disasters by Design: A Reassessment of Natural Hazards in the United States (1999) Joseph Henry Press, Washington D.C.

[2] Brabb, E.E., and B.L Harrod. (Eds) *Landslides: Extent and Economic Significance. Proceedings of the 28th International Geological Congress Symposium on Landslides.* (1989) Washington D.C., Rotterdam: Balkema.

[3.] Landslide Hazards, U.S. Geological Survey Fact Sheet 0071-00, Version 1.0, U.S. Department of the Interior - U.S. Geological Survey, http://pubs.usgs.gov/fs/fs-0071-00/

speeds up to 200 miles per hour speeds more commonly range 30 – 50 miles per hour. Travel rates depend on the slope angle, water content, and type of earth and debris in the flow.

This high rate of speed makes debris flows extremely dangerous to people and property in its path. Earthquakes often trigger debris flows, as discussed in Chapter 6: Earthquakes. These flows are also initiated by heavy, usually sustained, periods of rainfall, but sometimes can happen as a result of short bursts of concentrated rainfall in susceptible areas. Burned areas charred by wildfires are particularly susceptible to debris flows, given certain soil characteristics and slope conditions.[4]

Slow Moving Landslides

Landslides move in contact with the underlying surface. These movements include rotational slides where sliding material moves along a curved surface, and translational slides where movement occurs along a flat surface. These types of slides are generally slow moving and can be deep. Slumps are small rotational slides that are generally shallow. Slow-moving landslides can occur on relatively gentle slopes and can cause significant property damage over time, but are far less likely to result in serious injuries than rapidly moving landslides.[5] The best-known example of a slow moving landslide in Southern California is the Portuguese Bend translational landslide. This event was initially triggered in the 1950s due to road construction and continues to move even today.[6] This landslide and other historic occurrences are discussed in more detail in the following section.

HISTORIC EVENTS

The City of Pomona has never experienced a large-scale, damaging landslide. There are portions of the City, however that are susceptible to landslides and should be mitigated accordingly. In March 2003, a landslide occurred in Ganesha Park. The slide caused temporary closure of Paige Drive, which runs alongside the park's popular recreation center. The City commissioned a geotechnical study to investigate the event. It was determined that a buildup of water in the soil—due to irrigation and unexpectedly heavy rainfall—helped to trigger the landslide (in addition to landslides, Ganesha Park also harbors wildfire hazards, and regular irrigation is used to reduce fire threat in the area). The report recommended several alternatives for landslide mitigation in Ganesha Park, and City staff is still considering these actions.[7] Although there was not any significant damage caused by the event, it underscores the vulnerability of local slopes to this type of natural hazard.

In addition to local events, the following examples of historic events in the Southern California region provide baseline information to help understand the types of vulnerabilities and potential damage associated with landslides.[8]

1928: St. Francis Dam Failure Los Angeles County. Built atop the site of an ancient landslide, the dam gave way on March 12, 1928. Its waters swept through the Santa Clara Valley toward the Pacific Ocean, about 54 miles away. Sixty-five miles of the valley were devastated, and over 500 people were killed. Damages were estimated at $672.1 million (year 2000 dollars).

1956: Portuguese Bend Palos Verdes Peninsula. Land use on the Palos Verdes The Portuguese Bend landslide began its modern movement in August 1956, when displacement was noticed at its northeast margin. Movement gradually extended

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4. Ibid.

5. Interagency Hazard Mitigation Team, State Hazard Mitigation Plan (2000) Oregon Emergency Management.

6 Portuguese Bend Regional Open Space Park website: http://www.pvplc.org/land/portuguesebend/projectoverview.htm

7 AMEC Earth & Environmental, Inc. Geotechnical Investigation Ganesha Park Landslide at Paige Drive Between Sunset and North Hills Dive Pomona, California. April 2004.

8 Highland, L.M., and Schuster, R.L., *Significant Landslide Events in the United States.* USGS, Washington D.C., http://landslides.usgs.gov.html_files/pubs/report1/Landslides_pass_508.pdf. (No Date).

downslope so that the entire eastern edge of the slide mass was moving within 6 weeks. By the summer of 1957, the entire slide mass was sliding towards the sea. This slow moving landslide continues its movement in the area is even today, continuing to threaten the residential community that exists there. The estimated cost thus far is $14.6 million (2000 dollars).

1969: Glendora Los Angeles County. 175 houses damaged, mainly by debris flows. Estimated cost: $26.9 million (2000 dollars).

1969: Seventh Ave., Los Angeles County. Damage to California Highway 60. Estimated cost: $14.6 million (2000 dollars).

1970: Princess Park California Highway 14, 10 miles north of Newhall, near Saugus, northern Los Angeles County. Estimated cost: $29.1 million (2000 dollars).

1977-1980: Monterey Park, Repetto Hills, Los Angeles County. 100 houses damaged in 1980 due to debris flows. Estimated cost: $14.6 million (2000 dollars).

1978: Bluebird Canyon, Orange County. 60 houses destroyed or damaged. Unusually heavy rains in March of 1978 may have contributed to initiation of the landslide. Although the 1978 slide area was approximately 3.5 acres, it is suspected to be a portion of a larger, ancient landslide. Estimated cost: $52.7 million (2000 dollars).

1979: Big Rock, California, Los Angeles County. California Highway 1 rockslide. Estimated cost: approximately $1.08 billion (2000 dollars).

1980: Southern California. Estimated cost: $1.1 billion in damage (2000 dollars). Heavy winter rainfall in 1979-90 caused damage in six Southern California counties. In 1980, the rainstorm started on February 8. A sequence of 5 days of continuous rain and 7 inches of precipitation had occurred by February 14. Slope failures were beginning to develop by February 15 and then very high-intensity rainfall occurred on February 16. As much as 8 inches of rain fell in a 6-hour period in many locations. Records and personal observations in the field on February 16 and 17 showed that the mountains and slopes literally fell apart on those 2 days. Estimated cost: $1.1 billion in damage (2000 dollars).

1983 San Clemente, California, Orange County. California Highway 1. Litigation at that time involved approximately $43.7 million (2000 dollars). Estimated cost: $65 million (2000 dollars).

1978-1980: San Diego County. Experienced major damage from storms in 1978, 1979, and 1979-80, as did neighboring areas of Los Angeles and Orange County, California. One hundred and twenty landslides were reported to have occurred in San Diego County during these 2 years. Rainfall for the rainy seasons of 78-79 and 79-80 was 14.82 and 15.61 inches (37.6 and 39.6 cm) respectively, compared to a 125-year average (1850-1975) of 9.71 inches (24.7 cm). Significant landslides occurred in the Friars Formation, a unit that was noted as slide-prone in the Seismic Safety Study for the City of San Diego. Of the nine landslides that caused damage in excess of $1 million, seven occurred in the Friars Formation, and two in the Santiago Formation in the northern part of San Diego County.

March 1995: Los Angeles and Ventura Counties. Above normal rainfall triggered damaging debris flows, deep-seated landslides, and flooding. Several deep-seated landslides were triggered by the storms, the most notable was the La Conchita landslide, which in combination with a local debris flow, destroyed or badly damaged 11 to 12 homes in the small town of La Conchita, about 20 km west of Ventura. There also was widespread debris-flow and flood damage to homes, commercial buildings, and roads and highways in areas along the Malibu coast that had been devastated by wildfire two years before.

HAZARD LOCATION AND EXTENT

Most of Pomona is located on a flat alluvial plain, and therefore not subject to landslide hazards. However, hillsides in the western portion of the City are considered susceptible to landslides and could sustain loss of life and property from this natural hazard. Initial mapping efforts have been conducted by the USGS to determine those areas in the City that have conditions conducive to landslides. Figure 7-1 displays relative susceptibility to landslides, as well as locations where landslides may be triggered by earthquake (this latter information is also mapped in Figure 6-4: Seismic Hazards). This figure also includes the hillside area addressed in the City's Zoning Ordinance, which is further discussed in Section 7.4: Existing Landslide Mitigation Activities.

The landslide maps produced by the USGS are an invaluable asset to the City in identifying hazards and preparing mitigation measures. However, these maps were not prepared specifically for Pomona and may not provide the level of detail needed to identify all potential hazardous areas. Additionally, changing local conditions associated with development may increase the potential for landslides to occur, and this dynamic nature of the hazard is not reflected in these published maps.

An awareness of the conditions that give rise to landslides will assist City officials in making prudent decision about mitigation measures, and regulating future development in areas at-risk to landslides. In general, locations at risk from landslides or debris flows include areas with one or more of the following conditions:

- On or close to steep hills;
- Steep road-cuts or excavations;
- Existing landslides or places of known historic landslides (such sites often have tilted power lines, trees tilted in various directions, cracks in the ground, and irregular-surfaced ground);
- Steep areas where surface runoff is channeled, such as below culverts, V -shaped valleys, canyon bottoms, and steep stream channels;
- Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons; or
- Canyon areas below hillside and mountains that have recently (within one to six years) been subjected to a wildland fire.

Impacts of Development

Although landslides are a natural occurrence, human impacts can substantially affect the potential for landslide failures. The increasing scarcity of developable land, particularly in urban areas, increases the tendency to build on geologically marginal land. Additionally, hillside housing developments in Southern California are prized for the views that they provide. Given the demand for such amenities, and the hazards that are present when building in areas of potential landslides, it is essential to exercise proper planning and geotechnical engineering to reduce the threat of safety of people, property, and infrastructure.

Excavation and Grading

Slope excavation is common in the development of home sites or roads on sloping terrain. Grading these slopes can result in some slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes can be at an increased risk for landslides. The added weight of fill placed on slopes can also result in an increased landslide hazard. Small landslides can be fairly common along roads, in either the road cut or the road fill. Landslides occurring below new construction sites are indicators of the potential impacts stemming from excavation.

Drainage and Groundwater Alterations

Water flowing through or above ground is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide

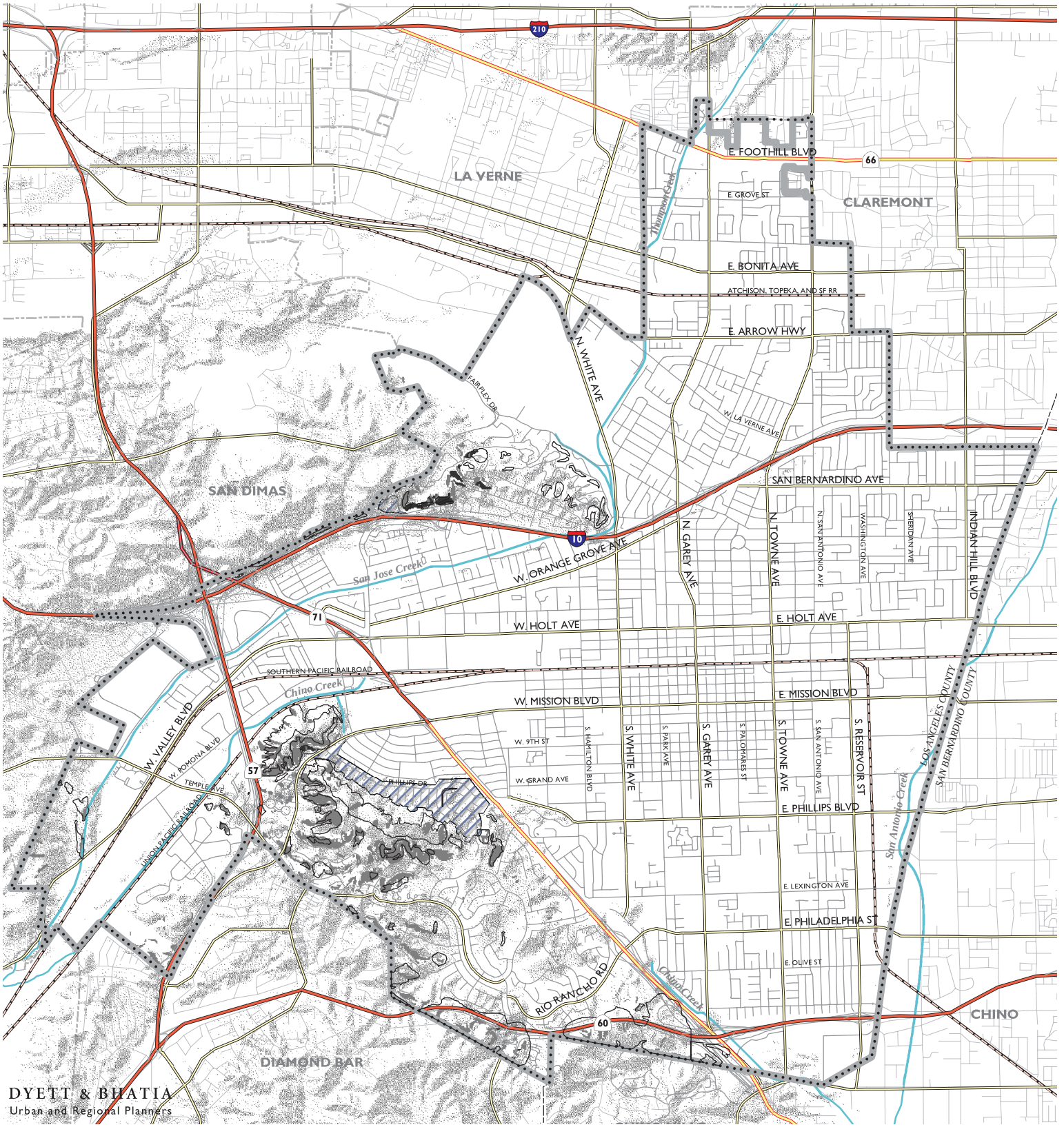


Figure 7-1

Landslide Hazards

Landslides Susceptibility (Unrelated to Earthquakes)

- Moderate Susceptibility
- High Susceptibility

Earthquake-Induced Landslide Susceptibility

- USGS-Delineated Area of Required Investigation

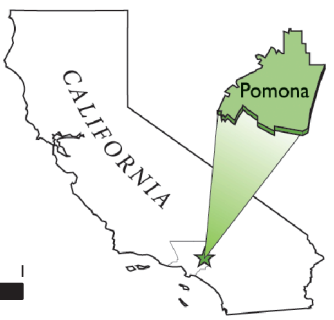
- Hillside Zoning Overlay
- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona, 2003;
Earthquake-Induced Landslide data:
CA Division of Mines and Geology, March 1999; Landslide Susceptibility: Morton, Doug. "Preliminary Soil-Slip Susceptibility Maps, Southwestern California."

POMONA NATURAL HAZARDS MITIGATION PLAN

10 Acres

0 0.25 0.5 1
Miles



hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, even excessive lawn irrigation in landslide prone locations can result in damaging landslides. Ineffective storm water management and excess runoff can also cause erosion and increase the risk of landslide hazards. Development that results in an increase in impervious surface impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, ponding, and erosion on slopes all indicate potential slope problems.

Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides.[9]

Changes in Vegetation

Removing vegetation from very steep slopes can increase landslide hazards. Areas that experience wildfire and land clearing for development may have long periods of increased landslide hazard. Also, certain types of ground cover have a much greater need for constant watering to remain green. Changing away from native ground cover plants may increase the risk of landslide.

The geographic extent of landslide hazards in Pomona is relatively small, comprising only a small percentage of the total area of the City. Additionally, the communities present in this area have some of the lower housing densities in the City; the number of people that would be directly impacted by a landslide is estimated to be very low. However, due to the potential for loss of life and property damage that can be caused by landslides, the extent of this hazard could have far-reaching community effects.

[9] Homeowners Guide for Landslide Control, Hillside Flooding, Debris Flows, Soil Erosion, (March 1997).

PROBABILITY OF FUTURE EVENTS

The City of Pomona has never experienced a landslide event that caused significant property damage or loss of life. This does not mean, however, that such an event cannot happen in the future. Given the susceptibility of certain areas of the City to landslides, it is reasonable to assume that damaging landslides could occur within Pomona in the future.

7.3 VULNERABILITY ASSESSMENT

OVERVIEW

The City of Pomona has a moderate vulnerability to landslides. Hillsides where landslides could occur comprise a small portion of the City, but the presence of lifeline routes and many residences in these areas augment the risk of significant damage to the City and its inhabitants. Development in these hillsides increases the risks in locations that are naturally prone to landslides, and where ancient landslides have occurred in the past.[10]

IDENTIFYING VULNERABILITIES

Landslides can affect structures, utility services, transportation lifelines, and critical facilities. Communities may suffer immediate damages and loss of service. Disruption of infrastructure, roads, and critical facilities may also have a long-term effect on the economy. Utilities, including potable water, wastewater, telecommunications, natural gas, and electric power are all essential to service community needs. Loss of electricity has the most widespread impact on other utilities and on the whole community. Natural gas pipes may also be at risk of breakage from landslide movements as small as an inch or two.

[10] Department of Conservation, Division of Mines and Geology. Seismic Hazard Evaluation of the San Dimas 7.5-Minute Quadrangle, Los Angeles County, California.1998.

Lifelines and Critical facilities

No critical facilities are located within areas susceptible to landslides. However, disruption of a major transportation lifeline could impair access to facilities in the City. To the greatest extent possible, lifelines and critical facilities should remain accessible during a natural hazard event. The impact of closed transportation arteries may be increased if the closed road or bridge is critical for hospitals and other emergency facilities. Therefore, inspection and repair of critical transportation facilities and routes is essential and should receive high priority. Primary transportation routes in Pomona that pass near hillsides at-risk to landslides are SR-57 and SR-60. Although debris that damaged or obstructed these routes would certainly have negative impacts on the flow of traffic, it would not be extremely adverse, as these routes do not pass through the center of the City, and there are alternative corridors available should these become compromised. In addition, portions of the Union Pacific Railroad pass by areas that are susceptible to landslides. Debris on the tracks would delay both passenger and freight cargo, and potentially cause serious damage to the tracks.

Recreation and Community Centers

As mentioned in Chapter 6: Earthquakes, the popular Ganesha Park is located near slopes susceptible landslides. In response to the landslide event of March 2003 in Ganesha Park (discussed above in the Historic Events portion of Section 7.2: Hazard Profile), the City evaluated the risk posed by slope movement, specifically to the park's swimming pool and community center. The City's geotechnical study asserted that in the event of a reoccurrence of slope failure at the site, the slide would be unlikely to reach the community center. The report concluded that this landslide area does not pose significant potential for loss of life or damage to the community center. In order to mitigate future occurrences from slope failure at the site, the City is in the process of requesting bids to implement recommendations contained in the geotechnical report.

Vulnerable Development Patterns

Fortunately, the majority of landslide-prone locations that have been mapped occur in areas of designated open space. However, nearby residential communities are at-risk to this hazard in portions of Phillips Ranch and of Ganesha Hills. These communities are largely developed, and any new development in these areas should be carefully evaluated to help avoid activities that increase landslide vulnerability.

ESTIMATING POTENTIAL LOSSES

Factors included in assessing landslide vulnerability include population and property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, soil characteristics, and precipitation intensity. This type of analysis could generate dollar estimates of the damages to the city due to a specific landslide or debris flow event. At the time of publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available.

7.4 EXISTING LANDSLIDE MITIGATION ACTIVITIES

Landslide Building and Zoning Codes

The City of Pomona Development Code addresses development on steep slopes in subsection 58010 concerning development for hillside properties. These sections outline standards for areas with median slopes of 10 percent or more before grading. Generally, the ordinance requires larger lot sizes based on slope percentage, as is indicated in Table 7-1.

The ordinance also allows for building design to accommodate the site, landscaping to protect against erosion, drainage, and controls for excavations and grading. The Hillside provisions also allow for a Hillside Advisory Review Committee to review development plans in hillside areas.

Table 7-1: Minimum Lot Sizes in Residential Hillside Areas

Grade of slope (percent)	*Minimum lot size (sq. ft.)*
0 - 10	7,200
10 - 30	10,000
30 - 40	20,000
40 or more	1 acre

Source: City of Pomona Zoning Ordinance, 1971-2; revised1996.

7.5 PROPOSED LANDSLIDE MITIGATION ACTION ITEMS

Mitigation Action 5.6: **Landslide Prevention**

Prioritize routine maintenance and repairs of water, sewer, and irrigation lines in and around landslide prone areas (see Figure 7-1), to avoid long-term leaks that saturate and de-stabilize earth materials to point of dangerous and destructive landslides.

Lead Department: Utility Services, Parks and Recreation

Implementation Schedule: On-going

Hazards Addressed: Landslide

Goals and Objectives Implemented:

> *Goal 3.1*: Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

Mitigation Action 5.7: **Landslide Prevention Development Standards**

Revise the City Grading Ordinance and development standards for hillside properties implemented through the "H" Overlay Zone to include best management practices for landslide prevention. Review the extent of property subject to the "H" overlay to ensure that all landslide potential areas are included, and also continue applying the standards to all property meeting the requirements of "Hillside Area" as defined in Development Code Section 58010.

Lead Department: Community Development

Implementation Schedule: Short-term

Hazards Addressed: Landslide

Goals and Objectives Implemented:

> *Goal 1.2:* Protect Pomona's unique character and values from being compromised by hazard events (Objective 1.2.3).
>
> *Goal 3.1:* Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

Mitigation Action 5.8: **Stabilizing Ganesha Park Slopes**

Develop and implement a program to stabilize the Ganesha Park slopes, in order to avoid landslides such as the 2003 event. Review the cost-effectiveness of the alternative strategies—including construction of a retaining wall—that were studied in the 2003 follow-up report commissioned by the City. Continue efforts to implement the recommendations of this report, and evaluate the application of these measures to other areas in Ganesha Park that are subject to similar conditions. Prioritize this mitigation action to avoid landslide recurrence and potential life loss, injury, and facility damage in this highly popular and treasured recreation center.

Lead Department: Parks and Recreation

Implementation Schedule: Short-term

Hazards Addressed: Landslide

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses (Objective 1.1.3).

*Goal 1.*3: Minimize losses to existing property and reduce potential for damage to future development (Objective 1.3.6).

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8 Wildfire

8.1 INTRODUCTION

For thousands of years, fires have been a natural part of the ecosystem in Southern California. However, wildfires present a substantial hazard to life and property in communities built within or adjacent to hillsides and mountainous areas. This risk is present wherever open space areas connect or 'interface' with urban and suburban areas. In California, the hot dry climate and large, mountainous wildland/urban interface area create a tremendous potential for losses due to wildfire.

In 2003, Californians were sharply reminded of the devastating capabilities of wildfire. According to the California Division of Forestry (CDF), there were over seven thousand reportable fires in California in 2003, with over one million acres burned. According to CDF statistics, in the October 2003 firestorms, over 4,800 homes were destroyed and 22 lives were lost.

8.2 HAZARD PROFILE

HAZARD DESCRIPTION

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed and spread quickly, particularly in dry areas, and are usually signaled by dense smoke that fills the area for miles around. These fires are classified into two broad categories.

- A wildland fire is a wildfire in undeveloped areas, which excludes the urbanized region around Pomona.
- An urban-wildland interface fire is a wildfire in an area where the vegetative fuel meets or intermingles with wildlands or vegetative fuel.

Although Pomona is not adjacent to a large wildland area, Pomona contains some open space lands in the east. Although the amount of open space is small compared to developed lands in Pomona, the potential for urban-wildland interface fires poses a considerable hazard.

Wildfire Characteristics

There are three categories of interface fire:[1]

- The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas;
- The mixed wildland/urban interface is characterized by isolated homes, subdivisions and small communities situated predominantly in wildland settings; and
- The occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area, as in the case of Pomona.

Certain conditions must be present for significant interface fires to occur. The most common conditions include: hot, dry and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel topography, weather, drought, and development.

Fuel

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading", or the amount of available vegetative fuel.

The type of fuel also influences wildfire. Chaparral is a primary fuel of Southern California wildfires. Chaparral habitat ranges in elevation from near sea

[1] *Planning for Natural Hazards: The Oregon Technical Resource Guide*, (July 2000) Department of Land Conservation and Development.

level to over 5,000 feet in Southern California. Chaparral communities experience long dry summers and receive most of their annual precipitation from winter rains. Although chaparral is often considered as a single species, there are two distinct types: hard chaparral and soft chaparral. Within these two types are dozens of different plants, each with its own particular characteristics.

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures, and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression "dog-hair" thickets have accumulated, which enable high intensity fires to flare and spread rapidly.

Topography

Topography influences the movement of air, thereby directing a fire course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Solar heating of dry, south-facing slopes produces up slope drafts that can complicate fire behavior. Unfortunately, hillsides with hazardous topographic characteristics are also desirable residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

Weather

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible.[2] High-risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The so-called "Santa Ana" winds, which are heated by compression as they flow down to Southern California from Utah, create a particularly high risk, as they can rapidly spread what might otherwise be a small fire.

Drought

Recent concerns about the effects of climate change – particularly drought – are contributing to concerns about wildfire vulnerability. The term drought is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance. Unusually dry winters, or significantly less rainfall than normal, can lead to relatively drier conditions and leave reservoirs and water tables lower. Drought leads to problems with irrigation and may contribute to additional fires, or additional difficulties in fighting fires.

Development

Wildfire has an effect on development, yet development can also influence wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation and use natural materials. A private setting may be far from public roads, or hidden behind a narrow, curving driveway. These conditions, however, make evacuation and fire fighting difficult. The scenic views found along mountain ridges can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.

HISTORIC EVENTS

Large fires have been part of the Southern California landscape for millennia. "Written documents reveal that during the 19th Century human settlement of southern California altered the fire regime of coastal California by increasing the fire frequency. This was an era of very limited fire suppression, and yet like today, large crown

[2] Ibid.

fires covering tens of thousands of acres were not uncommon. One of the largest fires in Los Angeles County (60,000 acres) occurred in 1878, and the largest fire in Orange County's history, in 1889, was over half a million acres."[3]

The fall of 2003 marked the most destructive wildfire season in California history. In a ten-day period, 12 separate fires raged across Southern California in Los Angeles, Riverside, San Bernardino, San Diego, and Ventura counties. The massive "Cedar" fire in San Diego County alone consumed 2,800 homes and burned over a quarter of a million acres. Although the 2003 fires did not reach Pomona, they did burn areas of the adjacent city of Claremont. Santa Ana winds blew heavy smoke into Pomona, and in other urban areas, such as the City of San Diego, it was again proven that wind-blown embers traveling long distances create new pockets of fire distant from the main fire.

HAZARD LOCATION AND EXTENT

Wildfire hazard areas are commonly identified in regions of the wildland/urban interface. In Pomona, this interface is present in the western and southwestern hills. The California Department of Forestry and Fire Protection (CDF) maps levels of fire threat base on groundcover and topography. The increased threat of fires in the hilly areas of Pomona is illustrated in Figures 8-1, with portions of the Phillips Ranch and Ganesha Hills areas obtaining a "High" and "Very High" level of fire threat. The rest of the City is considered to have a "Moderate" threat of fire as mapped by this system.[4] While groundcover and topography are the primary indices of fire vulnerability, there are other factors that can greatly influence the severity of a fire. Dry weather conditions, the natures of the fuel sources, the presence or absence of drought conditions, and the types of development present all have impacts on fire hazards. In Pomona, the critical times of the year when wildland fires could occur are the late summer and fall months, as the Santa Ana winds deliver hot, dry desert air into the region.

PROBABILITY OF FUTURE EVENTS

Although the probability of future wildfires in the region is high, the high fire risk areas of Pomona are largely isolated from the fire prone mountainous areas in the region. Therefore, the probability of large wildfires in the San Gabriel Mountains or other large open space areas in the region spreading to Pomona is not considered a high probability event. However, the City does have large areas of high fire risk, particularly in the southwestern corner of the City (in Phillips Ranch, Lanterman Center, and Cal Poly Pomona areas) and in the Ganesha Hills area. Provided with the right combination of factors (dry vegetation, Santa Ana winds), even a small fire could quickly spread and threaten nearby development.

8.3 VULNERABILITY ASSESSMENT

OVERVIEW

As a highly urbanized area, high risk to wildfire is limited to localized areas (see Figure 8-1). However, in those areas where the risk from wildfire is considered high, there are a number of vulnerabilities that should be considered in the mitigation planning process.

IDENTIFYING VULNERABILITIES

There are two critical facilities located within a High Threat Zone, and several vulnerable public and private schools. Parts of Cal Poly Pomona are also vulnerable to wildfire. Factors that decrease a structure's resistance to fire include combustible roofing material, wood construction, structures with no defensible space, and inadequate access for fire and other emergency vehicles. The highest rated risks from wildfire in Pomona are the residential communities near the wildland/urban

[3] http://www.usgs.gov/public/press/public_affairs/press_releases/pr1805m.html

[4] California Department of Forestry and Fire Protection, website: http://frap.cdf.ca.gov/data/frapgismaps/select.asp. Accessed June 6, 2004.

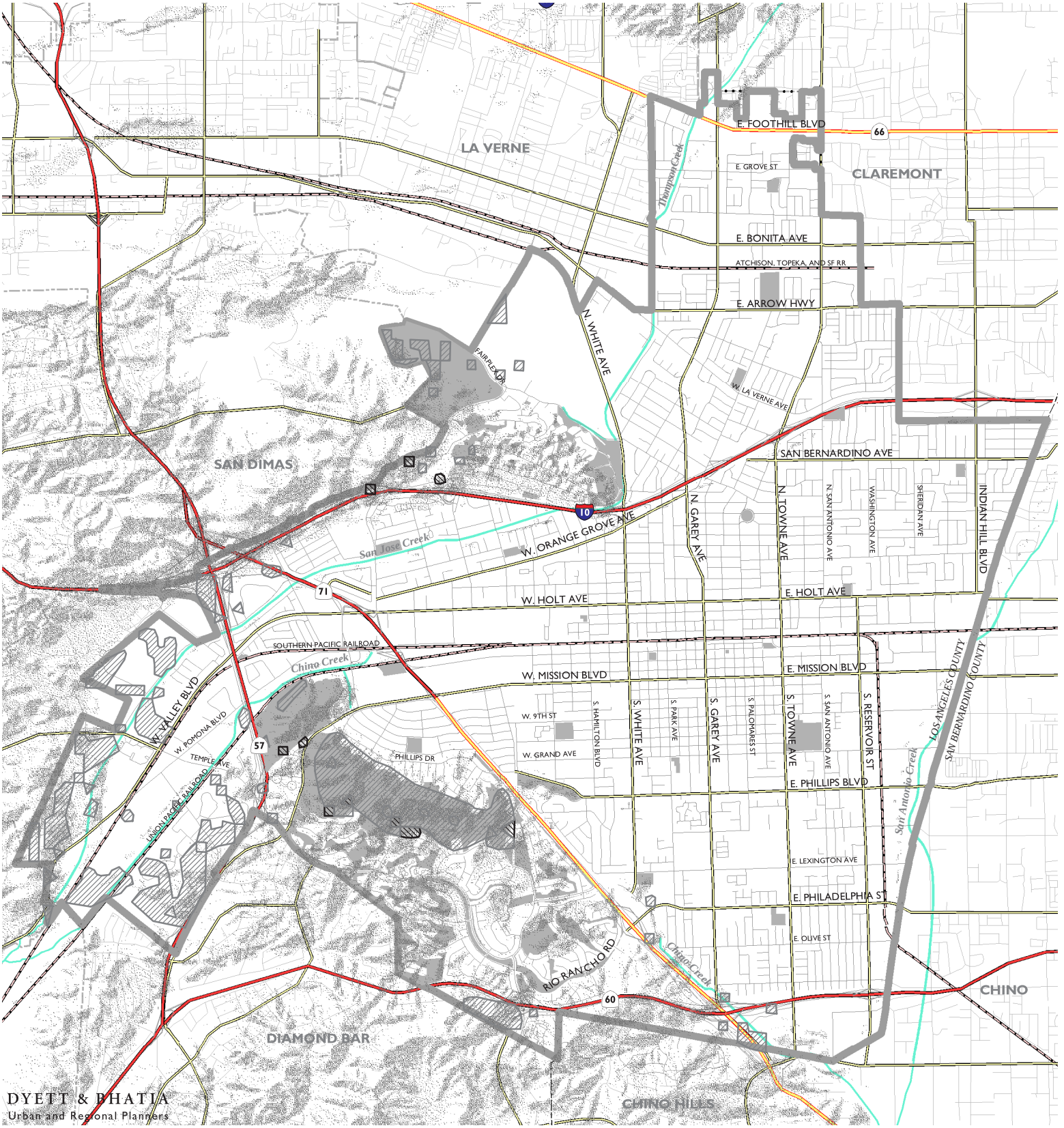


Figure 8-1

Wildfire Hazards

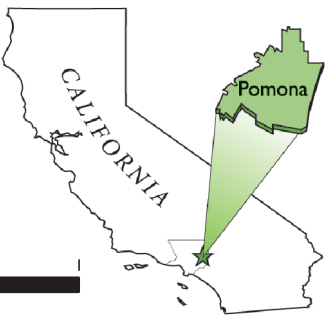
Fire Threat

- High
- Very High
- City Limits
- Sphere of Influence
- Open Space and Parks

Source:
Fire Threat, CA Dept.of Forestry and
Fire Protection, 2003; Basedata, City of Pomona, 2003.

POMONA
NATURAL HAZARDS
MITIGATION PLAN

0 0.25 0.5 1
Miles



interface. Not only are communities in Phillips Ranch and Ganesha Hills subject to fire risk due to prevalence of open spaces combined with steep slopes, but neighborhoods on the outskirts of fire hazard areas can be impacted by fire. This risk increases during Santa Ana wind conditions, with potential for property damage, injury, and fatalities. There are also a small number of facilities and assets that are considered to be at medium risk from wildfires in Pomona. These include the following:

- *Diamond Ranch High School.* The school is located in an area identified with a potential for wildfire. However, the modern building standards used in construction (including non-combustible materials) reduce the potential for damage to the facility. A more specific assessment of vulnerability, as well as potential mitigation, will be addressed in the Pomona Unified School District's Natural Hazards Mitigation Plan.
- *Cal Poly Pomona.* The open spaces around Cal Poly Pomona create the potential for high fire hazard. A more specific assessment of vulnerability, as well as potential mitigation, will be addressed in the university's Natural Hazards Mitigation Plan.
- *Lanterman Center.* Lanterman has large open space areas that are considered to have a high risk of wildfire. The State of California NHMP will establish needed mitigation for Lanterman.

ESTIMATING POTENTIAL LOSSES

The primary vulnerability in Pomona to wildfire is development within High or Very High Fire Threat Zones. However, it should be considered that the actual risk to these structures is dependent on a number of factors, most notably construction type, building standards, how a fire spreads, and the response from local fire crews.

8.4 EXISTING WILDFIRE MITIGATION ACTIVITIES

Existing mitigation activities include current mitigation programs and activities that are being implemented by county, regional, state, or federal agencies or organizations.

LOCAL PROGRAMS

In Southern California there are dozens of independent local fire departments as well as large county wide consolidated fire districts. Although each district or department is responsible for fire related issues in specific geographic areas, they work together to keep Southern California residents safe from fire. Although fire agencies work together to fight urban/wildland interface fires, each separate agency may have a somewhat different set of codes to enforce for mitigation activities.

In Pomona, fire protection is provided by the Los Angeles County Fire Department. The Fire Department not only provides response to fire emergencies, but also provides fire prevention, brush clearance, and education programs.

FIRE CODES

Developments within high fire threat are subject to the City of Pomona Zoning Ordinance and the California Building Code. These codes require buildings to incorporate fire resistant materials, maintain setbacks between buildings, and maintain landscaping and clear fire hazard brush. Both the Zoning Ordinance and the Building Code are subject to regular updates.

FEDERAL PROGRAMS

Federal Emergency Management Agency (FEMA) Programs

FEMA is directly responsible for providing fire suppression assistance grants and, in certain cases, major disaster assistance and hazard mitigation grants in response to fires. The role of FEMA in the wildland/urban interface is to encourage

comprehensive disaster preparedness plans and programs, increase the capability of state and local governments, and provide for a greater understanding of FEMA programs at the federal, state and local levels.[5]

Fire Suppression Assistance Grants

Fire Suppression Assistance Grants may be provided to a state with an approved hazard mitigation plan for the suppression of a forest or grassland fire that threatens to become a major disaster on public or private lands. These grants are provided to protect life and improved property and encourage the development and implementation of viable multi-hazard mitigation measures and provide training to clarify FEMA's programs. The grant may include funds for equipment, supplies and personnel. A Fire Suppression Assistance Grant is the form of assistance most often provided by FEMA to a state for a fire. The grants are cost-shared with states. FEMA's US Fire Administration (USFA) provides public education materials addressing wildland/urban interface issues and the USFA's National Fire Academy provides training programs.

National Wildland/Urban Interface Fire Protection Program

Federal agencies can use the National Wildland/Urban Interface Fire Protection Program to focus on wildland/urban interface fire protection issues and actions. The Western Governors' Association (WGA) can act as a catalyst to involve state agencies, as well as local and private stakeholders, with the objective of developing an implementation plan to achieve a uniform, integrated national approach to hazard and risk assessment and fire prevention and protection in the wildland/urban interface. The program helps states develop viable and comprehensive wildland fire mitigation plans and performance-based partnerships.

[5] Source: National Interagency Fire Center, Boise ID and California Division of Forestry, Riverside Fire Lab.

8.5 PROPOSED WILDFIRE MITIGATION ACTION ITEMS

Mitigation Action 2.3: **Reinforcement of Other City Facilities**

Conduct a structural assessment of City-owned properties constructed prior to the 1976 Building Code—which contain the latest seismic safety structural requirements—to identify buildings needing seismic safety improvements. This assessment should include City Hall, the Pomona Library, fire and police facilities, and community/recreation centers (particularly the Ganesha Hills Center). Prioritize improvements according to 1) minimizing injury and life loss, 2) ensuring emergency services and response, 3) ensuring distribution of hazard-resistant emergency facilities across the City to maximize emergency response and accessibility. Also consider cost-effectiveness in the prioritization ranking.

Lead Department: Redevelopment

Implementation Schedule: Mid-term

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objectives 1.1.1, 1.1.2, 1.1.3).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

Mitigation Action 2.5: **Water Reservoir Seismic Retrofit Completion**

Complete the program to retrofit the City's reservoirs to withstand strong ground shaking during earthquake events. While six of the City's 22 reservoirs have been improved, a number remain vulnerable and need seismic safety valves. Reservoir

damage could result in widespread water service disruptions and diminished fire fighting capabilities.

Lead Department: Utility Services

Implementation Schedule: Short-term

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

Mitigation Action 2.6: **Aging Water and Sewer Infrastructure Replacement**

As an older City with the development in the City center dating back to the late 1800s —including the system of water wells and pipelines— portions of the City's water and sewer infrastructure are in need of extensive maintenance and/or replacement. Older infrastructure is more prone to damage and service disruptions during earthquake, with potential ramifications for public safety and fire fighting capabilities. Continue to fund and prioritize water and sewer infrastructure improvements to reduce the potential for these hazard-related risks. Use the Sewer and Water Master Plans currently under preparation as the basis for the improvement schedule.

Lead Department: Utility Services

Implementation Schedule: On-going

Hazards Addressed: Earthquake, Wildfire

Goals and Objectives Implemented:

Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).

Goal 5.1: Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

Mitigation Action 5.4: **Reduced Wildfire Threat**

Continue existing programs to reduce risk of property damage and injury from wildfire, including:

- Citywide prohibition of new wood and wood shake roofing materials, and requirement of fire-resistant materials for re-roofing projects;
- Requirement of tile roofs in Phillips Ranch;
- Development of fire-resistant landscape program in coordination with Ganesha Hills homeowners; and
- County Fire Department weed abatement and brush clearance program.

Further measures to reduce the risks of wildfire include:

- Exploring options for further decreasing fire hazards through requirements established by ordinance in Ganesha Hills; and
- Limiting any increases in residential densities in wildfire hazard areas through appropriate land use policy applications in the General Plan Update.

Lead Department: Community Development, Fire

Implementation Schedule: Ongoing

Hazards Addressed: Wildfire

Goals and Objectives Implemented:

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objective 1.3.1).

Goal 3.1: Balance natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment (Objectives 3.1.1, 3.1.2).

9 Flooding

9.1 INTRODUCTION

Flooding has not been a serious hazard to Pomona in several decades, and the risk of disastrous flooding in the City is considered relatively small when compared to the potential for earthquake or wildfire damage to the City. Pomona does not lie within a 100- or 500- year floodplain, as delineated by the Federal Emergency Management Agency (FEMA). Although bisected by several waterways, these creeks have all been channelized, and remain dry except during storm events. However, the potential for a flood event still exists within Pomona, and it is an important hazard to be addressed in the City's NHMP.

9.2 HAZARD PROFILE

HAZARD DESCRIPTION

Flooding hazards are directly related to precipitation (rainfall) intensity and duration. Topography, type and extent of vegetation coverage, amount of impermeable surfaces, local slope characteristics, and available drainage facilities all factor into an area's ability to divert precipitation runoff. However, a key element in safely managing runoff volume is the extent of urbanized area. Urbanization increases the volume and velocity of runoff water via two main processes:

- Areas that would normally absorb rainfall (e.g., soils) have been replaced by impermeable surfaces (e.g., streets, houses); and
- The channelization and accumulation of runoff water adds to the collective whole, resulting in increased volumes and velocity.

The size, or magnitude, of a flood is described by a term called a "recurrence interval." By studying a long period of flow records for a stream, it is possible to estimate the size of a flood that would have a five-year recurrence interval (also called a five-year flood or five-year flood event). A five-year flood is one that would occur, on the average, once every five years (or has 20 percent of occurring during any year). Although a 100-year flood is expected to happen only once in a century, there is a one-percent chance that a flood of that size could happen during any year. The magnitude of flood events could be altered if changes are made to a drainage basin, such as an increase in the amount of impervious (i.e., urbanized) surfaces.

FEMA, as part of its statutory responsibilities to carry out the National Flood Insurance Program, has mapped most of the flood risk areas within the United States. In fact, most communities with a one percent chance of a flood occurring in any given year (100-year flood) have a floodway depicted on a Flood Insurance Rate Map (FIRM). However, according to FEMA, Pomona is designated as Flood Zone D, which is an area with "undetermined possible flood hazards".[1]

HISTORIC EVENTS

The history of flooding in Pomona provides an excellent basis to document the effectiveness of existing flood mitigation activities in the City. The flooding hazard is one that has been reduced, through mitigation, from a chronic and damaging natural disaster to a comparatively minor inconvenience to the residents of Pomona.

The City of Pomona is built on the edge of the San Antonio Canyon floodplain, and as a consequence was subjected to regular flooding events throughout its history. Witness reports describe floodwaters to the height of pickup truck beds and floodwaters covering the streets of downtown. In response to a series of particularly disastrous floods in the 1930s, the City developed an extensive network of flood control channels sufficient to provide protection

[1] FEMA, personal communication with Map Specialist, March 15, 2004.

from major flood events (for details on flood channels, refer to the Section 11.6: Existing Flood Mitigation).[2]

The City of Pomona was not alone in improving its flood control measures. The floods that affected the City were widespread and damaging in many cities in the vicinity; regional flood control structures were constructed as part of the Santa Ana River Basin flood protection program, authorized by the Flood Control Acts of 1936 and 1938.[3] These improvements included the San Antonio Dam, which was constructed and is currently located five miles northeast of the City.

Following construction of the flood control measures—which were collectively completed during the late 1950s and 1960s—the City of Pomona witnessed a drastic reduction in flooding hazards. Flooding hazards are now restricted to localized pockets of inundation, primarily in low-lying areas such as underpasses or locations with deficiencies in the storm drainage system. This local flooding occurs on a seasonal basis, depending on the intensity and duration of precipitation during the wet season.

HAZARD LOCATION AND EXTENT

Although Pomona does not lie within a designated floodplain management area, flooding is still a potential hazard to the community. The two types of flooding that could affect the City of Pomona are storm-related flooding and dam inundation.

Storm Related Flooding

Although the City has not experienced large-scale storm-related flooding since the construction of flood control infrastructure, localized inundation remains a concern for Pomona residents. Members of the community have indicated that heavy rainfall results in highly localized areas of minor flooding. This assertion is quantified by data provided by the Federal Emergency Management Agency (FEMA). The City has participated in FEMA's National Flood Insurance Program since 1984, and since that time FEMA has received five loss claims and made payments totaling approximately $39,000.[4] Although exact locations of recorded flood damage were unavailable at the time of publication of this plan, known locations with flooding issues include low-lying underpasses and locations with deficiencies in the storm drainage system. Specific locations of concern are depicted on Figure 9-1 and listed below:[5]

- Underpasses at the intersections of Garey, Towne, and White Avenues and the Union Pacific Railroad tracks;
- East End Avenue, between Mission Boulevard and Grand Avenue;
- Ninth Street, between the Union Pacific Railroad tracks and East End Avenue; and
- Cul-de-sacs bounded by SR-60, County Road, Garey Boulevard, and Reservoir Street.

While localized flooding does impede traffic flow, the extent of the flooding hazard in Pomona does not overwhelm the City's resources or result in significant adverse impacts.

Dam Inundation

The more widespread and serious flooding risk to Pomona is presented by the hazard of dam inundation. There are four impoundments in the vicinity of Pomona, two of which have the potential to flood the City in the event of dam failure. Although this hazard would have the potential to cause greater injury and property damage than the

[2] Ibid.

[3] U.S. Army Corps of Engineers, Los Angeles District Reservoir Regulation Section website. http://www.spl.usace.army.mil/resreg/htdocs/snto.html.Accessed July 2004.

[4] Federal Emergency Management Agency, National Flood Program website: http://www.fema.gov/nfip/10400312.shtm#06. Accessed July, 2004. Refers to claims processed through December 31, 2003.

[5] Technical Advisory Committee Members, Verbal Communication, May 6, 2004.

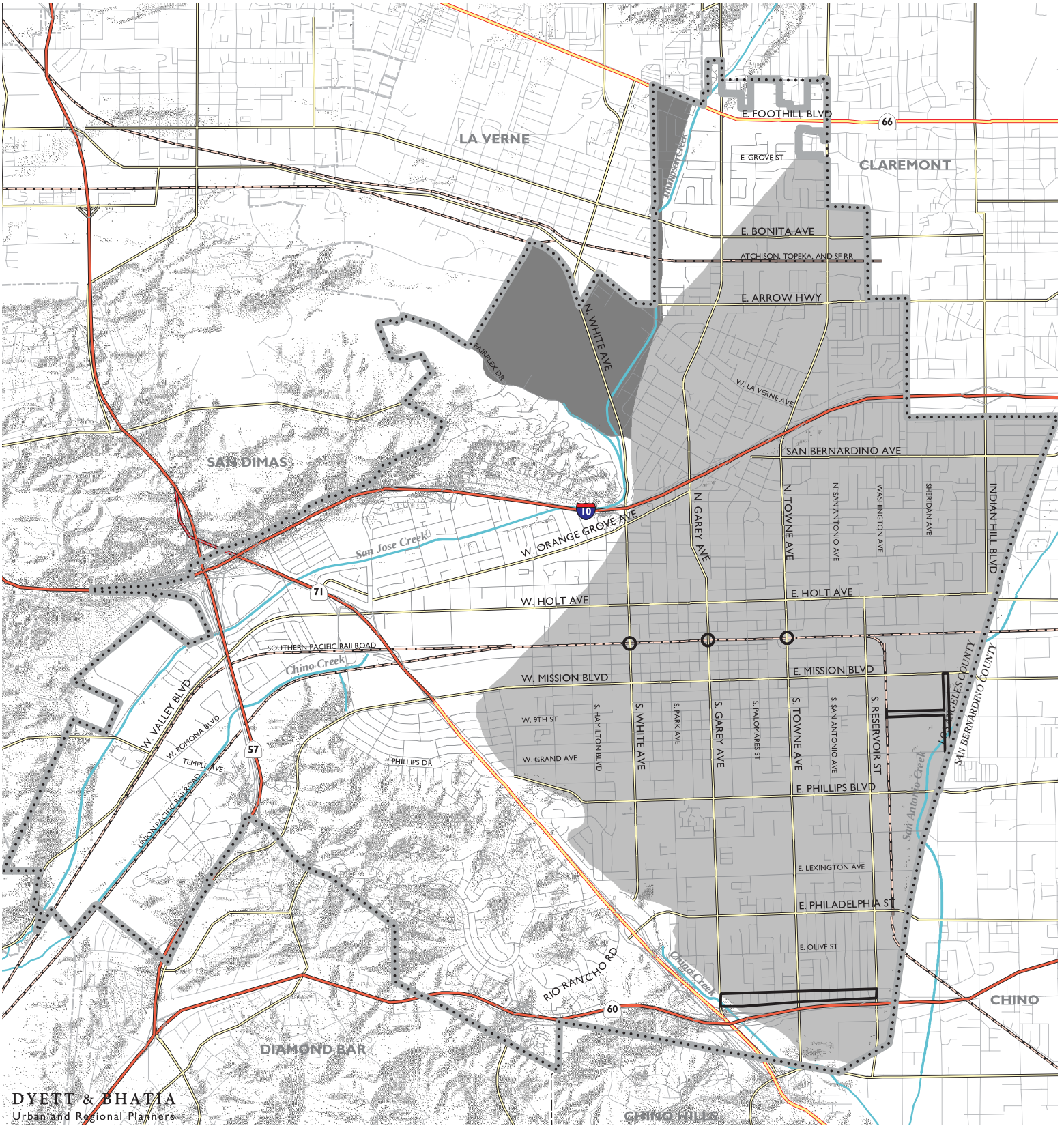


Figure 9-1

Flooding Hazards

Indundation Limits from Dam Failure

- Live Oak Reservoir
- San Antonio Dam
- Area with Localized Storm-Related Flooding
- City Limits
- Sphere of Influence

Source:
Basedata: City of Pomona, 2003; Dam Inundation: City of Pomona, "Master Environmental Assessment," April 1994; Localized flooding: Communication with Technical Advisory Committee and City Staff, 2004.

POMONA NATURAL HAZARDS MITIGATION PLAN

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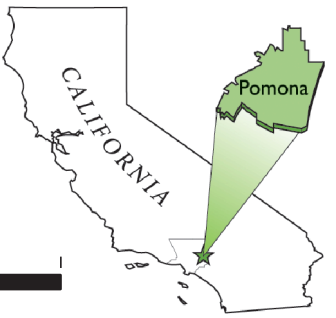

storm-related flood events, the likelihood of occurrence is vastly lower.

San Antonio Dam

The San Antonio Dam, completed in 1956, is located approximately five miles northeast of the City. The dam is operated by the United States Army Corps of Engineers (USACE). This dam serves primarily as a major flood control structure and therefore does not store large quantities of water except during periods of heavy rain. However, the reservoir has a capacity of 9,350 acre-feet of water and, when full, failure or rupture of the San Antonio Dam would release waters and result in the flooding of areas south of the dam. This area includes large portions of the City, in northern and eastern Pomona.[6] In total, the amount of Pomona at risk to inundation (7,170 acres) equals 48 percent of the City's total land area. The San Antonio Dam inundation boundary is illustrated in Figure 9-1.

Live Oak Reservoir

The Live Oak Reservoir also poses a flooding threat to Pomona. This reservoir is operated by the Metropolitan Water District of Southern California (MWD), and is utilized for flood control and water conservation purposes. It is located on unincorporated County land between the Cities of La Verne and Claremont, approximately two miles north of Pomona. This reservoir is smaller than the San Antonio Dam, and has a maximum capacity of 2,500 acre-feet.[7] In the event of failure of this reservoir, northern portions of the City could be inundated, primarily at the Fairplex. The total amount of land area subject to flooding from this dam is 640 acres, which accounts for four percent of the City. Figure 9-1 illustrates the areas that could be subject to inundation in the event of dam failure.

[6] City of Pomona, *Master Environmental Assessment*, April 1994.

[7] City of Pomona. *Materials Recovery Facility Draft Environmental Impact Report*. April 1996.

PROBABILITY OF FUTURE EVENTS

It is unlikely that the City of Pomona will experience significant storm-related flooding in the future, comparable to the scale of floods that took place in its early history. The considerable flood control infrastructure that was developed mid-century has been very effective in preventing large-scale flood events. On the other hand, it is anticipated that localized flooding will continue to occur in the City in the absence of appropriate mitigation measures.

The probability of dam inundation is low. For much of the year, the water levels at these dams are very low or empty. Due to the distance between the reservoirs and Pomona, even in the unlikely event of a dam breach—depending on the water level of the reservoirs—the flood may not even reach City limits.

9.3 VULNERABILITY ASSESSMENT

OVERVIEW

The City of Pomona has a low vulnerability to flood hazards. Current flood control measures effectively prevent the types of damaging floods that were experienced in the 1930s. Current flood issues are restricted to localized street inundation during heavy storm events and the potential for flooding due to dam inundation. Although localized flooding occurs seasonally, it is has minimal impacts on the City due to its limited location and extent. Dam inundation is also considered to be a low impact hazard. Although it would be far more damaging if it took place, the probability of dam failure is very low due to the engineering standards and safety procedures in place at the dams whose failures would impact the City.

IDENTIFYING VULNERABILITIES

The City of Pomona is quite resilient to storm-related flooding. Due to the limited scope of the hazard, no structures are considered directly vulnerable to flood damage.

The greatest impact caused by storm-related flooding is impediments to the circulation of traffic. Motorists are required to make detours when

flooding renders streets impassible. This is typically nothing more than an inconvenience; however, flooding at the underpasses at the Southern Pacific Railroad are a greater vulnerability to Pomona that the other flooding locations.

These major north-south arterials are the only transportation routes that have underpasses constructed beneath the railroad. In the event of a train derailment in the City, it would be crucial for these routes to remain open, as they are the only routes that would not be subjected to closure by a train derailment. North-south circulation in Pomona is crucial to be able to maintain access to the City's only hospital, the Pomona Valley Hospital Medical Center. If the underpasses were flooded during such an event, it would seriously hamper the ability of emergency response vehicles to traverse the City and gain access to the hospital. Although a highly improbably series of events would have to occur in order to result in this scenario, "worst case scenario" analysis is essential to address multi-hazard planning challenges and maximize mitigation effectiveness. For this reason, the underpasses of Garey, White, and Towne Avenues are considered vulnerabilities to the City, and are specifically addresses in the multi-hazard action plan items.

A tremendous number of critical facilities and vulnerabilities are located within the San Antonio Dam inundation zone. The extent of the hazard includes all of downtown Pomona, including all of the critical facilities necessary for emergency government operations. Approximately half of all of the fire and police stations would potentially be inundated, along with two medical facilities, including Pomona Valley Hospital. Thirty-five public and private schools are located within the flood zone as well. The inundation boundary also covers the length of several primary commercial corridors and industrial areas that have clusters of hazardous materials sites, which could be released into the flow of water during a disastrous flood. Approximately 21,000 residences are located within the area of inundation. Table 9-1 provides more detailed information about the types and number of facilities located within dam inundation limits.

Table 9-1: Structures Located within Dam Inundation Limits

	San Antonio Dam	*Live Oak Reservoir*
Low Density Residential	13,970	434
Medium Density Residential	3,242	1
High Density Residential	3,424	258
Automotive, Motels, and Service Commercial	247	2
Retail Commercial and Shopping Centers	86	-
Office	82	-
Light Industrial	878	-
Heavy Industrial and Outdoor Storage	26	-
Parks and Open Space	5	-
Education	15	-
Public, Civic, and Institutional	66	1
Vacant Land	26	-
Total	22,067	696

Source: L.A. County Assessor Parcel Data, GIS format, 2004.

There are relatively few critical facilities and vulnerabilities in the inundation limit of Live Oak Reservoir. The majority of the flooding would occur on grounds currently occupied by the Fairplex. However, approximately 700 residences are located within the inundation area, and would require significant emergency evacuation and response in the unlikely event of dam failure (see Table 9-1).

It is important to emphasize that the risk of widespread, damaging floods from dam inundation is very low. If a dam breach were to occur, the floodwaters would take several hours to reach the City. If a dam breach did occur, the scenario of dam

failure In Pomona would be that of a slow-moving, shallow body of water, rather than a catastrophic release of damaging water volumes.

ESTIMATING POTENTIAL LOSSES

Quantifying potential losses due to flooding is a complex process. The primary source of potential flooding damage to the City is dam inundation, a hazard that is highly unlikely to happen. In the event of a dam failure, factors such as the amount of water in the reservoir (both of the reservoirs' water levels fluctuate seasonally), rate of water output, and ability to implement emergency notification procedures would significantly influence the amount of loss sustained by the City.

9.4 EXISTING FLOOD MITIGATION ACTIVITIES

Flood mitigation activities listed here include current mitigation programs and activities that are implemented by the City of Pomona or other agencies.

FLOOD MANAGEMENT PROJECTS

Flood management structures can assist in regulating flood levels by adjusting water flows upstream of flood-prone areas. There are four dams in the immediate vicinity of the City, holding a total roughly 30,000 acre-feet of water. Releases of water from the impoundments are designed to protect the City of Pomona from high floodwaters. These facilities are:

- *San Antonio Dam and Reservoir*. 9,350 acre-feet (San Antonio and Chino Creeks);
- *Live Oak Reservoir*. 2,500 acre-feet (Live Oak)[8];
- *Puddingstone Dam and Reservoir*. 17,400 acre-feet (Walnut Creek); and
- *Thompson Creek Dam and Reservoir*. 812 acre-feet (Cobal, Williams, Palmer, Padua, and Thompson Creeks).[9]

STORMWATER SYSTEMS

Pomona has an extensive storm drainage network to prevent flooding by conveying water off the streets and into drainage channels. Its existing drainage system is an urban network that generally consists of curbside catch basins, inlet structures, and manholes connected by reinforced concrete laterals and main lines, draining into storm drain channels. The City has approximately 30 miles of drainage pipes and 300 miles of streets that are designed to withstand a 100-year storm event.

Stormwater runoff is transported via this network to five major channels. These channels are lined with concrete and designed to accommodate a 200-year storm event:[10]

- *San Antonio Creek and Flood Control Channel.* Located along the westerly and southwesterly limits of the City, it connects to Chino Creek going south;
- *Chino Creek.* Located along the southerly portion of the city in the Puente Hills, it joins to San Antonio Creek further south;
- *Thompson Creek.* Runs from north to south through the northern portion of the City, it bends westward and becomes North San Jose Creek;
- *North San Jose Creek.* Located in the western part of the City, it drains to the Whittier Narrows; and
- *South San Jose Creek.* Parallel to and south of North San Jose Creek in the western portion of the City, starting from the Corona Expressway and going southwest; drains to the Whittier Narrows.[11]

[8] City of Pomona. *Materials Recovery Facility Draft Environmental Impact Report.* April 1996.

[9] Los Angeles County Department of Public Works. *Hydrologic Report: 1996-1997*. 1997.

[10] City of Pomona, *Master Environmental Assessment*, 1994.

[11] Ahmad Ansari, City of Pomona P.E. / Assistant City Engineer, written communication, February 6, 2004.

DAM EMERGENCY PREPAREDNESS

Due to the potential severity of dam failures, FEMA requires that all dam owners develop Emergency Action Plans (EAP) for warning, evacuation, and post-flood actions. Plans have been established by the USACE and MWD to protect residents and businesses of the affected area in case of dam failures.

9.5 PROPOSED FLOODING MITIGATION ACTION ITEMS

Mitigation Action 2.7: **Localized Flood Control Improvements**

While the City has an effective flood control system, several localized areas continue to be subject to storm-related flooding. These include underpasses at the intersections of Garey, Towne, and White Avenues and the Union Pacific Railroad tracks; East End Avenue, between Mission Boulevard and Grand Avenue; Ninth Street, between the Union Pacific Railroad tracks and East End Avenue; and cul-de-sacs bounded by SR-60, County Road, Garey Boulevard, and Reservoir Street. In addition, five claims for National Flood Insurance Program assistance were filed between 1978 to 2003, indicating the need for improvements.

Conduct a study of these localized flooding hazards and identify needed improvements. Determine priority for implementation in part with cost-effectiveness analysis. Once the improvements are identified, consider options for requiring construction of the improvements as part of development projects if appropriate and feasible.

Lead Department: Public Works

Implementation Schedule: Mid-term

Hazards Addressed: Flooding

Goals and Objectives Implemented:

> *Goal 1.1:* Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).
>
> *Goal 5.1:* Ensure continued operations when the City is impacted by natural hazard events (Objective 5.1.1).

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10 Windstorms

10.1 INTRODUCTION

Windstorms have not been a serious hazard in Pomona, and the potential risk of widespread damage from wind is not as considerable as the risk from earthquakes or wildfires. Nevertheless, severe windstorms pose a significant risk to life and property by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. High winds can and do occasionally cause damage to local homes and businesses. Severe windstorms can present a very destabilizing effect on the dry brush that covers local hillsides and urban wildland interface areas and increase wildfire threat. Destructive impacts to trees, power lines, and utility services also are associated with high winds.

10.2 HAZARD PROFILE

HAZARD DESCRIPTION

Santa Ana Winds

Based on local history, most incidents of high wind in the City of Pomona are the result of Santa Ana wind conditions. While high impact wind incidents are not frequent in the area, significant Santa Ana wind events have been known to negatively impact the local community.

Santa Ana winds are blustery, warm – (often hot) – dry winds that blow from the east or northeast. These occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles basin, and typically occur from October to March when cooler air in the desert increase air pressure and creates the westward winds. Generally speaking, winds must reach 25 knots to be classified as a Santa Ana wind.

Figure 10-1: Santa Ana Winds

The map above (Figure 10-1) shows the direction of the Santa Ana winds as they travel from the stable, high-pressure weather system called the Great Basin High through the canyons and towards the low-pressure system off the Pacific. Located between Los Angeles and the San Bernardino Mountains, and south of the San Gabriel Mountains, the City of Pomona is in the direct path of the ocean-bound Santa Ana winds.

HISTORIC EVENTS

While the effects of Santa Ana Winds are often overlooked, it should be noted that in 2003, two deaths in Southern California were directly related to the fierce condition. A falling tree struck one woman in San Diego.[1] The second death occurred when a passenger in a vehicle was hit by a flying pickup truck cover launched by Santa Ana winds.[2]

In Pomona, the City does not track damage due to windstorms. However, reports of dislodged roofs and fallen trees and power lines are common. These are not considered major widespread threats to population and property, but do involve responses

[1] www.cbsnews.com, January 8, 2003

[2] www.cbsnews.com/stories/2003/01/06/national/

from emergency service personnel. Fallen power lines have potential for most widespread consequences of power outages and fire. It should be noted that falling trees can occasionally cause fatalities and serious structural damage. These types of incidents are rare in occurrence as well as localized. Due to their limited impacts, none of the risks associated with windstorm are considered high.

HAZARD LOCATION AND EXTENT

Windstorms that affect Pomona, notably Santa Ana winds, are not location specific but rather impact the entire City area. Passes between hillsides are susceptible to slightly higher wind speeds, although the amount of unsheltered development in hillside passes is not substantial.

In the case of a Santa Ana wind – which can last several days – hazards created by wind-fallen trees or utility poles can threaten property and have the potential for personal injury and even death. In Pomona, older neighborhoods generally have larger trees. Although these trees are usually large and well-rooted enough to withstand higher speed winds, tree limbs can create significant hazards.

PROBABILITY OF FUTURE EVENTS

Strong Santa Ana winds typically occur on an annual basis; although it is unlikely that Pomona will be subject to widespread damage from wind storm activity, there is potential for isolated events, such as damage to property or communication utilities from the Santa Ana winds which occur frequently during the October to March season. However, it must also be noted that although Santa Ana winds are frequent, the occurrence of a wind with enough velocity to cause significant damage is much less frequent.

10.3 VULNERABILITY ASSESSMENT

OVERVIEW

Based on local history, there has been past occurrences of winds strong enough to create damage to property in Pomona. However, there has not been a recorded instance of a windstorm strong enough to create wide spread damage in Pomona. Damage is usually restricted to isolated roof and tree damage.

Life and Property

Based on the history of the region, windstorm events can be expected, perhaps annually, across widespread areas of the region that can be adversely impacted during a windstorm event. This can result in the involvement of City emergency response personnel. Both residential and commercial structures with weak reinforcement are susceptible to damage. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift suction forces that pull building components and surfaces outward. With extreme wind forces, the roof or entire building can fail causing considerable damage.

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls. When severe windstorms strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

Utilities

Historically, falling trees have been the major cause of power outages in the region. Windstorms can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Falling trees can bring electric power lines down to the pavement, creating the possibility of electric shock.

Infrastructure

Windstorms can damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds.

Windstorms can result in collapsed or damaged buildings or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric services and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damages and interrupted services.

Increased Fire Threat

Perhaps the greatest danger from windstorm activity in Southern California comes from the combination of the Santa Ana winds with the major fires that occur every few years in the urban/wildland interface. With the Santa Ana winds driving the flames, the speed and reach of the flames is even greater than in times of calm wind conditions. The higher fire hazard raised by a Santa Ana wind condition requires that even more care and attention be paid to proper brush clearances on property in the wildland/urban interface areas.

Transportation

Windstorm activity can have an impact on local transportation in addition to the problems caused by downed trees and electrical wires blocking streets and highways. During periods of extremely strong Santa Ana winds, major highways can be temporarily closed to truck and recreational vehicle traffic. However, typically these disruptions are not long lasting, nor do they carry a severe long-term economic impact on the region.

IDENTIFYING VULNERABILITIES

The City of Pomona is not prone to widespread damage from wind and there are no critical facilities and vulnerabilities considered at high risk from windstorms.

ESTIMATING POTENTIAL LOSSES

Potential losses from windstorms are expected to be primarily limited to isolated impacts to property such as roof or tree damage. There are no areas of specific risk in Pomona; losses are not expected to be significant to the City.

10.4 EXISTING MITIGATION ACTIVITIES

As stated, one of the most common problems associated with windstorms is power outage. High winds can cause trees to bend, sag, or fail (tree limbs or entire trees), coming into contact with nearby distribution power lines. Fallen trees can cause short-circuiting and conductor overloading. Wind-induced damage to the power system causes power outages to customers, incurs cost to make repairs, and in some cases can lead to ignitions that start wild land fires.

CALIFORNIA CODE

One of the strongest and most widespread existing mitigation strategies pertains to tree clearance. Currently, California State Law requires utility companies to maintain specific clearances – depending on the type of voltage running through the line – between electric power lines and all vegetation.

The following California Public Resource Code Sections establish tree pruning regulations:[3]

- 4293: Power Line Clearance Required
- 4292: Power Line Hazard Reduction
- 4291: Reduction of Fire Hazards Around Buildings
- 4171: Public Nuisances

The following pertain to tree pruning regulations and are taken from the California Code of Regulations:

- Title 14: Minimum Clearance Provisions
- Sections 1250-1258
- General Industry Safety Orders
- Title 8: Group 3: Articles 12, 13, 36, 37, 38
- California Penal Code Section 385

Finally, the following California Public Utilities Commission section has additional guidance:

- California Public Utilities Commission
- General Order 95: Rule 35

Failure to allow a utility company to comply with the law can result in liability to the homeowner for damages or injuries resulting from a vegetation hazard. Many insurance companies do not cover these types of damages if the policy owner has refused to allow the hazard to be eliminated.

The power companies, in compliance with the above regulations, collect data about tree failures and their impact on power lines. This mitigation strategy assists the power company in preventing future tree failure. From the collection of this data, the power company can advise residents as to the most appropriate vegetative planting and pruning procedures.

[3] www.cpuc.ca.gov/js.asp

10.5 PROPOSED WIND STORM MITIGATION ACTIVITIES

***Mitigation Action 5.2:* Vulnerable Building Reinforcement**

As shown in Figure 3-3, much of the City was developed prior to current seismic standards. Older homes and buildings may require structural intervention to avoid significant damage in the event of a major earthquake. In addition, the clusters of mobile homes in the City may need reinforcements such as foundation strappings. Structural interventions are often straightforward and cost-effective, such as bolting structures to foundations. Through the community education campaigns, educate property owners about areas with structures potentially needing reinforcement, and provide technical assistance to property owners with vulnerable buildings to implement retrofit standards.

This action will be most effective when City building inspection staff are directed to prioritize identification and reinforcement of vulnerable buildings, are appropriately trained to detect vulnerable buildings and make reasonable, cost-efficient recommendations, and are consulted during formulation of community education campaigns.

The City currently offers a program for substantial rehabilitation of residential properties for low and moderate income households, funded with tax increment income from the redevelopment project areas. Expand the improvements eligible for funding to include seismic safety and windstorm structural reinforcements. Pursue grant funds for improvements benefiting special need population.

Lead Department: Community Development, Redevelopment

Implementation Schedule: Short-term

Hazards Addressed: Earthquake, Windstorm

Goals and Objectives Implemented:

Goal 1.3: Minimize losses to existing property and reduce potential for damage to future development (Objectives 1.3.3, 1.3.4).

Goal 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards (Objectives 2.1.5, 2.1.6).

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Appendix A

Public Participation

Appendix A: Public Participation

Public participation is a mandatory and essential component in the process of effective hazard mitigation planning. A strategic, multi-faceted public participation process establishes communication lines whereby residents, local stakeholders, and emergency response partners can contribute their local knowledge and experience and help prioritize mitigation actions.

When initially laying out the planning process for the Natural Hazards Mitigation Plan (NHMP), the City of Pomona integrated public participation into all steps to allow for incremental input and feedback. Furthermore, a variety of outreach methods were employed to allow for participation by the diversity of interests in the City, including public workshops and meetings, an advisory committee, and special publications. Because the Pomona General Plan Update was underway at the time of NHMP preparation kick-off, the City was able to use some of the public participation structures that had been established earlier for the General Plan Update.

The components of the NHMP public participation program are described in the sections following below.

TECHNICAL ADVISORY COMMITTEE

A Technical Advisory Committee was formed for assistance with NHMP preparation. As shown in Table A-1, the TAC was comprised of approximately 25 representatives of City departments, school district, utility and emergency service providers, and surrounding cities. The series of four meetings conducted at strategic points in the planning process allowed the TAC to review incremental materials and provide feedback based on their area of expertise and experience.

MEETINGS

Meeting #1: Issue Identification and Data Needs
May 6, 2004

At this kick-off meeting, the project team made a presentation on the purpose and scope of the NHMP and the process for plan preparation. Data needs were discussed and TAC members identified information that they could provide. The TAC was also asked to provide input on the roster of stakeholders that would be used for project announcements and invitations to the Public Scoping Meeting.

The bulk of the meeting consisted of roundtable discussion on the types of natural hazards that affect Pomona and associated risks. There was discussion of historic and recent hazard events, as well as mitigation activities that are currently undertaken by the City. This input helped the project team to focus the research and analysis tasks.

Meeting #2: Hazard and Risk Assessment Review
June 9, 2004

At this meeting, the project team presented conclusions from research on hazards and associated risks to the TAC. This presentation represented culmination of highly intensive research—using GIS—of earthquake, flooding, wildfire, and windstorm hazards and the potential for impact to critical facilities and vulnerable populations. The risks were laid out in a detailed matrix—the final version of this matrix is located in Appendix B. The matrix also provided ratings of low, medium and high relating to the intensity and probably impact on the population and activity of the City. The purpose of the rating system was to narrow down the risk scenarios for priority in the mitigation plan.

Table A-1: Technical Advisory Committee Roster

Name	*Affiliation*	*Name*	*Affiliation*
Rick Gomez, AICP, Director	Community Development Department City of Pomona	Jim Enriquez, Battalion Chief	Fire Department County of Los Angeles
Matthew Bassi, Planning Manager	Community Development Department City of Pomona	Leticia Pacillas	Fire Department County of Los Angeles
Ron Shinn, Senior Management Analyst	Community Development Department City of Pomona	Brenda Hunemiller, Area "D" Disaster Management Area Coordinator	Office of Emergency Services
Carrie Cruz, Emergency Preparedness Coordinator	Police Department City of Pomona	David Amdahl, Representative	Pomona Chapter Red Cross
Matthew Gorman Attorney	City Attorney's Office City of Pomona	Amy McElwain, Director of Risk Management	Pomona Unified School District
Tim Connor, Water Distribution Supervisor	Utility Services City of Pomona	Isela Vazquez	Pomona Unified School District
Monique Valdez, Public Information Officer	City Manager's Office City of Pomona	Joe Williams, Director, Maintenance and Operations	Pomona Unified School District
Londa Bock-Helms, Principal Accountant	Finance Department City of Pomona	Ron Young	Pomona Unified School District
Cynthia Montero, Building Permit Technician	Building and Safety Division City of Pomona	Dr. Richard Hyslop, Chair	Geography Department Cal Poly Pomona
Teeo DeLaPaz, Contracts Coordinator	Community Services Department City of Pomona	Debbi McFall, Emergency Preparedness Coordinator	Cal Poly Pomona
Kenneth Van Lul, Vice President of General Services	Pomona Valley Hospital Medical Center	John Bingham, Consultant	City of Diamond Bar
Mike Vestino, Director of Facilities	Pomona Valley Hospital Medical Center	Robert Cruz, Public Affairs Manager	Southern California Gas Company

Source: Dyett and Bhatia, 2004.

The project team led the TAC through the identified risks, hazard by hazard. The TAC helped to identify risks that were missing from the matrix and fine-tuned the risk ratings and conclusions. Some ideas about mitigation actions also surfaced during this discussion.

Meeting #3: Goals and Objectives June 24, 2004

Building on the hazard and risk identification analysis, the project team drafted goals and objectives for the NHMP, organized by the topics of Protect Life and Property, Public Awareness, Natural Systems, Partnerships and Implementation, and Emergency Services. At the June 24th meeting, the TAC reviewed the draft goals and objectives and provided feedback. The mission statement, goals, and objectives established in Chapter 4 of the NHMP reflect the discussion that occurred in the meeting.

Meeting #4: Draft Mitigation Strategy July 8, 2004

At this meeting, the TAC reviewed and discussed the set of draft mitigation actions formulated by the project team. The mitigation actions built on the hazard and risk identification analysis and the goals and objectives. Additional mitigation measures were recommended by TAC members, and the meeting also served to better-define the types of programs and projects currently undertaken by the City to reduce and/or avoid the risks associated with natural hazards. There was also discussion about the number of public comments on the need for expanded information on emergency preparedness—see Public Workshops and Meetings below. The Mitigation Action Plan in Chapter 5 of the NHMP reflects the TAC's refinement of the mitigation strategy.

PUBLIC WORKSHOPS AND MEETINGS

Assistance from the public at large was enlisted to help identify the types of issues and risks to address in the NHMP. This was largely accomplished in a series of Public Workshops and a Public Scoping Meeting, which were previously scheduled as part of the General Plan Update.

Public Workshops

In April 2004, interactive public workshops were held in each of the City Council Districts in Pomona. Participants—totaling approximately 180—were led through a variety of exercises and activities designed to solicit opinions and ideas on a variety of planning issues in their neighborhoods and the City. The primary means of invitation was a newsletter distributed to all mailing addresses in the City. The workshop format integrated specific questions pertaining to the preparation of the Natural Hazard Mitigation Plan. Most relevant was the question: *When considering the City's planning for natural disasters, such as a major earthquake, what should be considered?*

The City received a variety of responses to this question, which are catalogued by District in Table A-2. Five themes recurred throughout each of the District workshops:

- Create effective channels of communication to provide access to information before, during, and after an event;
- Coordinate pre-disaster planning, including evacuation and disaster "drills," and public education;
- Establish well-known central locations for emergency aid and shelter in each District;
- Ensure the ability of emergency vehicles to traverse City (especially at railroad tracks, freeway, bridges, and other major crossings); and
- Provide adequate police and fire services to respond to a natural disaster.

Table A-2: Responses to Natural Hazard Question at District Workshops

District 1	
Information (3)	Fairplex
Emergency facilities (3)	Gas shutoffs
Evacuation plan (2)	Practice runs
First aid and water (2)	Earthquakes
Landslides	Safety of residences
Structural help for old buildings downtown	
District 2	
More police (3)	Information access
Good emergency plan (2)	Safety
More hospitals (2)	Fire
Evacuation plan (2)	Supply food and clothing
Clinics (2)	Transportation
Emergency shelter (2)	Hold safety workshops for residents
Safety of high-use buildings (schools, hospitals, stairs, etc)	Plan for people who do not have money to recover
Services	Educate the public
Temporary housing	
District 3	
Alarms (2)	Disaster plan (Fairplex)
Keeping access route to hospital open should the freeway collapse, two overpasses to south of the hospital	Preparing residents so they can take care of their families in case the city can't help them right away
Building code compliance	Keep most development single story
Organizing police, firefighters, paramedics	Emergency water services
Watch out for overcrowding	Informing the public on latest news
Safety	Updated and safe infrastructure on all buildings, housing, etc
The threats we face, likelihood of those threats being realized, relative potential damage that may result from each	
District 4	
Evacuation planning (4)	Ongoing educational program
Water protection (2)	Police protection
Well-organized disaster center (2)	Safety of residents
Communication system (2)	Shelter and support services
Fairplex (2)	Educate residents about gas lines, etc
Alameda Railroad corridor, only three overpasses; the city could be cut in half with no police response	Adequate emergency housing, food, educating residents about this prior to disaster
Central neighborhood gathering centers	Emergency housing
Make sure everybody knows where they can go	Assign staff, police to each district, hold meetings, etc

Table A-2: Responses to Natural Hazard Question at District Workshops

Ability of emergency vehicles to traverse city (railroad tracks, freeway, bridges, etc)	Consider that the city's fire system is already overburdened, add a fire station or two
Victorian houses	Good disaster plan
Neighborhood resources for each district	Density of population
Promote retrofit work for older homes	Communication for individuals
Toxic/hazard transport by rail	Improve public safety
Needs of those with disabilities, residents who don't speak English	Cost of rebuilding city, rebuilding destroyed homes, how funds are distributed
Fire protection	Getting to medical care
Volunteers get training before it happens	Older people coming out of their homes
Training	Food distribution
Good, organized plan, including all service groups	Getting preparation info to those who don't have "web" access
Empty drains properly	Access out of city
Improve police response	
District 5	
Central command (2)	Adequate public safety
More information (2)	Fairplex
The needs of many people	Local radio broadcast on AM
Earthquake protection in schools	Seismic upgrading for all buildings.
Water and utilities	Prepare
Underground utility	Central area to go to if there is a disaster
Safety service deployed to each neighborhood	
District 6	
Police protection	Shelter, food, and water
Central areas where water, emergency supplies, and aid can be obtained	Communication system to keep residents informed of all available help
Immediate care for after the disaster and preparedness kits	Use Fairplex as a resource location for disaster relief
Emergency medical, food, transportation, and civil order	Evacuation locations for large groups of people
Where to house residents that lose their homes	Need police facility for response north of Holt Ave. The train corridor will shut of response time for 15 minute periods
Water supply	Disaster plan
Have safe places for children, clean water and food stored	Neighborhood talks by fire department
Disaster response center, safe command center	Continuance of government, self sufficiency for 1-3 days
Communications	Food, shelter, crowd control
Need a central office to "find" people and get hop for losses	Good community organization, reach out for resident officers
Communication and education	Easy access to supplies and shelter

Table A-2: Responses to Natural Hazard Question at District Workshops

Ample firemen, police, and paramedics	Communication by radio and land speakers
Information for people and plans of assistant	
Train a group of people to rescue and help each other	Workshops to inform residents of the city's plans
Have residents participate in disaster drills	Emergency equipment
District 3 – Special Workshop	
A place for people without homes (3)	Hotels, motels, places to stay
Shelters and community assistance (2)	Help with the firemen
Some parts for people with need	Place for people who lose everything

Source: Dyett and Bhatia, 2004.

Public Scoping Meeting

A Public Scoping Meeting was held on June 24, 2004 to collect additional input from community members on hazard risks, mitigation, and preparedness issues. The Public Scoping Meeting served the purposes of the NHMP process as well as the environmental review process for the General Plan Update and the Pomona Unified School District's (PUSD) NHMP. Personal invitation letters were sent to approximately hundred individuals, organizations, and agencies identified as stakeholders in hazard mitigation planning, with input from the TAC. Invitations were also sent to the Public Workshop participants and entities pertinent to environmental review for the General Plan Update.

The meeting was opened up to public comment following presentations made on the Pomona NHMP, General Plan Update environmental review, and PUSD's NHMP. The public comment period continued for approximately one hour, and focused on issues such as:

- Need for improved and expanded code enforcement in overcrowded neighborhoods;
- Air quality impacts experienced by residents around some industrial areas;
- Stronger City leadership to implement adopted development policies;
- Circulation issues such as congestion, alley closures, and sidewalk impediments;
- Potential incompatibilities in mixed use areas; and
- Considering the diversity of populations in emergency preparedness planning.

WEBSITE AND OTHER COMMUNICATIONS

A website dedicated to the NHMP—www.ci.pomona.ca.us/nhmp—was established, to allow interested parties to sign up for announcements, stay informed about project progress, and expand access to project information including the Draft NHMP for public review and comment.

The City also widely distributed a glossy flyer that announced kick-off of the NHMP process, the purpose of the NHMP, and opportunities to participate. The flyer was distributed at the Public Workshops and Scoping Meeting, as well as City Hall and other public venues. The City also issued press releases corresponding to project kick-off and release of the Draft NHMP for public review.

ADDITIONAL STAKEHOLDER COORDINATION

As the NHMP project team progressed with hazards analysis and mitigation planning,

representatives of various City departments, other agencies, and service providers were contacted for input and data. Table A-3 summarizes these additional contacts and the topics of the resulting discussions.

Table A-3: Additional Contacts

Name	*Agency*	*Topic*
Ahmad Ansari	Public Works Department City of Pomona	Existing storm drainage system conditions.
Ana Medrano Arthur Parks	Lanterman Developmental Center	Emergency preparedness of Lanterman Developmental Center, hospital statistics, and compliance with SB1953.
Candace Hill	California Geological Survey	Input on questions related to the seismic evaluation reports of the San Dimas and Ontario quadrangles performed by the USGS.
Ed Andrews	US Army Corps of Engineers	San Antonio Dam emergency preparedness and safety.
George Barber	Metropolitan Water District	Dam safety issues concerning the Live Oak Dam.
Hong Wang	Pomona Public Works Department	Landslide issues in Ganesha Park.
Jean Hurst	Pomona Finance Department	Identification of commercial childcare centers.
Jim Elliot	American Recovery Center	Emergency preparedness of American recovery center, and general information about the medical facility.
Jonathan Godt Lynn Highland	National Landslide Information Center, United States Geological Survey	Landslide mapping, identification, and mitigation information.
Kelly Shivertaker	Southern California Edison	Mitigation and emergency preparedness procedures of SCE.
Mickey Gallivan	The Historical Society of Pomona Valley	Input on historical hazard events in Pomona.
Robert Bavier	Union Pacific Railroad	Emergency preparedness procedures of the Union Pacific Railroad.
Roy Grier	Western University of Health Sciences	General information and statistics about Western University.
Scentha Barnes	Casa Colina Centers for Rehabilitation	Emergency preparedness of Casa Colina, hospital statistics, and compliance with SB1953.

Source: Dyett and Bhatia, 2004.

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Appendix B

Resource Directory

Appendix B: Resource Directory

The Resource Directory, provided by the Disaster Management Area D Coordinator, provides contact information for local, regional, state, and federal programs that are currently involved in hazard mitigation activities. The Hazard Mitigation Action Committee may refer to the organizations on the following pages for resources and technical assistance. The Resource Directory provides a foundation for potential partners in action item implementation.

American Public Works Association

Level: National	Hazard: Multi	http://www.apwa.net	
2345 Grand Boulevard		Suite 500	
Kansas City, MO 64108-2641		Ph: 816-472-6100	Fx: 816-472-1610

Notes: The American Public Works Association is an international educational and professional association of public agencies, private sector companies, and individuals dedicated to providing high quality public works goods and services.

Association of State Floodplain Managers

Level: Federal	Hazard: Flood	www.floods.org	
2809 Fish Hatchery Road			
Madison, WI 53713		Ph: 608-274-0123	Fx:

Notes: The Association of State Floodplain Managers is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program, and flood preparedness, warning and recovery

Building Seismic Safety Council (BSSC)

Level: National	Hazard: Earthquake	www.bssconline.org	
1090 Vermont Ave., NW		Suite 700	
Washington, DC 20005		Ph: 202-289-7800	Fx: 202-289-109

Notes: The Building Seismic Safety Council (BSSC) develops and promotes building earthquake risk mitigation regulatory provisions for the nation.

California Department of Transportation (CalTrans)

Level: State	Hazard: Multi	http://www.dot.ca.gov/	
120 S. Spring Street			
Los Angeles, CA 90012		Ph: 213-897-3656	Fx:

Notes: CalTrans is responsible for the design, construction, maintenance, and operation of the California State Highway System, as well as that portion of the Interstate Highway System within the state's boundaries. Alone and in partnership with Amtrak, Caltrans is also involved in the support of intercity passenger rail service in California.

California Resources Agency

Level: State	Hazard: Multi	http://resources.ca.gov/	
1416 Ninth Street		Suite 1311	
Sacramento, CA 95814		Ph: 916-653-5656	Fx:

Notes: The California Resources Agency restores, protects and manages the state's natural, historical and cultural resources for current and future generations using solutions based on science, collaboration and respect for all the communities and interests involved.

California Division of Forestry (CDF)

Level: State	Hazard: Multi	http://www.fire.ca.gov/php/index.php	
210 W. San Jacinto			
Perris CA 92570		Ph: 909-940-6900	Fx:

Notes: The California Department of Forestry and Fire Protection protects over 31 million acres of California's privately-owned wildlands. CDF emphasizes the management and protection of California's natural resources.

California Division of Mines and Geology (DMG)

Level: State	Hazard: Multi	www.consrv.ca.gov/cgs/index.htm	
801 K Street		MS 12-30	
Sacramento, CA 95814		Ph: 916-445-1825	Fx: 916-445-5718

Notes: The California Geological Survey develops and disseminates technical information and advice on California's geology, geologic hazards, and mineral resources.

California Environmental Resources Evaluation System (CERES)

Level: State	Hazard: Multi	http://ceres.ca.gov/	
900 N St.		Suite 250	
Sacramento, Ca. 95814		Ph: 916-653-2238	Fx:

Notes: CERES is an excellent website for access to environmental information and websites.

California Department of Water Resources (DWR)

Level: State	Hazard: Flood	http://wwwdwr.water.ca.gov	
1416 9th Street			
Sacramento, CA 95814		Ph: 916-653-6192	Fx:

Notes: The Department of Water Resources manages the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.

California Department of Conservation: Southern California Regional Office

Level: State	Hazard: Multi	www.consrv.ca.gov	
655 S. Hope Street		#700	
Los Angeles, CA 90017-2321		Ph: 213-239-0878	Fx: 213-239-0984

Notes: The Department of Conservation provides services and information that promote environmental health, economic vitality, informed land-use decisions and sound management of our state's natural resources.

California Planning Information Network

Level: State	Hazard: Multi	www.calpin.ca.gov	
		Ph:	Fx:

Notes: The Governor's Office of Planning and Research (OPR) publishes basic information on local planning agencies, known as the California Planners' Book of Lists. This local planning information is available on-line with new search capabilities and up-to-the- minute updates.

EPA, Region 9

Level: Regional	Hazard: Multi	http://www.epa.gov/region09	
75 Hawthorne Street			
San Francisco, CA 94105		Ph: 415-947-8000	Fx: 415-947-3553

Notes: The mission of the U.S. Environmental Protection Agency is to protect human health and to safeguard the natural environment through the themes of air and global climate change, water, land, communities and ecosystems, and compliance and environmental stewardship.

Federal Emergency Management Agency, Region IX

Level: Federal	Hazard: Multi	www.fema.gov	
1111 Broadway		Suite 1200	
Oakland, CA 94607		Ph: 510-627-7100	Fx: 510-627-7112

Notes: The Federal Emergency Management Agency is tasked with responding to, planning for, recovering from and mitigating against disasters.

Federal Emergency Management Agency, Mitigation Division

Level: Federal	Hazard: Multi	www.fema.gov/fima/planhowto.shtm	
500 C Street, S.W.			
Washington, D.C. 20472		Ph: 202-566-1600	Fx:

Notes: The Mitigation Division manages the National Flood Insurance Program and oversees FEMA's mitigation programs. It has of a number of programs and activities of which provide citizens Protection, with flood insurance; Prevention, with mitigation measures and Partnerships, with communities throughout the country.

Floodplain Management Association

Level: Federal	Hazard: Flood	www.floodplain.org	
P.O. Box 50891			
Sparks, NV 89435-0891		Ph: 775-626-6389	Fx: 775-626-6389

Notes: The Floodplain Management Association is a nonprofit educational association. It was established in 1990 to promote the reduction of flood losses and to encourage the protection and enhancement of natural floodplain values. Members include representatives of federal, state and local government agencies as well as private firms.

Gateway Cities Partnership

Level: Regional	Hazard: Multi	www.gatewaycities.org	
7300 Alondra Boulevard		Suite 202	
Paramount, CA 90723		Ph: 562-817-0820	Fx:

Notes: Gateway Cities Partnership is a 501 C 3 non-profit Community Development Corporation for the Gateway Cities region of southeast LA County. The region comprises 27 cities that roughly speaking extends from Montebello on the north to Long Beach on the South, the Alameda Corridor on the west to the Orange County line on the east.

Governor's Office of Emergency Services (OES)

Level: State	Hazard: Multi	www.oes.ca.gov	
P.O. Box 419047			
Rancho Cordova, CA 95741-9047		Ph: 916 845- 8911	Fx: 916 845- 8910

Notes: The Governor's Office of Emergency Services coordinates overall state agency response to major disasters in support of local government. The office is responsible for assuring the state's readiness to respond to and recover from natural, manmade, and war-caused emergencies, and for assisting local governments in their emergency preparedness, response and recovery efforts.

Greater Antelope Valley Economic Alliance

Level: Regional	Hazard: Multi		
42060 N. Tenth Street West			
Lancaster, CA 93534		Ph: 661-945-2741	Fx: 661-945-7711

Notes: The Greater Antelope Valley Economic Alliance, (GA VEA) is a 501 (c)(6) nonprofit organization with a 501(c)(3) affiliated organization the Antelope Valley Economic Research and Education Foundation. GA VEA is a public-private partnership of business, local governments, education, non-profit organizations and health care organizations that was founded in 1999 with the goal of attracting good paying jobs to the Antelope Valley in order to build a sustainable economy.

Landslide Hazards Program, USGS

Level: Federal	Hazard: Landslide	http://landslides.usgs.gov/index.html	
12201 Sunrise Valley Drive		MS 906	
Reston, VA 20192		Ph: 703-648- 4000	Fx:

Notes: The NLIC website provides good information on the programs and resources regarding landslides. The page includes information on the National Landslide Hazards Program Information Center, a bibliography, publications, and current projects. USGS scientists are working to reduce long-term losses and casualties from landslide hazards through better understanding of the causes and mechanisms of ground failure both nationally and worldwide.

Los Angeles County Economic Development Corporation

Level: Regional	Hazard: Multi	www.laedc.org	
444 S. Flower Street		34th Floor	
Los Angeles, CA 90071		Ph: 213-236-4813	Fx: 213-623-0281

Notes: The LAEDC is a private, non-profit 501 (c) 3 organization established in 1981 with the mission to attract, retain and grow businesses and jobs in the Los Angeles region. The LAEDC is widely relied upon for its Southern California Economic Forecasts and Industry Trend Reports. Lead by the renowned Jack Kyser (Sr. Vice President, Chief Economist) his team of researchers produces numerous publications to help business, media and government navigate the LA region's diverse economy.

Los Angeles County Public Works Department

Level: County	Hazard: Multi	http://ladpw.org	
900 S. Fremont Ave.			
Alhambra, CA 91803		Ph: 626-458-5100	Fx:

Notes: The Los Angeles County Department of Public Works protects property and promotes public safety through Flood Control, Water Conservation, Road Maintenance, Bridges, Buses and Bicycle Trails, Building and Safety, Land Development, Waterworks, Sewers, Engineering, Capital Projects and Airports

National Wildland/Urban Interface Fire Program

Level: Federal	Hazard: Wildfire	www.firewise.org/	
1 Batterymarch Park			
Quincy, MA 02169-7471		Ph: 617-770-3000	Fx: 617 770-0700

Notes: Firewise maintains a Website designed for people who live in wildfire- prone areas, but it also can be of use to local planners and decision makers. The site offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences.

National Resources Conservation Service

Level: Federal	Hazard: Multi	http://www.nrcs.usda.gov/	
14th and Independence Ave., SW		Room 5105-A	
Washington, DC 20250		Ph: 202-720-7246	Fx: 202-720-7690

Notes: NRCS assists owners of America's private land with conserving their soil, water, and other natural resources, by delivering technical assistance based on sound science and suited to a customer's specific needs. Cost shares and financial incentives are available in some cases.

National Interagency Fire Center (NIFC)

Level: Federal	Hazard: Wildfire	www.nifc.gov	
3833 S. Development Ave.			
Boise, Idaho 83705-5354		Ph: 208-387- 5512	Fx:

Notes: The NIFC in Boise, Idaho is the nation's support center for wildland firefighting. Seven federal agencies work together to coordinate and support wildland fire and disaster operations.

National Fire Protection Association (NFPA)

Level: National	Hazard: Wildfire	http://www.nfpa.org/catalog/home/index.asp	
1 Batterymarch Park			
Quincy, MA 02169-7471		Ph: 617-770-3000	Fx: 617 770-0700

Notes: The mission of the international non-profit NFPA is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training and education

National Floodplain Insurance Program (NFIP)

Level: Federal	Hazard: Flood	www.fema.gov/nfip/	
500 C Street, S.W.			
Washington, D.C. 20472		Ph: 202-566-1600	Fx:

Notes: The Mitigation Division manages the National Flood Insurance Program and oversees FEMA's mitigation programs. It has of a number of programs and activities of which provide citizens Protection, with flood insurance; Prevention, with mitigation measures and Partnerships, with communities throughout the country.

National Oceanic /Atmospheric Administration

Level: Federal	Hazard: Multi	www.noaa.gov	
14th Street & Constitution Ave NW		Rm 6013	
Washington, DC 20230		Ph: 202-482-6090	Fx: 202-482-3154

Notes: NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.

National Weather Service, Office of Hydrologic Development

Level: Federal	Hazard: Flood	http://www.nws.noaa.gov/	
1325 East West Highway		SSMC2	
Silver Spring, MD 20910		Ph: 301-713-1658	Fx: 301-713-0963

Notes: The Office of Hydrologic Development (OHD) enhances National Weather Service products by: infusing new hydrologic science, developing hydrologic techniques for operational use, managing hydrologic development by NWS field office, providing advanced hydrologic products to meet needs identified by NWS customers

National Weather Service

Level: Federal	Hazard: Multi	http://www.nws.noaa.gov/	
520 North Elevar Street			
Oxnard, CA 93030		Ph: 805-988- 6615	Fx:

Notes: The National Weather Service is responsible for providing weather service to the nation. It is charged with the responsibility of observing and reporting the weather and with issuing forecasts and warnings of weather and floods in the interest of national safety and economy. Briefly, the priorities for service to the nation are: 1. protection of life, 2. protection of property, and 3. promotion of the nation's welfare and economy.

San Gabriel Valley Economic Partnership

Level: Regional	Hazard: Multi	www.valleynet.org	
4900 Rivergrade Road		Suite A310	
Irwindale, CA 91706		Ph: 626-856-3400	Fx: 626-856-5115

Notes: The San Gabriel Valley Economic Partnership is a non-profit corporation representing both public and private sectors. The Partnership is the exclusive source for San Gabriel Valley-specific information, expertise, consulting, products, services, and events. It is the single organization in the Valley with the mission to sustain and build the regional economy for the mutual benefit of all thirty cities, chambers of commerce, academic institutions, businesses and residents.

Sanitation Districts of Los Angeles County

Level: County	Hazard: Flood	http://www.lacsd.ora/	
1955 Workman Mill Road			
Whittier, CA 90607		Ph:562-699-7411 x2301	Fx:

Notes: The Sanitation Districts provide wastewater and solid waste management for over half the population of Los Angeles County and turn waste products into resources such as reclaimed water, energy, and recyclable materials.

Santa Monica Mountains Conservancy

Level: Regional	Hazard: Multi	http://smmc.ca.gov/	
570 West Avenue Twenty-Six		Suite 100	
Los Angeles, CA 90065		Ph: 323-221-8900	Fx:

Notes: The Santa Monica Mountains Conservancy helps to preserve over 55,000 acres of parkland in both wilderness and urban settings, and has improved more than 114 public recreational facilities throughout Southern California.

South Bay Economic Development Partnership

Level: Regional	Hazard: Multi	www.southbaypartnership.com	
3858 Carson Street		Suite 110	
Torrance, CA 90503		Ph: 310-792-0323	Fx: 310-543-9886

Notes: The South Bay Economic Development Partnership is a collaboration of business, labor, education and government. Its primary goal is to plan an implement an economic development and marketing strategy designed to retain and create jobs and stimulate economic growth in the South Bay of Los Angeles County.

South Coast Air Quality Management District (AQMD)

Level: Regional	Hazard: Multi	www.aqmd.gov	
21865 E. Copley Drive			
Diamond Bar, CA 91765		Ph: 800-CUT-SMOG	Fx:

Notes: AQMD is a regional government agency that seeks to achieve and maintain healthful air quality through a comprehensive program of research, regulations, enforcement, and communication. The AQMD covers Los Angeles and Orange Counties and parts of Riverside and San Bernardino Counties.

Southern California Earthquake Center (SCEC)

Level: Regional	Hazard: Earthquake	www.scec.org	
3651 Trousdale Parkway		Suite 169	
Los Angeles, CA 90089-0742		Ph: 213-740-5843	Fx: 213/740-0011

Notes: The Southern California Earthquake Center (SCEC) gathers new information about earthquakes in Southern California, integrates this information into a comprehensive and predictive understanding of earthquake phenomena, and communicates this understanding to end-users and the general public in order to increase earthquake awareness, reduce economic losses, and save lives.

Southern California Association of Governments (SCAG)

Level: Regional	Hazard: Multi	www.scag.ca.gov	
818 W. Seventh Street		12th Floor	
Los Angeles, CA 90017		Ph: 213-236-1800	Fx: 213-236-1825

Notes: The Southern California Association of Governments functions as the Metropolitan Planning Organization for six counties: Los Angeles, Orange, San Bernardino, Riverside, Ventura and Imperial. As the designated Metropolitan Planning Organization, the Association of Governments is mandated by the federal government to research and draw up plans for transportation, growth management, hazardous waste management, and air quality.

State Fire Marshal (SFM)

Level: State	Hazard: Wildfire	http://osfm.fire.ca.gov	
1131 "S" Street			
Sacramento, CA 95814		Ph: 916-445-8200	Fx: 916-445-8509

Notes: The Office of the State Fire Marshal (SFM) supports the mission of the California Department of Forestry and Fire Protection (CDF) by focusing on fire prevention. SFM regulates buildings in which people live, controls substances which may, cause injuries, death and destruction by fire; provides statewide direction for fire prevention within wildland areas; regulates hazardous liquid pipelines; reviews regulations and building standards; and trains and educates in fire protection methods and responsibilities.

The Community Rating System (CRS)

Level: Federal	Hazard: Flood	http://www.fema.gov/nfip/crs.shtm	
500 C Street, S.W.			
Washington, D.C. 20472		Ph: 202-566-1600	Fx:

Notes: The Community Rating System (CRS) recognizes community floodplain management efforts that go beyond the minimum requirements of the NFIP. Property owners within the County would receive reduced NFIP flood insurance premiums if the County implements floodplain management practices that qualify it for a CRS rating. For further information on the CRS, visit FEMA's website.

United States Geological Survey

Level: Federal	Hazard: Multi	http://www.usgs.gov/	
345 Middlefield Road			
Menlo Park, CA 94025		Ph: 650-853-8300	Fx:

Notes: The USGS provides reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

US Army Corps of Engineers

Level: Federal	Hazard: Multi	http://www.usace.army.mil	
P.O. Box 532711			
Los Angeles CA 90053- 2325		Ph: 213-452- 3921	Fx:

Notes: The United States Army Corps of Engineers work in engineering and environmental matters. A workforce of biologists, engineers, geologists, hydrologists, natural resource managers and other professionals provide engineering services to the nation including planning, designing, building and operating water resources and other civil works projects.

USDA Forest Service

Level: Federal	Hazard: Wildfire	http://www.fs.fed.us	
1400 Independence Ave. SW			
Washington, D.C. 20250-0002		Ph: 202-205-8333	Fx:

Notes: The Forest Service is an agency of the U.S. Department of Agriculture. The Forest Service manages public lands in national forests and grasslands.

USGS Water Resources

Level: Federal	Hazard: Multi	www.water.usgs.gov	
6000 J Street		Placer Hall	
Sacramento, CA 95819-6129		Ph: 916-278-3000	Fx: 916-278-3070

Notes: The USGS Water Resources mission is to provide water information that benefits the Nation's citizens: publications, data, maps, and applications software.

Source: Disaster Management Area D Coordinator, 2004.

Western States Seismic Policy Council (WSSPC)

Level: Regional	Hazard: Earthquake	www.wsspc.org/home.html	
125 California Avenue		Suite D201, #1	
Palo Alto, CA 94306		Ph: 650-330-1101	Fx: 650-326-1769

Notes: WSSPC is a regional earthquake consortium funded mainly by FEMA. Its website is a great resource, with information clearly categorized - from policy to engineering to education.

Westside Economic Collaborative C/O Pacific Western Bank

Level: Regional	Hazard: Multi	http://www.westside-la.or	
120 Wilshire Boulevard			
Santa Monica, CA 90401		Ph: 310-458-1521	Fx: 310-458-6479

Notes: The Westside Economic Development Collaborative is the first Westside regional economic development corporation. The Westside EDC functions as an information gatherer and resource center, as well as a forum, through bringing business, government, and residents together to address issues affecting the region: Economic Diversity, Transportation, Housing, Workforce Training and Retraining, Lifelong Learning, Tourism, and Embracing Diversity.

Appendix C

Economic Analysis Guidelines for Natural Hazard Mitigation Projects

Appendix C: Economic Analysis Guidelines for Natural Hazard Mitigation Projects

Benefit/cost analysis is a key mechanism used by the state Office of Emergency Services (OES), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

This appendix outlines several approaches for conducting economic analysis of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, State Hazard Mitigation Plan, (Oregon State Police – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, Report on Costs and Benefits of Natural Hazard Mitigation.

This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to provide the details of economic analysis methods that can be used to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

PURPOSE

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred.

Evaluating natural hazard mitigation provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools.

Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

ECONOMIC ANALYSIS APPROACHES FOR MITIGATION STRATEGIES

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. The distinction between the two methods is the way in which the relative costs and benefits are measured. Additionally, there are varying approaches to assessing the value of mitigation for public sector and private sector activities.

Benefit/Cost Analysis

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoided future damages, and risk.

In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented (i.e., if net benefits exceed net costs, the project is worth pursuing). A project must have a benefit/cost ratio greater than 1 in order to be funded.

Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in public sector mitigation activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions that involve a diverse set of beneficiaries and nonmarket benefits.

Investing in private sector mitigation activities

Private sector mitigation projects may occur on the basis of one of two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

- Request cost sharing from public agencies;
- Dispose of the building or land either by sale or demolition;
- Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
- Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchasers. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

CONDUCTING AN ECONOMIC ANALYSIS

Benefit/cost analysis and cost-effectiveness analysis are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating alternative mitigation activities is outlined below:

1. Identify the Alternatives. Alternatives for reducing risk from natural hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or

demolition of exposed properties, among others. Different mitigation project can assist in minimizing risk to natural hazards, but do so at varying economic costs.

2. Calculate the Costs and Benefits. Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate alternative. Potential economic criteria to evaluate alternatives include:

- *Determine the project cost.* This may include initial project development costs, and repair and operating costs of maintaining projects over time.
- *Estimate the benefits.* Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.
- *Consider costs and benefits to society and the environment.* These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- *Determine the correct discount rate.* Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Alternatives. Once costs and benefits have been quantified, economic analysis tools can rank the alternatives. Two methods for determining the best alternative given varying costs and benefits include net present value and internal rate of return.

- *Net present value.* Net present value is the value of the expected future returns of an investment minus the value of expected future cost expressed in today's dollars. If the net present value is greater than the project costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- *Internal Rate of Return.* Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project.

Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk; project effectiveness; and economic, environmental, and social returns in choosing the appropriate project for implementation.

ECONOMIC RETURNS OF NATURAL HAZARD MITIGATION

The estimation of economic returns, which accrue to building or landowner as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided

- Content damages avoided
- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor's income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

ADDITIONAL COSTS FROM NATURAL HAZARDS

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

ADDITIONAL CONSIDERATIONS

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. Many communities are looking towards developing multi-objective projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development,

among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

RESOURCES

The following resources for economic analysis have been provided by the Disaster Management Area D Coordinator.

CUREe Kajima Project, Methodologies For Evaluating The Socio-Economic Consequences Of Large Earthquakes, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997.

Federal Emergency Management Agency, Benefit/Cost Analysis of Hazard Mitigation Projects, Riverine Flood, Version 1.05, Hazard Mitigation Economics Inc., 1996.

Federal Emergency Management Agency Report on Costs and Benefits of Natural Hazard Mitigation. Publication 331, 1996.

Goettel & Horner Inc., Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in The City of Portland, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., Benefit/Cost Analysis of Hazard Mitigation Projects Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures, Robert Olson Associates, Prepared for Oregon State Police, Office of Emergency Management, July 1999.

Interagency Hazards Mitigation Team, State Hazard Mitigation Plan, (Oregon State Police – Office of Emergency Management, 2000).

Risk Management Solutions, Inc., Development of a Standardized Earthquake Loss Estimation Methodology, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., A Benefit/Cost Model for the Seismic Rehabilitation of Buildings, Volumes 1 & 2, Federal Emergency Management Agency, FEMA, Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects, 1993.

VSP Associates, Inc., Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model, Volume 1, Federal Emergency Management Agency, FEMA, Publication Number 255, 1994.

Source: Disaster Management Area D Coordinator

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Appendix D

List of Acronyms

Appendix D: Acronyms

FEDERAL ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ATC	Applied Technology Council
BCA	Benefit/Cost Analysis
BFE	Base Flood Elevation
BLM	Bureau of Land Management
BSSC	Building Seismic Safety Council
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CRS	Community Rating System
EDA	Economic Development Administration
EPA	Environmental Protection Agency
ER	Emergency Relief
EWP	Emergency Watershed Protection (NRCS Program)
FAS	Federal Aid System
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance (FEMA Program)
FTE	Full Time Equivalent
GIS	Geographic Information System
GNS	Institute of Geological and Nuclear Sciences (International)
GSA	General Services Administration
HAZUS	Hazards U.S.
HMGP	Hazard Mitigation Grant Program
HMST	Hazard Mitigation Survey Team
HUD	Housing and Urban Development (United States, Department of)
IBHS	Institute for Business and Home Safety
ICC	Increased Cost of Compliance
IHMT	Interagency Hazard Mitigation Team
NCDC	National Climate Data Center
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NHMP	Natural Hazard Mitigation Plan (also known as "409 Plan")
NIBS	National Institute of Building Sciences
NIFC	National Interagency Fire Center
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
SBA	Small Business Administration
SEAO	Structural Engineers Association of Oregon
SHMO	State Hazard Mitigation Officer
TOR	Transfer of Development Rights
UGB	Urban Growth Boundary
URM	Unreinforced Masonry
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USFA	United States Fire Administration
USFS	United States Forest Service
USGS	United States Geological Survey
WSSPC	Western States Seismic Policy Council

CALIFORNIA ACRONYMS

A&W	Alert and Warning
AA	Administering Areas
AAR	After Action Report
ARC	American Red Cross
ARP	Accidental Risk Prevention
ATC20	Applied Technology Council20
ATC21	Applied Technology Council21
BCP	Budget Change Proposal
BSA	California Bureau of State Audits
CAER	Community Awareness & Emergency Response
CalARP	California Accidental Release Prevention
CalBO	California Building Officials
CalEPA	California Environmental Protection Agency
CalREP	California Radiological Emergency Plan
CALSTARS	California State Accounting Reporting System
CalTRANS	California Department of Transportation
CBO	Community Based Organization
CD	Civil Defense
CDF	California Department of Forestry and Fire Protection
CDMG	California Division of Mines and Geology
CEC	California Energy Commission

CEPEC	California Earthquake Prediction Evaluation Council
CESRS	California Emergency Services Radio System
CHIP	California Hazardous Identification Program
CHMIRS	California Hazardous Materials Incident Reporting System
CHP	California Highway Patrol
CLETS	California Law Enforcement Telecommunications System
CSTI	California Specialized Training Institute
CUEA	California Utilities Emergency Association
CUPA	Certified Unified Program Agency
DAD	Disaster Assistance Division (of the state Office of Emergency Svcs)
DFO	Disaster Field Office
DGS	California Department of General Services
DHSRHB	California Department of Health Services, Radiological Health Branch
DO	Duty Officer
DOC	Department Operations Center
DOE	Department of Energy (U.S.)
DOF	California Department of Finance
DOJ	California Department of Justice
DPA	California Department of Personnel Administration
DPIG	Disaster Preparedness Improvement Grant
DR	Disaster Response
DSA	Division of the State Architect
DSR	Damage Survey Report
DSW	Disaster Service Worker
DWR	California Department of Water Resources
EAS	Emergency Alerting System
EDIS	Emergency Digital Information System
EERI	Earthquake Engineering Research Institute
EMA	Emergency Management Assistance
EMI	Emergency Management Institute
EMMA	Emergency Managers Mutual Aid
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency (U.S.)
EPEDAT	Early Post Earthquake Damage Assessment Tool
EPI	Emergency Public Information
EPIC	Emergency Public Information Council

ESC	Emergency Services Coordinator
FAY	Federal Award Year
FDAA	Federal Disaster Assistance Administration
FEAT	Governor's Flood Emergency Action Team
FEMA	Federal Emergency Management Agency
FFY	Federal Fiscal Year
FIR	Final Inspection Reports
FIRESCOPE	Firefighting Resources of So. Calif Organized for Potential Emergencies
FMA	Flood Management Assistance
FSR	Feasibility Study Report
FY	Fiscal Year
GIS	Geographical Information System
HAZMAT	Hazardous Materials
HAZMIT	Hazardous Mitigation
HAZUS	Hazards United States (an earthquake damage assessment prediction tool)
HAD	Housing and Community Development
HEICS	Hospital Emergency Incident Command System
HEPG	Hospital Emergency Planning Guidance
HIA	Hazard Identification and Analysis Unit
HMEP	Hazardous Materials Emergency Preparedness
HMGP	Hazard Mitigation Grant Program
IDE	Initial Damage Estimate
IA	Individual Assistance
IFG	Individual & Family Grant (program)
IRG	Incident Response Geographic Information System
IPA	Information and Public Affairs (of state Office of Emergency Services)
LAN	Local Area Network
LEMMA	Law Enforcement Master Mutual Aid
LEPC	Local Emergency Planning Committee
MARAC	Mutual Aid Regional Advisory Council
MHID	Multihazard Identification
MOU	Memorandum of Understanding
NBC	Nuclear, Biological, Chemical
NEMA	National Emergency Management Agency
NEMIS	National Emergency Management Information System
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Association

NPP	Nuclear Power Plant
NSF	National Science Foundation
NWS	National Weather Service
OA	Operational Area
OASIS	Operational Area Satellite Information System
OCC	Operations Coordination Center
OCD	Office of Civil Defense
OEP	Office of Emergency Planning
OES	California Governor's Office of Emergency Services
OSHPD	Office of Statewide Health Planning and Development
OSPR	Oil Spill Prevention and Response
PA	Public Assistance
PC	Personal Computer
PDA	Preliminary Damage Assessment
PIO	Public Information Office
POST	Police Officer Standards and Training
PPA/CA	Performance Partnership Agreement/Cooperative Agreement (FEMA)
PSA	Public Service Announcement
PTAB	Planning and Technological Assistance Branch
PTR	Project Time Report
RA	Regional Administrator (OES)
RADEF	Radiological Defense (program)
RAMP	Regional Assessment of Mitigation Priorities
RAPID	Railroad Accident Prevention & Immediate Deployment
RDO	Radiological Defense Officer
RDMHC	Regional Disaster Medical Health Coordinator
REOC	Regional Emergency Operations Center
REPI	Reserve Emergency Public Information
RES	Regional Emergency Staff
RIMS	Response Information Management System
RMP	Risk Management Plan
RPU	Radiological Preparedness Unit (OES)
RRT	Regional Response Team
SAM	State Administrative Manual
SARA	Superfund Amendments & Reauthorization Act
SAVP	Safety Assessment Volunteer Program
SBA	Small Business Administration
SCO	California State Controller's Office
SEMS	Standardized Emergency Management System

SEPIC	State Emergency Public Information Committee
SLA	State and Local Assistance
SONGS	San Onofre Nuclear Generating Station
SOP	Standard Operating Procedure
SWEPC	Statewide Emergency Planning Committee
TEC	Travel Expense Claim
TRU	Transuranic
TTT	Train the Trainer
UPA	Unified Program Account
UPS	Uninterrupted Power Source
USAR	Urban Search and Rescue
USGS	United States Geological Survey
WC	California State Warning Center
WAN	Wide Area Network
WIPP	Waste Isolation Pilot Project

Source: Disaster Management Area D Coordinator, 2004.

Appendix E

Glossary

Appendix E: Glossary

Acceleration The rate of change of velocity with respect to time. Acceleration due to gravity at the earth's surface is 9.8 meters per second squared. That means that every second that something falls toward the surface of earth its velocity increases by 9.8 meters per second.

Asset Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Base Flood Flood that has a 1 percent probability of being equaled or exceeded in any given year. Also known as the 100-year flood.

Base Flood Elevation (BFE) Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as the standard for the National Flood Insurance Program.

Bedrock The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

Building A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Coastal High Hazard Area Area, usually along an open coast, bay, or inlet, that is subject to inundation by storm surge and, in some instances, wave action caused by storms or seismic sources.

Coastal Zones The area along the shore where the ocean meets the land as the surface of the land rises above the ocean. This land/water interface includes barrier islands, estuaries, beaches, coastal wetlands, and land areas having direct drainage to the ocean.

Community Rating System (CRS) An NFIP program that provides incentives for NFIP communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of policyholders in these communities are reduced.

Computer-Aided Design And Drafting (CADD) A computerized system enabling quick and accurate electronic 2-D and 3-D drawings, topographic mapping, site plans, and profile/cross-section drawings.

Contour A line of equal ground elevation on a topographic (contour) map.

Critical Facility Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

Debris The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digitize To convert electronically points, lines, and area boundaries shown on maps into x, y coordinates (e.g., latitude and longitude, universal transverse mercator (UTM), or table coordinates) for use in computer applications.

Displacement Time The average time (in days) which the building's occupants typically must operate from a temporary location while repairs are made to the original building due to damages resulting from a hazard event.

Duration How long a hazard event lasts.

Earthquake A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Erosion Wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.

Erosion Hazard Area Area anticipated to be lost to shoreline retreat over a given period of time. The projected inland extent of the area is measured by multiplying the average annual long-term recession rate by the number of years desired.

Essential Facility Elements that are important to ensure a full recovery of a community or state following a hazard event. These would include: government functions, major employers, banks, schools, and certain commercial establishments, such as grocery stores, hardware stores, and gas stations.

Extent The size of an area affected by a hazard or hazard event.

Extratropical Cyclone Cyclonic storm events like Nor'easters and severe winter low-pressure systems. Both West and East coasts can experience these non-tropical storms that produce gale-force winds and precipitation in the form of heavy rain or snow. These cyclonic storms, commonly called Nor'easters on the East Coast because of the direction of the storm winds, can last for several days and can be very large – 1,000-mile wide storms are not uncommon.

Fault A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.

Federal Emergency Management Agency (FEMA) Independent agency 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 Potential Index (FPI) Developed by USGS and USFS to assess and map fire hazard potential over broad areas. Based on such geographic information, national policy makers and on-the-ground fire managers established priorities for prevention activities in the defined area to reduce the risk of managed and wildfire ignition and spread. Prediction of fire hazard shortens the time between fire ignition and initial attack by enabling fire managers to pre-allocate and stage suppression forces to high fire risk areas.

Flash Flood A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

Flood A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Depth Height of the floodwater surface above the ground surface.

Flood Elevation Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.

Flood Hazard Area The area shown to be inundated by a flood of a given magnitude on a map.

Flood Insurance Rate Map (FIRM) Map of a community, prepared by the Federal Emergency Management Agency that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Floodplain Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

Frequency A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance – its probability – of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Fujita Scale of Tornado Intensity Rates tornadoes with numeric values from F0 to F5 based on tornado windspeed and damage sustained. An F0 indicates minimal damage such as broken tree limbs or signs, while and F5 indicated severe damage sustained.

Functional Downtime The average time (in days) during which a function (business or service) is unable to provide its services due to a hazard event.

Geographic Area Impacted The physical area in which the effects of the hazard are experienced.

Geographic Information Systems (GIS) A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Ground Motion The vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter, but soft soils can further amplify ground motions

Hazard A source of potential danger or adverse condition. Hazards in this how to series will include naturally occurring events such as floods, earthquakes, tornadoes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.

Hazard Event A specific occurrence of a particular type of hazard.

Hazard Identification The process of identifying hazards that threaten an area.

Hazard Mitigation Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Profile A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

HAZUS (Hazards U.S.) A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA.

Hurricane An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74-miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the north Atlantic Ocean, northeast Pacific Ocean, or the south Pacific Ocean east of 160°E longitude. Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Hydrology The science of dealing with the waters of the earth. A flood discharge is developed by a hydrologic study.

Infrastructure Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, drydocks, piers and regional dams.

Intensity A measure of the effects of a hazard event at a particular place.

Landslide Downward movement of a slope and materials under the force of gravity.

Lateral Spreads Develop on gentle slopes and entail the sidelong movement of large masses of soil as an underlying layer liquefies in a seismic event. The phenomenon that occurs when ground shaking causes loose soils to lose strength and act like viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Liquefaction Results when the soil supporting structures liquefies. This can cause structures to tip and topple.

Lowest Floor Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.

Magnitude A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigation Plan A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the state and includes a description of actions to minimize future vulnerability to hazards.

National Flood Insurance Program (NFIP) Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 CFR §60.3.

National Geodetic Vertical Datum of 1929 (NGVD) Datum established in 1929 and used in the NFIP as a basis for measuring flood, ground, and structural elevations, previously referred to as Sea Level Datum or Mean Sea Level. The Base Flood Elevations shown on most of the Flood Insurance Rate Maps issued by the Federal Emergency Management Agency are referenced to NGVD.

National Weather Service (NWS) Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and state entities in preparing weather and flood warning plans.

Nor'easter An extra-tropical cyclone producing gale-force winds and precipitation in the form of heavy snow or rain.

Outflow Follows water inundation creating strong currents that rip at structures and pound them with debris, and erode beaches and coastal structures.

Planimetric Describes maps that indicate only man-made features like buildings.

Planning The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Probability A statistical measure of the likelihood that a hazard event will occur.

Recurrence Interval The time between hazard events of similar size in a given location. It is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1000 each have been paid within any 10-year period since 1978.

Replacement Value The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Richter Scale A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.

Risk The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event 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 a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine Of or produced by a river.

Scale A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scarp A steep slope.

Scour Removal of soil or fill material by the flow of floodwaters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Seismicity Describes the likelihood of an area being subject to earthquakes.

Special Flood Hazard Area (SFHA) An area within a floodplain having a 1 percent or greater chance of flood occurrence in any given year (100-year floodplain); represented on Flood Insurance Rate Maps by darkly shaded areas with zone designations that include the letter A or V.

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

State Hazard Mitigation Officer (SHMO) The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post- disaster mitigation activities.

Storm Surge Rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure on the water surface.

Structure Something constructed. (See also Building)

Substantial Damage Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage.

Super Typhoon A typhoon with maximum sustained winds of 150 mph or more.

Surface Faulting The differential movement of two sides of a fracture – in other words, the location where the ground breaks apart. The length, width, and displacement of the ground characterize surface faults.

Tectonic Plate Torsionally rigid, thin segments of the earth's lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that cause seismic activity.

Topographic Characterizes maps that show natural features and indicate the physical shape of the land using contour lines. These maps may also include manmade features.

Tornado A violently rotating column of air extending from a thunderstorm to the ground.

Tropical Cyclone A generic term for a cyclonic, low-pressure system over tropical or subtropical waters.

Tropical Depression A tropical cyclone with maximum sustained winds of less than 39 mph.

Tropical Storm A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph.

Tsunami Great sea wave produced by submarine earth movement or volcanic eruption.

Typhoon A special category of tropical cyclone peculiar to the western North Pacific Basin, frequently affecting areas in the vicinity of Guam and the North Mariana Islands. Typhoons whose maximum sustained winds attain or exceed 150 mph are called super typhoons.

Vulnerability Describes how exposed or susceptible to damage an asset is. 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 – if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

Water Displacement When a large mass of earth on the ocean bottom sinks or uplifts, the column of water directly above it is displaced, forming the tsunami wave. The rate of displacement, motion of the ocean floor at the epicenter, the amount of displacement of the rupture zone, and the depth of water above the rupture zone all contribute to the intensity of the tsunami.

Wave Runup	The height that the wave extends up to on steep shorelines, measured above a reference level (the normal height of the sea, corrected to the state of the tide at the time of wave arrival).
Wildfire	An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.
Zone	A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

Source: Disaster Management Area D Coordinator, 2004.

Bibliography

Bibliography

AMEC Earth and Environmental, Inc. *Geotechnical Investigation Ganesha Park Landslide at Paige Drive between Sunset and North Hills Drive Pomona, California.* April 2004.

Ansari, Ahmad . City of Pomona P.E. / Assistant City Engineer. Written communications, February 6, 2004 and July 14, 2004.

Bender, Scentha. Administrative Assistant to Rob Barnes, Director of Project Development. Verbal Communication, June 4, 2004.

Burby, R. (Ed.) *Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities (1998), Washington D.C.* Joseph Henry Press.

California Department of Forestry and Fire Protection, website: http://frap.cdf.ca.gov/data/frapgismaps/select.asp. Accessed June 6, 2004.

California Public Utilities Commission, website: http://www.cpuc.ca.gov/js.asp.

CBS News, website: http://www.cbsnews.com. Accessed January 8, 2003.

CBS News, website: http://www.cbsnews.com/stories/2003/01/06/national/. Accessed January 2003.

City of Pomona. *Comprehensive General Plan, Pomona, California.* March 1976.

City of Pomona. 1994. *Master Environmental Assessment for the City of Pomona.* April 1994.

City of Pomona. *Materials Recovery Facility Draft Environmental Impact Report.* April 1996.

City of Pomona. *Water System Master Plan:* pp. 4-6. 1992.

Connor, Tim. Verbal Communication. July 20, 2004.

Cruz, Carrie. Verbal Communication. June 8, 2004.

David Evans and Associates, Inc. *Master Environmental Assessment for the City of Pomona.* April 1994.

Department of Conservation, Division of Mines and Geology. *Seismic Hazard Evaluation of the Ontario 7.5-Minute Quadrangle, Los Angeles County, California.*1998.

Department of Conservation, Division of Mines and Geology. *Seismic Hazard Evaluation of the San Dimas 7.5-Minute Quadrangle, Los Angeles County, California.*1998.

Department of Land Conservation and Development. *Planning For Natural Hazards: The Oregon Technical Resource Guide*: Chapter 5. 2000.

Department of Toxic Substances Control, website: http://www.dtsc.ca.gov/HazardousWaste/#Hazardous%20Waste%20Facilities. Accessed April 10, 2004.

Extent and Economic Significance. Proceedings of the 28th International Geological Congress Symposium on Landslides. 1989. Washington D.C., Rotterdam: Balkema.

Federal Emergency Management Agency, National Flood Insurance Program, website: http://www.fema.gov/nfip/10400312.shtm#06. Accessed July, 2004. Refers to claims processed through December 31, 2003.

Federal Emergency Management Agency, personal communication with Map Specialist. March 15, 2004.

Federal Emergency Management Agency, website: www.fema.gov. Accessed July 2004.

Federal Emergency Management Agency HAZUS, website: http://www.fema.gov/hazus. Accessed May 2003.

Gallivan, Mickey. President, Pomona Historical Society. Written Communication. June 22, 2004.

Governor's Office of Emergency Services by the California Earthquake Prediction Evaluation Council, Report to the Director. March 2, 2004.

Highland, L.M. and R.L. Schuster. *Significant Landslide Events in the United State,* website: http://landslides.usgs.gov.html_files/pubs/report1/Landslides_pass_508.pdf.

Homeowners Guide for Landslide Control, Hillside Flooding, Debris Flows, Soil Erosion. March 1997.

Institute for Business and Home Safety Resources. April 2001.

Lanterman Developmental Center, Office of the Director. Personal Communication. November 10, 2003

Los Angeles County Department of Public Works. *Hydrologic Report: 1996-1997.* 1997.

Mileti, Dennis. *Disasters by Design: A Reassessment of Natural Hazards in the United State.* 1999. Joseph Henry Press, Washington D.C.

Montero, Cynthia. City of Pomona, Department of Building and Safety. Written Communication. July 2004.

Morton, Doug, et al. *Preliminary Soil-Slip Susceptibility Maps, Southwestern California*. U.S. Geological Survey Open File report 03-17. Available online at: http://geopubs.wr.usgs.gov/open-file/of03-17/. 2003.

National Earthquake Information Center, website: http://neic.usgs.gov/neis/eqlists/10maps_usa.html. Accessed July 1, 2004.

Oregon Emergency Management, Interagency Hazard Mitigation Team. *State Hazard Mitigation Plan.* 2000.

Parks, Arthur. Assistant Planner of Operations. Verbal Communication. June 4, 2004.

Pomona Valley Hospital Medical Center, 2002 Annual Report. Website: http://www.pvhmc.org/Docs/AnReport2002_low. pdf. Accessed March 1, 2004.

Portuguese Bend Regional Open Space Park, website: http://www.pvplc.org/land/portuguesebend/projectoverview.htm.

Technical Advisory Committee Members. Verbal Communication. May 6, 2004.

U.S. Army Corps of Engineers, Los Angeles District Reservoir Regulation Section website, http://www.spl.usace.army.mil/resreg/htdocs/snto.html.

U.S. Census Bureau. United States Population and Housing Counts, 1980 and 2000 Census.

U.S. Department of the Interior, Landslide Hazards, U.S. Geological Survey Fact Sheet 0071-00, Version 1.0, website: http://pubs.usgs.gov/fs/fs-0071-00/.

U.S. Geological Survey Earthquake Hazards Program, website: http://earthquake.usgs.gov/faq/hist.html#5; http://earthquake.usgs.gov/faq/hazard.html#10; http://earthquake.usgs.gov/faq/plates.html. Accessed June 30 and July 1, 2004.

U.S. Geological Survey. "When Could the Next Large Earthquake Occur Along the San Andreas Fault?" http://pubs.usgs.gov/gip/earthq3/when.html.

Van Lul, Kenneth. Vice President, General Services, Pomona Valley Hospital Medical Center. Verbal Communication, June 4, 2004. Written Communication. June 10, 2004.

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