Earthquake Hazards in the Las Virgenes-Malibu Region

SECTION 6

EARTHQUAKES

TABLE OF CONTENTS **PAGE**

WHY ARE EARTHQUAKES A THREAT TO THE LAS VIRGENES-MALIBU REGION

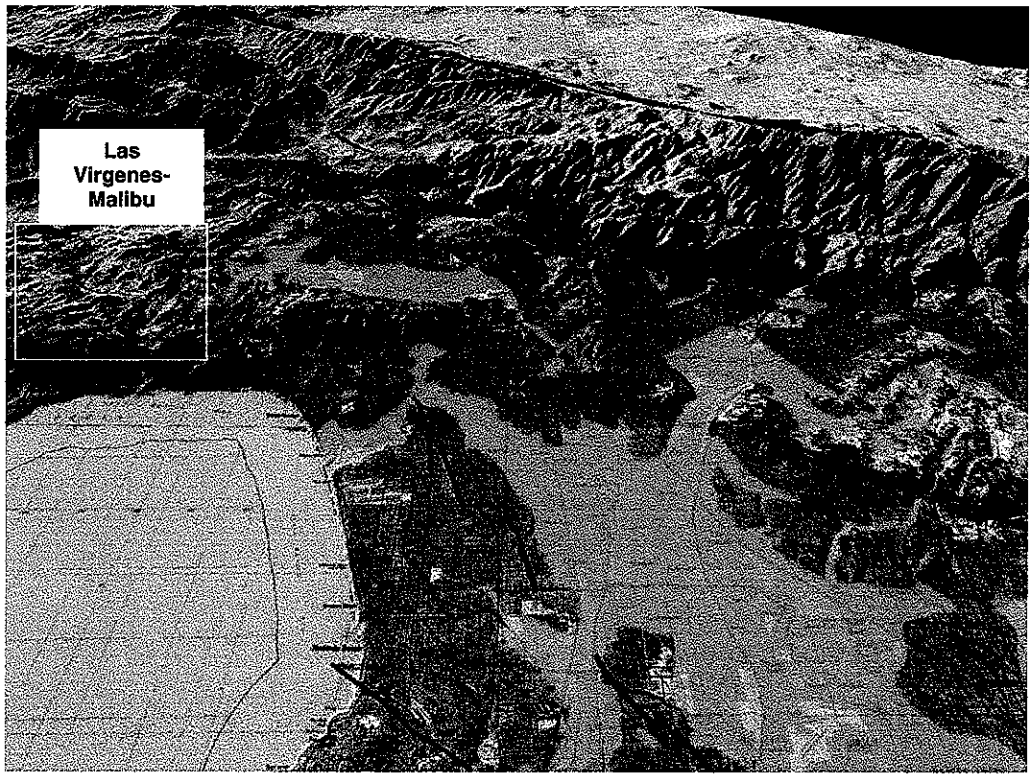
Recent reports from scientists with the U.S. Geological Survey and the Southern California Earthquake Center predict that the Los Angeles Area could expect to experience at least one earthquake every year of magnitude 5.0.

The Las Virgenes-Malibu is located in a region that is subject to frequent seismic activity. A major earthquake occurring on any one of several active faults could result in a substantial number of deaths and injuries and extensive damage to both public and private property. The Las Virgenes-Malibu is located along the boundary between the Transverse Ranges and Peninsular Ranges physiographic of Southern California. The Transverse Ranges consist of a complex series of elongate, east-west trending mountains, such as the Santa Monica Mountains, and intervening valleys. In contrast, the Peninsular Ranges province consists of northwest-southwest trending mountains, such as the Santa Ana Mountains, and intervening valleys. Both the Transverse Ranges and Peninsular Ranges physiographic provinces are seismically active and contain many active faults.

Building codes or earthquake design has evolved over the years and seismic design provisions have been added to or improved upon following major earthquakes. The cities within the Las Virgenes region follow the most current building practices. For more information please see "Current Mitigation Activities" at the end of this section.

Map 5 is provided to show seismic hazards areas. Yellow areas are zones of potential liquefaction. Red areas are zones of potential landslides. The Seismic Hazard Zones illustrated in the models are produced by the CGS Seismic Hazards Mapping Program and the Regional Geologic Hazards Mapping Program. These maps are updated frequently. The California Geological Survey's Earthquakes web page explains both programs in detail.

MAP 5. SEISMIC HAZARDS 3-D ANIMATION OF THE LOS ANGELES AREA.



Source: http://www.consrv.ca.gov/cgs/geologic_hazards/earthquakes/3d_snaps.htm

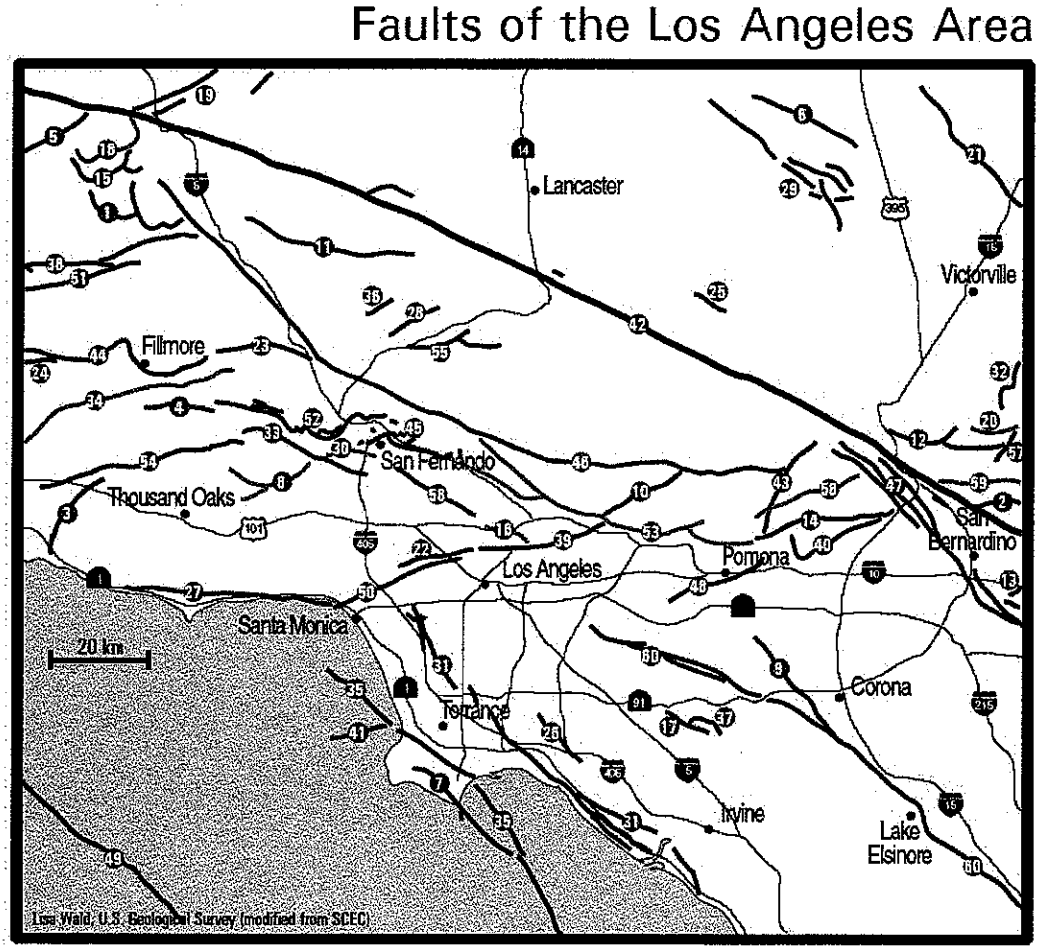
Yellow areas are zones of potential liquefaction. **Red areas** are zones of potential landslides.

Background

Earthquakes occur on faults. A fault is a thin zone of crushed rock separating blocks of the earth's crust. When an earthquake occurs on one of these faults, the rock on one side of the fault slips with respect to the other. Faults can be centimeters to thousands of kilometers (fractions of an inch to thousands of miles) long. The fault surface can be vertical, horizontal, or at some angle to the surface of the earth. Faults can extend deep into the earth and may or may not extend up to the earth's surface.

Stresses in the earth's outer layer push the side of the fault together. The friction across the surface of the fault holds the rocks together so they do not slip immediately when pushed sideways. Eventually enough stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the rock to cause the shaking that we feel during an earthquake. Earthquakes happen over an area of the fault, called the rupture surface. However, the whole fault plane does not slip at once. The rupture begins at a point on the fault plane called the hypocenter, a point usually deep down on the fault. The epicenter is the point on the surface directly above the hypocenter.

MAP 6. FAULTS OF THE LOS ANGELES AREA (Source: USGS)



1 Alamo thrust
2 Arrowhead fault
3 Bailey fault
4 Big Mountain fault
5 Big Pine fault
6 Blake Ranch fault
7 Cabrillo fault
8 Chatsworth fault
9 Chino fault
10 Clamshell-Sawpit fault
11 Clearwater fault
12 Cleghorn fault
13 Crafton Hills fault zone
14 Cucamonga fault zone
15 Dry Creek
16 Eagle Rock fault
17 El Modeno
18 Frazier Mountain thrust
19 Garlock fault zone
20 Grass Valley fault
21 Helendale fault
22 Hollywood fault
23 Holser fault
24 Lion Canyon fault
25 Llano fault
26 Los Alamitos fault
27 Malibu Coast fault
28 Mint Canyon fault
29 Mirage Valley fault zone
30 Mission Hills fault
31 Newport Inglewood fault zone
32 North Frontal fault zone
33 Northridge Hills fault
34 Oak Ridge fault
35 Palos Verdes fault zone
36 Pelona fault
37 Peralta Hills fault
38 Pine Mountain fault
39 Raymond fault
40 Red Hill (Etiwanda Ave) fault
41 Redondo Canyon fault
42 San Andreas Fault
43 San Antonio fault
44 San Cayetano fault
45 San Fernando fault zone
46 San Gabriel fault zone
47 San Jacinto fault
48 San Jose fault
49 Santa Cruz-Santa Catalina Ridge f.z.
50 Santa Monica fault
51 Santa Ynez fault
52 Santa Susana fault zone
53 Sierra Madre fault zone
54 Simi fault
55 Soledad Canyon fault
56 Stoddard Canyon fault
57 Tunnel Ridge fault
58 Verdugo fault
59 Waterman Canyon fault
60 Whittier fault

HISTORY OF EARTHQUAKE EVENTS IN THE LAS VIRGENES-MALIBU REGION

Most Recent Earthquake in Southern California

A micro earthquake occurred at 10:53:49 PM (PDT) on Thursday, October 7, 2004. The magnitude 1.1 event occurred 2 km (1 miles) SSW of Studio City, CA. The hypocentral depth was 9 km (6 miles). This information according to the United States Geological Survey, Southern California Earthquake Hazards Program.

This earthquake differed from the deep thrust faulting earthquake sequences recorded in the last two decades in the Los Angeles area such as 1987 M5.9 Whittier Narrows and 1994 M6.7 Northridge. This current earthquake did not cause any notable damage however the potential exists.

The most recent major earthquake event in Southern California and affecting Los Angeles region was the 1994 Northridge Earthquake. At 4:31 A.M. on Monday, January 17, a moderate but very damaging earthquake with a magnitude of 6.7 struck the San Fernando Valley. In the following days and weeks, thousands of aftershocks occurred, causing additional damage to affected structures. 57 people were killed and more than 1,500 people 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. 66,500 buildings were inspected. Nearly 4,000 were severely damaged and over 11,000 were moderately damaged. Several collapsed bridges and overpasses created commuter havoc on the freeway system. Extensive damage was caused by ground shaking, but earthquake triggered liquefaction and dozens of fires also caused additional severe damage. This extremely strong ground motion in large portions of Los Angeles County resulted in record economic losses.

The earthquake occurred early in the morning on a holiday. This circumstance considerably reduced the potential effects. Many collapsed buildings were unoccupied, and most businesses were not yet open. The direct and indirect economic losses to the county of Los Angeles were estimated at $40 billion.

The cities within the Las Virgenes-Malibu region were minimally affected by the earthquake, counting only nominal financial losses compared to the most affected parts of Los Angeles County. The City of Hidden Hills had a number of chimneys fall, one structure severely damaged and one home suffering major damage. The total dollar damage amount was $1,377,500. As a result of the earthquake in a move to better assist the residents to repair their homes more expediently, the city of Hidden Hills waived all customary fees for permits sought for the primary purpose of repairing, reconstructing or restoring structures. The cost to the city because of this wavier was approximately $61,750. The following is a list of the most significant earthquakes centered in Los Angeles County within the last 15 years.

CHART 7. SIGNIFICANT LOS ANGELES COUNTY EARTHQUAKES

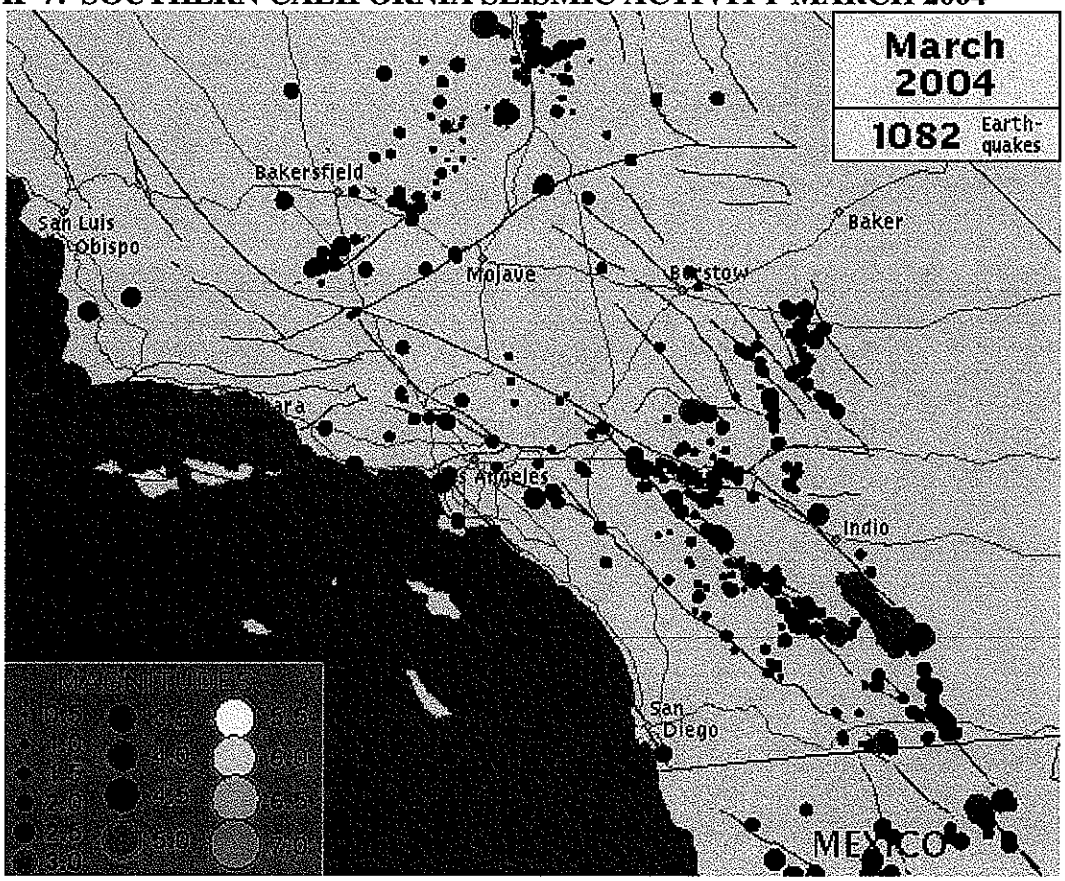
Year	Date	Location	Time	Richter	Deaths & Property Damage
1989	Jan 19	Malibu	10:38pm	5.0	No deaths; slight damage
1989	Jun 12	Montebello	9:57am	4.6	No deaths; No appreciable damage
1991	Jun 28	Sierra Madre	7:44am	5.8	2 deaths; $40 million
1994	Jan 17	Northridge	4:31am	6.7	61 deaths Est. $20 billion
2001	Sep 9	SE of West Hollywood	4:59pm	4.2	No deaths; moderate damage

Source: www.losangelesalmanac.com

With this chart we can see that seismic activity is frequent when compared to most communities in California and the United Stares. Seismic activity cannot be predicted therefore preemptive emergency preparations are vital and necessary to minimize the loss of property and life during an earthquake event. The cities within the Las Virgenes-Malibu COG practice preventive measures such as enforcing recent seismic building codes and preventing development in areas that can be in the way of danger as a result to earthquake induced hazards such as landslides and liquefaction activities. The following map also shows the frequent seismic activity in the area.

Map 7 shows seismic activity within Southern California area in the month of March 2004. The Las Virgenes-Malibu region had a significant amount and activity proving that the area is susceptible to frequent seismic activity.

MAP 7. SOUTHERN CALIFORNIA SEISMIC ACTIVITY MARCH 2004



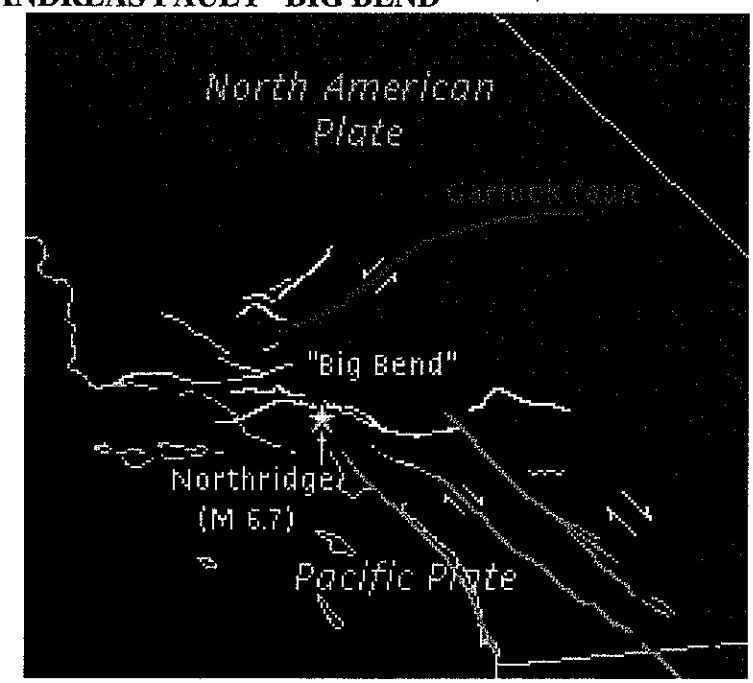
Source: http://www.data.scec.org/Module/module.html

CAUSES AND CHARACTERISTICS OF EARTHQUAKES IN THE LAS VIRGENES-MALIBU REGION

The Las Virgenes-Malibu exposure to geologic and seismic hazards is directly related to the location of the region relative to active faults. Numerous faults in Southern California can be attributed to the San Andreas Fault system. This system is a major crustal discontinuity that separates the southeast moving North American plate from the northwest moving Pacific plate, and extends for more than 1100 kilometers along nearly the entire length of the State of California.

The "Big Bend" of the San Andreas Fault is responsible for much of the complexity of faulting in Southern California. This bend is a convergent (restraining) bend, creating a localized collision of tectonic plates, and generates a tremendous amount of compressional stress. To release this stress, additional faults have formed over time. A typical response to large-scale compression is crustal shortening. This allows compression to continue by "squeezing" up the rocks in the compressional zone. This is accomplished by thrust faults - low-angle reverse faults that drive sections of crust over one another to create a thicker pile of crust with a shorter (horizontal) length. The surface traces of such faults are shown in pale yellow on the map view below. The 1994 Northridge earthquake (magnitude 6.7) occurred on one of these numerous thrust faults.

MAP 8. SAN ANDREAS FAULT "BIG BEND"



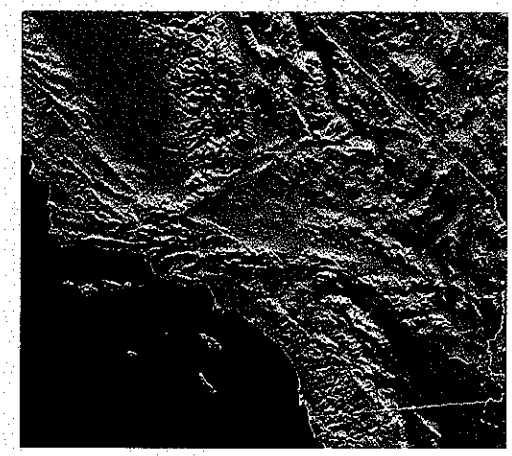
Source: http://www.consrv.ca.gov/cgs/geologic_hazards/earthquakes/3d_snaps.htm

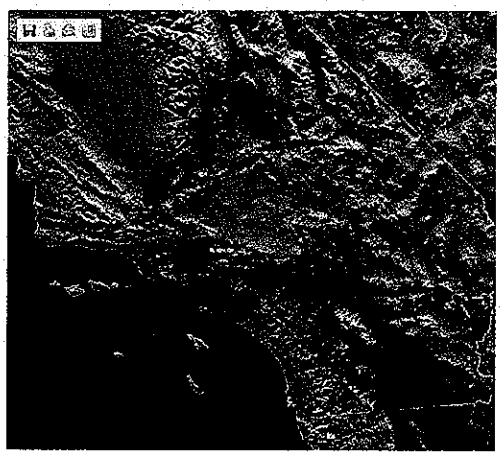
Not all the compressional force generated by the "Big Bend" of the San Andreas Fault goes into thrust faults. The collision boundary is not square with the plate motion, but at an angle, in such a way that some of the material "caught in the middle" has a chance to move laterally out of the way. This is exactly what happens. Large zones of left- lateral faulting, shown here in green, have formed in an effort to relieve some of the stress created by the fault bend. An example of this left-lateral faulting is the Hollywood / Santa Monica fault zone and the Garlock fault which intersects with the San Andreas near the northern end of the "Big Bend" and continues eastward for several hundred kilometers.

In addition, several right-lateral strike-slip faults south of the Big Bend, and west of the southern San Andreas Fault zone, seem to be managing some of the overall slip between the two tectonic plates. These fault zones, shown here in orange, are quite lengthy and roughly parallel the plate boundary.

But San Andreas is only one of dozens of known earthquake faults that crisscross Southern California. Some of the better known faults include the Newport-Inglewood, Santa Monica, Hollywood, Puente Hills, Whittier, Chatsworth, Elsinore, Los Alamitos, and Palos Verdes faults. Beyond the known faults, there are a potentially large number of "blind" faults that underlie the surface of Southern California. One such blind fault was involved in the Whittier Narrows Earthquake in October 1987.

MAP 9. TOPOGRAPHY OF THE LOS ANGELES BASIN (Red spots/areas represent earthquake occurrences 1932 – 1996).





source:http://www.data.scec.org/Module/module.html

Local Soil Conditions

Certain soils greatly amplify the shaking in an earthquake. Passing from rock to soil, seismic waves slow down but get bigger. Hence a soft, loose soil may shake more intensely than hard rock at the same distance from the same earthquake.

Ground shaking, landslides, liquefaction, and amplification 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.

Rock and soil units within the City of Westlake Village consist of a "basement" rock composed primarily of volcanic units, but with a relatively limited area of sedimentary rocks, primarily shale and siltstone, in the hills north of the freeway. The volcanic units include basaltic lava flows and complex combinations of ash and other material ejected from ancient volcanoes. The units are overlain in the valleys of alluvium (stream deposits) composed of varying amounts of sand, silt and clay. The City requires certain precautions and investigations take place in case of development on areas planned on thicker alluvium, sediments and on volcanic rocks.

Earthquake Faults In or Near the Las Virgenes-Malibu Region

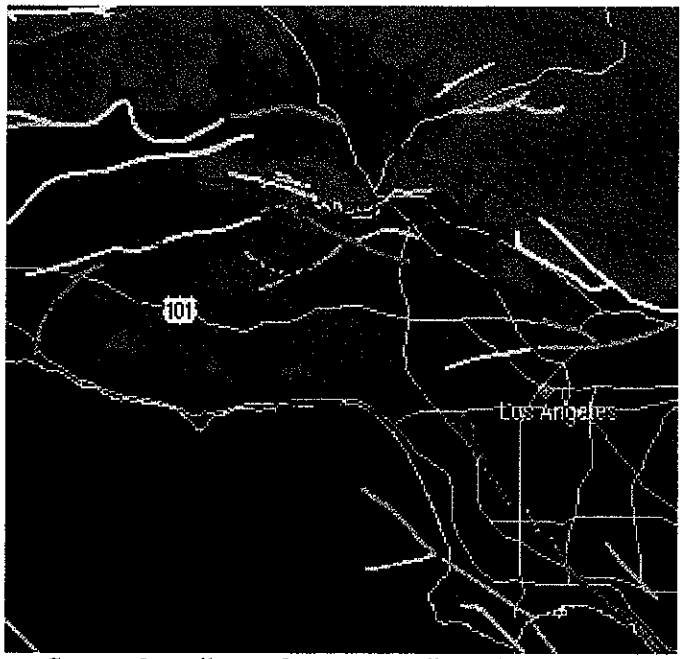
Numerous active earthquake faults present a potential danger to the Las Virgenes-Malibu. The following chart identifies faults that present the most probable danger to the Las Virgenes-Malibu region.

CHART 8. MAJOR FAULTS AROUND THE LAS VIRGENES-MALIBU REGION

Fault Name	Slip Rate (mm/yr)	Maximum Magnitude
Chatsworth	unknown	6.8
Malibu	0.3	6.7
Simi –Santa Rosa	1	6.7
Bailey	-	-
Northridge Hills	3	7

Source: http://www.consrv.ca.gov/CGS/rghm/psha/ofr9608/b_faults2.htm (U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT, 96-706)

MAP 10. KNOWN FAULTS IN AND AROUND THE LAS VIRGENES-MALIBU REGION



Source: http://www.data.scec.org/faults/lafault.html

THE MALIBU COAST FAULT

This fault is located along the coast near the City of Malibu and has an east/west trajectory. It is 10 miles long and is considered an active fault. Its slip rate is roughly 0.3 mm/yr. This is a north-dipping fault. he slip rate may be higher at its eastern end, where it meets the Santa Monica fault, and develops left-reverse motion. This turns into the Santa Monica Fault.

SIMI FAULT (also known as Santa Rosa Fault)

The Simi Fault is approximately 40 km. long and has a reverse type of faulting. Nearby communities include Santa Susana, Simi Valley, Moorpark, Camarillo and the Las Virgenes-Malibu region. This fault dips to the north.

CHATSWORTH FAULT

This fault is 20 km. in length and has a reverse type of faulting. Its slip rate is unknown and has a probable magnitude that ranges from 6.0 -6.8. This is a north dipping fault.

BAILEY FAULT

The Bailey fault has a type of faulting that is left-lateral oblique reverse and is 20 km. in length. This fault marks the western edge of the Santa Monica Mountains.

NORTHRIDGE HILLS FAULT

The Northridge fault has a reverse type of faulting and is 25 km. in length. According to the Southern California Earthquake Center, the dip is probably to the north. This is not the fault on which the 1994 Northridge earthquake occurred. hat was a south-dipping blind thrust fault, cut off at a depth of roughly 6 km by the Santa Susana fault zone, and probably connected at depth with the Oak Ridge fault.

OTHER NOTABLE FAULTS WITH PROXIMITY TO THE LAS VIRGENES-MALIBU REGION

The following are a list of faults that lie further from the Las Virgenes-Malibu region but may still affect the area in case of a large earthquake.

THE NEWPORT/INGLEWOOD FAULT

This fault extends to just south/east of the region and is capable of producing a 6.9 magnitude earthquake with a slip rate at 1mm/yr. Because of its proximity to the region, it is thought to present a greater danger to the region in terms of death and destruction than the San Andreas.

The Newport-Inglewood is a right- lateral fault system. The movement on this fault caused the 1933 Long Beach magnitude 6.3 earthquake, and the 1920 Inglewood Earthquake (estimated magnitude 4.9).

The 1933 Long Beach Earthquake resulted in 120 deaths and over $50 million in property damage in Los Angeles County. Most of the damaged buildings were of un-reinforced masonry. Many school buildings were destroyed.

THE HOLLYWOOD FAULT

This fault is located near the base of the Santa Monica Mountains. The fault dips steeply to the north beneath the Santa Monica Mountains. Movement on the fault has juxtaposed the granitic, metamorphic, and sedimentary rocks of the Santa Monica Mountains up and over the sedimentary deposits south of the mountains. This fault has a slip rate of 1 mm/yr and is capable of producing a 6.4 magnitude earthquake. Thus, like the Newport/Inglewood Fault, the Hollywood Fault is also thought to present a great danger to the region. The Hollywood Fault is also a part of a major east-west trending, northward dipping, left lateral-reverse fault system that forms the southern boundary of the Transverse Ranges physiographic province. Other faults that appear to be a part of this system are the Anacapa (Dume) fault, Malibu Coast fault, Raymond fault (located to the east of the City of Pasadena area).

THE SANTA MONICA FAULT

This fault has a slip rate of 1 mm/yr; this fault is capable of producing a 6.6 magnitude earthquake. Thus, like the Newport/Inglewood Fault, the Santa Monica Fault is also thought to present a great danger to the region.

The Santa Monica Fault is a part of a major east-west trending, northward dipping, left lateral-reverse fault system that forms the southern boundary of the Transverse Ranges physiographic province. This system of faults is located along the southern front of the Santa Monica Mountains and extends from offshore in Santa Monica Bay to the San Gabriel Mountains. Other faults that appear to be a part of this system are the Anacapa (Dume) fault, Malibu Coast fault, Raymond fault (located to the east of the City in Pasadena area).

THE PUENTE HILLS FAULT

This fault system runs under downtown Los Angeles could generate an earthquake of magnitude 7.0 or greater. The fault snakes underground for at least 25 miles, form Puente Hills in northern Orange County through downtown Los Angeles and west toward Las Virgenes-Malibu region.

THE SIERRA MADRE/SAN FERNANDO FAULT SYSTEM

This fault system includes the Cucamonga, Sierra Madre, San Fernando and Santa Susana faults. Of this system of faults, the San Fernando Fault is most likely to present a danger to the Las Virgenes-Malibu region. Located approximately fourteen (14) miles to the north of the Las Virgenes-Malibu area, this fault, caused great destruction and numerous deaths and injuries in 1971. With a slip rate of 3 mm/yr, this fault is capable of producing a 7.0 magnitude earthquake.

THE WHITTIER FAULT

The Whittier Fault is located approximately twenty-three (23) miles to the southeast. This fault is capable of a 7.0 magnitude earthquake. During the Whittier Narrows earthquake of October 1987, which registered a magnitude of only 5.9, several buildings in Las Virgenes-Malibu region sustained damage, including one of the City's parking structures.

THE SAN ANDREAS FAULT

Undoubtedly the most well known fault in California, the San Andreas Fault is located approximately nearly forty (40) miles to the east and with a slip rate of 24 mm/yr, this fault is capable of an 8.5 magnitude earthquake. Although capable of causing major damage throughout the Los Angeles Basin, it is now thought by many experts that because of its distance from Metropolitan Los Angeles (including Las Virgenes-Malibu region), it probably presents less danger to the COG region than some of the other faults mentioned above.

RAYMOND FAULT

Located near San Marino and South Pasadena, with a slip rate of 0.5 mm/yr, this fault is capable of producing a 6.5 magnitude earthquake. The exact nature of the slip along the Raymond fault has been a subject of debate for quite some time. The fault produces a very obvious south- facing scarp along much of its length, and this has made many favor reverse-slip as the predominant sense of fault motion. However, there are also places along this scarp where left-lateral stream offsets of several hundred meters can be seen. The matter will not be conclusively resolved until the Raymond fault ruptures at the surface, but some new light was shed on the debate in late 1988, when the Pasadena Earthquake occurred.

Apparently located on the Raymond fault, the motion of this quake was predominantly left-lateral, with a reverse component only about 1/15th the size of the lateral component. Curiously enough, this corresponds very well with a scarp height of about 30 meters (reverse slip) versus a left- lateral stream offset of about 400 meters (lateral slip), which are found along the scarp of the Raymond fault south of Pasadena. If the Raymond fault is indeed primarily a left- lateral fault, it could be responsible for transferring slip southward from the Sierra Madre fault zone to other fault systems.

EARTHQUAKE RELATED HAZARDS IN LAS VIRGENES-MALIBU REGION

The amount of damage to a building does not depend solely on how hard it is shaken. In general, smaller buildings such as houses are damaged more by higher frequencies, so usually a house must be relatively close to the hypocenter to be severely damaged. Larger structures such as high-rises are damaged more by lower frequencies and will be more noticeably affected by the largest earthquakes, even at considerable distances.

In addition to regional aspects of the earthquake hazard, there are location-specific hazards that can cause additional damage: surface rupture, ground shaking, amplification, settlement, liquefaction, and landslides. State laws require that every person buying a home or real property in California to be told if the property is in on one of these zones. The Las Virgenes-Malibu regional cities abide by these guidelines and will continue to implement policies that provide the most current information regarding development in hazard areas.

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 (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

Earthquake Induced Landslides

Earthquake induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. The Las Virgenes-Malibu has a high likelihood of encountering such risks, especially in areas with steep slopes. See earth movement (Landslide) section for more information. There are few areas within the Las Virgenes-Malibu regional cities that are in areas prone to landslides induced by earthquakes.

Earthquake Induced Liquefaction

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 buildings and structures.

Liquefaction- induced ground failure has historically been a major cause of earthquake damage in Southern California. During the 1971 San Fernando and 1994 Northridge earthquakes, significant damage to roads, utility pipelines, buildings, and other structures in the Los Angeles area was caused by liquefaction-induced ground displacement. Localities most susceptible to liquefaction-induced damage are underlain by loose, water

saturated granular sediments at depths less than 40 feet subsurface. These geological and groundwater conditions exist in the Las Virgenes-Malibu.

Liquefaction Zone
Some areas in the region have a high water table. Where this condition occurs, it is possible for the ground to liquefy during an earthquake, becoming like quicksand. If this occurs, buildings may settle or tilt. Such damage occurred in the Marina District in San Francisco in the 1989 Loma Prietta earthquake.

Specific to the Las Virgenes-Malibu Region
Maps available on the United States Geological Survey (USGS) website indicate landslide and liquefaction zones within the cities in the Las Virgenes-Malibu region. Most of the cities and urban areas lie outside of the major liquefaction and landslide areas.

AGOURA HILLS
The City of Agoura Hills seems to be in area that has the possibility of landslide events according to the regional map provided by the USGS. However in terms of liquefaction occurrences, the probability is low. The city can be affected by neighboring earthquake induced hazard events if the seismic activity were large enough.

CALABASAS
For the City of Calabasas, the closest liquefaction possibilities lie to the east of the city. As far as landslide areas, those are to the south, west and north of the city. The city seems to avoid any real exposure to the landslide areas.

HIDDEN HILLS
The City of Hidden Hills, according their Safety Element of their general plan, is subject to moderate to high shaking from nearby faults, and the presence of sandy, fine grained soils may induce liquefaction. According to the USGS, liquefaction zones are located east of the city of Hidden Hills and landslide areas surround the city in various locations, but do not lie within the city. In regards to landslides, a few areas in the city of Hidden Hills may have potentially unstable slopes. Slope severity, soil conditions, and underlying geology contribute to these conditions in the event of seismic activity.

MALIBU
The City of Malibu is situated along areas more likely to experience landslide and liquefaction events. Because of Malibu's fire history, the topography has been grossly changed over time. Native vegetation has been lost and made the soil more at risk to become soft in case of large rainfall. Malibu Seismic Hazard Map 11 for the City of Malibu and surrounding areas shows liquefaction and landslide areas in the City of Malibu and surrounding areas. To the north are the areas of Agoura Hills, Calabasas, Hidden Hills and Westlake Village. This map was provided to the City of Malibu by the

California Department of Conservation, Division of Mines and Geology. For more information on methodology and rationale refer to www.consrv.ca.gov/dmg/.

Several condominium sites throughout the City of Malibu contain 'soft stories' as do many of the larger hillside homes making them more prone to failure in an earthquake. This 'soft-story' construction is vulnerable in an earthquake. The seismic performance of these buildings can be significantly improved by adding shear panels or seismic frames.

Economic losses in the event of a major earthquake can be devastating in terms of damaged structures and lifelines in the city.

WESTLAKE VILLAGE

The potential for liquefaction in areas of alluvium and shallow groundwater in the City of Westlake Village has been previously identified by the County of Los Angeles and more recently by the California Division of Mines and Geology (Davis, et al., 1982). However for liquefaction to actually occur, strong earthquake shaking, shallow groundwater, and poorly consolidated soils are all required. Since the latter can only be determined by detailed soils investigations on individual sites, the evaluation and mitigation of this potential hazard should occur as a part of the soils engineering investigation required for all development sites.

The City of Westlake Village is located in the Transverse Ranges Geologic Province, a system of east-west trending valleys and mountain ranges that extends from Cajon Pass on the east to Point Conception on the west. These major physiographic features are controlled by the trends of major faults and folds in the rock units that also trend east-west.

The geologic structure of the rock units consists primarily of a relatively consistent north and northeast inclination of the rock layers at angles generally in the range of 20 to 30 degrees. This simple arrangement is interrupted by a moderately complex pattern of faulting, and some rock units, particularly the sediments, are more intensely deformed near the faults. There is no direct evidence to indicate that any of these faults have been active in the recent geologic past, nor is there any reason to suspect from regional relationships that any of them should be considered hazardous.

Significant earthquakes which should be expected to occur in the foreseeable future are of two distinct types: (1) major events generated by movement on a very large but relatively distant fault, and (2) medium-sized events generated by movement on a closer fault.

With regard to the first type, the most likely event is a magnitude 8-8.5 earthquake on the San Andreas Fault within the next 100 years. The shaking that would accompany this earthquake is expected to be only moderately strong in Westlake Village because the source fault is 42 miles away at its nearest point. The maximum ground accelerations

should be in the range of only 0.1-0.2g, where "g" is the decimal fraction of the acceleration of gravity. However, because of the length of the fault break and way in which ruptures propagate the shaking will probably last for at least one minute. For comparison purposes, the duration of the 1971 San Fernando earthquake was 12-15 seconds.

More intense, but shorter duration shaking should be expected from one of the active faults closer to the City. One possibility is the San Fernando fault, located approximately 20 miles to the northeast. A more likely candidate for the maximum intensity earthquake shaking that should be taken into account is the offshore Malibu fault. Movement on this fault zone generated the Richter magnitude 6.0 Point Mugu earthquake of 1973, and the future movement of a segment more southerly of Westlake Village could generate higher intensities of shaking than those which occurred in 1973. Little is known about the earthquake history of this fault zone, but a magnitude of 6.5 is reasonable considering the recent historic past.

Recent reports from scientists of the U.S. Geological Survey and the Southern California Earthquake Center say that the Los Angeles Area could expect one earthquake every year of magnitude 5.0 or more for the foreseeable future. A major earthquake occurring in or near the COG Region may cause many deaths and casualties, extensive property damage, fires and hazardous material spills and other ensuing hazards. The effects could be aggravated by aftershocks and by the secondary affects of fire, hazardous material/chemical accidents and possible failure of the waterways and dams. The time of day and season of the year would have a profound effect on the number of dead and injured and the amount of property damage sustained. Such an earthquake would be catastrophic in its effect upon the population and could exceed the response capabilities of the individual cities, Los Angeles County Operational Area and the State of California Emergency Services. Damage control and disaster relief support would be required from other local governmental and private organizations, and from the state and federal governments.

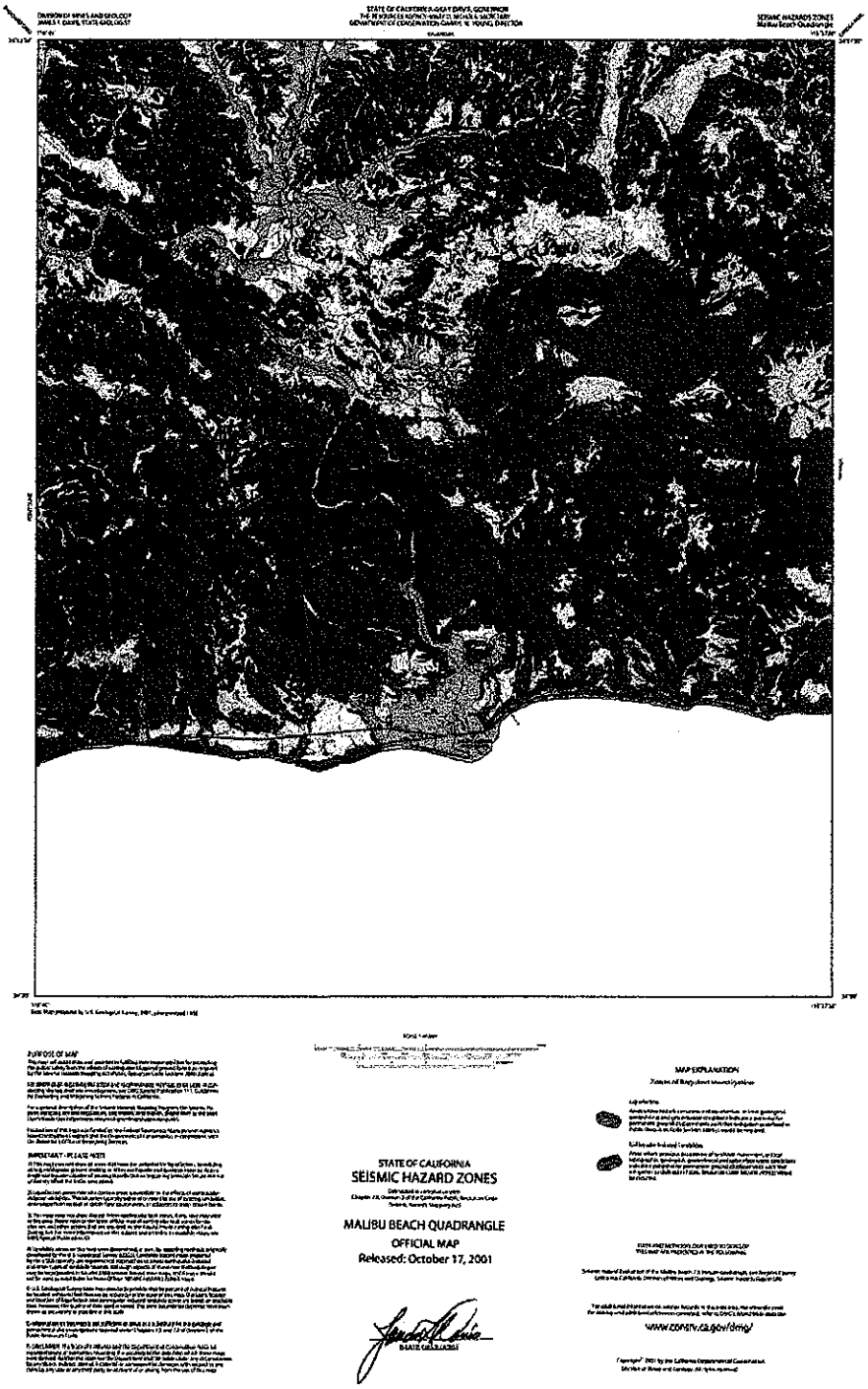
Extensive search and rescue operations would be required to assist trapped or injured persons. Emergency medical care, food and temporary shelter could be required by injured or displaced persons. Identification and burial of many dead persons would pose difficult problems; public health would be a major concern. Mass evacuation may be essential to save lives, particularly in areas downwind from hazardous material releases. Many families would be separated particularly if the earthquake should occur during working hours, and a personal inquiry or locator system could be essential to maintain morale. Emergency operations could be seriously hampered by the loss of communications and damage to transportation routes within, and to and from, the disaster area and by the disruption of public utilities and services.

The economic impact on the City of Westlake Village from a major earthquake could be considerable in terms of loss of employment and loss of tax base. A major earthquake could also cause serious damage and/or outage of computer facilities. The loss of such facilities could curtail or seriously disrupt the operations of banks, insurance companies and other elements of the financial community. In turn, this could affect the ability of local government, business and the population to make payments and purchases.

Refer to Malibu Seismic Hazard Map 11

The areas in **blue** denote areas that may experience earthquake induced landslides.	Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation defined in Public Resources Code Section 2693 (c) would be required.
The areas in **green** denote areas that may experience liquefaction.	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. www.consrv.ca.gov/dmg/.

MAP 11. MALIBU SEISMIC HAZARD ZONES



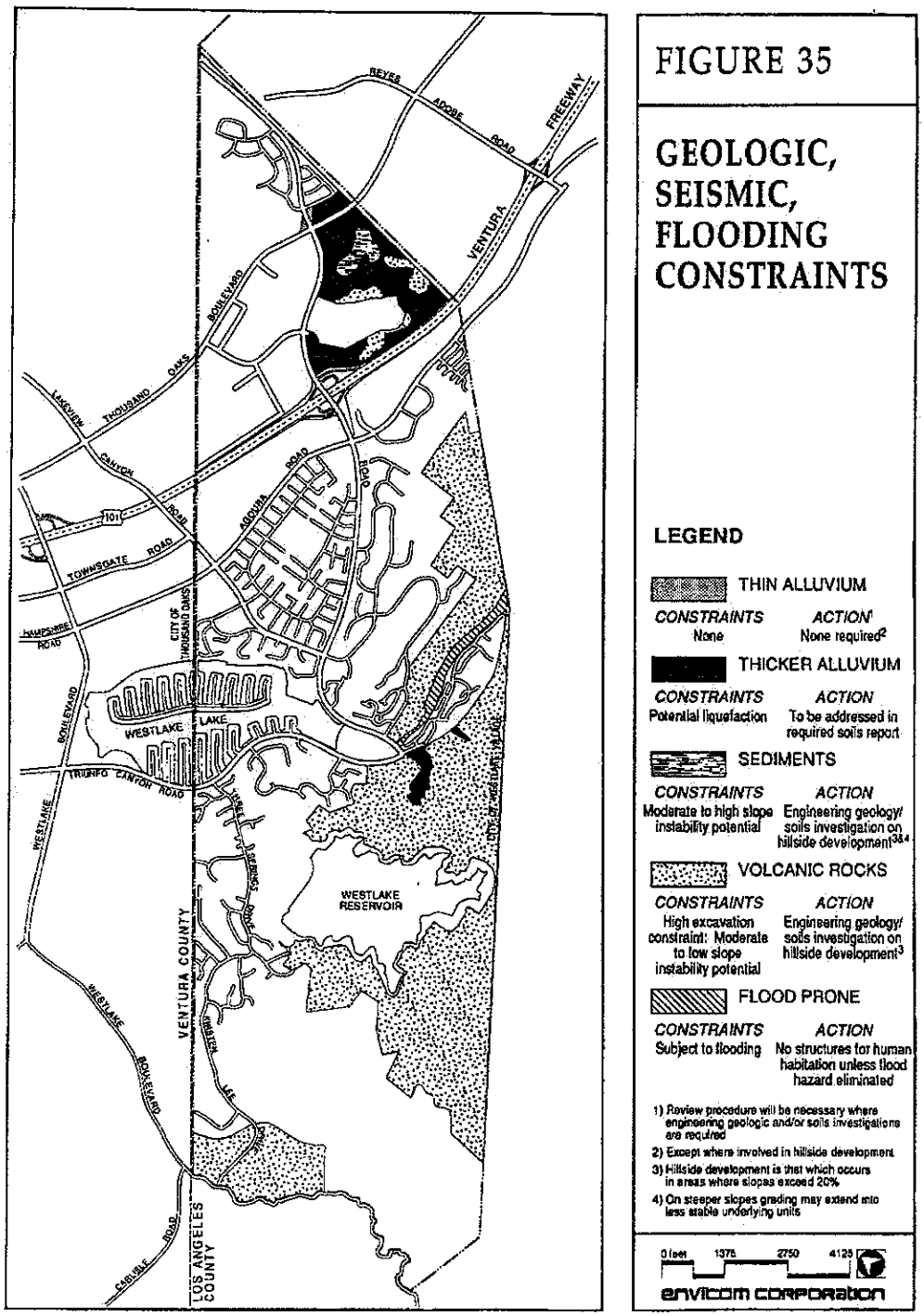
STATE OF CALIFORNIA
SEISMIC HAZARD ZONES

MALIBU BEACH QUADRANGLE
OFFICIAL MAP
Released: October 17, 2001

Source: http://gmw.consrv.ca.gov/shmp/MapProcessor

According to the maps provided by the United States Geological Survey, the City of Westlake Village lies clear from any major landslide or liquefaction areas; however due to the mountainous terrain of the entire region, landslides and liquefaction events are possibilities. Therefore the loss of life and property cannot be ignored in case of the effect of an indirect incident on the surrounding area.

Map 11 illustrates specific regions in the City that may be prone to liquefaction and landslides in case of an earthquake event. There is some concern with potential liquefaction, especially in the lower areas of the City, due to the high water table. The City requires certain precautions and investigations take place in case of development on areas planned on thicker alluvium, sediments and on volcanic rocks.



MAP 11. WESTLAKE VILLAGE GEOLOGIC, SEISMIC AND FLOODING CONSRAINTS

Amplification
Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Amplification can also occur in areas with deep sediment filled basins and on ridge tops.

Settlements
Dissipation of seismically induced port water pressure in saturated granular soils may lead to settlements after the shaking has stopped. The areas most susceptible to this potential hazard are the same areas that are in the liquefaction zone. Earthquake induced settlements can also occur in dry or moist granular materials simply as a result of shaking without pore water pressure buildup.

EARTHQUAKE HAZARD IDENTIFICATION
Southern California earthquakes have been identified by several sources including the Steering Committee, the Focus Group, various representatives from the five cities staff and from the community to be the one of the most likely disasters to occur within the Las Virgenes-Malibu.

RISK ANALYSIS
Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time. 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 **(FEMA HAZUS http://www.fema.gov/hazus/hazus2.htm (May 2001).** The HAZUS software is available some cities within the Las Virgenes-Malibu COG but has not been used for this plan. A thorough risk assessment shall be proposed by the Las Virgenes-Malibu cities a as a multi hazard mitigation strategy. This will include hazard maps that include but not limited to, number of parcels and buildings that are located in hazard areas along with a total valuation.

For greater Southern California there are multiple worst case scenarios, depending on which fault might rupture, and which communities are in proximity to the fault. But damage will not necessarily be limited to immediately adjoining communities. Depending on the hypocenter of the earthquake, seismic waves may be transmitted through the ground to unsuspecting communities. In the Northridge 1994 earthquake, Santa Monica suffered extensive damage, even though there was a range of mountains between it and the origin of the earthquake.

Non-structural bracing of equipment and contents is often the most cost-effective type of seismic mitigation. Inexpensive bracing and anchoring may be the most cost effective way to protect expensive equipment. Non-structural bracing of equipment and furnishings will also reduce the chance of injury for the occupants of a building.

- 20 - 27% of wood frame single family homes would be lost for 120 - 200 days
- 19 – 22% of wood frame apartment building would be lost for 130 – 220 days
- 20 – 27% of steel frame office buildings would be lost.
- 27 – 35% of reinforced masonry buildings would be lost for 65-90 days

The entire built environment in the Las Virgenes-Malibu region follows the most current building codes and ordinances in regards to earthquakes.

PEAK GROUND ACCERLERATION IN LAS VIRGENES-MALIBU REGION

Peak ground acceleration (PGA) is when a small particle attached to the earth during an earthquake will be moved back and forth rather irregularly. This movement can be described by its changing position as a function of time, or by its changing velocity as a function of time, or by its changing acceleration as a function of time.

Since any one of these descriptions can be obtained from any other, we may choose whichever is most convenient. Acceleration is chosen, because the building codes prescribe how much horizontal force building should be able to withstand during an earthquake. This force is related to the ground acceleration. The peak acceleration is the maximum acceleration experienced by the particle during the course of the earthquake motion. (United States Geological Survey)

For PGA or 0.2g, earthquake loss estimation tables provide a simplified indication of the damages to different kinds of buildings (FEMA 386-2)

- Approximately 3% of wood frame single family homes would be lost for 9 – 15 days.
- Approximately 3% of wood frame apartment building would be lost for 10 – 16 days.
- 3 - 5% of steel frame office buildings would be lost.
- 6 - 8% of reinforced masonry buildings would be lost for 10 – 20 days.

Source: FEMA 386-2 – Understanding Your Risks identifying hazards and estimating losses.

WHAT IS SUSCEPTIBLE TO EARTHQUAKES

Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, schools, and lifelines (roadways and utility lines) suffer damage in earthquakes and can cause death or injury to humans. The welfare of homes, major businesses, and public infrastructure is very important. Addressing the reliability of buildings, critical facilities, and infrastructure, and understanding the potential costs to government, businesses, and individuals as a result of an earthquake, are challenges faced by the COG.

Buildings	The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people. Lives are at risk and the cost to clean up the damages is great.
Infrastructure and Communication	Residents in the Las Virgenes-Malibu commute frequently by automobiles and public transportation such as buses. An earthquake can greatly damage bridge, tunnels and roads, hampering emergency response efforts and the normal movement of people and goods. Damaged infrastructure strongly affects the economy of the community because it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers,
Damage to Lifelines	Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. Lifelines need to be usable after earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.
Disruption of Critical Services	Critical facilities include the police station, the fire stations, City Halls and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event.
Businesses	Seismic activity can cause great loss to businesses, both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to large and small shop owners who may have difficulty recovering from their losses. Forty percent of businesses do not reopen after a disaster and another twenty-five percent fail within one year according to the Federal Emergency Management Agency (FEMA). Similar statistics from the United States Small Business Administration indicate that over ninety percent of businesses fail within two years after being struck by a disaster. **(http://www.chamber101.com/programs_committee/natural_disasters/DisasterPreparedness/Forty.htm).**

EXSITING MITIGATION ACTIVITIES

Earthquake mitigation activities listed here include current mitigation programs and activities that are being implemented by the Las Virgenes-Malibu region.

Southern California Edison (SCE)

SCE's service territory is an area of high seismic activity. The company has specifically acted to mitigate the impacts of a seismic event on our electrical system. Recognizing that the location, time and magnitude of an earthquake cannot be precisely predicted, we forecast the maximum magnitudes and approximate boundaries of earthquakes on a probability basis by reviewing:

- Geological data and studies of earthquake records
- Depth, direction, geologic formation, location and proximity of faults that can induce earthquakes
- Accumulation of energy on a specific fault since its last major eruption
- Adoption of seismic-safe models and new material:
  - Live tank circuit breakers were replaced with dead tank circuit breakers at every opportunity to lower the center of gravity and reduce internal seismic loads.
  - Conventional porcelain insulators were replaced with polymer / silicon rubber insulators in selective applications to reduce seismic loads.
  - High-strength insulators are used more generously throughout the system.

CODE DEVELOPMENT

In California, each earthquake is followed by revisions and improvements in the Building Codes. The 1933 Long Beach earthquake resulted in the Field Act, affecting school construction. The 1971 Sylmar earthquake brought another set of increased structural standards. Similar re-evaluations occurred after the 1989 Loma Prieta and 1994 Northridge earthquakes. These code changes have resulted in stronger and more earthquake resistant structures.

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This state law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface rupture is the most easily avoided seismic hazard.
(http://www.consrv.ca.gov/CGS/rghm/ap/)

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides **(Ibid)**. The State Department of Conservation operates the Seismic Mapping Program for California. Extensive information is available at their website:
http://gmw.consrv.ca.gov/shmp/index.htm.

CALIFORNIA EARTHQUAKE MITIGATION LEGISLATION

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. Chart 9 below provides a sampling of some of the 200 plus laws in the State's codes. All new development within each of the individual cities within the Las Virgenes-Malibu complies with all current Los Angeles County Building codes. The following chart is a partial list of California laws on earthquake safety.

CHART 9. 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 un-reinforced 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	

AGOURA HILLS

The City of Agoura Hills implements LARUCP seismic Zone 4 requirements. The city also implements the following building codes in order to mitigate the impact of earthquake hazards. In regards to seismic requirements for the City, besides enforcing the currently adopted 2001 California Building Code, the City of Agoura Hills has adopted additional more restrictive seismic requirements noted in the following Agoura Hills Building Code sections, followed by the California Building Code section amended.

The following building codes are implemented as preventative measures for loss of life and property because of a seismic hazard event.

Section	Title
8103(i), 1612.2.1	Basic load combinations
8103(j), 1629.4.2	Seismic Zone 4 near-source factor
8103(k), 1630.8.2.2	Detailing requirements in Seismic Zones 3 and 4
8103(l) 1630.10.2	Calculated
8103(m) 1630.10.3	Limitations
8103(n) 1633.2.9	Diaphragms supporting concrete or masonry walls shall have continuous ties or struts between diaphragm chords to distribute the anchorage forces specified in Section 1633.2.8
8103(p) 1701.5	Lateral force resisting frames
8103(q) 1702	Structural observation
8103(r) 1703	Piling, drilled piers, caissons and connecting grade beams

Seismic Safety Element

The City of Agoura Hills implements the following policies that focus on Seismic safety.

- Ensure that geologic hazards are recognized and properly mitigated or avoided;
- Ensure adequate response to potential earthquakes;
- Maintain current standards and codes to reduce or avoid seismic and geologic risks;
- Provide greater safety standards for important and critical-use structures;
- Advocate improved seismic safety programs;
- Improve inter-jurisdictional cooperation; and
- Advocate improved earthquake insurance programs.

Housing Rehabilitation Program
The City of Agoura Hills, through the Redevelopment Agency of the County of Los Angeles, assists homeowners interested in repairing their homes. Such improvements include foundation repair. This program aides low to moderate income households make safety improvements to their homes.

CALABASAS

The City of Calabasas has not had any significant damages or costs during any earthquake event in recent history. However it is standard procedure in the Community Development Department is to ensure that existing and new structures are built to minimize the amount of damage that can be caused by natural disasters. Projects are required to go through an EIR (Environmental Impact Review) to determine what kind of hazards the project may encounter and how to mitigate the impact.

Examples include, conducting soil tests to determine the stability of the land and the need of extra support for the structure, requiring the use of special roofing materials, chimney spark arrestors, and vegetation clear zone buffers for fire prevention, access roads must meet a certain width requirement in order to allow safety vehicles through, and other safety precautions.

As information becomes available, the City of Calabasas' building codes that mitigate the loss of life and property during a seismic event will be included in the plan.

HIDDEN HILLS

The City of Hidden Hills is the smallest of the five cities within the Las Virgenes-Malibu Council of Governments. Within the Safety Element of their General Plan, the city implements an Emergency Evacuation Plan. The Safety Element tries to minimize damage in the event of a natural disaster.

The Housing and Land Use Elements of the General Plan ensure that structures are of standard design and building materials, and are not subject to undue hazard based on their location. These steps are preemptive measures taken by the City of Hidden Hills to protect life and property in case of an earthquake.

Along with these steps, in January 2003, all Charles Abbott building inspectors, plan checkers, and engineers, who are contracted by the City of Hidden Hills, attended a training hosted by the California Building Officials (CalBO) as part of the "Safety Assessment Program". Attendees were certified by California Office of Emergency Services as "Certified Disaster Service Workers."

The following building codes are implemented as preventative measures for loss of life and property because of a seismic hazard event.

Section	Title
3319.2	Geologic Hazard

MALIBU

The City of Malibu is located in the area of several known earthquake faults, active and potentially active, including the Malibu fault, Newport-Inglewood fault, San Andreas Fault, and Whittier-Elsinore fault. New faults are continuously being discovered, one hundred of which in the Los Angeles area alone are capable of a magnitude 6.0 or greater earthquake.

The City of Malibu has a Safety Element section of their general plan, such planning is a proactive approach to earthquake planning. The city also implements a comprehensive Emergency Operations Plan. As information becomes available, the City of Malibu's building codes that mitigate the loss of life and property during a seismic event shall be included in the plan.

WESTLAKE VILLAGE

Soils Investigations

Prior to development on certain soils such as thicker alluvium where liquefaction may occur, the City requires a soils report before development can commence in order to ensure the safety of the development and resident. Additionally, if a hillside development is planned on an area located on sediments or volcanic rocks, an engineering geology and soil investigation is required.

INDIVIDUAL PREPARDENESS

Because the potential for earthquake occurrences and earthquake related property damage is relatively high in the Las Virgenes-Malibu region, increasing individual preparedness is a significant need. Strapping down heavy furniture, water heaters, and expensive personal property, as well as being earthquake insured, and anchoring buildings to foundations are just a few steps individuals can take to prepare for an earthquake. Each city has taken different steps to inform the public on safety issues regarding earthquake preparedness. Section 2 of the Plan contains the "Emergency Preparedness" information by city. Appendix D documents public awareness and education through public involvement.

EARTHQUAKE MITIGATION STRATEGIES

The following is a list of mitigation strategies the Las Virgenes-Malibu COG cities have for future planning. See Section 4 for complete Mitigation Strategies.

- **Soft Story Retrofitting – City of Malibu**

Wildland/Urban Interface Fire Hazards the Las Virgenes-Malibu Region

SECTION 7

WILDFIRE

TABLE OF CONTENTS **PAGE**

WHY ARE WILDFIRES A THREAT TO THE LAS VIRGENES-MALIBU REGION?

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 such as the Las Virgenes-Malibu region which are built within or adjacent to hillsides and mountainous areas. There is a huge potential for losses due to wildland/urban interface fires in the region. According to the California Division of Forestry and Fire Protection (CDF), there were over seven thousand reportable fires in California in 2003, with over one million acres burned **(http://www.fire.ca.gov/php/2003fireseasonstats_v2.asp).** According to CDF statistics, in the October, 2003 Firestorms, over 4,800 homes were destroyed and 22 lives were lost **(http://www.fire.ca.gov/php/fire_er_content/downloads/2003LargeFires.pdf).** More specifically, the region has suffered immense damage from firestorms in 1993, 1996 and 2003.

LACoFD BACKGROUND

The Las Virgenes-Malibu region is covered under Region VII, Central Region, of the Los Angeles County Department (LACoFD). Battalions 1 and 5 of the Los Angles Fire Department are assigned to directly serve the Las Virgenes-Malibu region with a total of 17 stations assigned to serve six cities and over 65,000 residents. The cities include Agoura Hills, Calabasas, Hidden Hills, Malibu, West Hollywood and Westlake Village.

Battalion 5 is the main division since its stations are located within the region itself. They have a total of 11 stations throughout the region. Headquarters are located at 3970 Carbon Canyon Rd., Malibu 90265.

Operating 9 divisions, 20 battalions, 159 fire stations and 11 fire suppression camps, the County of Los Angeles Fire Department answers over 234,000 emergency calls annually. Additionally, the Department has Planning, Information Management, Fire Prevention, Air and Wildland, Lifeguard, Forestry and Health Hazardous Materials Divisions which provide valuable services to the more than 3.5 million people who reside in the 1.1 million housing units located throughout the Department's 2,278 square mile area.

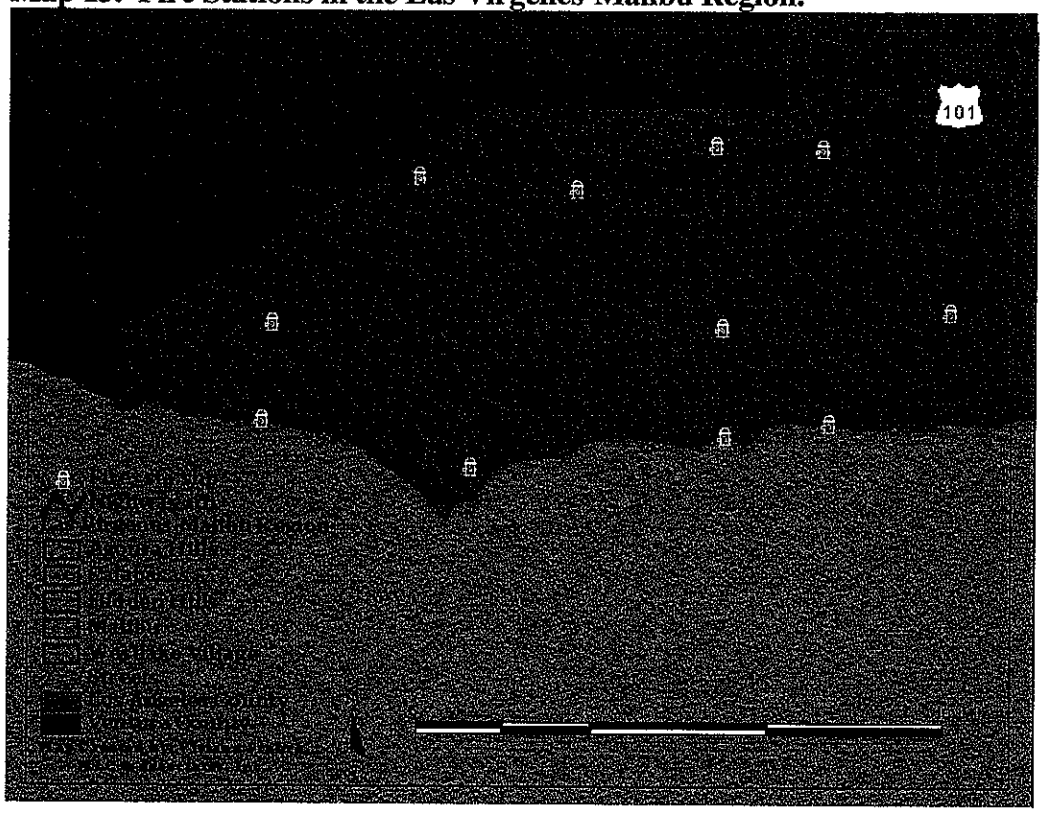
The Los Angeles County Fire Department currently has 159 fire stations, 235 fire engines, 21 ladder trucks, 20 quints, 85 paramedic squads, 11 wildland fire suppression camps, 8 bulldozers, 7 helicopters, 23 Prevention Offices, 12 Forestry Units and numerous other response vehicles and facilities. The Department serves 57 incorporated, as well as the unincorporated areas of the County.

The LACoFD is one of six Contract Counties that maintain a contractual relationship with California Department of Forestry and utilizes the California Fire Plan within Los Angeles County as the primary wildland fire protection plan. The Las Virgenes-Malibu region is served by Battalion 5 of the LACoFD. The following chart is a list of the fire stations in the Las Virgenes-Malibu region.

CHART 6. LAS VIRGENES-MALIBU COG FIRE STATIONS

FS 65	4206 N. Cornell Rd., Agoura 91301-2528
FS 67	25801 Piuma Rd., Calabasas 91302-2153
FS 68	24130 Calabasas Rd., Calabasas 91302-1511
FS 69	401 S. Topanga Cyn Blvd., Topanga 90290-9774
FS 70 (Div & Batln. HQ)	3970 Carbon Cyn Rd., Malibu 90265-5005
FS 71	28722 W. Pacific Coast Hwy., Malibu 90265-3902
FS 72	1832 S. Decker Rd., Malibu 90265-9613
FS 88	23720 W. Malibu Rd., Malibu 90265-4603
FS 99	32550 Pacific Coast Hwy., Malibu 90265-2432
FS 125	5215 N. Las Virgenes Rd., Calabasas 91302-1061
FS 144	31981 Foxfield Dr., Westlake Village 91361-4203

Map 13. Fire Stations in the Las Virgenes-Malibu Region.



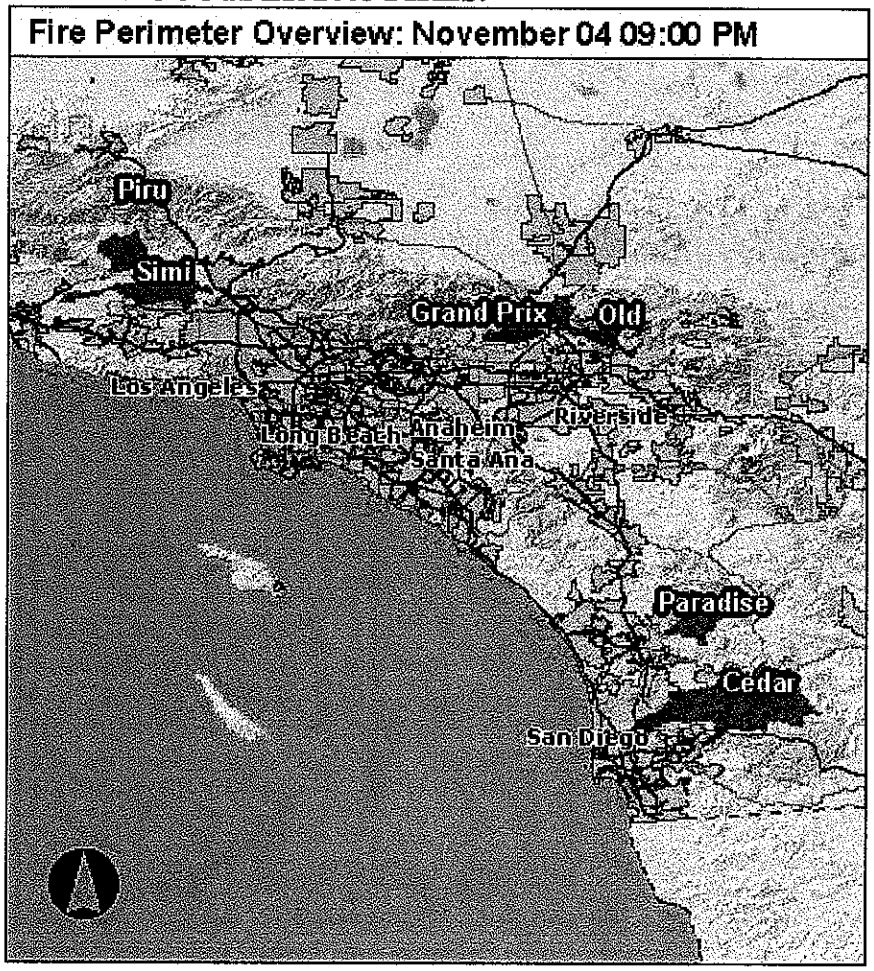
HISTORY OF FIRE EVENTS IN THE LAS VIRGENES-MALIBU REGION

Piru and Simi Fires of 2003

The most recent fire events occurred in the Las Virgenes-Malibu region in 1993, 1998 and 2003. In 2003, over 14,000 acres burned in the Los Angeles County Fire Department coverage area, totaling $130,633,624 in losses **(http://www.lacofd.org).**

The following map provides an overview of all the fires burning on November 4 2003. The closest fires to the Las Virgenes-Malibu region were the Simi and Piru fires, both in neighboring Ventura County. The Simi Fire burned approximately 108,000 acres in late October 2003. The region was also threatened by the Piru Fire, which burned nearly 64,000 acres in late October 2003. The fire burned hillsides behind houses, leaving them vulnerable to erosion and mud flows. See Chart 10 for additional information.

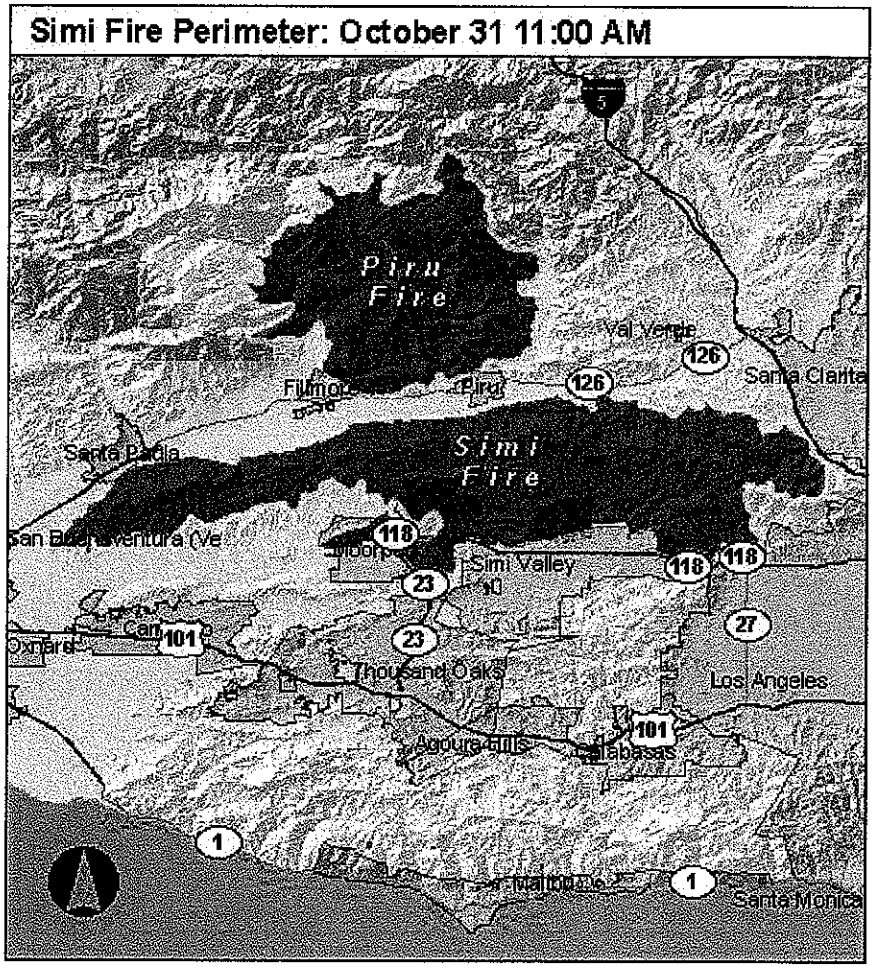
MAP 14. OCOTBER 2003 FIRES.



Source: http://www.esri.com/jicfire/maps/#livemaps

The following map shows a more specific area of the Simi Fire on October 31, 2003. Notice its proximity to the Las Virgenes-Malibu region.

MAP 15. PIRU FIRE MAP



Source: http://www.esri.com/jicfire/maps/#livemaps

THE 2003 SOUTHERN CALIFORNIA FIRES

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 of 2,800 homes and burned over a quarter of a million acres. Statistics from the 2003 firestorms are listed below in Chart 10.

CHART 10. OCTOBER 2003 FIRESTORM STATISTICS

County	Fire Name	Date Began	Acres Burned	Homes Lost	Homes Damaged	Lives Lost
Riverside	Pass	10/21/03	2,397	3	7	0
Los Angeles	Padua	10/21/03	10,446	59	0	0
San Bernardino	Grand Prix	10/21/03	69,894	136	71	0
San Diego	Roblar 2	10/21/03	8,592	0	0	0
Ventura	Piru	10/23/03	63,991	8	0	0
Los Angeles	Verdale	10/24/03	8,650	1	0	0
Ventura	Simi	10/25/03	108,204	300	11	0
San Diego	Cedar	10/25/03	273,246	2,820	63	14
San Bernardino	Old	10/25/03	91,281	1,003	7	6
San Diego	Otay / Mine	10/26/03	46,000	6	11	0
Riverside	Mountain	10/26/03	10,000	61	0	0
San Diego	Paradise	10/26/03	56,700	415	15	2
Total Losses			**749,401**	**4,812**	**185**	**22**

Source: http://www.fire.ca.gov/php/fire_er_content/downloads/2003LargeFires.pdf

Pacific Fire

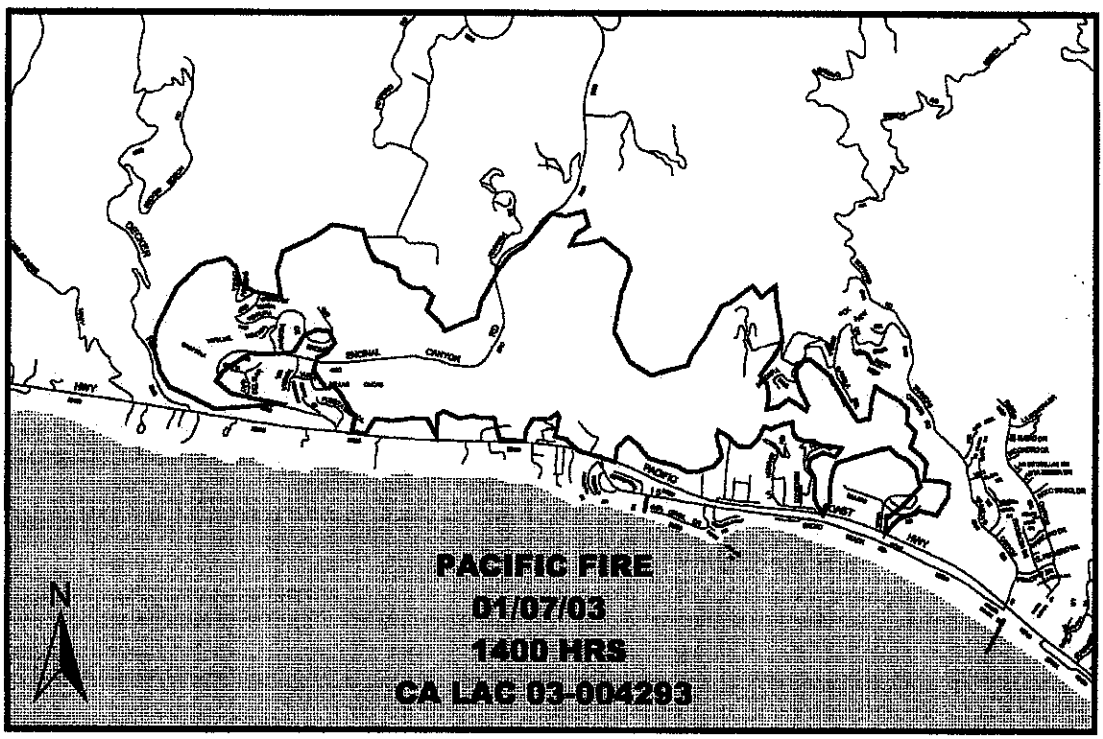
The City of Malibu was also directly affected by the Pacific Fire of 2003. Although 450 homes were saved, over 2200 acres burned and a total private property damage assessment was made of $421,500 dollars. (Incident # CA LAC 03-004293)

The Fire was 100% contained as of Wednesday, January 8, 2003. After containment, fire crews continued with mop up operations and monitored the area for hot spots. During the fire, Bluffs Park was closed in order to allow the Fire Department helicopters to use the Park as a landing zone. Charmlee Park was closed in order to assess fire and wind damage. Both parks were reopened by Wednesday morning. Malibu High School and Juan Cabrillo Elementary School were closed on Tuesday, January 7 but reopened on Wednesday January 8. A Red Cross evacuation shelter was set up at Malibu High School. An evacuation center was set up at Leo Cabrillo State Beach.

Three homes and one vehicle were damaged. At the peak of the fire, over 1,000 emergency personnel were on duty. The fire was confined to the Trancas Canyon, Encinal Canyon and Decker Canyon areas.

Fighting the Pacific Fire was a collaborative effort which included 56 agencies responding to the incident. (http://www.ci.malibu.ca.us/index.cfm?fuseaction=detailgroup&navid=182&cid=2035) Note the following map which outlines in **black** the Pacific Fire area.

MAP 16. PACIFIC FIRE – CITY OF MALIBU



The Pacific Fire was a clear example that the region, but most notably the City of Malibu is prone to wildfires that can affect the urbanized areas in the city. Quick response, climate conditions and proper planning here were the cause of its successful containment. The following is a picture depicting damage by the fire and how brush clearance and fuel modification saved these homes.

IMAGE 1. DAMAGE FROM THE PACIFIC FIRE – CITY OF MALIBU

HISTORIC FIRES IN SOUTHERN CALIFORNIA

Large fires have always been part of the Southern California landscape. The Las Virgenes-Malibu terrain makes it an easy target for wildfire activity. In 1993, a very destructive fire came through the region and destroyed hundreds of homes and acres. The following chart list major fires in Los Angeles County from 1961-1993.

CHART 11. LARGE HISTORIC FIRES IN LOS ANGELES COUNTY 1961-1993

Largest Los Angeles County Wildland Fires (Structures Destroyed)						
	Fire Name	Date	County	Acres	Structures	Deaths
8	Bel Air	November 1961	Los Angeles	6,090	484	0
13	Topanga	November 1993	Los Angeles	18,000	323	3
18	Kanan	October 1978	Los Angeles	25,385	224	0
19	Kinneloa	October 1993	Los Angeles	5,485	196	1
"Structures" is meant to include all loss - homes and outbuildings, etc.						

Source: http://www.fire.ca.gov/FireEmergencyResponse/HistoricalStatistics/PDF/20LSTRUCTURES.pdf

During the 2002 fire season, more than 6.9 million acres of public and private lands burned in the US, resulting in loss of property, damage to resources and disruption of community services. Taxpayers spent more than $1.6 billion to combat more than 88,400 fires nationwide **(http://research.yale.edu/gisf/assets/pdf/ppf/wildfire_report.pdf)**. Many of these fires burned in wildland/urban interface areas and exceeded the fire suppression capabilities of those areas. Chart 12 illustrates fire suppression costs for state, private and federal lands.

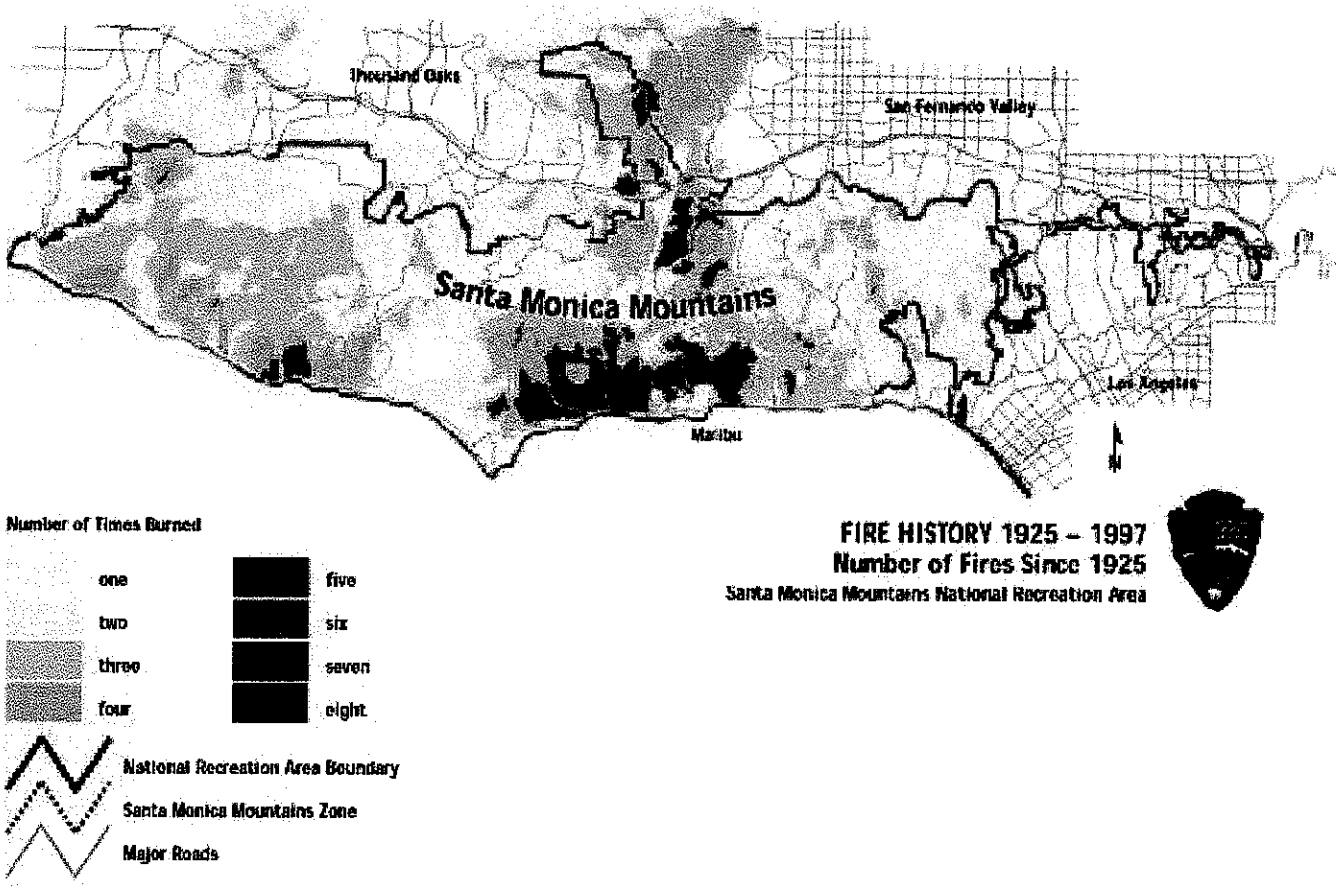
CHART 12. NATIONAL FIRE SUPPRESSION COSTS

Year	Suppression Costs	Acres Burned	Structures Burned
2000	$1.3 billion	8,422,237	861
2001	$0.5 billion	3,570,911	731
2002	$1.6 billion	6,937,584	815

Source: http://research.yale.edu/gisf/assets/pdf/ppf/wildfire_report.pdf

The Las Virgenes-Malibu COG region has a long history of wildland fires. The following map shows fire history of the Santa Monica Mountains, showing the number of wildfires that occurred for the range between 1925 and 1997. Note that the Central Malibu coast has received 6-8 fires over this period compared to much lower frequencies to the west and east.

MAP 17. FIRE HISTORY IN THE LAS VIRGENES-MALIBU REGION



source: http://www.ioe.ucla.edu/publications/report99/fire.html

CAUSES AND CHARACTERISTICS OF WILDFIRES THE LAS VIRGENES-MALIBU REGION

There are three categories of interface fire. 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. 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.

Southern California has two distinct areas of risk for wildland fire. The foothills and lower mountain areas are most often covered with scrub brush or chaparral. The higher elevations of mountains also have heavily forested terrain. The lower elevations covered with chaparral create one type of exposure.

The higher elevations of Southern California's mountains are typically heavily forested. The magnitude of the 2003 fires is the result of three primary factors: (1) severe drought, accompanied by a series of storms that produce thousands of lightning strikes and windy conditions; (2) an infestation of bark beetles that has killed thousands of mature trees; and (3) the effects of wildfire suppression over the past century that has led to buildup of brush and small diameter trees in the forests.

WILDFIRE HAZARD IDENTIFICATION

The cities within the Las Virgenes-Malibu region face an ongoing threat from wildfires along its hillsides and mountainous areas where wildland and residential areas interface. Fires can be sparked by human activity and natural causes. The next section will further describe the areas in which the hazard can occur.

For the purposes of describing the severity of fire hazard areas, the Los Angeles County Fire Department classifies areas according to criteria established in the State legislation commonly referred to as the "Bates Bill". The Bates Bill Process determines Very High Fire Hazard Severity Zones (VHFHSZs) in Local Responsibility Areas (LRAs). The Las Virgenes-Malibu region does contain some VHFHSZs. Fire zone areas are rated on a scale of I – IV, with IV representing the most severe fire hazard zone. The region contains both Zone III and Zone IV areas.

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 scar egion 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. Southern California is currently in its sixth year of drought conditions.

Development

Growth and development in scrubland and forested areas is increasing the number of human-made structures in the Las Virgenes-Malibu interface areas. 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. There are many types of these homes within the region that use vegetation as privacy barriers. 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. Narrow and winding roads in these developed areas tend to make evacuation of civilians slow and difficult especially when fire resources are trying to gain access to the area utilizing the same roads.

Wildfire hazard areas are commonly identified in regions of the wildland/urban interface. Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control such as the surrounding fuel load, weather, topography, and property characteristics. Generally, hazard identification rating systems are based on weighted factors of fuels, weather and topography.

Within the cities in the Las Virgenes-Malibu region, increased development in and adjacent to naturally vegetated areas exposes additional structures to potential wildland fires. With sound construction practices, sufficient water flows, brush clearance and provision of adequate access the risk can be reduced.

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. In the Las Virgenes- Malibu region, there is much chaparral and woodland vegetation that is a catalyst for fire activity. Additionally, there are a number of Oak Trees in the region that may act as fuel, being that they are the most prevalent wild tree in the region.

The type of fuel also influences wildfire. Like much of Southern California, chaparral is a primary fuel prevalent in The Las Virgenes-Malibu region along with grasses, non-native vegetation and large trees such as Junipers, Palm, Eucalyptus and Pines. All of these fuel types

are highly combustible. Added to this is the fact that a large percentage of the fuel beds in the Santa Monica Mountains contain dead and down vegetation.

This "die back" condition as it is known is due largely to drought conditions that have been experienced in recent years. This condition makes these fuel beds far more receptive to ignition and spread of wildfires than if the vegetation were alive and healthy. This type of fuel model is of particular concern when the fires are wind driven as it can lead to short and long range spotting which can affect the entire region, not just the VHFHSZ.

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. 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.

Numerous canyons, saddles, and ridges in the VHFHSZ will also contribute to erratic fire behavior due to the funnel and subsequent acceleration effect it will have on wind traveling through the area.

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. This is a definite classification of the Las Virgenes-Malibu region. Southern California is known for its lack of precipitation and is currently in a six year drought.

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 "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.

The Las Virgenes-Malibu region experiences Santa Ana Wind conditions typically in the Fall months and this poses a threat in two ways. A fire starting in The Las Virgenes-Malibu region will spread rapidly and has the potential of overwhelming initial attack forces and destroying structures within minutes of ignition. A fire starting adjacent to the Las Virgenes-Malibu region

could quickly burn into the region either by direct flame contact or by fire brands being carried by the winds and spotting onto structures or combustible vegetation.

Wind bends the flames to pre-heat the fuel ahead and can carry fire brands up to ¼ mile or more ahead of the flame front. The majority of catastrophic fires that Southern California has experienced have occurred in the months of September, October, and November when Santa Ana Winds typically occur. Wind is considered to be the primary factor that influences fire spread. To the south end, by the City of Malibu, there are many canyons and valleys that may propel fire activity through wind gusts.

SPECIFIC IN THE LAS VIRGENES-MALIBU REGION

CALABASAS

The City of Calabasas has characteristics that can lead to potential wildfires. In 1996, the city experienced a devastating fire. The fire started in Calabasas on October 21 and, eventually, burned more than 12,000 acres (**source: http://www.jpl.nasa.gov/releases/96/avfire.html**). This fire proved to be less devastating than the Old Topanga Fire of Malibu in 1993 because of a rapid mobilization of fire fighters, a lower population density of homes, and improved levels of clearance around homes built with less flammable materials. These combined efforts served to greatly reduce the level of property damage.

As a result of the October 1996 Calabasas Fire, the Los Angeles City Fire Department, Glendale Fire Department, and Los Angeles County Fire Departments developed a task force to research, analyze, and create a Calabasas Fire Report. Within the report, 56 recommendations were developed to enhance fire agencies' capability to combat wildland fire incidents and provide for maximum safety for personnel. Of these 56 recommendations, there was agreement among the three departments that approximately 12 of those recommendations should be adopted on a statewide basis for review and concurrence **(source: http://www.wildlandfire.com/docs/ciccs/history.htm)**.

HIDDEN HILLS

The City of Hidden Hills is vulnerable to small wildland fire hazards. Brush fires pose the primary threat due to the terrain and natural vegetation of the undeveloped areas adjacent to the City. Primary considerations for determining the severity of fire hazards in the City include fuel loading, fire weather and topography which is described in detail later in regards the region as well.

MALIBU

The City of Malibu has had a devastating history of wildfires. In the Santa Monica Mountains range where fires have crisscrossed the terrain so often, some residents not only have lost one home, but some have lost two-three after rebuilding on the same site. The Santa Monica Mountains can be a design for disaster in terms of wildland fires.

In the fall and early winter months of the year, strong Santa Ana winds set off through the canyons and out to sea and the relative humidity plummets to single digits. Hot summers take their toll on chaparral, stressed by the lack of precipitation, and the winds set a scene for disaster. Once a fire gains a foot-hold, with Santa Ana winds blowing it is virtually impossible to contain until the wind abates or it runs into the sea. The fires historically follow well-defined wildfire corridors in the Malibu region.

The Old Topanga Canyon fire in November of 1993, destroyed more homes than any previous fire in the history of the Los Angeles County Fire Department. The Malibu Fire in October 1978 was the worst previous fire laying waste to thousands of acres and 230 homes. The Old Topanga Fire destroyed 369 homes and resulted in the deaths of three civilians. The fire crossed ways with a total of seven previous burns through brush that was as young as eight and as old as 70 years. It had been eight years since the last major fire.

Since 1927, a total of 24 wildland fires have caused the loss of 1,502 homes, 830 other structures, 271,047 acres and five fatalities. Previous fires include the 1985 Malibu Fire, 1982 Dayton Fire (85 homes destroyed), and the 1970 Malibu Canyon Fire (103 homes destroyed). The 1993 Old Topanga Fire burned much of the same area covered in the 1970 burn. The last time Topanga Canyon had seen a damaging fire was December 1958 when 74 homes were reduced to rubble. Between 1938 and 1943, three fires destroyed more than 600 structures in the Topanga Canyon area. **(source: http://www.coastal.ca.gov/fire/firerept.html)**

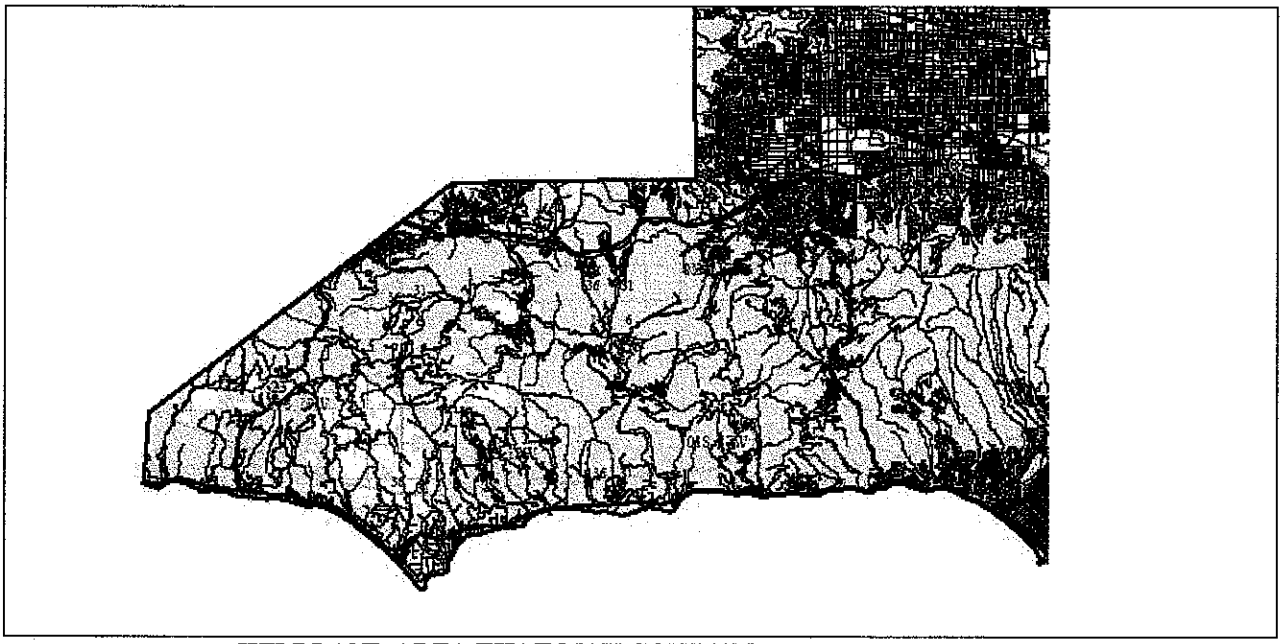
WESTLAKE VILLAGE

The City of Westlake Village is partially located in the mountainous watershed are which experiences periods of severe fire hazard when the weather is characterized by high temperatures, low humidity, and high wind velocities. Fire hazard within the City is primarily related to highly flammable brush which ignites readily, burns with intense heat and spreads rapidly. Large, destructive fires have burned through the Santa Monica Mountains and in and near the City of Westlake Village on a regular basis.

Additionally, areas of the City developed prior to the Non-Combustible Roofing Ordinance of 1977 include structures with combustible wood shingle/shake roofs. These roofs present a hazard and fire fighting problem during severe fire weather due to flying brands from a wildland or structure fire. Property owners are also required to maintain a firebreak around and adjacent to all buildings and structures by removing all flammable vegetation or other combustible growth for a minimum distance of 30 feet from the structure or to the property line, whichever is closer.

The City is currently in the process of phasing out any wood shingle roofs that do not comply with the building codes as homeowners get their roofing permits for any new roof removals and replacements.

MAP 18. WEST LOS ANGELES COUNTY FIRE MAP



WILDLAND AREA THAT MAY CONTAIN SUBSTANTIAL FOREST FIRE RISKS AND HAZARDS

Pursuant to Section 4125 of the Public Resources Code. The owner of this property is subject to the maintenance requirements of Section 4291 of the Public Resources Code. Additionally, it is not the state's responsibility to provide fire protection services to any building or structure located within the wildlands unless the Department of Forestry and Fire Protection has entered into a cooperative agreement with a local agency for those purposes pursuant to Section 4142 of the Public Resources Code.

VERY HIGH FIRE HAZARD SEVERITY ZONE - AB 337

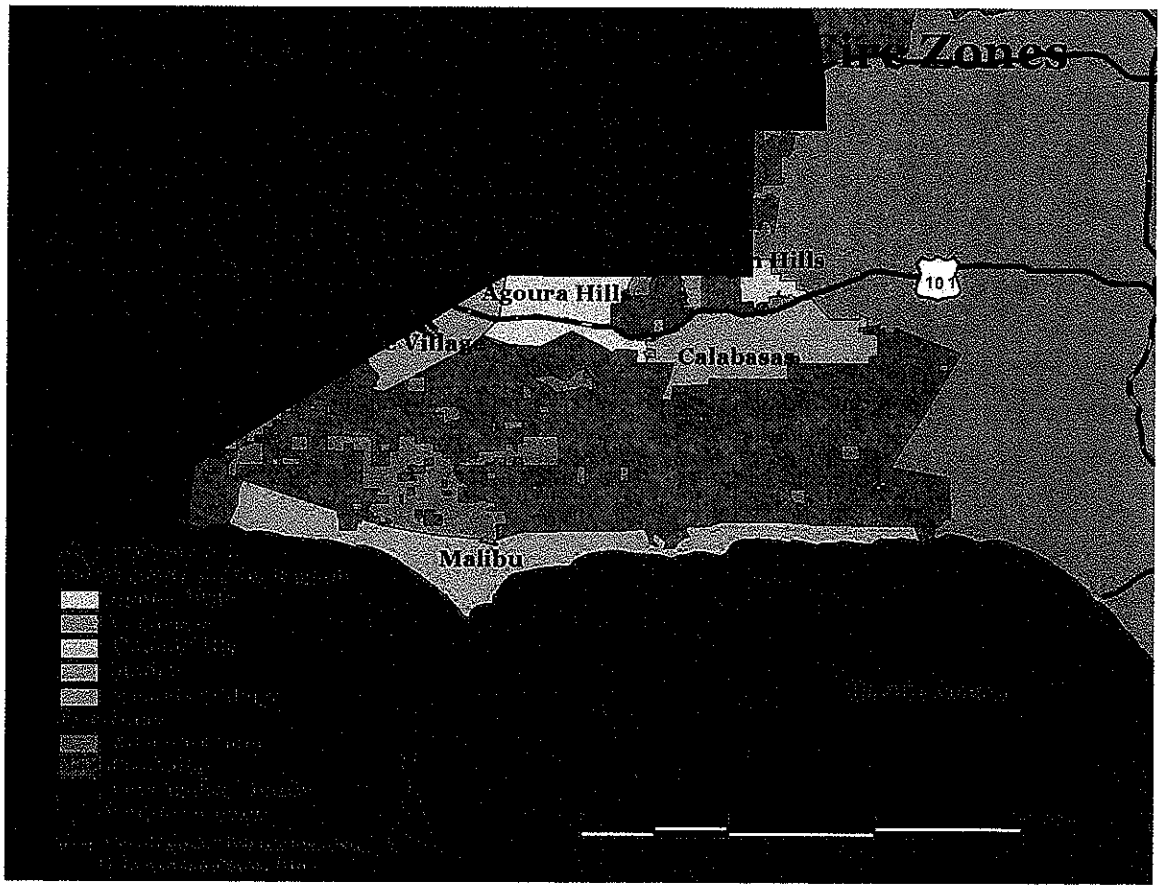
Pursuant to Section 51179 of the Government Code. The owner of this property is subject to the maintenance requirements of Section 51182 of the Government Code.

MAJOR HIGHWAYS	
ROADS	
RAILROADS	
POWERLINES	
AIRFIELDS	
HYDROGRAPHY	
SECTION LINE	
TOWNSHIP/RANGE	

source: http://www.fire.ca.gov/ab6/ab6lst.html

Using data provided by the California Department of Forestry and Fire Protection, the following map shows specific areas within the Las Virgenes-Malibu region that are in fire hazard zones.

MAP 19. LAS VIRGENES-MALIBU REGION FIRE ZONES.



THE INTERFACE

The Las Virgenes-Malibu region is like many Southern California communities that are challenged by the increasing number of houses being built on the urban/wildland interface. The National Wildland Coordinating Group defines urban/wildland interface as "the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel.

In 1992, Assembly Bill -337, known as the "Bates Bill", required all cities and counties in California to identify within their communities "The Very High Wildland Fire Hazard Severity Zones" or VHFHSZ.

Once the cities within the Las Virgenes-Malibu region identified this VHFHSZ and submitted it to the California Department of Forestry and Fire Protection, the state required that an ordinance be passed covering the following elements in the identified zone:

- Minimum standards on roof coverings
- Minimum standards on clearances around occupied dwellings by removal of combustible vegetation
- Minimum standards on clearances of tree limbs around chimneys
- Regulations regarding the maintenance of trees and their litter on and around structures

THE THREAT OF URBAN CONFLAGRATION

Although communities without an urban/wildland interface are much less likely to experience a catastrophic fire, in the Las Virgenes-Malibu region there is a scenario where any community might be exposed to an urban conflagration.

In the Las Virgenes-Malibu region this scenario highlights the need for fire mitigation activity in all sectors of the region, urban/wildland interface or not. The Las Virgenes-Malibu region could conceivably experience such a fire in the areas outside of the VHFHSZ either as a result of an earthquake or some other phenomenon. Possible scenarios include a disruption in the water system that could allow a normally controllable structure fire to escape containment by fire forces and spread to adjoining buildings. Another scenario is a fire that starts in the flatlands and could be wind driven from the roof of one building to the roofs of adjoining buildings. In the area outside the VHFHSZ, many wood shake or shingle roofs exist and there is a potential for fires being driven from roof to roof faster than firefighting efforts can keep up under strong Santa Ana wind conditions.

Other large dollar loss or large life loss fire potential exist within the region as well. The Las Virgenes-Malibu region is home to many large hotels having large occupancies per day and numerous high rise buildings. The region is also home to many business parks that house commercial structures at risk to lose millions in terms of structural damage in case of a large fire hazard.

Identifying the hazard area as set forth above is the first step in assessing the cities' vulnerability to wildland fires. Other key factors in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence and weather, as well as occurrences of drought. These factors can affect how quick a fire can spread.

The following is a Natural Hazard Disclosure Map. Natural Hazard Disclosure (Fire) maps show the two types of fire hazard areas referred to in legislation as disclosure items in real estate transactions. These areas are:

- Wildland Areas that may contain substantial forest fire risks and hazards (Wildland Areas)
- Very High Fire Hazard Severity Zones (VHFHSZ)

Chart 13 Illustrates a rating system to identify wildfire hazard risk (with a score of 3 equaling the most danger and a score of 1 equaling the least danger.)

CHART 13. SAMPLE HAZARD IDENTIFICATION RATING SYSTEM

Category	Indicator	Rating
Roads and Signage	Steep; narrow; poorly signed	
	One or two of the above	
	Meets all requirements	
Water Supply	None, except domestic	
	Hydrant, tank, or pool over 500 feet away	
	Hydrant, tank, or pool within 500 feet	
Location of the Structure	Top of steep slope with brush/grass below	
	Mid-slope with clearance	
	Level with lawn, or watered groundcover	
Exterior Construction	Combustible roofing, open eaves, Combustible siding	
	One or two of the above	
	Non-combustible roof, boxed eaves, non-combustible siding	

In order to comply with the Bates Bill, the cities within the Las Virgenes-Malibu region completed an evaluation of the following factors to determine the areas of the Region which would qualify as a Very High Wildland Fire Hazard Severity Zone.

- Fuel
- Topography
- Dwelling density
- Weather
- Infrastructure
- Fire codes and ordinances as they relate to brush issues

Each factor was given a value of 1-4 with a 4 being the highest danger rating. Any total score over 10 qualified the area as being one of VHFHSZ. Each of the three areas evaluated rated 10 or above with the highest area receiving a 12.

In order to determine the "base hazard factor" of specific wildfire hazard sites and interface regions, several factors must be taken into account. Categories used to assess the base hazard factor include:

- Topographic location, characteristics and fuels;
- Site/building construction and design;
- Site/region fuel profile (landscaping);
- Defensible space;
- Accessibility;
- Fire protection response; and
- Water availability.

The use of Geographic Information System (GIS) technology in recent years has been a great asset to fire hazard assessment, allowing further integration of fuels, weather and topography data for such ends as fire behavior prediction, watershed evaluation, mitigation strategies and hazard mapping.

RISK ANALYSIS

Las Virgenes-Malibu region residents are served by a variety of fire stations from the County of Los Angeles Fire Department. Data that includes the location of interface areas in the county can be used to assess the population and total value of property at risk from wildfire and direct these fire agencies in fire prevention and response.

Key factors included in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence and weather, as well as occurrences of drought.

The National Wildland/Urban Fire Protection Program has developed the Wildland/Urban Fire Hazard Assessment Methodology tool for communities to assess their risk to wildfire. For more information on wildfire hazard assessment refer to http://www.Firewise.org. A thorough risk assessment shall be proposed by the Las Virgenes-Malibu cities a as a multi hazard mitigation strategy. This will include hazard maps that include but not limited to, number of parcels and buildings that are located in hazard areas along with a total valuation.

WHAT IS SUSCEPTIBLE TO WILDFIRE

The hills and mountainous areas of Southern California are considered to be interface areas. The development of homes and other structures is encroaching onto the wildlands and is expanding the wildland/urban interface. The interface neighborhoods are characterized by a diverse mixture of varying housing structures, development patterns, ornamental and natural vegetation and natural fuels.

In the event of a wildfire, vegetation, structures and other flammables can merge into unwieldy and unpredictable events. Factors important to the fighting of such fires include access, firebreaks, proximity of water sources, distance from a fire station and available firefighting

personnel and equipment. Reviewing past wildland/urban interface fires shows that many structures are destroyed or damaged for one or more of the following reasons:

- Combustible roofing material;
- Wood construction;
- Structures with no defensible space;
- Fire department with poor access to structures;
- Subdivisions located in heavy natural fuel types;
- Structures located on steep slopes covered with flammable vegetation;
- Limited water supply; and
- Winds over 30 miles per hour.

Road Access

Road access is a major issue for all emergency service providers. As development encroaches into the rural areas of the county, the number of houses without adequate turn-around space is increasing. In many areas, there is not adequate space for emergency vehicle turnarounds in single-family residential neighborhoods, causing emergency workers to have difficulty doing their jobs because they cannot access houses. As fire trucks are large, firefighters are challenged by narrow roads and limited access. When there is inadequate turn around space, the fire fighters can only work to remove the occupants, but cannot safely remain to save the threatened structures.

Water Supply

Water supply, both in terms of volume and pressure, is always a critical factor in fighting fires and particularly in keeping fires in the wildland/urban interface areas manageable by initial attack forces. Generally speaking the water supply to most areas of the region is very good.

PUBLIC INVOLVEMENT

Public Awareness

October is "Fire Prevention Month" within the Los Angeles County Fire Department. This is only part of the public awareness campaigns that the Fire Departments conduct within the Las Virgenes-Malibu region. The following are programs, activities and public awareness campaigns the LACFD implements.

A.W.A.R.E.

The goal of A.W.A.R.E., a community awareness and education program, is to use community education and involvement to help reduce the loss of life and property resulting from wildland brush fires.

The LACoFD also posts a variety of Safety Handouts for the public to view on their website and at various fire stations in the Las Virgenes-Malibu region. These pamphlets include but are not limited to:

- Home Fire Safety Tips
- Brush Clearance Tips

- Exit Drills in the Home
- Storm Safety Guidelines
- Rolling Electric Outage Safety
- Link to So Cal Gas Co. for safety tips on gas appliances

The cities within the Las Virgenes-Malibu region provide ongoing community education on fire hazards through the following programs:

- CERT (Citizen Emergency Response Team) training
- The region of Calabasas offers CERP, Citizen's Emergency Response Team, Disaster Triage Assistance Team (DTAT) and Medical Reserve Corps
- The region of Malibu offers an Emergency Preparedness Program
- The region of Westlake offers a Disaster Response Team and a Volunteers in Policing program

The Las Virgenes-Malibu regional cities along with the LACoFD educate the public in terms of fire and life Safety by providing the following special programs upon request. Fire Safety Education Programs that consist of the following:

- Local cable television education and informational programs are shown throughout the year, but most often during the months considered being fire season.
- Informational brochures have also been prepared and are distributed informing citizens about the need for evacuation plans and tips on home protection.
- Disaster Assistance Programs that are taught to the Las Virgenes-Malibu Unified School District employees
- Fire Safety and Prevention in schools

OTHER AGENCIES

It is important to work with other organizations and agencies to create a more comprehensive Hazard Mitigation Plan. There are numerous agencies that Region VII of the LACoFD works closely with, including but not limited to:

Political Entity	Jurisdiction
Los Angeles County Sheriff's Department	Local Government/ Law Enforcement
City of Los Angeles	Local Government/LRA Fire Protection
Ventura County Fire Department	LRA and SRA Fire Protection
National Park Service	Public Land Ownership, DPA Fire Protection
City of Agoura Hills	Contract
City of Hidden Hills	Contract
City of Malibu	Contract
City of Westlake Village	Contract

Political Entity	Jurisdiction
City of Calabasas	Contract
California State Parks	Public Land Ownership, SRA Fire Protection
Santa Monica Mountains Conservancy	Public Land Ownership, Recreational Use
Public Utility Companies	State/County
California Department of Forestry and Fire Protection	State/County
Malibu Lakeside	Homeowner's Association
Malibu Lake Mountain Club	Homeowner's Association
Horizon Hills	Homeowner's Association
Ganesha Hills	Homeowner's Association
The Country Estates	Homeowner's Association

FEDERAL PROGRAMS

The role of the federal land managing agencies in the wildland /urban interface is reducing fuel hazards on the lands they administer; cooperating in prevention and education programs; providing technical and financial assistance; and developing agreements, partnerships and relationships with property owners, local protection agencies, states and other stakeholders in wildland/urban interface areas. These relationships focus on activities before a fire occurs, which render structures and communities safer and better able to survive a fire occurrence.

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.

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.

Hazard Mitigation Grant Program

Following a major disaster declaration, the FEMA Hazard Mitigation Grant Program provides funding for long-term hazard mitigation projects and activities to reduce the possibility of damages from all future fire hazards and to reduce the costs to the nation for responding to and recovering from the disaster.

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.

U.S. Forest Service

The U. S. Forest Service (USFS) is involved in a fuel-loading program implemented to assess fuels and reduce hazardous buildup on forest lands. The USFS is a cooperating agency and, while it has little to no jurisdiction in the lower valleys, it has an interest in preventing fires in the interface, as fires often burn up the hills and into the higher elevation US forest lands.

EXISTING MITIGATION ACTIVITES

Region VII of the LACoFD takes many steps in order to prevent the event of a wildfire occurring within the Las Virgenes-Malibu region. The following are a sample of the programs, activities and practices they implement.

Prescribed Burning

The health and condition of a forest will determine the magnitude of wildfire. The LACoFD does practice prescribed burning. If fuels - slash, dry or dead vegetation, fallen limbs and branches - are allowed to accumulate over long periods of time without being methodically cleared, fire can move more quickly and destroy everything in its path. The results are more catastrophic than if the fuels are periodically eliminated. Prescribed burning is the most efficient method to get rid of these fuels. In California during 2003, various fire agencies conducted over 200 prescribed fires and burned over 33,000 acres to reduce the wildland fire hazard.

Pre-Fire Management Plan

As a preventative measure, the LACFD also implements a Pre-Fire Management Plan whose overall goal is to reduce total cost and losses from wildland fire in California by protecting assets at risk through focused pre-fire management prescriptions and increased initial attack success.

Special Operations Bureau
The Special Operations Bureau provides many highly technical operational functions to County residents, including Emergency Medical Services, Urban Search and Rescue, Hazardous Materials, Air Operations, Fire Camps for wildland firefighting, Heavy Equipment and central Dispatch. Also included in Special Operations is the Department's Terrorism Response Section, which coordinates the Department's response to incidents involving Weapons of Mass Destruction.

Fire Prevention Region
The Las Virgenes-Malibu region is part of the LACoFD Fire Prevention Region led by Captain Jim Jordan in the Region of Malibu. Fire prevention and code enforcement in these regions historically requires concentrated efforts on the provisions for water supply for fire protection, and vehicular access for fire apparatus. Geographic and terrain limitations as well as the lack of water supply in mountainous terrain, present challenges that our Inspectors review and inspect, and often times provide alternative solutions for the owners/occupants to consider.

Fire codes have been amended throughout the years to assist fire department personnel with wildland fire fighting in the rural urban interface zones. Building construction in these areas may have additional requirements for non-combustible construction components and water supply. Inspectors assigned to these regional offices can best inform the developers and homeowners with information for fire safe construction and fire protection systems.

In California, the Los Angeles County Fire Department has retrofitted more than 100 fire engines with fire retardant foam capability and Orange County is evaluating a pilot insurance grading and rating schedule specific to the wildland/urban interface. All are examples successful programs that demonstrate the value of pre-suppression and prevention efforts when combined with property owner support to mitigate hazards within the wildland/urban interface.

Fuel Modification Plan
Part of the Forestry Division of the LACoFD, this publication was prepared to establish a set of guidelines and landscape criteria for all new construction that would implement an ordinance relating to fuel modification planning and help reduce the threat of fire in high hazard areas.

Vegetation Management Program
The County of Los Angeles Department of Forester and Fire Warden created the Vegetation Management Program in 1979 to develop strategies for responding to the growing fire hazard problem. These include:

- An ongoing effort to analyze the history of wildland fires in Los Angeles County
- Experimentation with different methods of reducing and removing fuels in fire prone areas.
- Evaluation of the environmental impacts and effects of these practices.

Brush Clearance Inspection Program
The LACoFd participates in a brush clearance program in order to prevent hazardous situations. Detailed suggestions and instructions on how to prevent a fire hazard situation and protect homes is available as a hard copy and on the LACoFD website. The LACoFD requires a 100 foot clearance around structures of all native brush, grass and hazardous vegetation to minimize fore hazards.

Teleminder System
To assist in the notification and early warning of the residents in the high-hazard zone, an automated computer dialing system called Teleminder is used. This system can make hundreds of calls to a geographical area within minutes and will broadcast a customized message to whomever, or whatever answers the phone.

AGOURA HILLS
The City of Agoura Hills implements separate fire codes than the ones already required. They include:

Section	Title
112(6)	Fire Sprinkler Revisions
6402.2	Roof Covering Revisions
6402.3,6402.4,6402.6,6402.7,6402.8	Fire Zone 4 Revisions

CALABASAS
The City of Calabasas has recently begun a program that grants free Oak Tree / Brush clearance permits. The intent of this program is to encourage proper maintenance of Oak Trees that may create a public safety hazard during a fire or windstorm event.

HIDDEN HILLS
The City of Hidden Hills has an extensive fire prevention program. The city reviews each new development to ensure that structures are adequately separated and that fore retardant materials are used in construction. Fire retardant Class A roofs are required. In addition, the Hidden Hills Municipal Code requires that property owners maintain right-of-way improvements and public works in a clean, hazard-free condition to ensure safety.

The following building codes are implemented as preventative measures for loss of life and property because of a fire hazard event.

Section	Title
Section 1. Chapter 3 of Title 4	Fire Code

MALIBU

Rambla Pacifico Alternative Access Project

This project will provide direct access from Rambla to Las Flores Canyon, greatly reducing the commute for Rambla residents and improving fire safety. Additionally, this project is providing alternative emergency routes in case of any hazard emergency.

BAER (Burned Area Emergency Rehabilitation)

Los Angeles County Fire Department, working in cooperation with the City of Malibu, Public Works and Conservation, will survey the burned areas of the Pacific Fire and determine what mitigation efforts are necessary to avoid mudslides in the event of a large rainfall (ex. strategically placing K-rails to deter mudslides) and to begin revegetation.

WESTLAKE VILLAGE

Mandated by the City's General Plan, property owners are presently required to maintain a firebreak around and adjacent to all buildings and structures by removing all flammable vegetation or other combustible growth for a minimum distance of 30 feet from the structure or to the property line, whichever is closer.

Furthermore, additional fuel modification may be required when it is found that because of extra hazardous conditions a firebreak of only 30 feet around such structures is not sufficient to provide reasonable fire safety.

WILDFIRE MITIGATION STRATEGIES

The following is a list of mitigation strategies the Las Virgenes-Malibu COG cities have for future planning.

- **Review Fuel Modification Plan Program –City of Calabasas**
- **Fire Code Update – City of Calabasas**
- **Incentive Based Lot Mergers – City of Calabasas**

See Section 4 for complete Mitigation Strategies.

Terrorist Hazards in the Las Virgenes-Malibu Region

SECTION 8

TERRORISM

TABLE OF CONTENTS **PAGE**

WHY IS TERRORISM A THREAT TO THE LAS VIRGENES-MALIBU REGION

Terrorism is a continuing threat throughout the world and within the United States. A variety of political, social, religious, cultural, and economic factors underlie terrorist activities. Terrorists target civilian targets to spread their message or communicate dissatisfaction with the status quo. The media interest generated by terrorist attacks makes this a high visibility threat.

HISTORY OF TERRORIST EVENTS IN THE LAS VIRGENES-MALIBU REGION

The Las Virgenes-Malibu region is an internationally known community with strong political and economic ties. There are a variety of businesses and high-profile individuals who live within the region. For example, the City of Westlake Village, it is not home to any particular group or operation that would appear to be a terrorist threat; however, given a number of corporate headquarters and an affluent population, such a threat always exists to some degree. Factors such as these make the Las Virgenes-Malibu region an attractive potential target. Although there is not history of terrorist events within the region, the possibility exists.

The Las Virgenes-Malibu region receives their police protection services from the Los Angeles County Sheriff's Department Malibu/Lost Hills Station located at 27050 Agoura Road, Agoura, CA 91301. All five cities contract with the Los Angeles County Sheriff's Department. They shall be the lead agency for region response/crisis management. Individual cities will be responsible for consequence management. The Malibu/Lost Hills Division patrol areas include the western portion of Los Angeles County, including Agoura Hills, Calabasas, Hidden Hills, Malibu, and Westlake Village.

SPECIFIC THREATS

Recent trends toward large scale incidents generating significant casualties make preparedness and the mechanisms for effective response essential. In addition to large scale attacks, a full range of assault styles must be considered. Contemporary terrorist activity runs the gamut from simple letter bombings, assassinations with small arms, bio-chemical attacks, car, and suicide and building bombings to full-out attacks.

Bombings and arson remain significant sources of terrorist activity. Related threats include bomb threats, which disrupt the normal operations. Venues likely to suffer the impact of terrorism include government facilities, entertainment and cultural facilities and business canters. Conventional political motivations for terrorism continue, however, issues involving weapons proliferation, organized crime and narcotics trafficking are seen as having increasing influence. The potential for nuclear, biological, or chemical (NBC) is a concern. Recent events make NBC emergencies a plausible scenario necessitating the detailed contingency planning and preparation of emergency responders to protect the civilian populace in the Las Virgenes-Malibu region and in Los Angeles County.

CAUSES AND CHARACTERISTICS OF TERRORIST EVENTS IN THE LAS VIRGENES-MALIBU REGION

Defining Terrorism

The United States Code defines terrorism as premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents usually intended to influence an audience. The United States Department of Justice defines terrorism as a violent act dangerous to human life, in violation of the criminal laws of the U.S. or any segment to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. The FBI defines terrorism as the unlawful use of force or violence against persons or property to intimidate or coerce government, the civilian population, or any segment thereof, in furtherance of political or social objectives. Terrorists are categorized based on their actions, not beliefs. Even if we have sympathy for their cause, they are still criminals.

All three of these definitions share important components:

1. Criminal action
2. The action must include violence against civilians
3. The action is carried out in order to further political or social objectives
4. The action is intended to coerce a government or civilian population

TERRORISM IN THE UNITED STATES

Terrorism has touched U.S. soil at several locations over the years. After the September 11, 2001 World Trade Center airplane bombing, terrorism was no longer an international problem. In recent years, terrorism has taken on new form with the introduction of chemical, biological, and radiological weapons. The first step in preparing to respond to incidents of this kind is to understand the nature of the threat.

TERRORISM HAZARD IDENTIFICATION

The following are the types of terrorist groups:

Domestic Terrorism

Right Wing Terrorist Groups	Often engage in survivalist/ paramilitary training to ensure the survival of the U.S. as a white, Christian nation. Many extremists work through political involvement; however, some are members of the "militia" or "patriot" movement, and cannot work within existing structures of government. It is not illegal activity to belong to a militia. Many members of militias express that an impending armed conflict with the federal government necessitates paramilitary training and the stockpiling of weapons. The growth of the militia movement can be attributed to an effective communication system through the use of the Internet, videotape, gun shows, etc. Another phenomenon related to militias is "Common Law Courts."
Left-wing Terrorist Groups	Typically, left-wing groups profess a revolutionary socialist doctrine and view themselves as protectors of the American people against capitalism and imperialism. They believe that bombings alone will not result in change, but are tools to gain public recognition for their cause.
Special Interest Terrorist Groups	Differs from traditional right- and left-wing groups in that they pursue specific objectives. These terrorist groups attempt, through their violent criminal actions, to force members of society to change their attitudes about issues considered important to them. Such groups who defend animal rights, right to life, environmental preservation and abortion rights are some examples.

International Terrorist Groups

International terrorism against the U.S. is foreign based and/or directed by countries or groups outside the U.S. State sponsors view terrorism as a tool of foreign policy. State sponsors continue to engage in anti-Western terrorist activities by funding, organizing, networking, and providing other support to many extremists.

Emergency Response Actions

In the case of a terrorist event the Los Angeles County Sheriff's Department will be the lead agency for crisis management, perimeter security, access control, traffic/crowd control, evacuations, notifications, and safeguarding evidence. Crisis management activities may include:

- Investigation, tracking, and maintaining scene integrity.
- Coordinating coroner issues with the Los Angeles County Coroner's Department.
- Use of Special Weapons and Tactics (SWAT) or Rapid Deployment Force (RDF) units Assisting with damage assessment and fatalities management.

The Los Angeles County Fire Department will be the lead for fire response, hazardous materials events, and medical/rescue operations. The Fire Department will provide support as necessary to the police department for Crisis Management activities. Existing procedures, such as the Fire Department's Hazardous Materials Response procedures and NBC Response Protocols will be used as necessary. The Department will assist with:

- Fire and rescue operations
- Emergency medical services coordination
- Perimeter and access control
- Evacuation operations
- Notifications
- Safeguarding evidence
- Damage assessment and
- Fatalities management
- Potential areas of concern may include:
- Addressing environmental needs
- Obtaining personnel with radiological training
- Insuring decontamination procedures (radiological and chemical) in place and
- Insuring biological agents containment

On-Scene Coordination

Once the WMD incident has occurred (with or without a pre-release crisis period), local government emergency response organizations will respond to the incident scene and appropriate notifications to local, State, and Federal authorities (likely a senior fire or law enforcement official). Command and control of the incident scene is vested with the Incident Commander. Operational control of assets at the scene is retained by the designated officials representing the agency (local, State, or Federal) providing the assets. These officials manage tactical operations at the scene in coordination with the IC as directed by their agency counterparts at the field-level operational centers, if used. As mutual aid partners, state and Federal responders arrive to augment the local responders.

The incident command structure that was initially established will likely transition into a Unified Command (UC) This UC structure will facilitate both crisis and consequence management activities. The UC structure used at the scene will expand as support units and agency representatives arrive to support crisis and consequence management operations. On-scene consequence management activities will be supported by the local and State EOC, which will be augmented by the FEMA's Regional Operations Center or Disaster Field Office, and their Emergency Support Team, as appropriate.

When Federal resources arrive at the scene, they will operate as a Forward Coordinating Team (FCT). The senior FBI representative will join the Unified Command group while the senior FEMA representative will coordinate activity of Federal consequence management liaisons to

the Unified Command. On-scene Federal crisis management resources will be organized into a separate FBI Crisis Management Branch within the Operations section, and an FBI representative will serve as deputy to the Operations Section Chief. Federal consequence management resources will assist the appropriate CS function, as directed.

Throughout the incident, the actions and activations of the Unified Command at the incident scene and the Command Group of the FBI's Joint Operations Center (JOC) will be continuously and completely coordinated.

Federal Agency Efforts

During a terrorist incident, the organizational structure to implement the federal response at the field level is the JOC. The JOC is established by the FBI under the operational control of the Federal On-scene coordinator, and acts as the focal point for the strategic management and direction of on-site activities, identification of State and local requirements and priorities, and coordination of the Federal response. The local FBI field office will activate a Crisis Management team to establish the Joint Operations Center (JOC), which will be in the affected area, possibly collocated with the City's EOC.

Similar to the Area Command concept within the ICS, the JOC is established to ensure inter-incident coordination and to organize multiple agencies and jurisdictions within an overall command and coordination structure. The JOC includes the following functional groups: Command, Operations, Administration, Logistics and Consequence Management. Representation within the JOC includes official from local, State and Federal agencies with specific roles in crisis and consequence management.

A FEMA representative coordinates the actions of the JOC Consequence Management Group, and expedites activation of a Federal consequence management response should it become necessary. FBI and FEMA representatives will screen threat incident intelligence of the Consequence Management Group. The JOC Consequence Management Group monitors the crisis management response in order to advise on decisions that may have implications for consequence management, and to provide continuity should a Federal consequence management response become necessary.

WHAT IS SUSCEPTIABLE TO TERRORISM

In the Las Virgenes-Malibu region there are several critical facilities that may be targets for terrorism. Because of safety and security concerns, these targets will not be named specifically. Probability that an individual/location will be targeted by a terrorist is a function of several factors including the attractiveness of target, the potential for success of the event and potential for avoiding identification and capture. Samples of general targets are provided below.

General Targets
1. Symbolic buildings
2. Federal, state, and local government buildings
3. Mass-transit facilities
4. Public buildings and assembly areas
5. Controversial businesses
6. Communication and utility facilities
7. Water supply locations
8. Research laboratories
9. Places where large groups of people congregate

Malibu
The City of Malibu has identified a list of terrorist targets for possible terrorist attack, as per our Homeland Security Assessment Report 2003. The following are these targets.

- **Malibu Court House**
  23525 Civic Center Way, Malibu 90265
- **Pepperdine University**
  24255 Pacific Coast Highway, Malibu 90265
- **Hughes Research Labs**
  3011 South Malibu Canyon Rd, Malibu 90265
- **Malibu Beaches and Coastline / "Malibu Colony" Community**
  (No street address)
- **Infrastructure / Road tunnels**
  Malibu Canyon Road and Kanan Dune Rd.

Impact on the Community
While many agencies will be mobilized to respond to a terrorist event, it will take time for that assistance to arrive. Many specialized resources (such as military response teams) may need to be airlifted to the area requiring local resources to manage the initial phases of a WMD emergency. This initial response phase may range from a few to many hours (response times for Federal resources ranging from 2-24 hours can be expected). Local first responders (law enforcement, fire, hazmat, EMS, etc.) will be augmented by the Metropolitan Medical Response System (MMRS) to manage this crucial initial phase. Key initial activities include situation assessment, responder safety, containment, protective actions (evacuation in-place protection), decontamination, treatment and transport of injured persons.

Panic, intense media interest, and the convergence of contaminated persons at local hospitals and urgent care centers can be expected. With proper planning and management these situations can be controlled and remedied.

Rapid assessment of the scope of the incident, activation of the SEMS emergency management infrastructure, designation of casualty collection points or field treatment sites, and

decontamination points are essential to mitigating potential community panic. Efforts to assess the situation and provide clear, easy to follow emergency management instructions of the public are essential. The following describe some of the concerns expected during the initial stages of a terrorist event.

Down Wind Evacuation
A large release may result in a lethal plume that may travel for miles. Emergency agencies in neighboring jurisdictions must be advised of the release and included in incident management activities.

Traffic Restrictions and Congestion
Roads, freeways and transit systems may need to be closed to contain the incident. Regardless of the need, panic may cause some persons to self evacuate, Traffic congestion and gridlock conditions and confusion may result. These factors will slow response by emergency agencies and specialized resources to affected areas. Detailed traffic management plans will need to be developed.

Self Transport to Medical Providers
Injured and contaminated victims may leave the immediate site of the incident and then go to hospitals. In most cases, the care provider will not be equipped to decontaminate victims or treat terrorist related casualties. This can extend the scope of the incident, potentially lead to secondary contamination and strain local medical and emergency response resources Hospitals impacted by an influx of casualties who have not been decontaminated will have to establish decontamination area and may not be able to continue providing treatment.

Panic Victims
In the immediate aftermath of a terrorist event, responders should anticipate a number of people who think they have been exposed to or contaminated by the agent(s) even though there has been no actual exposure. Provisions must be made to manage these persons and provide supportive care as necessary.

Scarce Supplies
Equipment and supplies needed to manage a terrorist event will be in short supply. Sufficient pharmacological supplies may not be available. Antidotes and other drugs used to treat WMD victims are usually not stockpiled in sufficient quantities for use in a mass casualty incident. Efforts to secure additional supplies will be an immediate need.

Personnel involved in managing potential terrorist event must be aware of these concerns. Measures to address these issues must be incorporated into the Incident Action Plan and should be considered and assessed throughout the management of the WMD incident.

WEAPONS OF MASS DESTRUCTION (WMD)

Most law enforcement officers know very little about WMD because, up until recently, no one seriously thought that WMD would ever be used against U.S. targets. Law enforcement agencies with more immediate problems have had little time to prepare for a potential WMD attack. It is essential that law enforcement officers, who are likely to be first responders, become familiar with WMD. Additional training can occur once officers are aware of these WMD and how they can be used.

Five Types of WMD That Could be Employed by Terrorists

WMD can be categorized into five categories using the acronym B-NICE: Biological, nuclear, incendiary, chemical and explosive.

1. Four common types of biological agents are bacteria, viruses, rickettsia, and toxins.
2. Nuclear terrorism can occur in two different ways.
    a. Detonation or threat of detonation of a nuclear bomb
    b. Dispersion of radiological material using a conventional explosive or other dispersal device
3. An incendiary device is any mechanical, electrical, or chemical device used to intentionally initiate combustion and start a fire.
4. Chemical agents can be classified into five categories: nerve agents, blister agents, blood agents, choking agents, and irritating agents.
5. Explosive devices are the most common WMD (70% of all terrorist attacks).

LAW ENFORCEMENT ROLE IN COMBATING TERRORISM

The following are steps and efforts that various law enforcement agencies are taking to combat terrorist activities.

1. On-going attention to known potential targets within the service area
2. Identification of new potential targets within the service area
3. Identification of suspicious persons, places, or things which may be related to potential terrorist activity
4. Recognition of potential surveillance and intelligence-gathering activities
5. Recognition of potential terrorist involvement in routine crimes (ID theft, shoplifting, credit card fraud, forgeries, etc.)
6. Organizing and informing community resources regarding anti- terrorism
7. Ability to respond safely and effectively to a terrorist incident or a terrorist use of a WMD.
8. Identify the terrorist group
9. Monitor weapons/materials
10. Threat/vulnerability assessment
11. Counter surveillance
12. Target hardening
13. Awareness of suspicious behavior as terrorists egress from target

EXISITING MITIGATION ACTIVITIES

Currently the Malibu/Lost Hills Sheriff's station and individual city's implement projects and or programs to help prevent a terrorist situation or be highly prepared if one were to occur. The following are practices or projects that are currently active in the region. As more information

LOS ANGELES COUNTY SHERIFF'S DEPARTMENT

Explosive Sniffing Canine

A canine trained to sniff out explosives is available in the Los Angeles County Sheriff's Department through the departments of Arson/Explosive Detail.

Terrorism Training

The Los Angeles County Sheriff's Department is currently updating its training for terrorist attacks. As information becomes available, it shall be included in the plan.

HIDDEN HILLS

The City of Hidden Hills has a Emergency Services Director that has attended Homeland Security trainings sin order to better inform the city and the community on terrorism preparedness and events.

MALIBU

Ongoing Public Information Program

- A monthly series on the City website features a different theme each month. These are adapted from the monthly Emergency Survival Program bulletins on preparing for and responding to terrorism incidents.
- A series of messages on the City's cable TV channel urge viewers to take emergency response training, to write a family emergency plan, and to contact the Emergency Preparedness Coordinator for further information.
- Ongoing meetings and presentations about emergency preparedness are made to the public at meetings of Homeowner's Associations and Emergency Preparedness Fairs.

Emergency warnings and information will be provided to the public in the event of a terrorist incident. This will be accomplished via the City of Malibu website, Cable TV channel-3, the City's AM Radio Station (1620 AM), a telephone Hotline service (456-9982), a call center located at City's Emergency Operations Center, and an email subscription service which notifies subscribers whenever emergency information is updated on the City website

LAS VIRGENES MUNICIPAL WATER DISTRICT

The LVMWD takes many security precautions to secure their facilities including fencing sites and securing facilities with alarms. Major facilities have security access gates locked 24/7 and a security company monitors and responds to alarms.

The district has operating / response procedures to ensure that any potential interruption of services will be as short as possible. Further, the district has completed a Vulnerability Assessment as required by federal law to assess and mitigate any potential security issues.

TERRORISM MITIGATION STRATEGIES
See Section 4 for complete Mitigation Strategies.

Flooding Hazards in the Las Virgenes-Malibu Region

SECTION 9

FLOOD

TABLE OF CONTENTS

WHY ARE FLOODS A THREAT TO THE LAS VIRGENES-MALIBU REGION

Flooding poses a threat to life and safety, and can cause severe damage to public and private property. Because of wildfire and changes in the natural landscape, flooding has been a factor in the history of the region. There is much mountainous terrain which creates water runoff during storms. The Las Virgenes-Malibu region was most recently significantly affected by flooding in the winter storms of 1998, also known as El Nino.

HISTORY OF FLOODING IN THE LAS VIRGENES-MALIBU REGION AND THE LOS ANGELES AREA

The Las Virgenes-Malibu region, which is located within Los Angeles County, which has historically experienced flooding from major winter storm events. The region is at the western edge of the Santa Monica Mountain range.

Long-term precipitation (1950 – 2002) in this area is based on data collected and recorded by the Los Angeles County Department of Public Works (LACDPW). Annual precipitation ranges from a minimum of zero (recorded in 1989) to a maximum of 59.13 inches (1998 El Nino). Very little precipitation is recorded between the months of May and October although an average of 17.3 inches of rain is measured annually. Rain fall increases northward toward the Santa Monica Mountains to the north and northwest, and decreases toward the center of the Coastal Plain.

Historical annual precipitation and cumulative departure from mean annual precipitation for The Las Virgenes-Malibu region demonstrate the severity and extent of dry and wet periods, the information below indicate five cyclical variations in the precipitation pattern between 1930 and 2003.

1. 1930 to 1976: a dry period
2. 1978 to 1983: an overall wet period
3. 1984 to 1990: a relatively dry period
4. 1991 to 1998: a relatively wet period
5. 1999 to present: beginning of a dry period

The most significant flooding events to affect the region occurred in 1994, 1995 and 1998. In 1998 a phenomenon known as El Nino hit Southern California and broke several rainfall records across Los Angeles County.

FEMA has declared the following to be significant floods. A significant event is one with 1,500 or more paid losses, or occasionally one added for other reasons. Events have been named according to the most popular name at the time the events occurred, or if there is no apparent name, one has been created for this report.

CHART 14. SIGNIFICANT FLOOD EVENTS IN SOUTHERN CALIFORNIA 1978 - 2004

Event	Year	# Pd Losses	Amount Pd ($)	Avg Pd Loss
California Flood - Southern	Jan-98	1,523	$18,539,717	$12,173
California Flood December 1996	Dec-96	1,831	$39,433,756	$21,537
S. California Flood	Jan-95	2,732	$64,928,365	$23,766

These events had a definite impact on the cities within the Las Virgenes-Malibu region. Mitigation activities are key to prevent any further incidents and mitigate the loss of property and life.

The following chart represents flood losses for the five cities within the Las Virgenes-Malibu COG from January 1, 1978 to December 31, 2003.

CHART 15. FLOOD LOSS STATISTICS FROM NFIP FOR THE STATE OF CALIFORNIA (From January 1, 1978 to December 31, 2003)

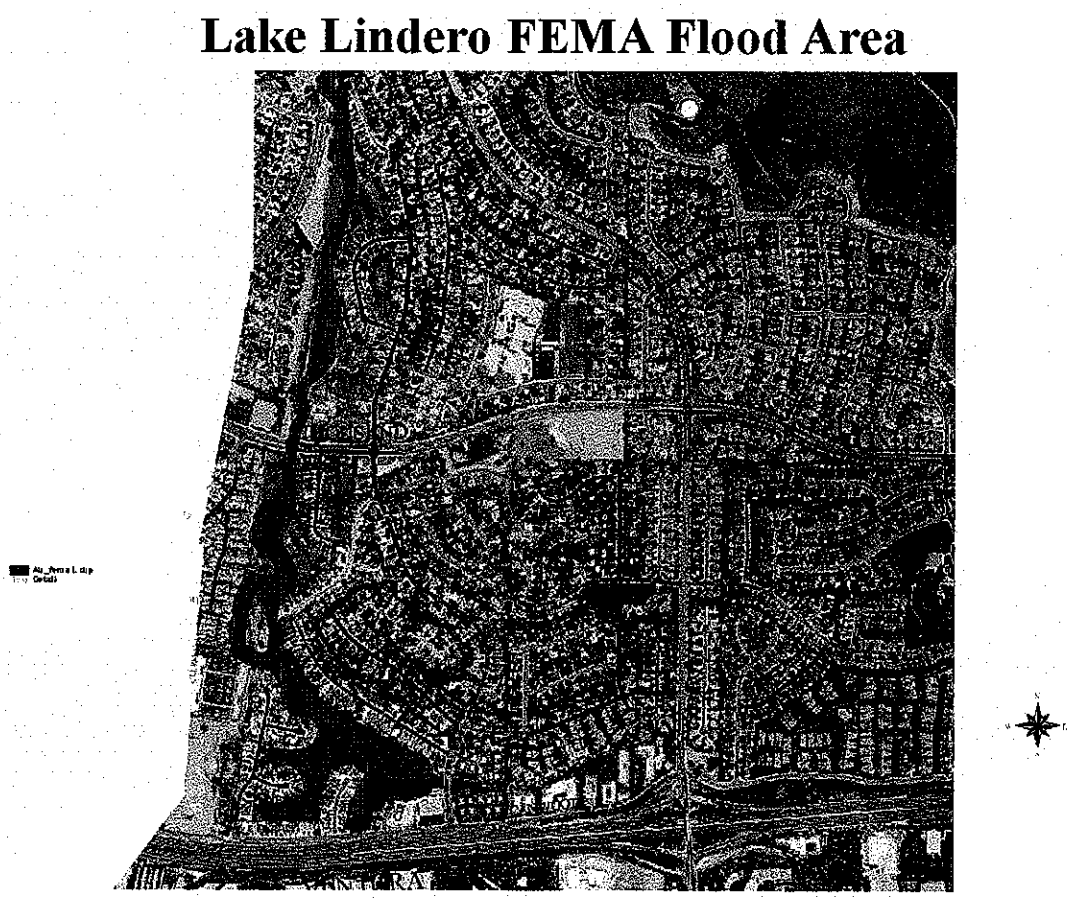
Community Name	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments
Agoura Hills	46	27	0	19	$289,436.36
Calabasas	5	2	0	3	$16,227.71
Hidden Hills	31	18	0	13	$165,649.37
Malibu	50	26	1	18	$582,594.45
Westlake Village	2	1	0	1	$566.83
TOTAL	**134**	**74**	**1**	**54**	**$ 1,054,474.72**

(Source: http://www.fema.gov/nfip/10400312.shtm#06)

AGOURA HILLS

The City of Agoura Hills has one reservoir within city boundaries. The city has no major record of flooding activity in the city within the last decade and thus no major loss of property of life. However the city has identified a problem in the city that is prone to flooding. Heavy rains can result in flooding on Thousand Oaks Boulevard, at the intersection of Lake Lindero. The city has a project slated but until completion, this area will continue to flood. The following map shows the flood areas on Lake Lindero on the west side of the city.
The red zones indicate areas prone to flooding according to FEMA.

MAP 20. LAKE LINDERO FEMA FLOOD AREA IN AGOURA HILLS



The following map is a flood map for the City of Agoura Hills. The red areas are FEMA recognized zones prone to flooding. The black boundary indicates the City of Agoura Hills.

MAP 21. CITY OF AGOURA HILLS FLOOD AREAS

Agoura Hills FEMA Flood Areas

CALABASAS

The City of Calabasas does not have a history of flood events in the City. However, during the El Nino storms of 1998, the City incurred an estimated amount of $700,000 dollars in damages created by floods.

HIDDEN HILLS

The Malibu Hydrographic Unit, located in the northwestern portion of the Los Angeles River Basin contains the City of Hidden Hills. The Malibu Hydrographic Unit occupies approximately 242 square miles in the western portion of Los Angeles County and the southeastern portion of Ventura County. The city is part of the Arroyo Calabasas Drainage Basin.

There are no year round streams or ponds within the city. Surface water runoff only occurs during and after periods of intense rainfall. The city's topography and soil conditions subject the

City to flood hazards from storm drain overflow, as well as from erosions, mudflows and debris deposits.

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps indicate that the City of Hidden Hills is located in Zone C, meaning it has a low potential for flooding. The Master Plan for Storm Drains map illustrates the existing flood control facilities. The Los Angeles County Flood Control District maintains these facilities.

MALIBU

Malibu's flood hazard stems from two primary sources: rainfall and high surf. Both these types of flooding pose significant problems.
Factors affecting flooding:
Drainage capacity, duration of rainfall, intensity of rainfall, absorbency of the soil, drain blockage, mitigation techniques utilized.

The City of Malibu has conducted a full Flood Mitigation Plan in 2001. Along with that the City also implements a Master Plan of Drainage. The City has a history of repetitive flooding caused by a variety of conditions. There are 21 major water courses within the city's boundaries. Malibu Creek is the largest of the watershed areas with an area of 119 square miles. Wildfires in canyon areas have destroyed over the years most of the native vegetation, increased runoff, erosion and sedimentation and caused heavy flooding in 1993, 1994, 1995 and 1998. (See Malibu Flood Mitigation Plan Appendix E).

The City also continues to enforce the FEMA requirements for development in Special Flood Hazard Areas.

WESTLAKE VILLAGE

Flood hazard areas within the City of Westlake Village are limited to the Triunfo Canyon drainage below Westlake Lake and the banks of the lake itself. A storm drain system has been constructed in the vicinity of the canyon to moderate the effects of storm runoff. The Los Angeles County Flood Control District has prepared a Triunfo Creek Floodway Map (LACFCD 154-ML2, Ord. 81-0021), which defines the physical limits of the flood hazard and the minimum floor elevations required for structures outside the hazard area. Any development within the canyon will be subject to the review and approval of the District.

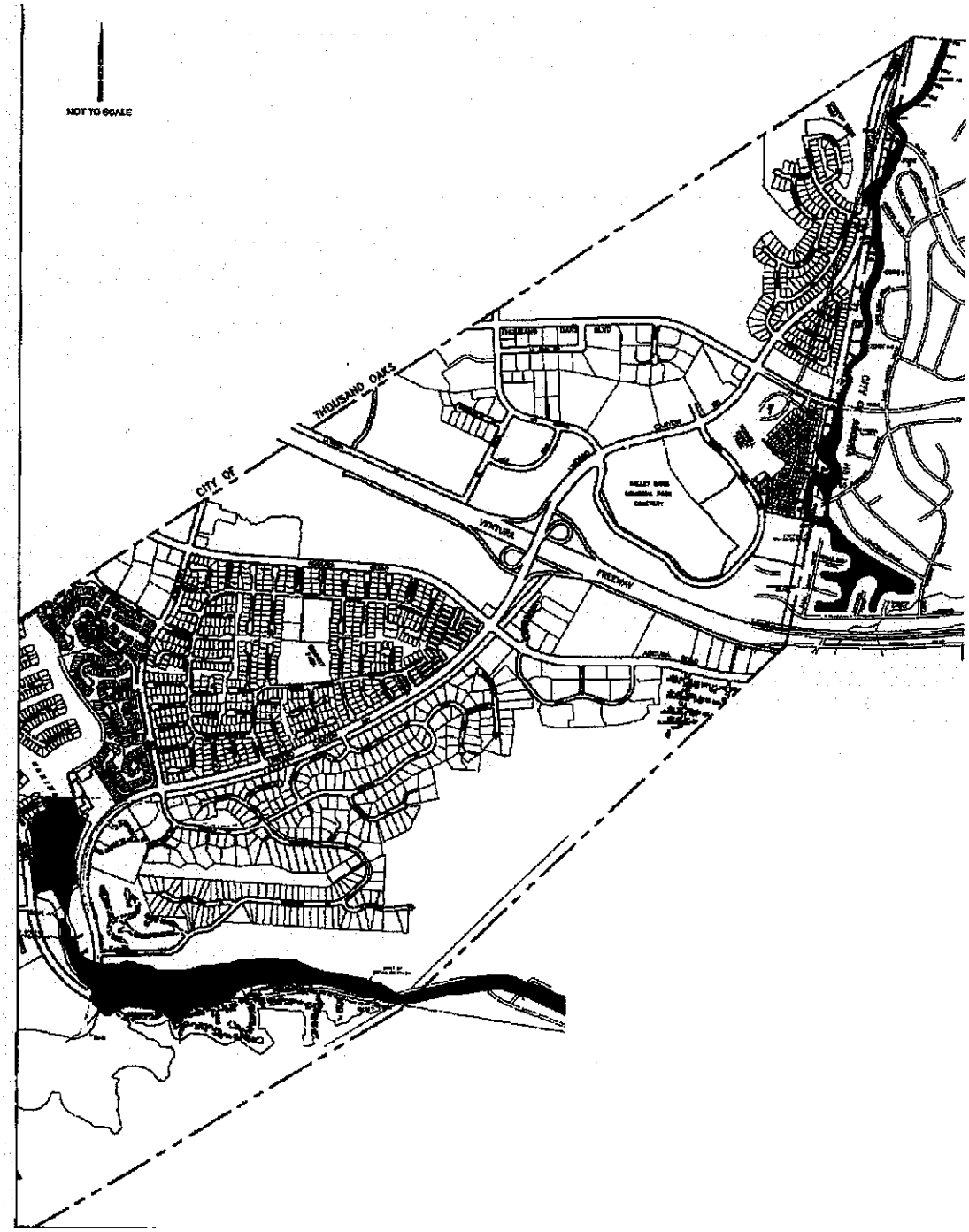
Development on the shores of Westlake Lake has been set back several feet from the highest water level which could be expected to occur. This setback is recognized as a flood hazard area and is maintained as open space. The "spillover" design of the Westlake Lake dam ensures that flooding beyond the lake's banks cannot occur.

Urban flooding can sometimes be possible due to debris accumulation on storm drains and in flood control channels and basins, over burdened pumping stations and aged drainage systems. Low-lying areas are particularly susceptible to urban flooding.

There are no specific areas identified as frequent drainage problems. However, the general areas most susceptible are those around the Westlake Lake since this is the lowest elevation level in the City. These areas include First Neighborhood, Lakeshore, and Southshore.

The following map illustrates known flood areas in the City. The dark areas show areas that may experience potential flooding. The City of Westlake Village currently allows no structures for human habitation in areas identified to possible flooding unless flood hazard has been eliminated.

MAP 22. CITY OF WESTLAKE VILLAGE FLOOD ZONES



CAUSES AND CHARACTERISTICS OF FLOODS IN THE LAS VIRGENES-MALIBU REGION

Typically, the Las Virgenes-Malibu region experiences flooding during or after a large rain storm. This is usually the case. However, flooding may occur as a result of large wave activity on the coast, reservoir or dam failure. However these events have no record of causing major flood situations.

The Las Virgenes-Malibu region is susceptible to flash or fast rise flooding because a high percentage of the surface area is composed of canyons, hills and mountainous terrain. The runoff caused by heavy rains potentially leads to flooding.

The standard for flooding is the so called "100 year flood" a benchmark used by the Federal Emergency Management Agency (FEMA) to establish a standard flood control throughout the country. Thus, the 100- year flood is also referred to as the regulatory or baseline for all flooding events.

A flood, as defined by the National Flood Insurance Program is: A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual or rapid accumulation or runoff of surface waters from any source, or mudflow.

Urban flooding primarily affects the Las Virgenes-Malibu region. Flooding of areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it. In addition, low- lying and areas at the foot of mountainous terrain have the potential to flood.

Winter Rainfall

Over the last 125 years, the average annual rainfall in Los Angeles is 14.9 inches. But the term "average" means very little as the annual rainfall during this time period has ranged from only 4.35 inches in 2001-2002 to 38.2 inches in 1883-1884. In fact, in only fifteen of the past 125 years, has the annual rainfall been within plus or minus 10% of the 14.9 inch average. And in only 38 years has the annual rainfall been within plus or minus 20% of the 14.9 inch average. This makes the Los Angeles basin a land of extremes in terms of annual precipitation.

FLOOD HAZARD IDENTIFICATION

Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course.

As described earlier, due to the close proximity to the Santa Monica Mountain range and the variations of typography ranging from an elevation of 1600 feet to 250 feet, flood waters have the potential to contribute to flooding hazards. Furthermore, due to continued growth, economic development and an increase of impermeable areas, the regions storm water collection and conveyance system were fast becoming incapable of safely disposing urban runoff. Thus,

contributing to flooding conditions in the region and in particular, the flood zone areas earlier described.

As a result of the need for flood control, the Los Angeles County Flood Control District was established in 1915. Currently, the Los Angeles County Flood Control District's Drainage Area flood control system is one of the world's largest and most extensive flood protection infrastructures.

Another relatively regular source for heavy rainfall, particularly in the mountains and adjoining cities is from summer tropical storms. These tropical storms usually coincide with El Nino years.

El Nino is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather in California. Among these consequences are increased rainfall across the southern tier of the US and Peru, which has caused destructive flooding and drought in the West Pacific. During El Nino, the trade winds begin to relax in the central and western Pacific leading to a depression of the thermocline in the eastern Pacific and an elevation of the thermocline in the west. The result was a rise in sea surface temperature and a drastic decline in primary productivity, the latter of which adversely affected higher tropic levels of the food chain, including commercial fisheries as well. The weakening of the easterly trade winds during El Nino and the increase of rain fall follows the warm water eastwards, with associated flooding in the west. The eastward displacement of the atmospheric heat source overlaying the warmest water results in large changes in the global atmospheric circulation, which in turn forces changes in weather far removed from the tropical Pacific. December 1997 was near the peak of a strong El Nino year. There was also El Nino in 1991 – 1992, 1993-1994 and 1994-1995. El Nino caused much damaged to the Las Virgenes-Malibu region, particularly to the City of Malibu.

Long-term annual precipitation
Two striking features of Los Angeles rainfall are its seasonal nature and its reflection of topographic effects.

Over the entire Los Angeles Basin, excluding mountain locations, the average annual precipitation ranges less than 12 inches at the immediate coast to more than 20 inches at the foothills. The normal seasonal rainfall measured at downtown Los Angeles is 15.14 inches.

On average, 92 percent of the seasonal precipitation falls between November 1st and April 30th. This percentage is roughly the same for all stations, regardless of elevation or distance from the ocean.

Seasonal rainfall variability was strongly demonstrated once again in Los Angeles during the 1998 calendar year. LAX received 352 % of normal rainfall within the first six months of 1998, but only 63% of normal in the second half of the year. The end of a very wet El Nino episode and the transition to a dry La Nina circulation was responsible for the change.

On a longer term, the 100- year change in rainfall rates within California in general and Los Angeles County in particular is practically nil, however there was an apparent increase in the number of heavy precipitation in the last two decades of the twentieth century. From 1943 to 1992 (a period of almost fifty years) extreme rain falls occurred in southern California on only five occasions. This time span covered an era of incredible growth with the Los Angeles Basin and the concurrent flood control construction projects has tamed the flood-prone communities of Los Angeles. Heavy rainfall events were noted in the basin during the years 1992, '93, '95, '97, and '98 – helping to make the decade of the nineties the wettest since the 1930's and early "40s.

Geography and Geology

The greater Los Angeles Basin is the product of rainstorms and erosion for hundreds of years. Much of the coastal plain rests on the ancient rock debris and sediment washed down from the mountains. This sediment can act as a sponge, absorbing vast quantities of rain in those years when heavy rains follow a dry period. But like a sponge that is near saturation, the same soil fills up rapidly when a heavy rain follows a period of relatively wet weather. So even in some years of heavy rain, flooding is minimal because the ground is relatively dry. The same amount of rain following a wet period of time can cause extensive flooding.

The Las Virgenes-Malibu region geologic features consist of mainly un-consolidated and semi-consolidated alluvial materials underlain and bounded on the north and east by consolidated sediments and crystalline rocks. The deposits consist of a shallow layer of Quaternary fill that has been washed down from the Santa Monica Mountains.

The materials are generally poorly sorted sands and gravels, intermingled with silts and clays. This lack of open ground forces water to remain on the surface and rapidly accumulate. If it were not for the massive flood control system with its concrete lined river and stream beds, flooding would be a much more common occurrence. And the tendency is towards even less and less open land. In- fill building is becoming a much more common practice in many areas. Developers tear down an older home which typically covers up to 40% of the lot size and replacing it with three or four town homes or apartments which may cover 90-95% of the lot.

Another potential source of flooding is "asphalt creep." The street space between the curbs of a street is a part of the flood control system. Water leaves property and accumulates in the streets, where it is directed towards the underground portion of the flood control system. The carrying capacity of the street is determined by the width of the street and the height of the curbs along the street. Often, when streets are being resurfaced, a one to two inch layer of asphalt is laid down over the existing asphalt. This added layer of asphalt subtracts from the rated capacity of the street to carry water. Thus the original engineered capacity of the entire storm drain system is marginally reduced over time. Subsequent re-paving of the street will further reduce the engineered capacity even more.

FLOODWAY/FLOOD CHANNELS

The Las Virgenes Municipal Water District (LVMWD) manages no floodways or flood channels in the region.

DAM AND RESERVOIR FAILURE FLOODING

Two factors influence the potential severity of a full or partial reservoir or dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Loss of life and damage to structures, roads, and utilities may result from a reservoir or dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. These effects would certainly accompany the failure of one of the reservoirs in the Las Virgenes-Malibu region.

There are many above and partially below-ground storage reservoirs. Because reservoir failure can have severe consequences, FEMA requires that all reservoir owners develop Emergency Action Plans (EAP) for warning, evacuation, and post- flood actions. Although there may be coordination with county officials in the development of the EAP, the responsibility for developing potential flood inundation maps and facilitation of emergency response is the responsibility of the reservoir owner. For more detailed information regarding reservoir failure flooding, and potential flood inundation zones, refer to the city's Disaster Plans.

There is no history of dam or reservoir failure due to flooding. The Las Virgenes Municipal Water District (LVMWD) serves the cities of Agoura Hills, Calabasas, Hidden Hills and Westlake Village (the City of Malibu is served by Los Angeles County Water District 29) They have 27 reservoirs in the Las Virgenes-Malibu region. The following is a breakdown of locations.

Agoura Hills, 8 potable water reservoirs; 1 recycled water reservoir
Calabasas, 11 potable water reservoirs, 3 recycled water reservoirs
Hidden Hills, 2 reservoirs
Westlake Village, 2 reservoirs

The region also has two dams. The Las Virgenes Reservoir dam located at 2860 Threesprings Drive, Westlake Village and the Reservoir #2 dam, 4232 Las Virgenes Road, Calabasas. Additionally there is one water filtration plant located at 32601 Torchwood Place, Westlake Village.

The district has operating and response procedures to ensure that any potential interruption of services will be as short as possible. Further, the district has completed a Vulnerability Assessment as required by federal law to assess and mitigate any potential security issues.

There have been a total of 45 reservoir failures in California, since the 19th century. The significant reservoir failures in Southern California are summarized below.

CHART 16. SIGNIFICANT RESERVOIR FAILURES IN CALIFORNIA

Dam	Location	Year	Cause
Sheffield	Santa Barbara	1925	Earthquake slide
Puddingstone	Pomona	1926	Overtopping during construction
Lake Hemet	Palm Springs	1927	Overtopping
Saint Francis	San Francisquito Canyon	1928	Sudden failure at full capacity through foundation, 426 deaths
Cogswell	Monrovia	1934	Breaching of concrete cover
Baldwin Hills	Los Angeles	1963	Leak through embankment turned into washout, 3 deaths

Source: http://cee.engr.ucdavis.edu/faculty/lund/reservoirs/Reservoir_History_Page/Failures.htm

The two most significant reservoir failures in Los Angeles County are the St. Francis Reservoir in 1928, which killed over 500 people and caused damage estimates topped $20 million and the Baldwin Hills Reservoir in 1963. Five people were killed. Sixty-five hillside houses were ripped apart, and 210 homes and apartments were damaged.

DEBRIS FLOWS

Debris flows referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast- moving landslides. Debris flows are discussed in Section 10 Earth Movements of this plan.

HOW ARE FLOOD-PRONE AREAS IDENTIFIED

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and sound floodplain management. The NFIP and related building code regulations went into effect on March 1, 1978. NFIP regulations (44 Code of Federal Regulations (CFR) Chapter 1, Section 60, 3) require that all new construction in floodplains must be elevated at or above base flood level

The Las Virgenes-Malibu regional cities have municipal codes that provide for the protection of residential and non-residential structures in Flood Hazard areas.

FLOOD INSURANCE RATE MAPS (FIRM) AND FLOOD INSURANCE STUDIES (FIS)
FEMA has classified the Region under Zone "C", which does not require mandatory flood mitigation enforcement. Properties are therefore not required to carry flood insurance. The cities within the Las Virgenes-Region however to participate in FEMA's National Flood Insurance Program (NFIP). Below is a chart of their date of entry.

CHART 17. NATIONAL FLOOD INSURANCE PROGRAM COMMUNITES

CID	Community Name	County	Date of Entry [Emer or Reg]	Current Effective Map
065072#	AGOURA HILLS	Los Angeles	03/04/86(R)	8/3/1998
060749#	CALABASAS	Los Angeles	03/10/93(R)	
060125#	HIDDEN HILLS	Los Angeles	09/07/84(R)	11/21/2001
060745#	MALIBU	Los Angeles	10/01/92(R)	
060744#	WESTLAKE VILLAGE	Los Angeles	10/01/92(R)	

The Community Identification (CID) number is a unique 6 digit number assigned to each community that has been identified under the National Flood Insurance Program. The CID number is shown on each FIRM panel and is the first 6 digits of all non-countywide format FIRM panel numbers.

Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by FEMA which delineates communities where NFIP regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases they also include base flood elevations (BFEs) and areas located within the 500-year floodplain. Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. However, it is important to note that not all 100-year or 500-year floodplains have been mapped by FEMA. FEMA flood maps, like many maps, are not entirely accurate. These studies and maps represent flood risk at the point in time when FEMA completed the studies, and does not incorporate planning for floodplain changes in the future due to new development. Although FEMA is considering changing that policy, it is optional for local communities. Man-made and natural changes to the environment have changed the dynamics of storm water run-off since then.

DATA SOURCES

FEMA mapped the 100 -year and 500-year floodplains through the Flood Insurance Study (FIS) in conjunction with the United States Army Corps of Engineers (USACE) in August of 1987. There were previous studies done, including a Housing and Urban Development (HUD) study, which mapped the floodplain in March of 1978, The County has updated portions of the USACE and FEMA maps through smaller drainage studies in the county since that time.

RISK ANALYSIS

Within the broad components of a risk analysis, it is possible to predict the severity of damage from a range of events. Flow velocity models can assist in predicting the amount of damage expected from different magnitudes of flood events. The data used to develop these models is based on hydrological analysis of landscape features. Changes in the landscape, often associated with human development, can alter the flow velocity and the severity of damage that can be expected from a flood event. Using GIS technology and flow velocity models, it is possible to map the damage that can be expected from flood events over time. It is also possible to pinpoint the effects of certain flood events on individual properties.

At the time of publication of this plan, data was insufficient to conduct a risk analysis for flood events in the Las Virgenes-Malibu region. However, a thorough risk assessment shall be proposed by the Las Virgenes-Malibu cities a as a multi hazard mitigation strategy. This will include hazard maps that include but not limited to, number of parcels and buildings that are located in hazard areas along with a total valuation.

WHAT IS SUSCEPTIBLE TO DAMAGE DURING A FLOOD EVENT

The largest impact on communities from flood events is the loss of life and property. In addition, other losses include vehicles in subterranean garages, loss of electrical and gas services, municipal services (i.e. water, wastewater, solid waste collection and disposal) and transportation.

Property Loss Resulting from Flooding Events

The type of property damage caused by flood events depends on the depth and velocity of the flood waters. Faster moving flood waters can wash buildings off their foundations and sweep cars downstream. Pipelines and other infrastructure can be damaged when high waters combine with flood debris. Extensive damage can be caused by flooding and landslide damage related to soil saturation from flood events. Most flood damage is caused by water saturating materials susceptible to loss (i.e., wood, insulation, wallboard, fabric, furnishings, floor coverings, appliances and vehicles parked in subterranean garages).

Business/Industry

Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customer access to a business as well as close a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain

economic vitality in the face of flood damage. There has been no significant long term effect to the business and industry sector.

Public Infrastructure
Publicly owned facilities are a key component of daily life for all citizens of the county. Damage to public water and sewer systems, transportation networks, emergency facilities, and offices can hinder the ability of the government to deliver services. Previous mitigation measures have fixed many of the problems in flooding around government facilities. The Region's water distribution and the wastewater conveyance systems are self-maintained. During natural hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. Roads systems in the Las Virgenes-Malibu region are self- maintained.

Storm Water Systems
There is a drainage master plan, and Las Virgenes-Malibu region Public Works staff is aware of local drainage threats and deficiencies. The problems are often present where storm water runoff enters culverts or goes underground into storm sewers. Inadequate maintenance can also contribute to the flood hazard in urban areas. The Las Virgenes-Malibu region operates a wastewater collection system, which conveys the wastewater to a regional wastewater treatment plant (Hyperion) that is owned and operated by the Region of Los Angeles. The Las Virgenes-Malibu region wastewater is treated by this facility. The Las Virgenes-Malibu region also provides domestic drinking water to the residents as part of region services.

Water quality problems include bacteria, toxins, and pollution. The Las Virgenes-Malibu region imports approximately 85 percent of its drinking water from the Metropolitan Water District of Southern California. The remaining 15 percent is produced locally from four municipal water wells and treated at a 3MGD water treatment plant that is owned and operated by Earth Tech, Inc. a subsidiary of Tyco International.

EXISTING MITIGATION ACTIVITIES
Flood mitigation activities listed here include current mitigation programs and activities that are being implemented by the Las Virgenes-Malibu region.

The Las Virgenes-Malibu region uses building codes, zoning codes, and various planning strategies to address development in areas of known hazards, and applying the appropriate safeguards.

AGOURA HILLS
The City of Agoura Hills implements a Flood Hazard Building code (8103.110.1).
Additionally the City has identified a problem area in the City that is prone to flooding. The Lake Lindero Project is a task the city has been trying to acquire funding for.
Currently the City is attempting to acquire funding from FEMA through the Hazard Mitigation Grant Program.

CALABASAS

The City of Calabasas has no record of loss of life and property due to a flood event. Because of lack of impact of flood activity in the city, the City currently does not take proactive measures regarding flood activity. As information becomes available and the city amends it's policies that mitigate the loss of life and property during a flood event, this information shall be added to the plan.

HIDDEN HILLS

The City of Hidden Hills has implemented the following building codes as preventative measures for loss of life and property because of a flood hazard event.

Section	Title
3319.1	Flood Hazard

MALIBU

Malibu Road Drainage and Pavement Rehabilitation Project

This project relieved the drainage problem behind Malibu Colony Plaza, and repaired pavement to Malibu Road. Construction and was completed in December 2003.

Big Rock Storm Drain Project

This project will improve drainage and prevent erosion on Big Rock Drive. The design is currently being reviewed by the California Office of Emergency Services (OES) and the Federal Emergency Management Agency (FEMA) for funding approval. Construction is expected to begin in the spring of 2004.

Cross Creek Road Redesign

This project is intended to improve safety for pedestrians and vehicles, improve traffic circulation, and beautify the commercial area between Civic Center Way and the Pacific Coast Highway. It will also improve drainage in the area, thereby reducing flooding. The conceptual design was approved by the City Council in December, 2001. Detailed design is expected to begin in early 2003 followed by the permitting process. Construction is planned for early 2005.

Annual Pavement Rehabilitation Project

The Annual Pavement Rehabilitation Project (for Fiscal Year 02-03) was completed in September 2003. The Annual Pavement Rehabilitation project is an annual project to resurface the City's public roads. The 2002-2003 project was the last one completed. The City of Malibu anticipates the next pavement rehabilitation project will be in 2005.

WESTLAKE VILLAGE

The City of Westlake Village currently allows no development, including structures for human habitation in areas identified to possible flooding unless flood hazard has been eliminated.

FLOOD MITIGATION STRATEGIES

The following is a list of mitigation strategies the Las Virgenes-Malibu COG cities have for future planning.

- **Lake Lindero Revitalization Project – City of Agoura Hills**
- **Malibu Mitigation Plan – City of Malibu**
- **Flood Action – City of Malibu**
- **Cross Creek Road Redesign – City of Malibu**
- **Big Rock Drainage Improvements Project – City of Malibu**

See Section 4 for complete Mitigation Strategies.

Landslide Hazards in the Las Virgenes-Malibu Region

Section 10

LANDSLIDES

TABLE OF CONTENTS **PAGE**

WHY ARE LANDSLIDES A THREAT TO THE LAS VIRGENES-MALIBU REGION?

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year. The best estimate of direct and indirect costs of landslide damage in the United States range between $1 and $2 billion annually (FEMA). As a seismically active region, California has had a significant number of locations impacted by landslides. Some landslides result in private property damage; other landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life.

Landslides can be broken down into two categories: (1) rapidly moving (generally known as debris flows), and (2) slow moving. Rapidly moving landslides or 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. Slow moving landslides can cause significant property damage, but are less likely to result in serious human injuries.

There are areas within the Las Virgenes-Malibu region that are susceptible to landslides to due slope instability, fire activity, rainfall and geologic make-up of the region. Although all of the cities with the COG prohibit developments in areas that may be prone to landslides, there are existing properties that may be susceptible to landslide activity.

WHAT IS A LANDSLIDE?

"A landslide is defined as, the movement of a mass of rock, debris, or earth flow down a slope. Landslides are a type of "mass wasting" which denotes any down slope movement of soil and rock under the direct influence of gravity. 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." **(FEMA)**

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.

Slides 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 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, but are far less likely to result in serious injuries than rapidly moving landslides **(http://pubs.usgs.gov/fs/fs-0071-00/).**

"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 can move quickly and disastrously, as is the case with debris-flows. Debris-flows can travel down a hillside of speeds up to 200 miles per hour (more commonly, 30 – 50 miles per hour), depending on the slope angle, water content, and type of earth and debris in the flow. These flows are 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." **(Interagency Hazard Mitigation Team, State Hazard Mitigation Plan (2000) Oregon Emergency Management).**

Several slope failures have been reported in the northern hillside areas of the Region. The major cause of the slope failures were reported to be heavy rainfalls and soil erosion. Also the hillside residential development has placed additional loads on the subsurface bedrock which contributed to the slope failure. These failure planes are few feet deep and it extended through the soils overlaying bedrock. The reported slope failures occurred in the Santa Monica slate area that are characterized as having landslide potential due to the existence of bedding planes dipping out of the slope.

WHAT IS DEBRIS FLOW

A debris or mud flow is a river of rock, earth and other materials, including vegetation that is saturated with water. This high percentage of water gives the debris flow a very rapid rate of movement down a slope. Debris flows often with speeds greater than 20 mile per hour, and can often move much faster **(http://www.consrv.ca.gov/cgs/information /publications/cgs_notes/note_33/).** This high rate of speed makes debris flows extremely dangerous to people and property in its path.

No significant debris flow resulting from landslide activity is recorded in the Las Virgenes-Malibu region. In the event of a major landslide in the hillside area, debris flow will destroy roadway pavement and fill the storm drain catch basins. Any significant surface movement along the streets will however isolate residents in those areas. The City of Malibu is most prone to landslide, and hence, debris flow activity. This is covered in greater detail later in this section.

HISTORY OF LANDSLIDE EVENTS IN THE LAS VIRGENES-MALIBU REGION

The cities of the Las Virgenes-Malibu Region have experienced landslide events due to heavy rains although these have not resulted in large amounts of loss or property or life. The City of Malibu has experienced the most landslide events of the five cities with the Calle del Barco, Kanan, Pacific Coast Highway, Las Flores, Love, and Malibu Road landslides.

AGOURA HILLS

The City of Agoura Hills landslide events since 1990 include the Morrison Ranch, Liberty Canyon Slope Failure, Laura La Plante, Laro and Chateau Park landslides.

In 1999, the city experienced the Kanan Slope Repair as a result of the El Nino storms of 1998; total cost to the city was $170,000. Another landslide incident, named the Via Amistosa, cost the city $1,800,000 in damages.

The Northridge Earthquake caused minimal landslide damage totaling $158,000. During the 1993 storms, the city incurred $177,000 in damage in terms of landslide events. The following chart provides a description of the total landslide event damages to the city and to private entities in the City of Agoura Hills since 1980.

CHART 18. CITY OF AGOURA HIILLS LANDSLIDE EVENTS since 1980

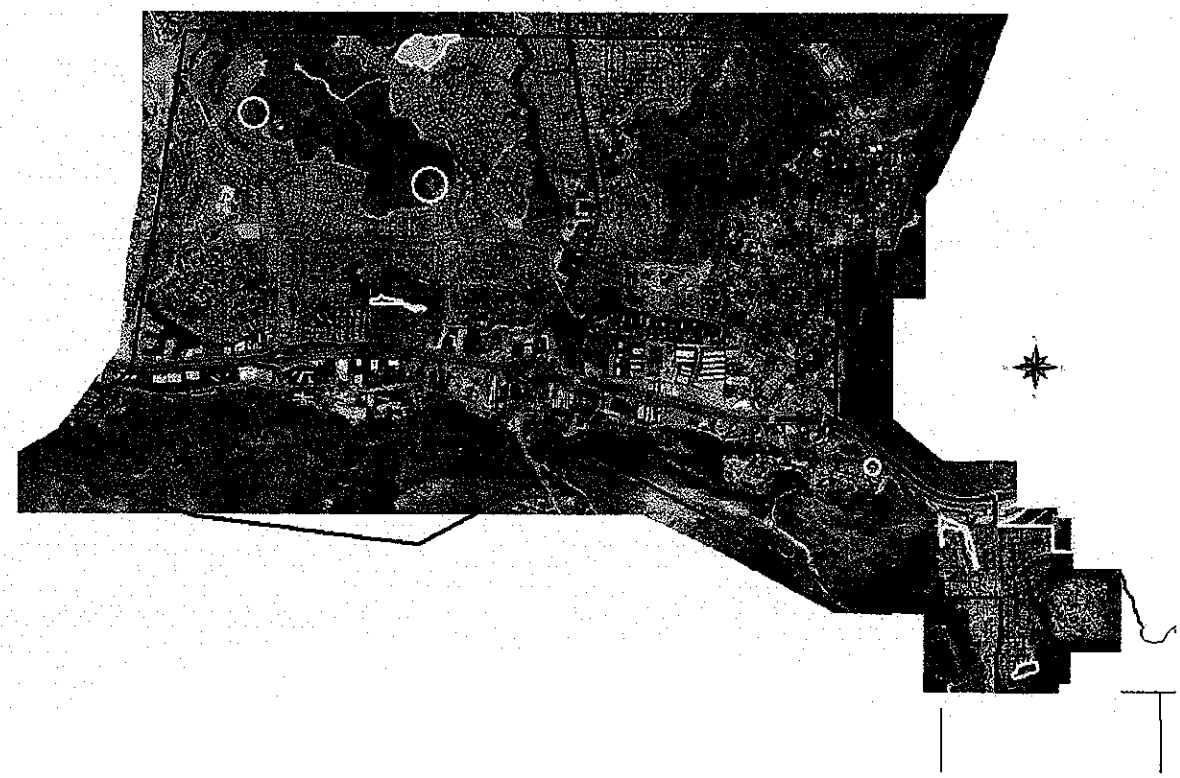
Costs to the City of Agoura Hills	Costs
1. Kanan Slope Repair(1999 El Nino)	$170,000.00
2. Via Amistosa	$1,800,000.00
3. Northridge Earthquake (miscellaneous)	$158,000.00
4. 1993 Storms	$177,000.00
Total	**$2,305,000.00**
Costs to Private Developers	**Costs**
1. Morrison Ranch Slide	$8,000,000.00
2. Liberty Cyn Slope	$1,000,000.00
3. Laro Landslide	$1,500,000.00
4. Chateau Park slide	$1,000,000.00
Total	**$11,500,000.00**

The City of Agoura Hills has identified areas that may be prone to landslides. The following map indicates those areas.

The yellow boundaries enclose areas that may be prone to landslide events within the City.

MAP 23. AGOURA HILLS LANDSLIDE AREAS

Agoura Hills Landslide Areas



Source: City of Agoura Hills Internal Map

HISTORIC SOUTHERN CALIFORNIA LANDSLIDES

1980 Southern California Slides

$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.

1983 Big Rock Mesa, California

Cost $706 million (2000 dollars) in legal claims. Condemnation of 13 houses, and 300 more threatened by rockslide caused by rainfall

1978-1979, 1980 San Diego County, California
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.

1994 Northridge, California Earthquake Landslides
As a result of the magnitude 6.7 Northridge, California, earthquake, more than 11,000 landslides occurred over an area of 10,000 km2. Most were in the Santa Susana Mountains and in mountains north of the Santa Clara River Valley. The earth movement destroyed dozens of homes, blocked roads, and damaged oil-field infrastructure. It also caused deaths from Coccidioidomycosis (Valley Fever), the spore of which was released from the soil and blown toward the coastal populated areas. The spore was released from the soil by the landslide activity.

March 1995 Los Angeles and Ventura Counties, Southern California
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 2 years before.
Source: (http://landslides.usgs.gov.html_files/pubs/report1/Landslides_pass_508.pdf)

CAUSES AND CHARACTERISTICS OF LANDSLIDES IN THE LAS VIRGENES-MALIBU REGION

LANDSLIDE EVENTS AND IMPACTS

Landslides are a common hazard in California. Weathering and the decomposition of geologic materials produces conditions conducive to landslides and human activity further exacerbates many landslide problems. Many landslides are difficult to mitigate, particularly in areas of large historic movement with weak underlying geologic materials. As communities continue to modify the terrain and influence natural processes, it is important to be aware of the physical properties of the underlying soils as they, along with climate, create landslide hazards. Even with proper planning, landslides will continue to threaten the safety of people, property, and infrastructure, but without proper planning, landslide hazards will be even more common and more destructive.

The increasing scarcity of build-able 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 view lots that they provide.

Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. They are fast moving with the materials free falling or bouncing down the slope. In falls, material is detached from a steep slope or cliff. The volume of material involved is generally small, but large boulders or blocks of rock can cause significant damage.

Earth flows are plastic or liquid movements in which land mass (e.g. soil and rock) breaks up and flows during movement. Earthquakes often trigger flows. Debris flows normally occur when a landslide moves down slope as a semi-fluid mass scouring, or partially scouring soils from the slope along its path. Flows are typically rapidly moving and also tend to increase in volume as they scour out the channel **(Robert Olson Associates, Metro Regional Hazard Mitigation and Planning Guide, June 1999).** Flows often occur during heavy rainfall, can occur on gentle slopes, and can move rapidly for large distances.

The slope failures reported in the Region were caused by heavy rainfalls and the saturated soil eroded down slope. Debris from these slope failures was localized and it was cleaned up by the Region's Public Works crew. No major lost of property or personal injury reported.

LANDLSIDE CONDITIONS

Landslides are often triggered by periods of heavy rainfall. Earthquakes, subterranean water flows and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events. Landslides on steep slopes are more dangerous because movements can be rapid.

Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness. Grading and construction can decrease the stability of a hill slope by adding weight to the top of the slope, 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.

Wildland fires in hills covered with chaparral are often a precursor to debris flows in burned out canyons. The extreme heat of a wildfire can create a soil condition in which the earth becomes impervious to water by creating a waxy-like layer just below the ground surface. Since the water cannot be absorbed into the soil, it rapidly accumulates on slopes, often gathering loose particles of soil in to a sheet of mud and debris. Debris flows can often originate miles away from unsuspecting persons, and approach them at a high rate of speed with little warning.

A few areas in the City of Hidden Hills may have potentially unstable slopes. Slope severity, soil conditions, and underlying geology contribute to these conditions in the event of high rainfall.

In the City of Westlake Village, potential landslide hazards are primarily limited to the areas of sedimentary rocks in the northeast tip of the City. However there is no record in recent history that indicates a landslide event.

NATURAL CONDITIONS

Natural processes can cause landslides or re-activate historical landslide sites. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on gentle slopes above steep streams and riverbanks.

PARTICULARY HAZARDOUS LANDSLIDE AREAS

Locations at risk from landslides or debris flows include areas with one or more of the following conditions:

1. On or close to steep hills;
2. Steep road-cuts or excavations;
3. 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);
4. Steep areas where surface runoff is channeled, such as below culverts, V -shaped valleys, canyon bottoms, and steep stream channels; and
5. Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.
6. Canyon areas below hillside and mountains that have recently (within 1-6 years) been subjected to a wildland fire.

IMPACTS OF DEVELOPMENT

Although landslides are a natural occurrence, residential development can substantially affect the potential for landslide failures in Las Virgenes-Malibu region. Proper planning and geotechnical engineering can be exercised to reduce the threat of safety of people, property, and infrastructure. Although all of the cities with the COG prohibit developments in areas that may be prone to landslides, there are existing properties that may be susceptible to landslide activity.

HIDDEN HILLS

The major pressures on hillside development in the City of Hidden Hills are caused by intensification of existing development on residential lots throughout the City and the resultant expansion into currently undeveloped areas. Intensification consists of additional construction and modification of existing construction or the complete demolition and redevelopment of a residential lot.

Intensification expands that developed pad area into previously "natural" hillslope areas and

often involves a corresponding increase in the size and volume of the onsite sewage disposal systems. The potential consequence of such development suggests that appropriate retroactive and proactive measures that govern the long term stability of potentially active landslides should be part of a comprehensive hillslope management program, a program that recognizes the concern for future property damages incurred by residents.

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.

The Las Virgenes-Malibu region Building Department requires a geotechnical report for grading activities for the hillside developments. Grading plan is designed and certified by a licensed geotechnical engineer in accordance with the requirements of the Las Virgenes-Malibu region Building Codes. The site grading and excavation will be inspected by the Building Inspector during construction. Proper planning and geotechnical engineering will greatly reduce the potential for landslide and slope failure.

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 hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, even 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. Drainage can be affected naturally by the geology and topography of an area; 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.

Building Codes require drainage devices to dispose storm runoff from the hillside development. Ultimately the storm runoff is discharged into the storm drain system. Storm drain catch basins are maintained by Public Works Departments and they were cleaned to prevent any flooding or ponding.

CHANGES IN VEGETATION

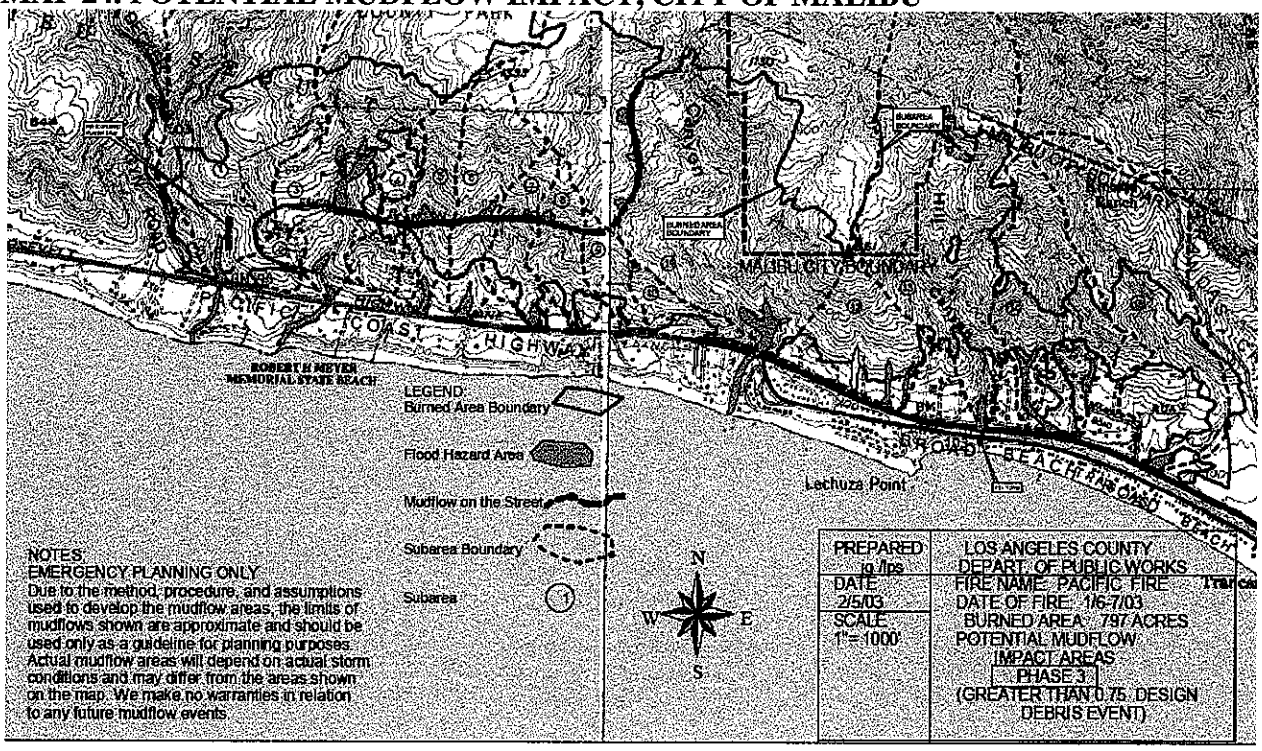
If the vegetation on very steep slopes has been removed by either fire or man, this can cause for increase risk of a landslide hazard. Additionally, if certain vegetation exists that requires much watering; this may also change the condition of the soil. Changing away from native ground cover plants may increase the risk of landslide.

LANDSLIDE HAZARD IDENTIFICATION

Identifying hazardous locations is an essential step towards implementing more informed mitigation activities. The Las Virgenes-Malibu region contains many areas that may be susceptible to landslide because of slopes and mountainous terrain. However, development in landslide risk areas is prohibited in the five cities.

For the City of Malibu, a mudflow risk assessment was conducted by the Los Angeles County Department of Public Works as a result of the Pacific Fire. The fire destroyed much native vegetation and left the soil and terrain vulnerable to absorbing much water from possible rainfall, therefore creating a chance for a landslide hazard. The following map shows Phase III of the Potential Mudflow Impact Areas, which reflects a worst case scenario, greater than .75 design debris event.

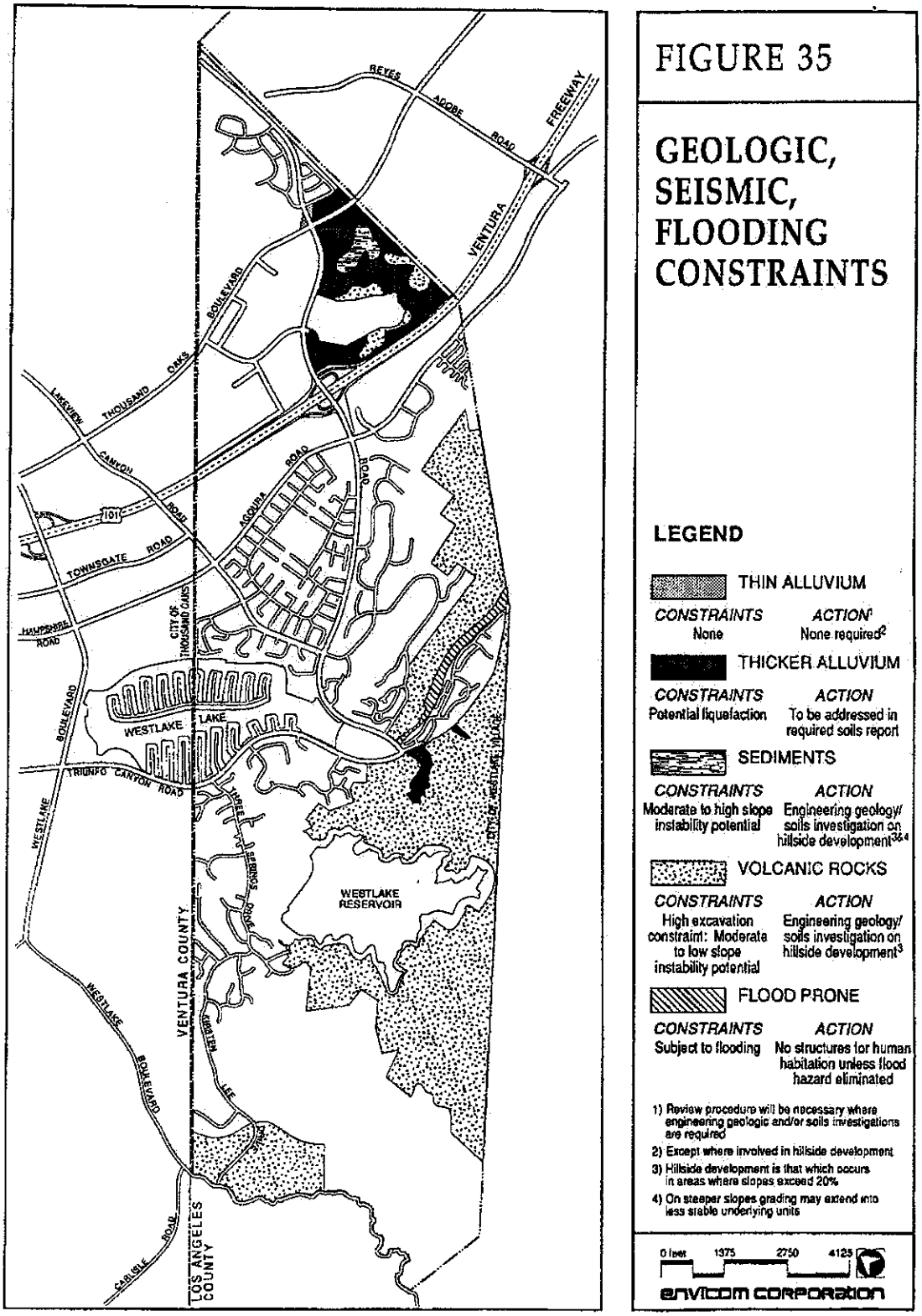
MAP 24. POTENTIAL MUDFLOW IMPACT, CITY OF MALIBU



WESTLAKE VILLAGE

The City of Westlake Village has identified areas in the city that may have unstable slopes. The following slope instability map for the City of Westlake Village shows areas with sediments and volcanic rocks. Areas with sediments have moderate to high slope instability potential. Areas with volcanic rocks have moderate to low sloe instability potential. However both areas require an engineering/geology soils investigation prior to hillside development.

MAP 25. WESTLAKE VILLAGE SLOPE INSTABILITY MAP



RISK ANALYSIS

Vulnerability assessment for landslides will assist in predicting how different types of property and population groups will be affected by a hazard. Data that includes specific landslide-prone and debris flow locations in the region can be used to assess the population and total value of property at risk from future landslide occurrences.

While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been conducted for Las Virgenes-Malibu region landslide events, there are many qualitative factors that point to potential vulnerability. Landslides can impact major transportation arteries, blocking residents from essential services and businesses.

Past landslide events have caused major property damage or significantly impacted region residents, and continuing to map region landslide and debris flow areas will help in preventing future loss.

Factors included in assessing landslide risk 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 estimates of the damages to the region due to a specific landslide or debris flow event. A thorough risk assessment shall be proposed by the Las Virgenes-Malibu cities a as a multi hazard mitigation strategy. This will include hazard maps that include but not limited to, number of parcels and buildings that are located in hazard areas along with a total valuation.

WHAT IS SUSCEPTIBLE TO LANDSLIDES?

Landslides can affect a variety of everyday life functions including utility services, transportation systems, and critical lifelines. 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. Natural gas pipes may also be at risk of breakage from landslide movements as small as an inch or two.

Roads

Public Works Departments along with other departments within the cities in the Las Virgenes-Malibu region are responsible to clean up slides that inhibit the flow of traffic or are damaging the roadway. These departments do their best to communicate with residents impacted by landslides, but can usually only repair the roadway itself, as well as the areas adjacent to the slide where the region has the right of way. Individual property damage does fall under their immediate attention.

Landslide hazards can be alleviated by grading slides, by posting load bearing walls on roadsides and by installing new drainage systems on the slopes to divert water from the landslides. This type of response activity is often the most cost-effective in the short-term, but is only temporary.

Unfortunately, many property owners are unaware of slides and the dangers associated with them.

Lifelines and critical facilities
Lifelines and critical facilities should remain accessible, if possible, 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. Losses of power and phone service are also potential consequences of landslide events. Due to heavy rains, soil erosion in hillside areas can be accelerated, resulting in loss of soil support beneath high voltage transmission towers in hillsides and remote areas. Flood events can also cause landslides, which can have serious impacts on gas lines that are located in vulnerable soils.

EXISTING MITIGATION ACTIVITIES
Landslide mitigation activities include current mitigation programs and activities that are being implemented by local or region organizations.

AGOURA HILLS
The following building codes are implemented as preventative measures for loss of life and property because of a landslide hazard event.

Section	Title
8103(a)110.2	Geologic Hazard
8103(u)1806.5	Foundations on Adjacent Slopes
8103(aaa)3304.6.11	Debris Prohibited

The city also implements the following ordinances:

A. Requirement for geotechnical and geologic report submittal and review prior to development entitlement.
B. Requirement for graded slopes to be landscaped for stability.

In addition the city also has slope set-back requirements and expansive soil requirements.

Landslide Building/Zoning Codes
All cities within the Las Virgenes-Malibu region follow the CBC. The CBC requires geotechnical investigation of the potential soil liquefaction and soil strength loss during earthquakes for development in the liquefaction zones, which. The geotechnical report shall address potential consequences of any liquefaction and soil strength loss and discuss mitigating measures.

CALABASAS

There have been no significant landslide events in recent history in the City of Calabasas that have caused costs or damages. The City of Calabasas has no record of loss of life and property due to a landslide event.

Because of lack of impact of landslide activity in the city, the City currently does not take proactive measures regarding landslide activity. As information becomes available and the city amends it's policies that mitigate the loss of life and property during a landslide event, this information shall be added to the plan.

HIDDEN HILLS

The following building codes are implemented as preventative measures for loss of life and property because of a landslide hazard event.

Section	Title
3316	Erosion Control
1806.11	Foundations on Expansive Soil

MALIBU

Landslide Building/Zoning Codes

The City of Malibu Building Code addresses development on steep slopes. This section outlines standards for steep slope hazard areas on slopes of 20 percent or more. Generally, the ordinance requires soils and engineering geologic studies for developments proposed on slopes of 20 percent or greater. More detailed surface and subsurface investigations shall be warranted if indicated by engineering and geologic studies to sufficiently describe existing conditions. This may include soils, vegetation, geologic formations, and drainage patterns. Site evaluations may also occur where stability might be lessened by proposed grading/filling or land clearing.

WESTLAKE VILLAGE

The City of Westlake Village has identified areas in the city that may have unstable slopes. The slope instability map for the City of Westlake Village shows areas with sediments and volcanic rocks. Areas with sediments have moderate to high slope instability potential. Areas with volcanic rocks have moderate to low sloe instability potential. However both areas require an engineering/geology soils investigation prior to hillside development in order to mitigate the loss of property or life in an event of a landslide.

LANDSLIDE MITIGATION STRATEGIES

The following is a list of mitigation strategies the Las Virgenes-Malibu COG cities have for future planning.

- **Big Rock Drainage Improvements Project – City of Malibu**
- **Comprehensive Hillslope Management Program – City of Hidden Hills**

See Section 4 for complete Mitigation Strategies.

Windstorm Hazards in The Las Virgenes-Malibu Region

SECTION 11

WINDSTORMS

TABLE OF CONTENTS **PAGE**

WHY ARE WINDSTORMS A THREAT TO THE LAS VIRGENES-MALIBU REGION

Severe wind storms pose a significant risk to life and property in the region by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. High winds have the potential to cause damage to local homes and businesses. High winds, over prolonged periods of time, can increase the risk of urban wildfire as moisture content decreases in brush on hillsides and at urban interface areas. High winds can displace or interrupt building structural elements, trees, electrical lines and other utility services.

CAUSES AND CHARACTERISTICS OF WINDSTORMS IN THE LAS VIRGENES-MALIBU REGION

High winds are generally related to thunderstorm activity, strong frontal systems or pressure gradient differences created at an interface of high and low pressure weather fronts. Most significant wind related events in the Las Virgenes-Malibu region are generally related to a climate condition termed "Santa Ana Winds". Between October and February, residents face the threat of the hot, dry Santa Ana winds, particularly in the fire-prone chaparral country.

Santa Ana wind conditions are a concern for the general Las Virgenes-Malibu area. The diverse topography within the Las Virgenes-Malibu region seems to favor isolated wind events whereas the hillside areas may be windy.

WINDSTORM HAZARD IDENTIFICATION

A windstorm event in the Las Virgenes-Malibu region can come in the form of short term, topographically influenced, high wind gusts to extended duration Santa Ana wind conditions. Significant wind events in the Las Virgenes-Malibu region could pose a significant concern to trees and structural elements of buildings, especially as wind thrown trees and detached structural elements block or disrupt roadways and utility delivery systems. The following chart is the Beaufort scale and has been used for 200 years to estimate wind strengths.

CHART 19. BEAUFORT SCALE

Beaufort Force	Speed (mph)	Wind Description - State of Sea - Effects on Land
0	Less 1	Calm - Mirror-like - Smoke rises vertically
1	1-3	Light - Air Ripples look like scales; No crests of foam - Smoke drift shows direction of wind, but wind vanes do not
2	4-7	Light Breeze - Small but pronounced wavelets; Crests do not break - Wind vanes move; Leaves rustle; You can feel wind on the face
3	8-12	Gentle Breeze - Large Wavelets; Crests break; Glassy foam; A few whitecaps - Leaves and small twigs move constantly; Small, light flags are extended

Beaufort Force	Speed (mph)	Wind Description - State of Sea - Effects on Land
4	13-18	Moderate Breeze - Longer waves; Whitecaps - Wind lifts dust and loose paper; Small branches move
5	19-24	Fresh Breeze - Moderate, long waves; Many whitecaps; Some spray - Small trees with leaves begin to move
6	25-31	Strong Breeze - Some large waves; Crests of white foam; Spray - Large branches move; Telegraph wires whistle; Hard to hold umbrellas
7	32-38	Near Gale - White foam from breaking waves blows in streaks with the wind - Whole trees move; Resistance felt walking into wind
8	39-46	Gale - Waves high and moderately long; Crests break into spin drift, blowing foam in well marked streaks - Twigs and small branches break off trees; Difficult to walk
9	47-54	Strong Gale - High waves with wave crests that tumble; Dense streaks of foam in wind; Poor visibility from spray - Slight structural damage
10	55-63	Storm - Very high waves with long, curling crests; Sea surface appears white from blowing foam; Heavy tumbling of sea; Poor visibility - Trees broken or uprooted; Considerable structural damage
11	64-73	Violent Storm - Waves high enough to hide small and medium sized ships; Sea covered with patches of white foam; Edges of wave crests blown into froth; Poor visibility - Seldom experienced inland; Considerable structural damage
12	>74	Hurricane - Sea white with spray. Foam and spray render visibility almost non-existent – Widespread damage. Very rarely experienced on land.

Source: http://www.compuweather.com/decoder-charts.html

In terms of region resources, trees come to mind as potential hazards during high wind events. The leafy canopy and structural elements of a tree crown present a drag type barrier to winds. Trees are naturally engineered to minimize wind drag through the re-orientation of leaves and through the independent motion of limbs and branches to minimize the transfer of uniform sway motion forces to the trunk during wind events. The Beaufort Wind Scale (BWS-see Chart 16) specifically notes problems with trees as wind speeds increase. The BWS references the likelihood of whole tree motion as wind speeds exceed thirty two (32) miles per hour (MPH), twig breakage at thirty nine (39) MPH and whole tree windthrow as wind speeds exceed fifty five (55) MPH. The susceptibility of trees to windthrow can be influenced by the general structural condition of the trees, the location of the trees in reference to wind patterns and the level and frequency of pruning maintenance given the trees.

In the case of building structures, the likelihood of structural element detachment may be influenced by local construction code requirements, the location of buildings in reference to wind patterns and in the level of maintenance upkeep provided buildings by owners. Given the location of the Las Virgenes-Malibu in relation to historic Santa Ana wind flows, coupled with the topography of some areas of the region that favor the development of isolated high wind conditions; the effects of windstorms will be a continuing management concern in the region.

While the historic impact of these events on the Las Virgenes-Malibu region seems low, these events always stand to pose a threat to life, property, utility delivery systems, infrastructure elements and transportation. In the case that a wind event results in a major utility disruption, it may prove necessary to utilize private and region resources to aid in the care and sheltering of displaced residents. In the case of a severe event, the economic impact of providing these services on a long term basis could prove taxing. Additionally, the cost to restore disrupted or damaged region infrastructure or utility elements could be significant.

RISK ANALYSIS

Historically, windblown debris liability claims in relation to trees are considered "acts of God" from a risk management perspective, unless a known condition existed that lent to an accident. In addition to a the rare frequency of this type of problem as seen in the previous analysis, the Las Virgenes-Malibu region has made no claim payments to address this type of problem.

The level of expenditures for all emergency type tree services (i.e. limb failures, clearance of private property tree failures into roadways, etc.) has decreased over the past few years from two (2) percent of the total funding availability to a current level of less than one (1) percent. As the previous analysis showed, few of the responses are directly related to wind events. In regards to wind related damage to region structures; the region has no record of claim payments related to structural damage during windstorms during the last decade.

In summary, historical data suggests that the vulnerability and risk levels for windstorm related damage and liability in the Las Virgenes-Malibu region is low.

WHAT IS SUSCEPTIBLE TO WINSTORMS

Life and Property

Based on the known wind patterns in the Los Angeles area, windstorms can be expected. As wind speeds increase, the likelihood that trees will be uprooted, building structural elements torn away and utility delivery elements damaged. Detached tree limbs and building elements present a significant hazard to life. As large trees are uprooted, the likelihood that loss of life or significant damage to structures and vehicles will occur increases dramatically.

Utilities and infrastructure

Many times, when power poles and lines fall to the ground, it is because a tree has fallen across the lines. The region's electricity provider is Southern California Edison (SCE). SCE implements its own Hazard Mitigation Plan.

Live power lines on the ground can pose a deadly electrical shock hazard to pedestrians or people trapped in vehicles. Displaced tree limbs or flying structural debris can cause power line arching and subsequent utility delivery disruptions. Windstorms can cause structural damage to buildings and other critical infrastructure, especially as trees are wind thrown. With this damage comes the potential for disruption of communications and technological systems, especially as disruption timeframes become lengthy.

Transportation
Windblown debris, tree limbs and wind thrown trees can damage traffic control apparatus, block roadways, damage vehicles and limit the accessibility of emergency vehicles. Power lines that have been knocked down by falling trees create the potential for fire and electrocution hazards.

Increased Fire Threat
The Las Virgenes-Malibu region has had problems with Santa Winds in terms of fire hazards. When the winds come in, they can potentially be a catalyst in the canyons to spread fire at a rapid rate.

Prolonged winds during the warmer months of the year can decrease foliar moisture levels and increase the ignition potential in drying underbrush. When urban/wildland interface fires occur, Santa Ana wind conditions can drive the flames and increase the spread speed and severity of the fire. This is a concern near homes, especially where brush clearance has been lax.

EXISTING MITIGATION ACTIVITIES

AGOURA HILLS
The City of Agoura Hills has no record of loss of life and property due to a windstorm. Because of lack of impact of windstorm activity on the city, the City currently does not take proactive measures regarding windstorm activity. As information becomes available and the city amends it's policies that mitigate the loss of life and property during a windstorm event, this information shall be added to the plan.
Additionally, the city has a record of 8,000 trees that it maintains with proper standards regarding public safety.

CALABASAS
The City of Calabasas has a Tree Board. The purpose of the board is to consider and propose recommendations for the adoption of the urban forestry master plan and to make recommendations to carry out the policies and goals of that plan.
The objectives of the Commission are:

1. Making recommendations for updates to the plan;
2. Continued education for the care and welfare of trees;

3. At the request of the City Council, the board shall consider, investigate, make findings, report and recommend upon any special matter or question coming within the scope of its work.

Additionally, the City has recently begun a program that grants free Oak Tree / Brush clearance permits. The intent of this program is to encourage proper maintenance of oak trees that create a public safety hazard.

HIDDEN HILLS
The City of Hidden Hills has had no incidents of loss of property or life due to windstorm activity therefore does not take any steps in regards to current mitigation activities.

MALIBU
The most recent windstorm event to affect the City of Malibu was in 1994 and the city incurred $50,000 dollars in damages.

WESTLAKE VILLAGE
Because of lack of impact of windstorm activity on the city, the City of Westlake Village currently does not take proactive measures regarding windstorm activity. As information becomes available and the city amends it's policies that mitigate the loss of life and property during a windstorm event, this information shall be added to the plan.

EXISTING WINDSTORM MITIGATION ACTIVITES – INTERAGENCY EFFORTS
As stated, one of the most common problems associated with windstorms are power outages. High winds commonly occur during winter storms, and 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.

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. Enforcement of the following California Public Resource Code Sections provides guidance on tree pruning regulations.

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
Homeowner Liability:
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.

POWER SERVICES
Southern California Edison (SCE) has taken steps in an attempt to prevent power failure due to down infrastructures in the case of a hazard such as earthquake or windstorm. Some of the activities SCE has undertaken to mitigate potential damage include:

- Reinforcement of existing equipment / structures
- Shock absorbing capability was added at base of transformer bushings.
- Anchorages were reinforced at base of transformers.
- Braces were added at bottom of transformer radiators.

Changes in equipment layouts to reduce interactions among substation equipment

- Surge arrestors were relocated away from transformers to independent supports.
- Extra length of conductors (cables) was provided between equipment.

Adoption of seismic-safe models and new material

- Live tank circuit breakers were replaced with dead tank circuit breakers at every opportunity to lower the center of gravity and reduce internal seismic loads.
- Conventional porcelain insulators were replaced with polymer / silicon rubber insulators in selective applications to reduce seismic loads.
- High-strength insulators are used more generously throughout the system.

Continuous upgrades to engineering design criteria based on the latest industrial progress, geotechnical findings, and Code revisions are being conducted. For instance, Dynamic Shake Table Tests were recently made mandatory for certain equipment in addition to analytical design.

WINDSTORM MITIGATION ACTIVITIES

The following is a list of mitigation strategies the Las Virgenes-Malibu COG cities have for future planning.

- **Tree Pruning Program and Fire Code Sections – Regional**

See Section 4 for complete Mitigation Strategies.