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:

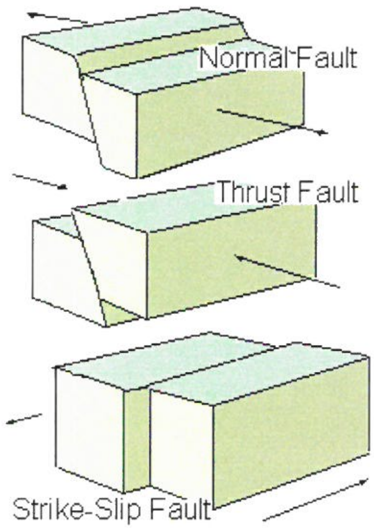
- *Normal Fault.* A dip-slip fault in which the block above the fault has moved downward relative to the block below. This type of faulting occurs in response to extension and is often observed in the Western United States Basin and Range Province and along oceanic ridge systems.
- *Thrust Fault.* A 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

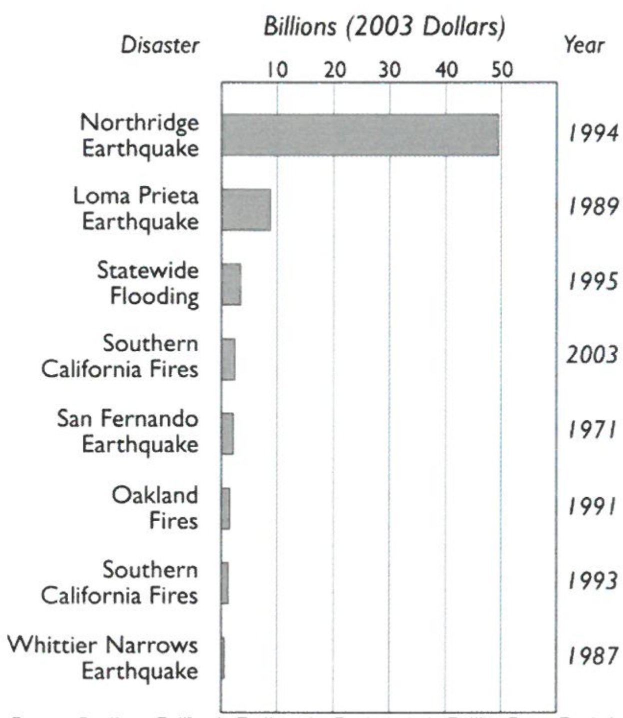
Source: http://geology.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fpasadena.wr.usgs.gov%2Finfo%2Fcahist_eqs.html

[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

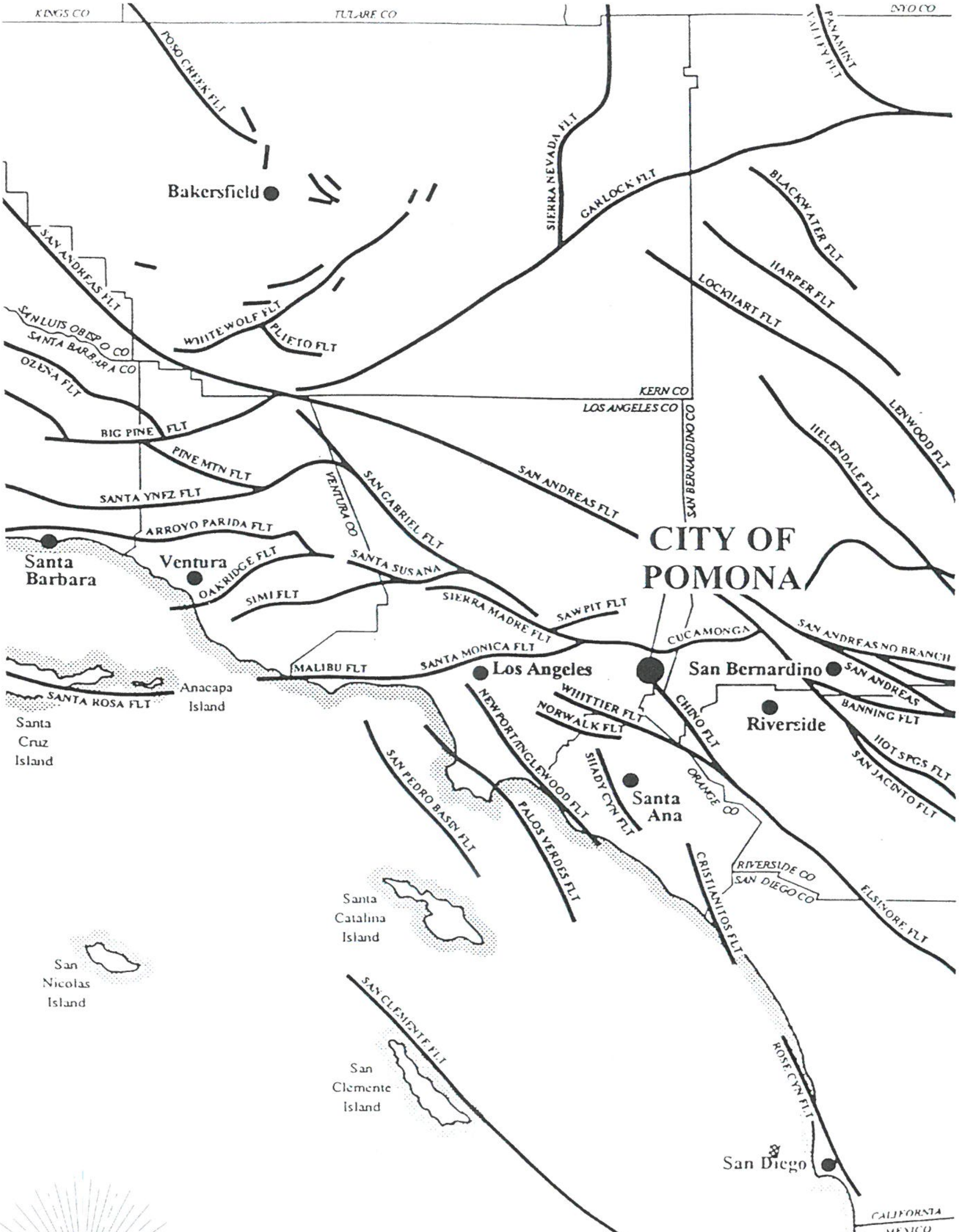
There are numerous faults in the Los Angeles area that are categorized as active, potentially active, and inactive. A fault is classified as *active* if it has either moved during the Holocene time (during the last 11,000 years) or is included in an Alquist-Priolo Earthquake Fault zone (as established 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

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.

It should be noted in 2008 the Chino Fault had a quake that damaged Pomona City Hall and a number of UBM in the downtown area

- *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.

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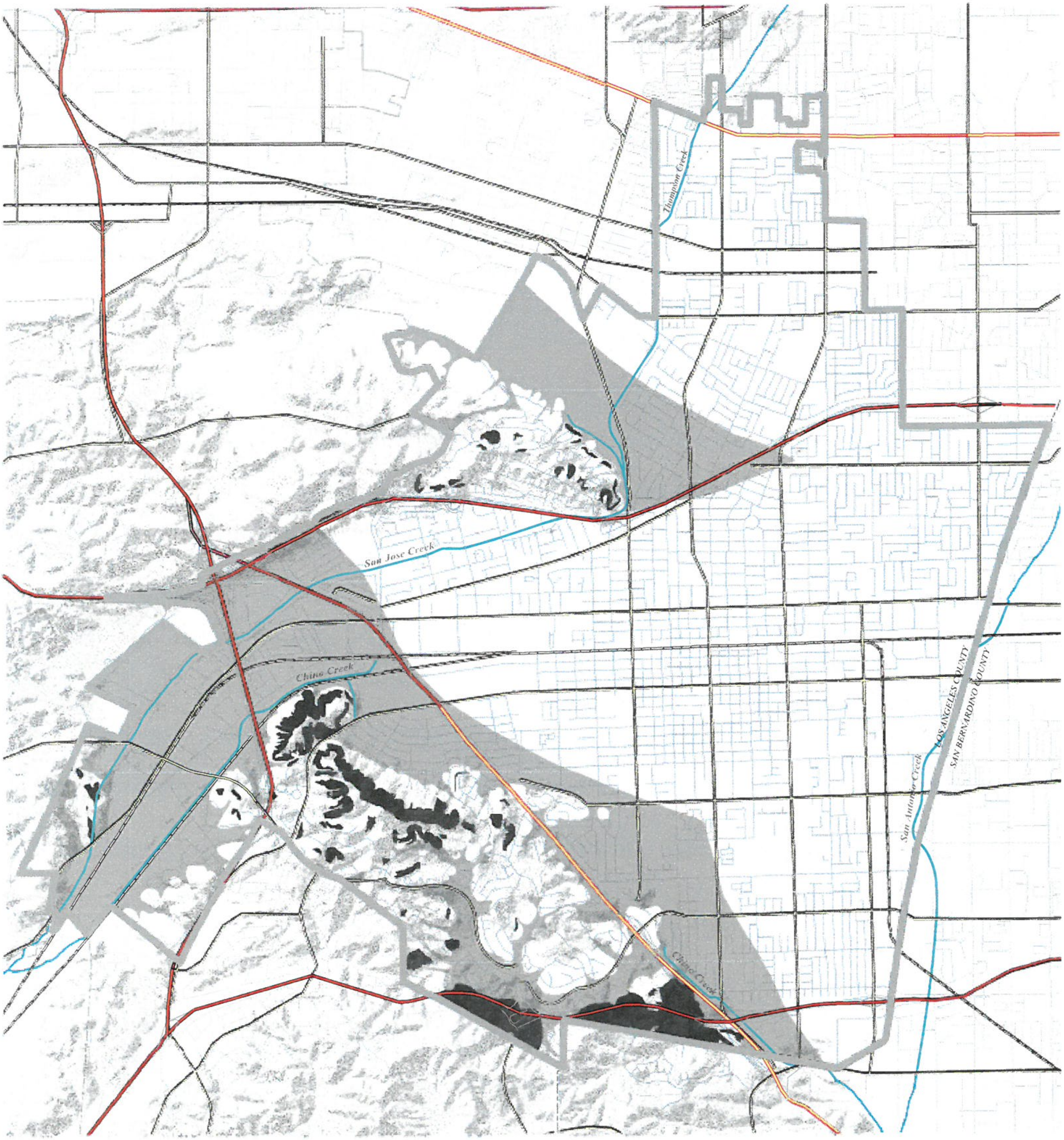

6-4 Seismic Hazards

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 [9] for an earthquake within the next few decades. 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.

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

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

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

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

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

181 will be closed in 2012 due to budget crisis

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] Lanterman is scheduled to close in 2014 due to budget crisis.

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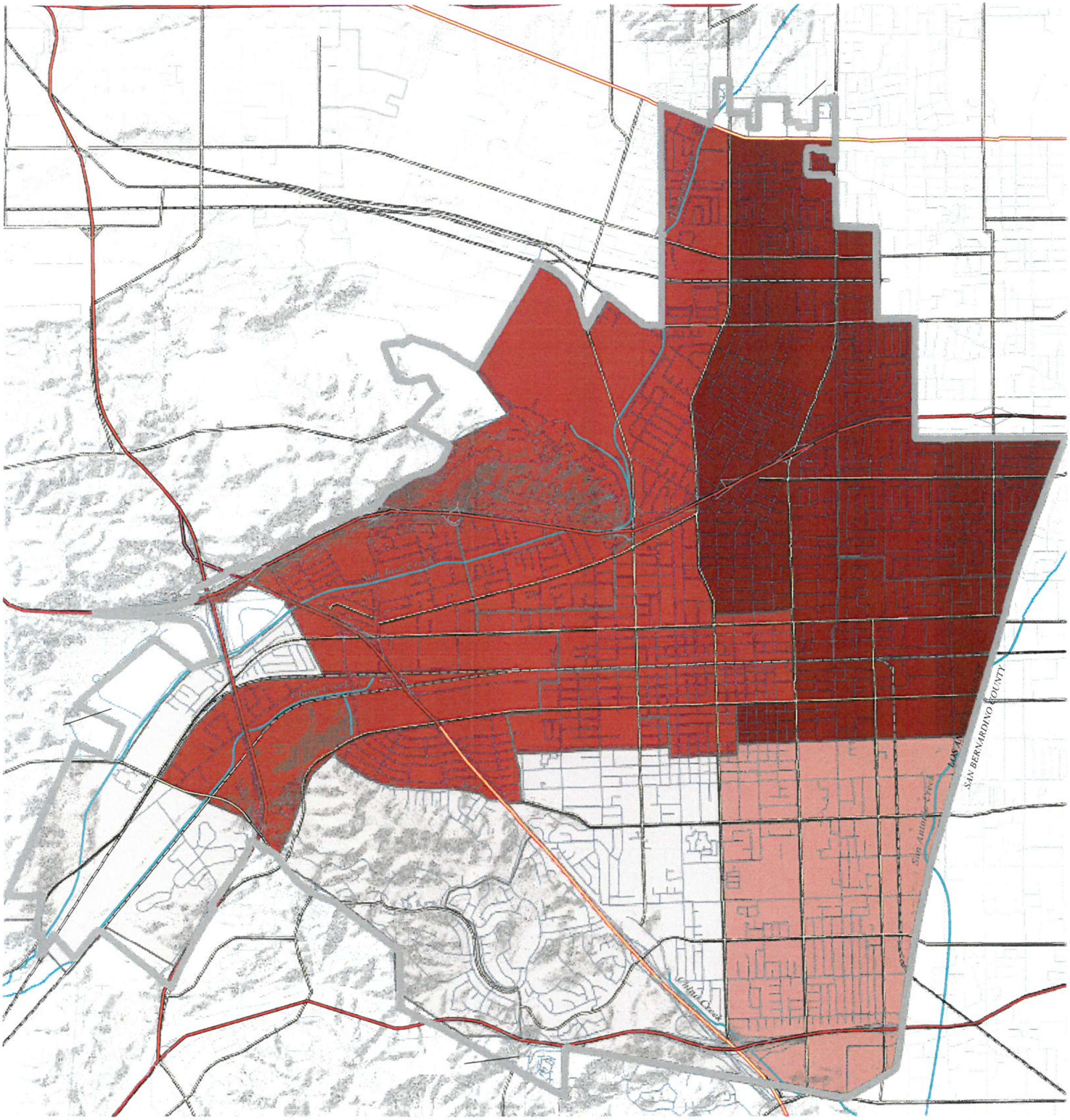
[14] Burby, R. (Ed.) Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities (1998), Washington D.C., Joseph Henry Press.

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



6-5 Peak Ground Acceleration
HAZUS

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

City Lmits

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: Community Developemnt

Implementation Schedule: ongoing

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: ongoing

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 5.1: 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: ongoing

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,

Implementation Schedule: ongoing

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

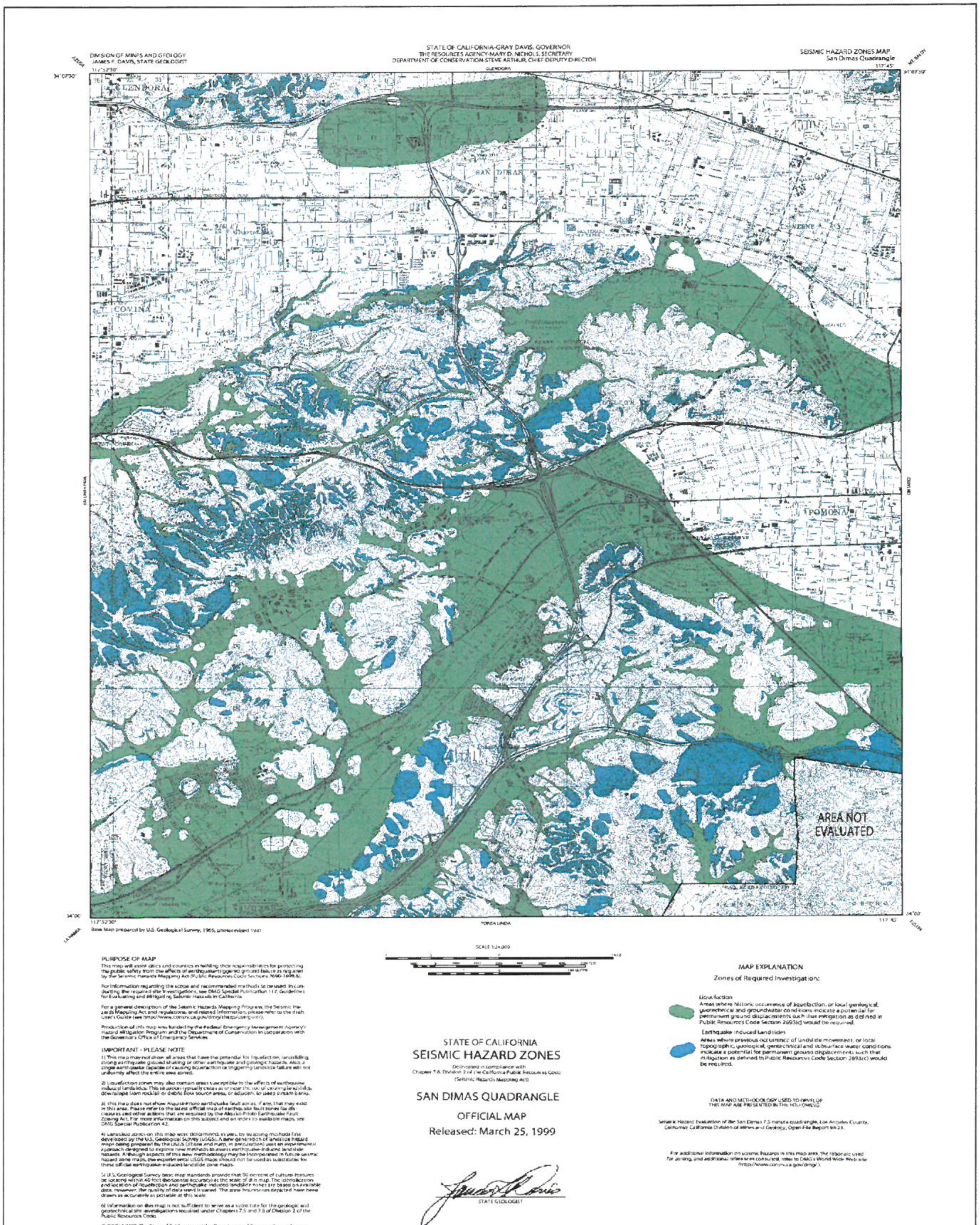
Implementation Schedule: ongoing

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).

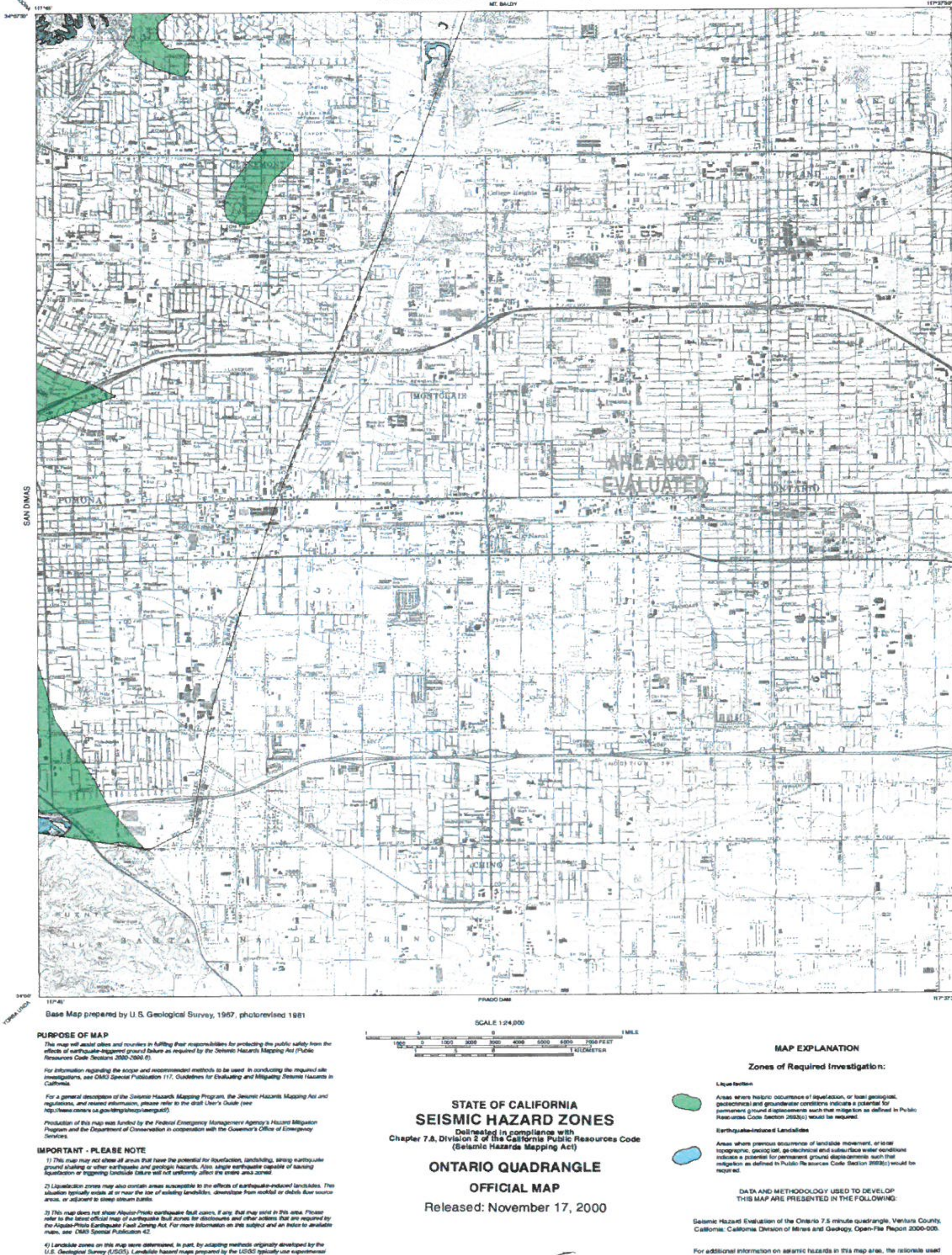


6-6 Seismic Map San Dimas

DIVISION OF MINES AND GEOLOGY
JAMES F. DAVIS, STATE GEOLOGIST

STATE OF CALIFORNIA-GRAY DAVIS, GOVERNOR
THE RESOURCES AGENCY-MARY D. NICHOLS, SECRETARY
DEPARTMENT OF CONSERVATION-DARRYL W. YOUNG, DIRECTOR

SEISMIC HAZARD ZONES
Ontario Quadrangle



Base Map prepared by U.S. Geological Survey, 1967, photorevised 1981

SCALE 1:24,000

PURPOSE OF MAP

This map will assist cities and counties in fulfilling their responsibilities for protecting the public safety from the effects of earthquake-triggered ground failure as required by the Seismic Hazards Mapping Act (Public Resources Code Sections 2690-2699.6).

For information regarding the scope and recommended methods to be used in conducting the required site investigations, see DMG Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California.

For a general description of the Seismic Hazards Mapping Program, the Seismic Hazards Mapping Act and regulations, and related information, please refer to the draft User's Guide (see http://www.consrv.ca.gov/dmg/shezp/userguid/).

Production of this map was funded by the Federal Emergency Management Agency's Hazard Mitigation Program and the Department of Conservation in cooperation with the Governor's Office of Emergency Services.

IMPORTANT - PLEASE NOTE

1) This map may not show all areas that have the potential for liquefaction, landsliding, strong earthquake ground shaking or other earthquake and geologic hazards. Also, single earthquake capable of causing liquefaction or triggering landslide failure will not uniformly affect the entire area zoned.

2) Liquefaction zones may also contain areas susceptible to the effects of earthquake-induced landslides. This situation typically exists at or near the toe of existing landslides, downslope from rockfall or debris flow source areas, or adjacent to steep stream banks.

3) This map does not show Alquist-Priolo earthquake fault zones, if any, that may exist in this area. Please refer to the latest official map of earthquake fault zones for disclosures and other actions that are required by the Alquist-Priolo Earthquake Fault Zoning Act. For more information on this subject and an index to available maps, see DMG Special Publication 42.

4) Landslide zones on this map were determined, in part, by adapting methods originally developed by the U.S. Geological Survey (USGS). Landslide hazard maps prepared by the USGS typically use experimental approaches to assess earthquake-induced and other types of landslide hazards. Although aspects of these new methodologies may be incorporated in future CDMG seismic hazard zone maps, USGS maps should not be used as substitutes Official SEISMIC HAZARD ZONES maps.

5) U.S. Geological Survey base map standards provide that 90 percent of cultural feature be located within 40 feet (horizontal accuracy) at the scale of this map. The identification and location of liquefaction and earthquake-induced landslide zones are based on available data. However, the quality of data used is varied. The zone boundaries depicted have been drawn as accurately as possible at this scale.

6) Information on this map is not sufficient to serve as a substitute for the geologic and geotechnical site investigations required under Chapters 7.5 and 7.8 of Division 2 of the Public Resources Code.

7) DISCLAIMER: The State of California and the Department of Conservation make no representations or warranties regarding the accuracy of the data from which these maps were derived. Neither the State nor the Department shall be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any with claim by any user or any third party on account of or arising from the use of this map.

STATE OF CALIFORNIA
SEISMIC HAZARD ZONES
Delineated in compliance with
Chapter 7.8, Division 2 of the California Public Resources Code
(Seismic Hazards Mapping Act)

ONTARIO QUADRANGLE

OFFICIAL MAP

Released: November 17, 2000

STATE GEOLOGIST

MAP EXPLANATION

Zones of Required Investigation:

Liquefaction

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-induced Landslides

Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

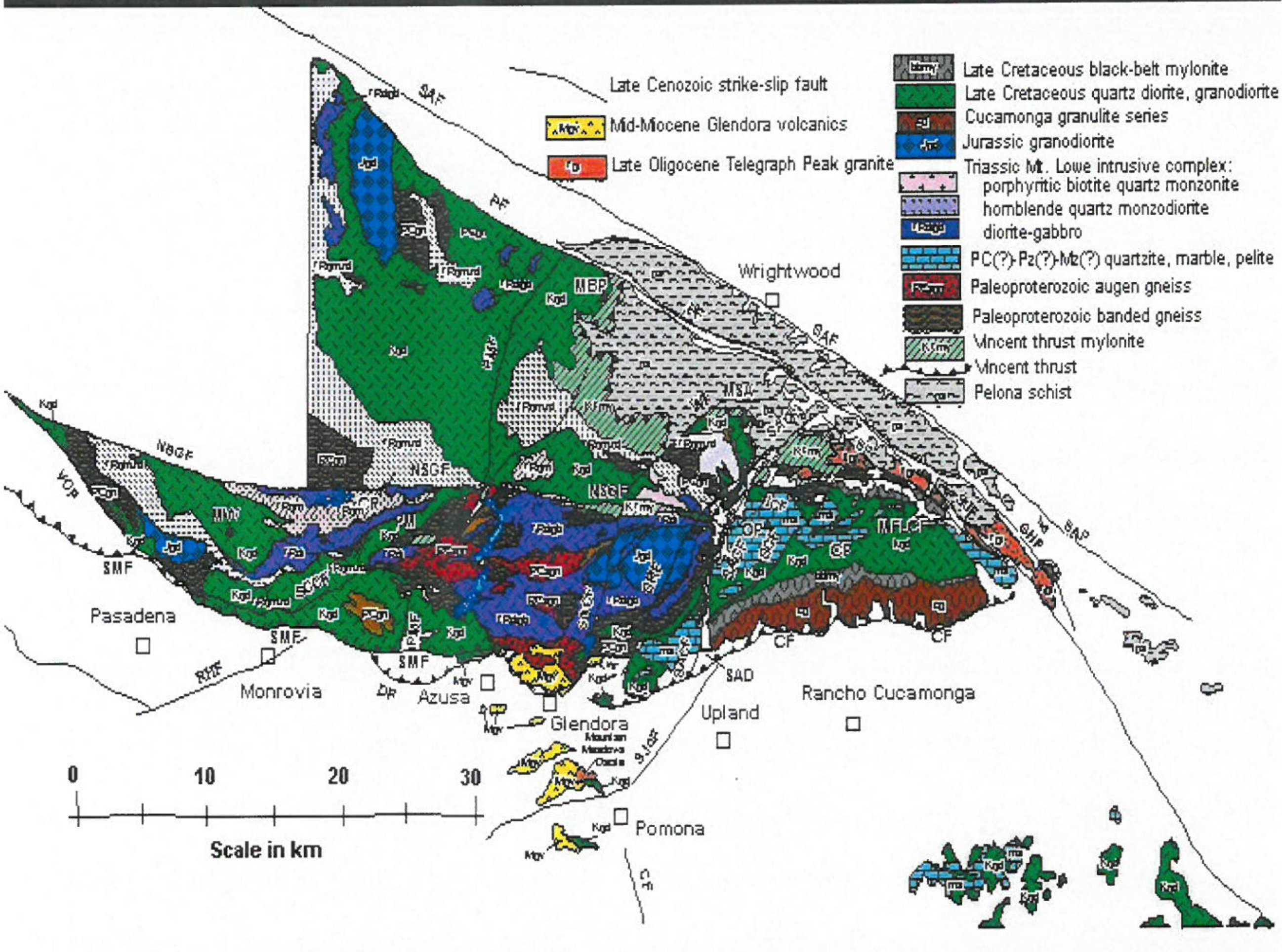
DATA AND METHODOLOGY USED TO DEVELOP
THIS MAP ARE PRESENTED IN THE FOLLOWING:

Seismic Hazard Evaluation of the Ontario 7.5 minute quadrangle, Ventura County, California: California Division of Mines and Geology, Open-File Report 2000-006.

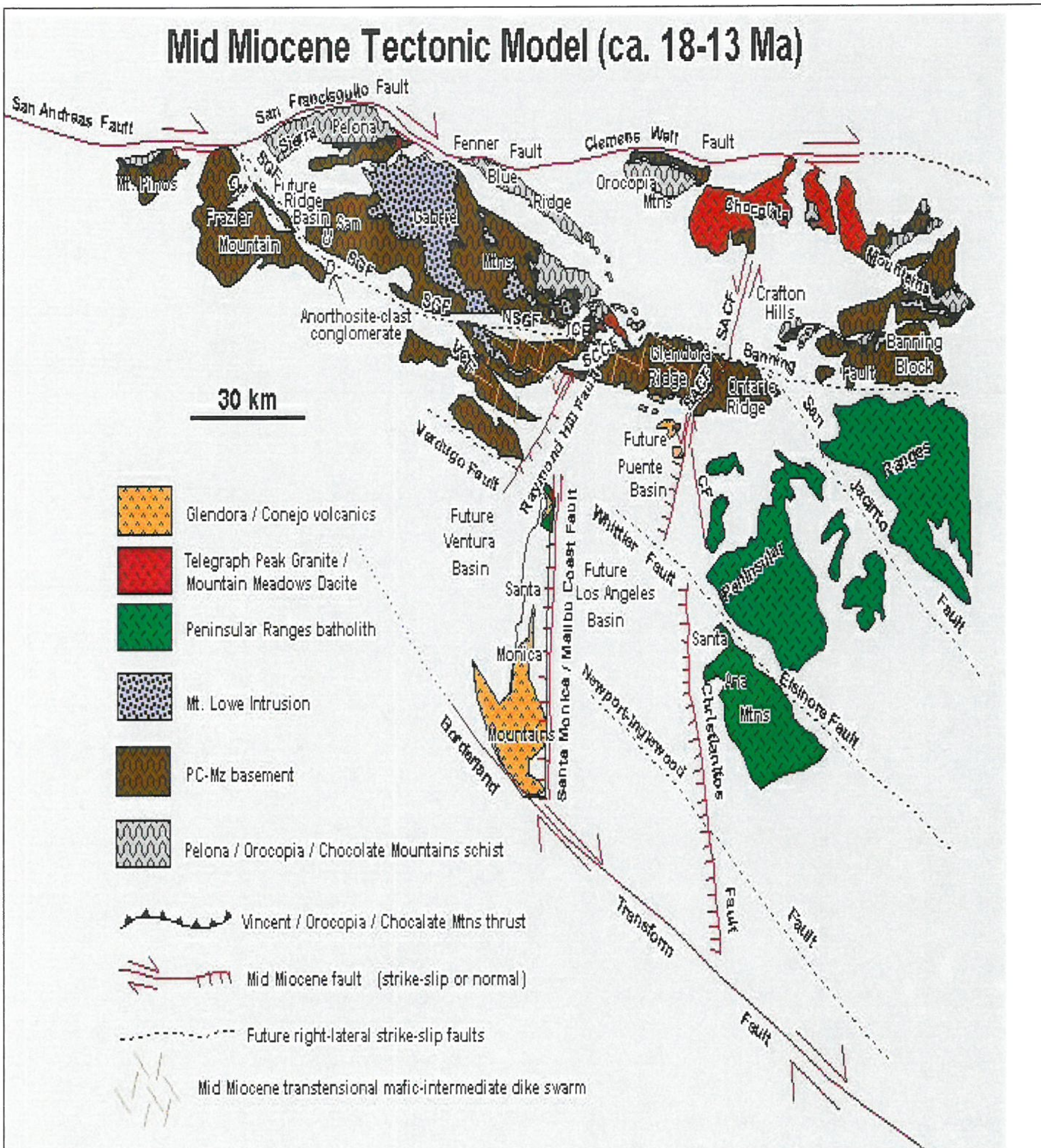
For additional information on seismic hazards in this map area, the rationale used for zoning, and additional references consulted, refer to DMG's World Wide Web site (http://www.consrv.ca.gov/dmg/).

6-7 Seismic Map Ontario

Pre-15 Ma Geology of the Eastern San Gabriel Mountains and Pomona Valley



6-8 Geology of San Gabriel Valley



6-9 Mid Miocene Map

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 had a small slide in 2006 that destroyed 4 homes, with 6 million dollars in damage.

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.

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

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

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

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_pa s_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

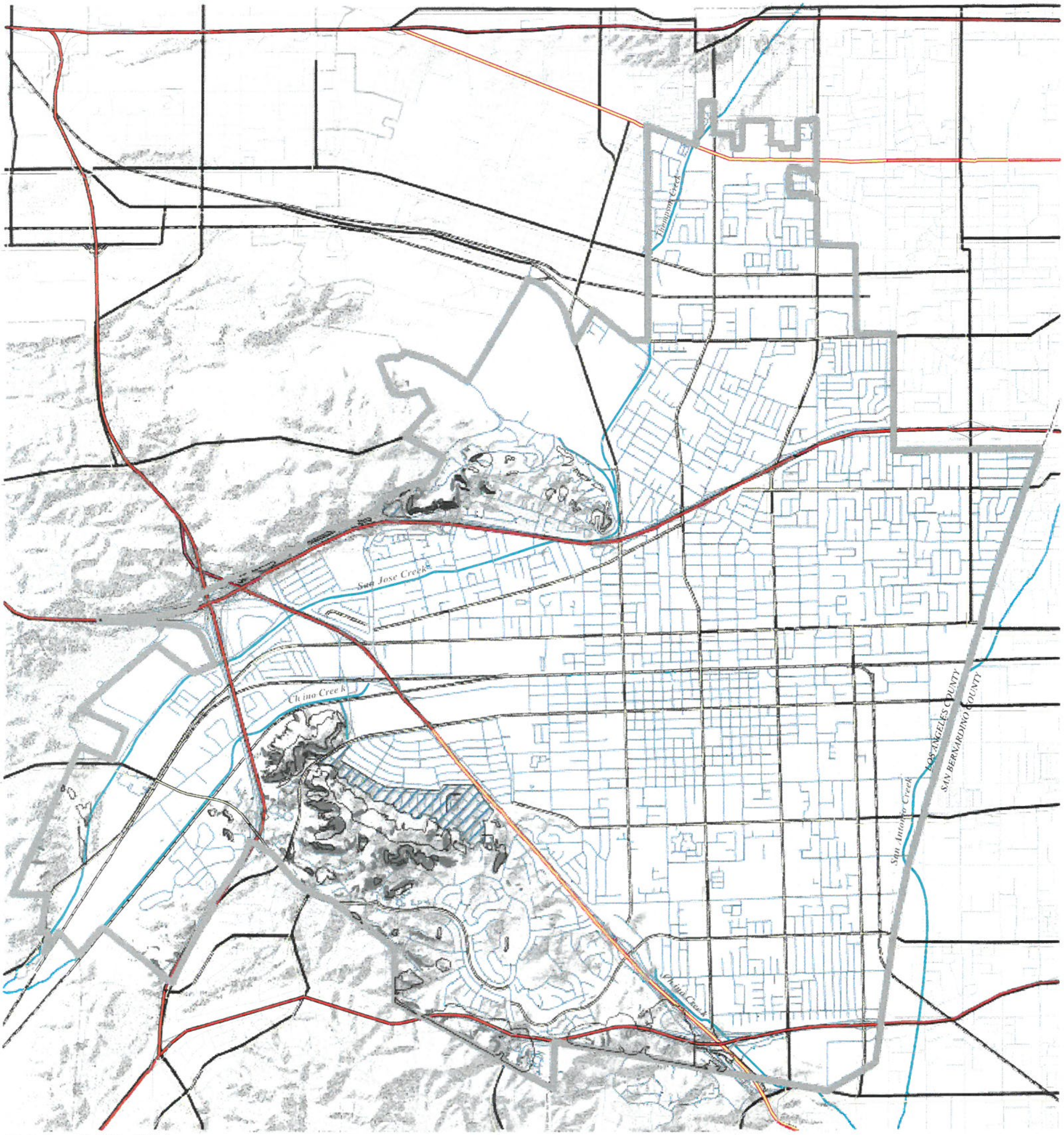
Although landslides are a natural occurrence, human impacts can substantially affect the potential for landslide failures. The increasing scarcity of developable land, particularly in urban areas, increases the tendency to build on geologically marginal land. Additionally, hillside housing developments 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



7-1 Landslide Risk

Moderate Risk

High Risk

Hillside Zoning

City Limits

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.

PROBABILITY OF FUTURE EVENTS

The probability of a landslide event is extremely low. Less than 5% chance of occurring. The City of Pomona has only once experienced a landslide event and that was 4 homes in the in the hillside area of southwest Pomona. Immediate revision of the hillside ordinance will prevent in the future any repeat of this event.

VULNERABILITY ASSESSMENT

7.3 OVERVIEW

The City of Pomona has a low (<5%) 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.

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

[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: Ongoing

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: **completed 2010**

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, 2007 and 2009, 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 2007, 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

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[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

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[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 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 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, the risk of wildfire is limited to localized areas (see Figure 8-1). The probability is very low (<5%) 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. As building recovery continues in 2014 the area of open space is rapidly diminishing. Very few open areas remain and those are on hill sides with strict building codes. By 2020 remaining open areas will be park space only.

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.

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: Ongoing as budget permits

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: Ongoing as funding permits

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

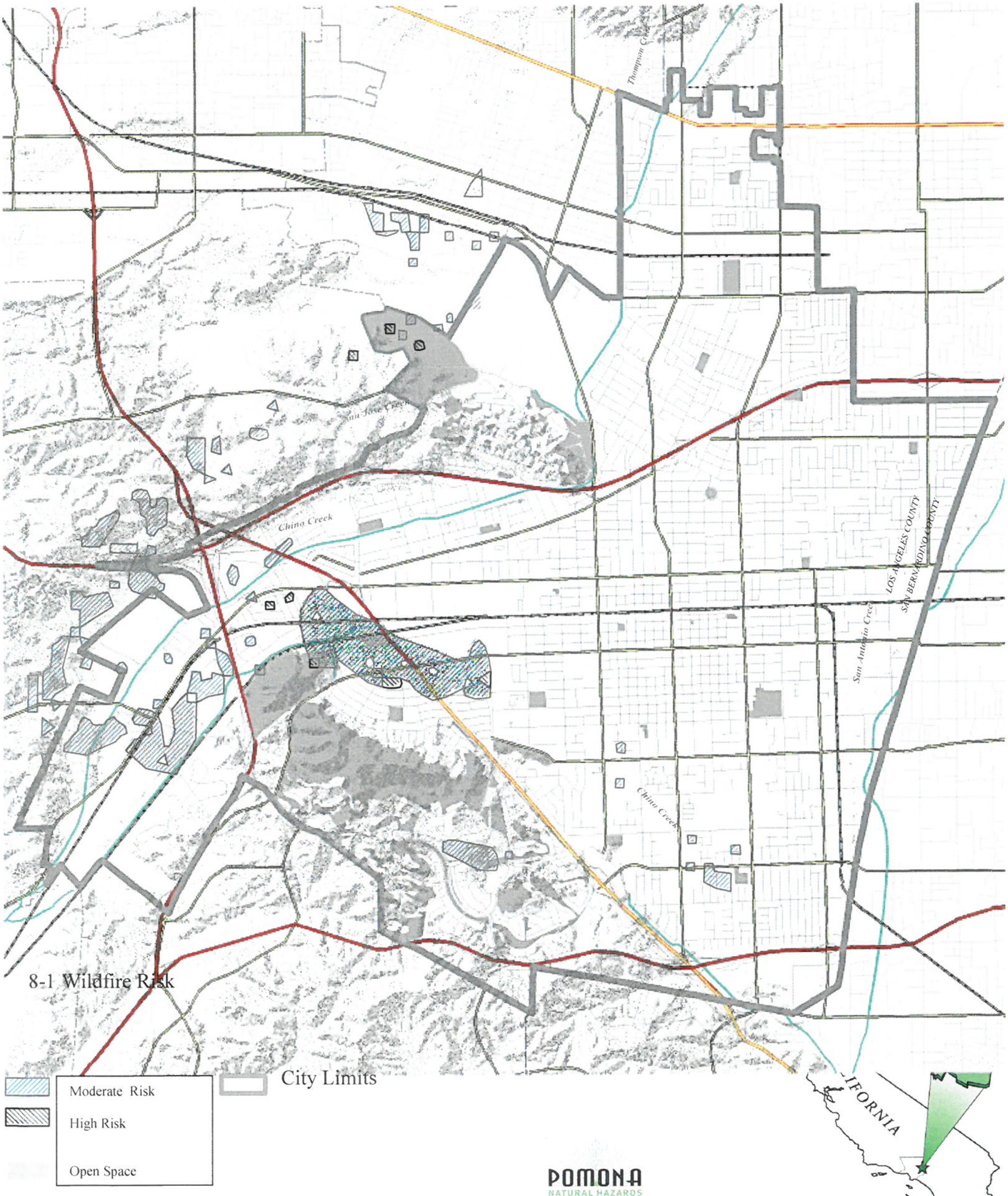
Implementation Schedule: Ongoing

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, environment



POMONA
NATURAL HAZARDS
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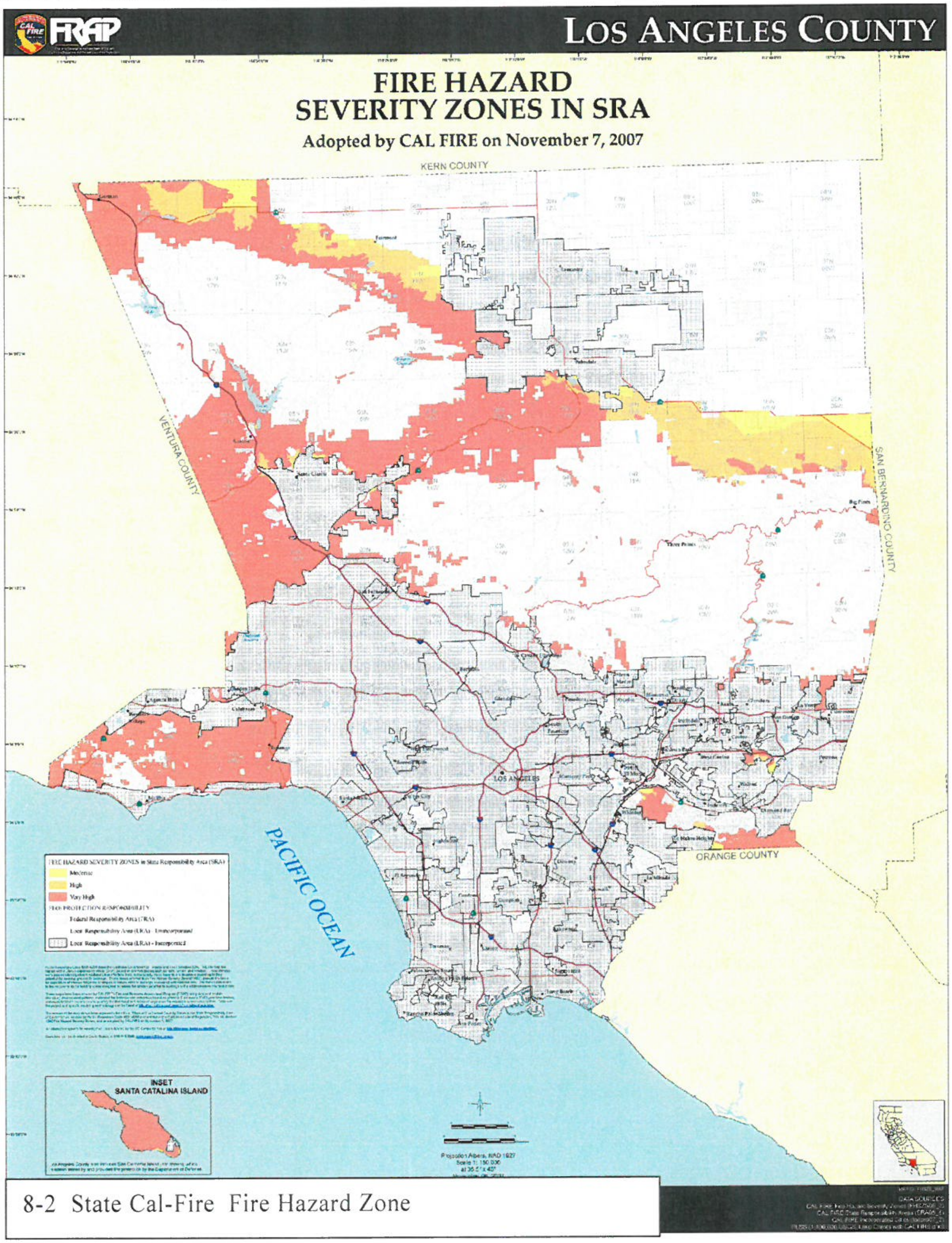

8-2 State Cal-Fire Fire Hazard Zone

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

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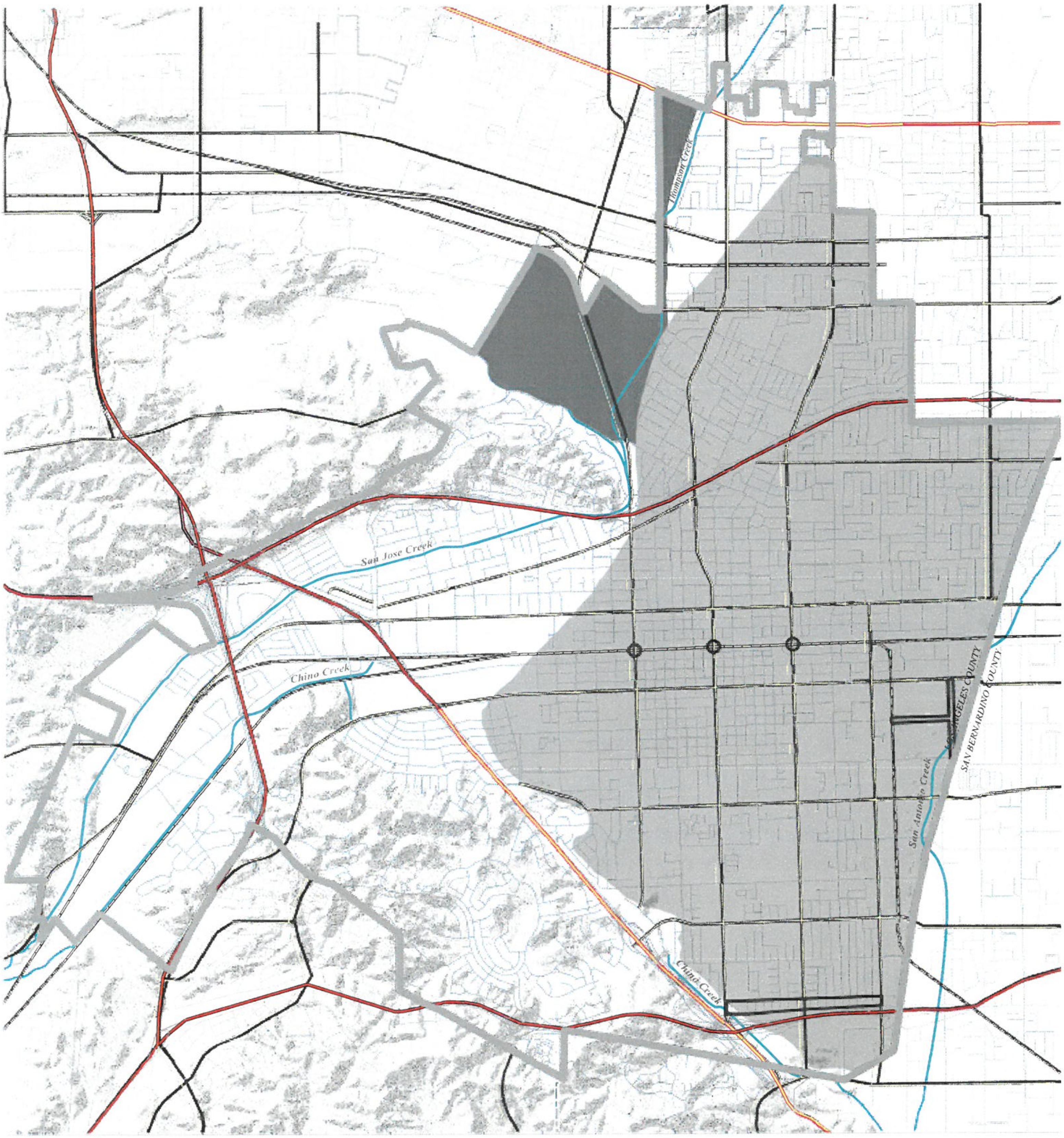
[2] Ibid.

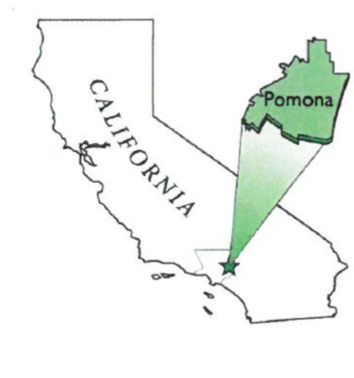
[3] U.S. Army Corps of Engineers, Los Angeles District Reservoir Regulation Section website. http://www.spl.usace.army.mil/resreg/htdocs/snto.html. Accessed July 2004.

[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.



9-1
Flooding



Live Oak Reservoir

San Antonio Dam

Street flooding

City Limits

POMONA
NATURAL HAZARDS
MITIGATION PLAN

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 [6] of the City, in northern and eastern Pomona. 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[7], and has a maximum capacity of 2,500 acre-feet. 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.

PROBABILITY OF FUTURE EVENTS

It is unlikely that the City of Pomona will experience significant storm-related flooding in the future,(<5%) 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 (<5%). 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. With the completion of the 210 freeway the dam inundation was eliminated 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

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[6]

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

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

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.

With the completion of the 210 Freeway, the waters from the San Antonio Dam would divert around the city. The freeway is below grade through LaVerne, Claremont and Upland which would catch the flow and send the water around Pomona. A new study from the Corps of Engineers and the State is needed to address the new inundation area. The old inundation area covered most of the city and would greatly impact the community.

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 (<5%). 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]

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[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: ongoing

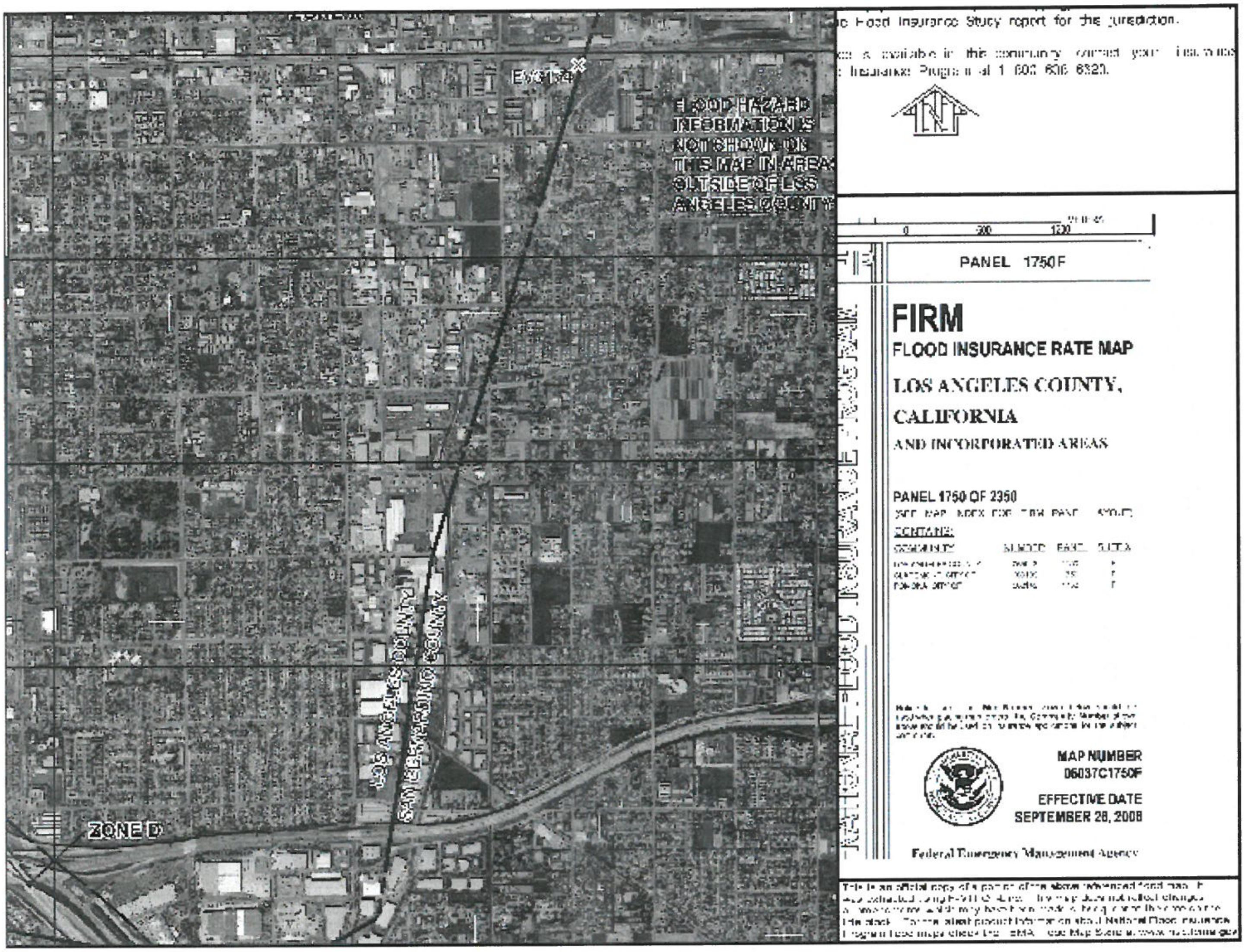
Hazards Addressed: Flooding

Goals and Objectives Implemented:

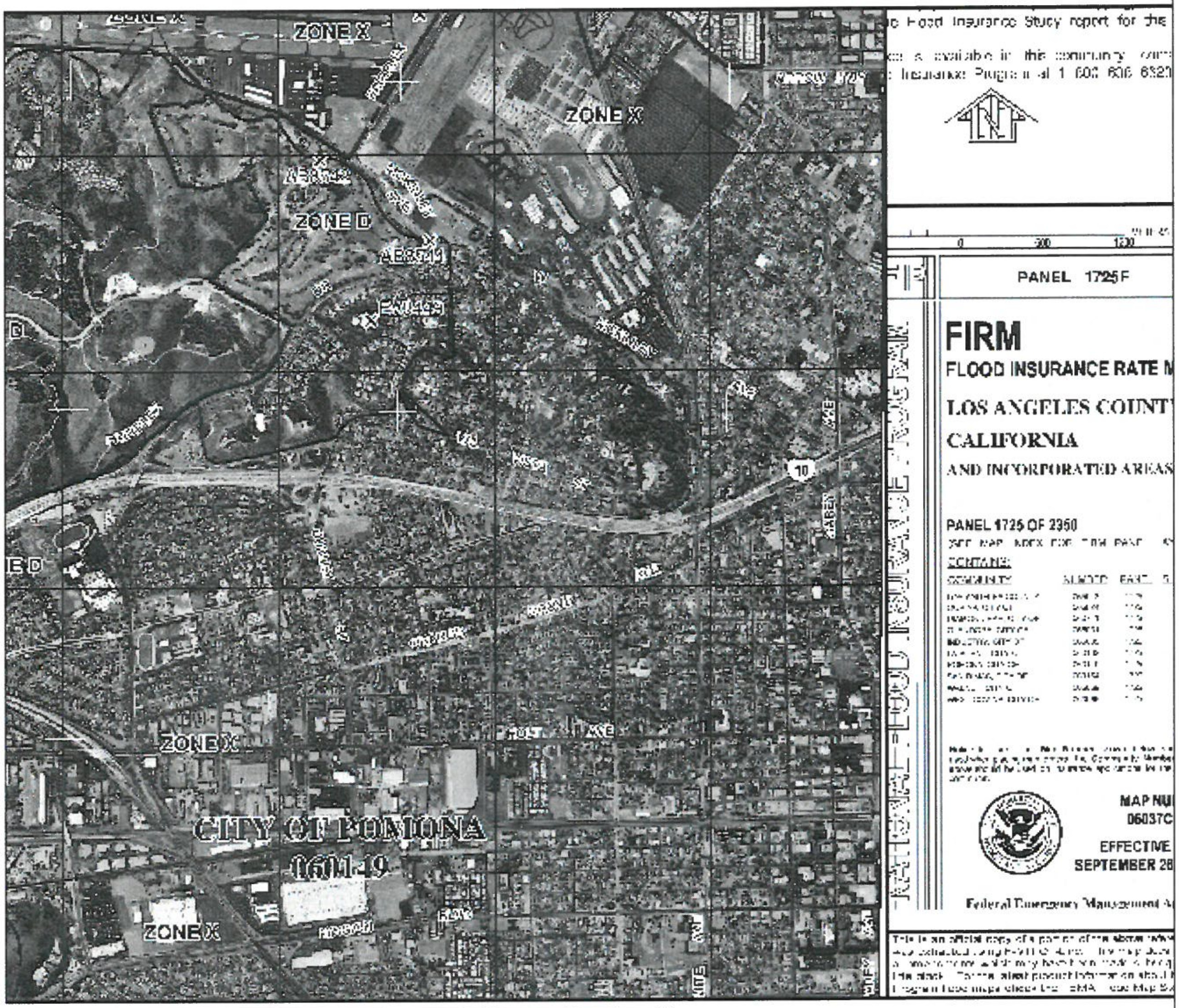
Goal 1.1: Reduce the potential for life loss, injury, and economic damage to Pomona residents and businesses by maximizing emergency preparedness capabilities (Objective 1.1.1).

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

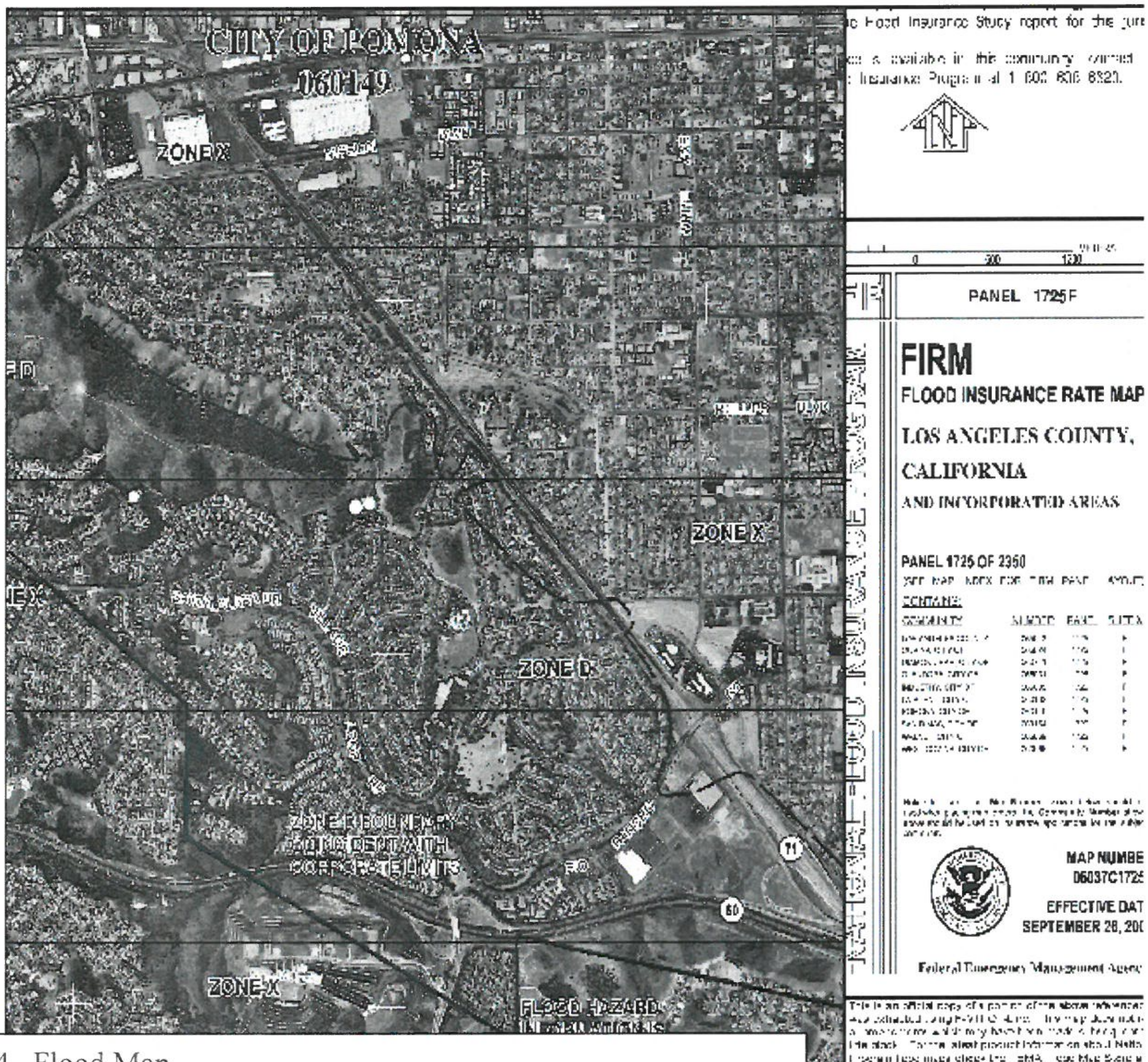
> The City of Pomona will actively promote to the public participation in the National Flood Insurance Program at every opportunity.
> City Code Section 18-600 Flood Plan Management was enacted in 2006 to address the requirements of the NFIP and to mitigate the Flood Hazard in the City of Pomona. The City Code for Flood Plan Management follows on pages 9-11 to 9-24



9-2 Flood Map 1750F



9-3 Flood Map 2350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9-4 Flood Map

Pomona, CA

City of Pomona California Flood Plain Management

1 C Sec. 18-600. - Statutory authorization. | **Code of Ordinances**

2 C STATE LAW REFERENCE TABLE | **Code of Ordinances**

3 C Secs. 18-643—18-699. - Reserved. | **Code of Ordinances**

4 C Secs. 18-633—18-639. - Reserved. | **Code of Ordinances**

5 C Secs. 18-627—18-629. - Reserved. | **Code of Ordinances**

6 C Secs. 18-611—18-619. - Reserved. | **Code of Ordinances**

7 C Secs. 18-602—18-609. - Reserved. | **Code of Ordinances**

8 C Secs. 18-527—18-599. - Reserved. | **Code of Ordinances**

▲ Scroll to Top

9 C Secs. 18-497—18-520. - Reserved. | **Code of Ordinances**

10 C Secs. 18-471—18-490. - Reserved. | **Code of Ordinances**

11 C Secs. 18-438—18-460. - Reserved. | **Code of Ordinances**

12 C Secs. 18-396—18-430. - Reserved. | **Code of Ordinances**

13 C Secs. 18-366—18-390. - Reserved. | **Code of Ordinances**

14 C Secs. 18-317—18-350. - Reserved. | **Code of Ordinances**

15 C Secs. 18-263—18-300. - Reserved. | **Code of Ordinances**

16 C Secs. 18-224—18-260. - Reserved. | **Code of Ordinances**

17 C Secs. 18-185—18-220. - Reserved. | **Code of Ordinances**

18 C Secs. 18-155—18-180. - Reserved. | **Code of Ordinances**

19 C Secs. 18-126—18-150. - Reserved. | **Code of Ordinances**

20 C Secs. 18-95—18-120. - Reserved. | **Code of Ordinances**

21 C Secs. 18-46—18-80. - Reserved. | **Code of Ordinances**

22 C Secs. 18-1—18-30. - Reserved. | **Code of Ordinances**

23 C Secs. 58-571—58-600. - Reserved. | **Code of Ordinances**

24 C Secs. 46-567—46-600. - Reserved. | **Code of Ordinances**

25 C Secs. 30-564—30-600. - Reserved. | **Code of Ordinances**

ARTICLE XI. - FLOOD PLAIN MANAGEMENT

DIVISION 1. - STATUTORY AUTHORIZATION AND PURPOSE

Sec. 18-600. - Statutory authorization.

The legislature of the State of California has in Government Code §§ 65302, 65560, and 65800 conferred upon local governments the authority to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry. Therefore, the City Council of the City of Pomona does hereby adopt the following flood plain management regulations.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-601. - Statement of purpose.

It is the purpose of this article to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

(1) Protect human life and health;

(2) Minimize expenditure of public money for costly flood control projects;

(3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) Minimize prolonged business interruptions;

(5) Minimize damage to public facilities and utilities such as water and gas mains; electric, telephone and sewer lines; and streets and bridges located in areas of special flood hazard;

(6) Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future blighted areas caused by flood damage;

(7) Ensure that potential buyers are notified that property is in an area of special flood hazard; and

(8) Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

(Ord. No. 4066, § 1, 7-19-2006)

Secs. 18-602—18-609. - Reserved.

DIVISION 2. - DEFINITIONS

Sec. 18-610. - Definitions.

Unless specifically defined below, words or phrases used in this article shall be interpreted so as to give them the meaning they have in common usage and to give this article its most reasonable application:

Area of special flood hazard means the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year.

Base flood means a flood which has a one percent chance of being equaled or exceeded in any given year (also called the "100-year flood"). Base flood is the term used throughout this article.

Building. See "structure."

Development means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Flood or *flooding* means:

(1) A general and temporary condition of partial or complete inundation of normally dry land areas from: the overflow of inland or tidal waters; the unusual and rapid accumulation or runoff of surface waters from any source; or mudslides (i.e., mudflows) which are proximately caused by flooding as defined herein and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.

(2) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusual and unforeseeable event which results in flooding as defined in this definition.

Floodplain or *flood-prone area* means any land area susceptible to being inundated by water from any source. See "flooding."

Floodplain administrator is the individual appointed to administer and enforce the flood plain management regulations.

Floodplain management means the operation of an overall program of corrective and preventive measures for reducing flood damage and preserving and enhancing, where possible, natural resources in the floodplain, including but not limited to emergency preparedness plans, flood control works, floodplain management regulations, and open space plans.

Floodplain management regulations means this article and other zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as grading and erosion control) and other application of police power which control development in flood-prone areas. This term describes federal, state or local regulations in any combination thereof which provide standards for preventing and reducing flood loss and damage.

Governing body is the local governing unit, i.e. county or municipality that is empowered to adopt and implement regulations to provide for the public health, safety and general welfare of its citizenry.

Historic structure: means any structure that is

(1) Listed individually in the National Register of Historic Places (a listing maintained by the department of interior) or preliminarily determined by the secretary of the interior as meeting the requirements for individual listing on the National Register;

(2) Certified or preliminarily determined by the secretary of the interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the secretary to qualify as a registered historic district;

(3) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the secretary of interior; or

(4) Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either by an approved state program as determined by the secretary of the interior or directly by the secretary of the interior in states with approved programs.

Manufactured home means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when attached to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

Manufactured home park or subdivision means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

New construction, for floodplain management purposes, means structures for which the "start of construction" commenced on or after the effective date of floodplain management regulations adopted by this community, and includes any subsequent improvements to such structures.

One-hundred-year flood or *100-year flood.* See "base flood."

Recreational vehicle: means a vehicle which is

(1) Built on a single chassis;

(2) Four hundred square feet or less when measured at the largest horizontal projection;

(3) Designed to be self-propelled or permanently towable by a light-duty truck; and

(4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

Start of construction includes substantial improvement and other proposed new development and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, or other improvement was within 180 days from the date of the permit. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading, and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

Structure means a walled and roofed building that is principally above ground; this includes a gas or liquid storage tank or a manufactured home.

Substantial damage means damage of any origin sustained by a structure 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 occurred.

Substantial improvement means any reconstruction, rehabilitation, addition, or other proposed new development of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "substantial damage", regardless of the actual repair work performed. The term does not, however, include either:

(1) Any project for improvement of a structure to correct existing violations or state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or

(2) Any alteration of a "historic structure," provided that the alteration will not preclude the structure's continued designation as a "historic structure."

(Ord. No. 4066, § 1, 7-19-2006)

Secs. 18-611—18-619. - Reserved.

DIVISION 3. - GENERAL PROVISIONS

Sec. 18-620. - Lands to which this article applies.

This article shall apply to all areas identified as flood-prone within the jurisdiction of the City of Pomona.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-621. - Basis for establishing flood-prone areas.

The floodplain administrator shall obtain, review, and reasonably utilize any base flood data available from other federal or state agencies or other source to identify flood-prone areas within the jurisdiction of Pomona. This data will be on file at the Public Works Department, City Hall, 505 S. Garey Avenue, Pomona, California.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-622. - Compliance.

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the term of this ordinance and other applicable regulations. Violation of the requirements (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Nothing herein shall prevent the city council from taking such lawful action as is necessary to prevent or remedy any violation.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-623. - Abrogation and greater restrictions.

This article is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this article and another ordinance, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-624. - Interpretation.

In the interpretation and application of this ordinance, all provisions shall be:

(1) Considered as minimum requirements;
(2) Liberally construed in favor of the governing body; and
(3) Deemed neither to limit nor repeal any other powers granted under state statutes.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-625. - Warning and disclaimer of liability.

The degree of flood protection required by this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This article does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This article shall not create liability on the part of City Council of the City of Pomona, any department, agency, officer or employee thereof; the State of California; or the Federal Insurance Administration, Federal Emergency Management Agency, for any flood damages that result from reliance on this article or any administrative decision lawfully made hereunder.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-626. - Severability.

This ordinance and the various parts thereof are hereby declared to be severable. Should any section of this ordinance be declared by the courts to be unconstitutional or invalid, such decision shall not affect the validity of the ordinance as a whole, or any portion thereof other than the section so declared to be unconstitutional or invalid.

Secs. 18-627—18-629. - Reserved.

DIVISION 4. - ADMINISTRATION

Sec. 18-630. - Establishment of development permit.

A development permit shall be obtained for all proposed construction or other development in the community, including the placement of manufactured homes, so that it may be determined whether such construction or other development is within flood-prone areas.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-631. - Designation of the flood plain administrator.

The public works director is hereby appointed to administer, implement, and enforce this article by granting or denying development permits in accord with its provisions.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-632. - Duties and responsibilities of the floodplain administrator.

The duties and responsibilities of the floodplain administrator shall include, but not be limited to the following:

(1) *Permit review.* Review all development permit applications to determine:

   a. Permit requirements of this article have been satisfied;

   b. All other required state and federal permits have been obtained; and

   c. The site is reasonably safe from flooding.

(2) *Review and use of any other base flood data.* The floodplain administrator shall obtain, review, and reasonably utilize any base flood data available from other federal or state agency or other source.

(Ord. No. 4066, § 1, 7-19-2006)

Secs. 18-633—18-639. - Reserved.

DIVISION 5. - PROVISIONS FOR FLOOD HAZARD REDUCTION

Sec. 18-640. - Standards of construction.

If a proposed building site is in a flood-prone area, all new construction and substantial improvements, including manufactured homes, shall:

(1) Be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.

(2) Be constructed:

- a. With materials and utility equipment resistant to flood damage;
- b. Using methods and practices that minimize flood damage;
- c. With electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-641. - Standards for subdivisions or other proposed new development.

If a subdivision proposal or other proposed new development, including manufactured home parks or subdivisions, is in a flood-prone area, any such proposals shall be reviewed to assure that:

(1) All such proposals are consistent with the need to minimize flood damage within the flood-prone area;

(2) All public utilities and facilities such as sewer, gas, electrical, and water systems are located and constructed to minimize or eliminate flood damage; and

(3) Adequate drainage is provided to reduce exposure to flood hazards.

(Ord. No. 4066, § 1, 7-19-2006)

Sec. 18-642. - Standards for utilities.

(a) All new and replacement water supply and sanitary sewage systems shall be designed to minimize or eliminate:

  (1) Infiltration of flood waters into the systems, and

  (2) Discharge from the systems into flood waters.

(b) On-site waste disposal systems shall be located to avoid impairment to them, or contamination from them during flooding.

(Ord. No. 4066, § 1, 7-19-2006)

Secs. 18-643—18-699. - Reserved.

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

It should be noted that in 2011 the cities West of Pomona suffered millions in damage due to downed trees from the winds over a 2 day period. Power was out for over 1 week in some areas

2

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, the probability is low (<5%) for a damaging windstorm. 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.

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,

Implementation Schedule: ongoing

Hazards Addressed: Earthquake, Windstorm

Goals and Objectives Implemented:

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

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).

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.

The technical committee for the 2012 update consisted of the following:
Planning Director
Risk Manager
Human Resource Director
Information Technology Director
Emergency Services Planner

The committee met on the following dates to discuss any updates to the plan:
August 29, 2012
September 04, 2012

The following stakeholders were contacted for input in the update of the plan:

Pomona Valley Medical Center

Los Angeles County Fire Department

Los Angeles County Area D

American Red Cross

Pomona Unified School District

Cal-Poly Pomona

Southern California Gas Company

Southern California Edison

Union Pacific Railroad

Western University

Casa Colina Hospital

Metropolitan Water District

U.S. Army Corps of Engineers

Lanterman Hospital

Public Meetings

The City of Pomona conducted a series of public meetings to gather input from the public on the plan. These meeting were held on the following dates:

September 13, 2012 Pomona First Baptist Church

October 24, 2012 Jaycee's Park

October 29,2012 City Hall

November 12, 2012 City Hall

Over 60 people attended the meetings. No new hazards or mitigation ideas.

Had lots of preparedness questions because of recent events nation-wide.

City Hall

- City Hall HOME
- City Codes
- City Commissioners
- Current Salary Schedule
- Press Releases: City of Pomona
- Press Releases: Utilities and Community Partners

Natural Hazard Mitigation Planning Meetings

Your input is very much needed!

As part of the Emergency Planning Process for the City of Pomona, every five years the City must update the Natural Hazard Mitigation Plan. An important part of the updating process is public review and comments on the updated plan would include suggestions how the City can reduce the effects of natural disasters that might occur in Pomona.

Two public meeting have been scheduled for the public's comment and participation in the updating process. Both meetings will take place in the City of Pomona City Council Chambers located at 505 S. Garey Avenue, Pomona, California. This first meeting is scheduled for October 29, at 7pm and the second meeting is scheduled for November 12, 2012 at 7pm. Officials will discuss the natural hazards Pomona must prepare for and then gather ideas from the audience on how to reduce those harzards.

If you have any questions please call the Human Resources Department at (909) 620-3741 or e-mail John Schmidt at john_schmidt@ci.pomona.ca.us .

Thank you.

Schmidt, John

From: City of Pomona Emergency Management [city-of-pomona-emergency-management@emails.nixle.com]
Sent: Monday, October 22, 2012 11:26 AM
To: Schmidt, John
Subject: Community Message: Your input is needed

909-620-2741 appears to be a phone that can not receive text messages. Please check this is a valid cell phone number. If 909-620-2741 is not your mobile phone, please login to update your settings.

Monday October 22, 2012, 11:25 AM

City of Pomona Emergency Management

Share | Tweet | g+ | Forward

Community: Your input is needed

Hi John Schmidt,

You input is very much needed!

As part of the Emergency Planning Process for the City of Pomona, every 5 years the City must update the Natural Hazard Mitigation Plan. An important part of the updating process is public review and comments on the updated plan would include suggestions how the City can reduce the effects of natural disasters that might occur in Pomona

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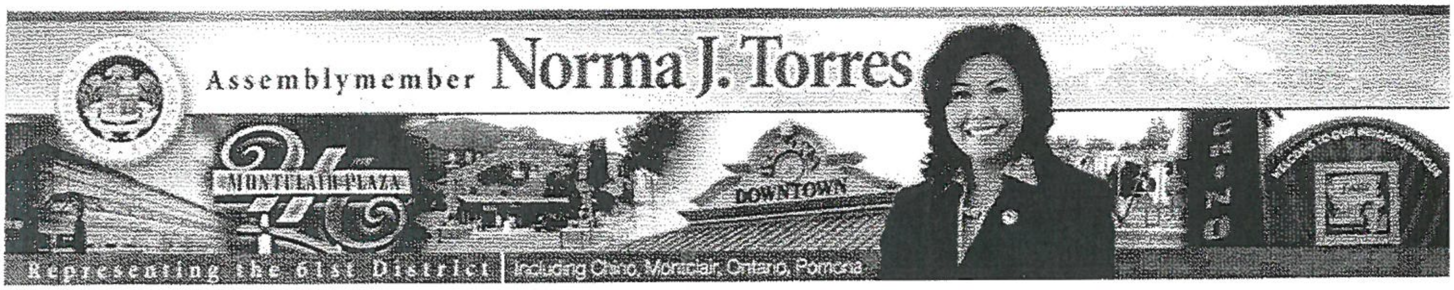
For full details, view this message on the web.



EMERGENCY PREPAREDNESS WORKSHOP

SEPTEMBER 13, 2012 • 6:00 – 8:00 P.M.

DRAFT AGENDA

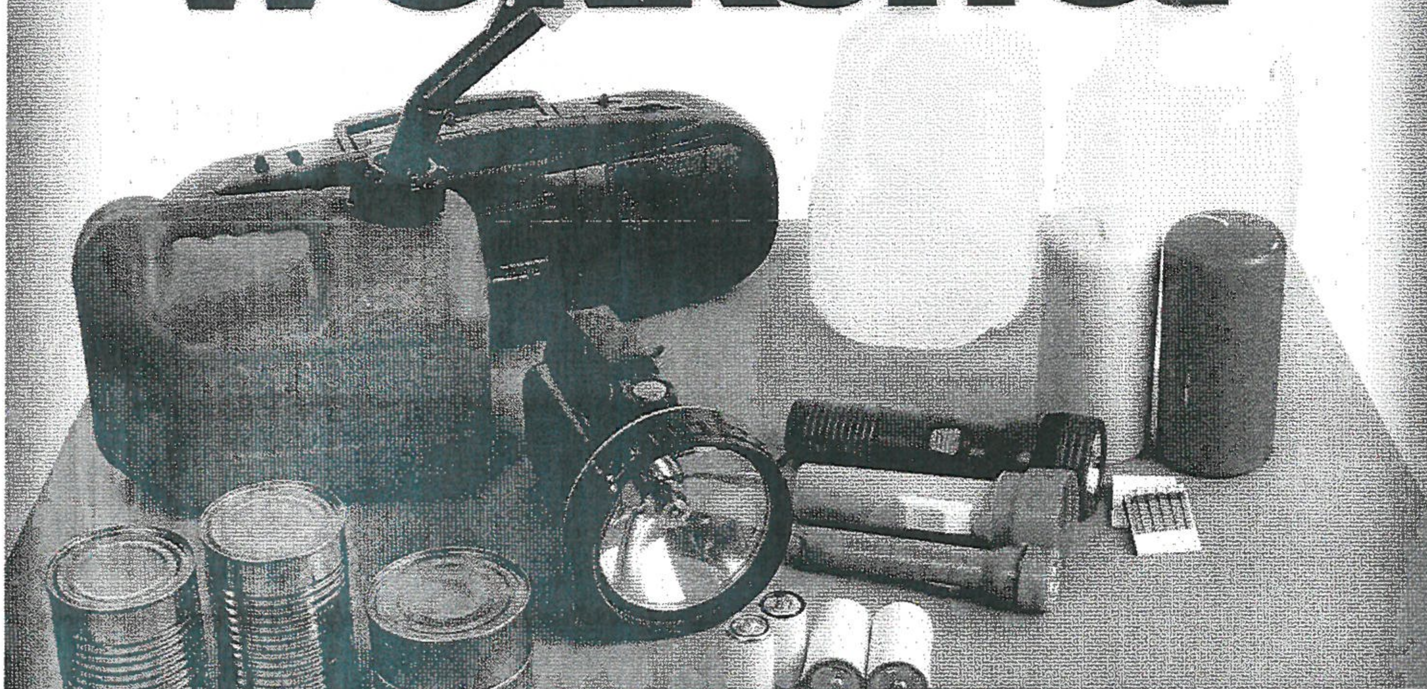
- Greetings/Introductions — Erica Ambriz, District Director for Assemblymember Norma Torres
- Welcome — Assemblymember Norma Torres
- Remarks by Co-Hosts — Pomona Vice Mayor Freddie Rodriguez
Ontario Council Member Debra Dorst-Porada
Pomona Council Member Paula Lantz
Montclair Council Member Bill Ruh

SPEAKERS & PRESENTATIONS

- Earthquake Preparedness
  - Mark Benthien, Education and Outreach for the Southern California Earthquake Center
- How cities plan to reduce hazards to natural disasters through planning!
  - John Schmidt, City of Pomona
- Grease Fires • Smoke Alarms • Home Escape Routes • Ready, Set, Go
  - Bill Peters, Public Information Officer for Cal Fire of San Bernardino
- Transfer the Risk
  - Nona Tirre, State Farm Insurance
- Donna Lee, Central Region Manager for Southern California Edison Public Affairs
- Robert J. Cruz, Public Affairs Manager for The Gas Company
- How to properly use a Fire Extinguisher: Live Demonstration
  - Captain Larry Jordan, LACFD Fire Station 182
- Closing Remarks — Assemblymember Norma Torres

Assemblymember Norma J. Torres invites you to an

Emergency Preparedness WORKSHOP



THURSDAY, SEPTEMBER 13

6 – 8 p.m.

Pomona First Baptist Church
586 N. Main Street
Pomona

Assemblymember Norma J. Torres
along with *The California Earthquake Association, Pomona Vice Mayor Freddie Rodriguez, Pomona Council Member Paula Lantz, Montclair Council Member Bill Ruh, and Ontario Council Member Debra Dorst-Porada* invite you to an Emergency Preparedness Workshop.

First 75 guests will receive a FREE first aid kit.

FOR MORE INFORMATION AND TO RSVP, PLEASE CALL **909-902-9606** • WEB: **www.asmdc.org/torres**

THE CITY OF
POMONA
Human Resources Department

You input is very much needed!

As part of the Emergency Planning Process for the City of Pomona, every 5 years the City must update the Natural Hazard Mitigation Plan. An important part of the updating process is public review and comments on the updated plan would include suggestions how the City can reduce the effects of natural disasters that might occur in Pomona

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City Hall, 505 S. Garey Ave., Box 660, Pomona, CA 91769 (909) 620-2291 Fax (909) 620-2295