# X SAFETY ELEMENT

Adopted September 2018

Source: Miwa, Moto. 2010. “North Star over Rancho Palos Verdes, CA.” Flickr. Accessed at https://flic.kr/p/8buWEa. June 18, 2010.

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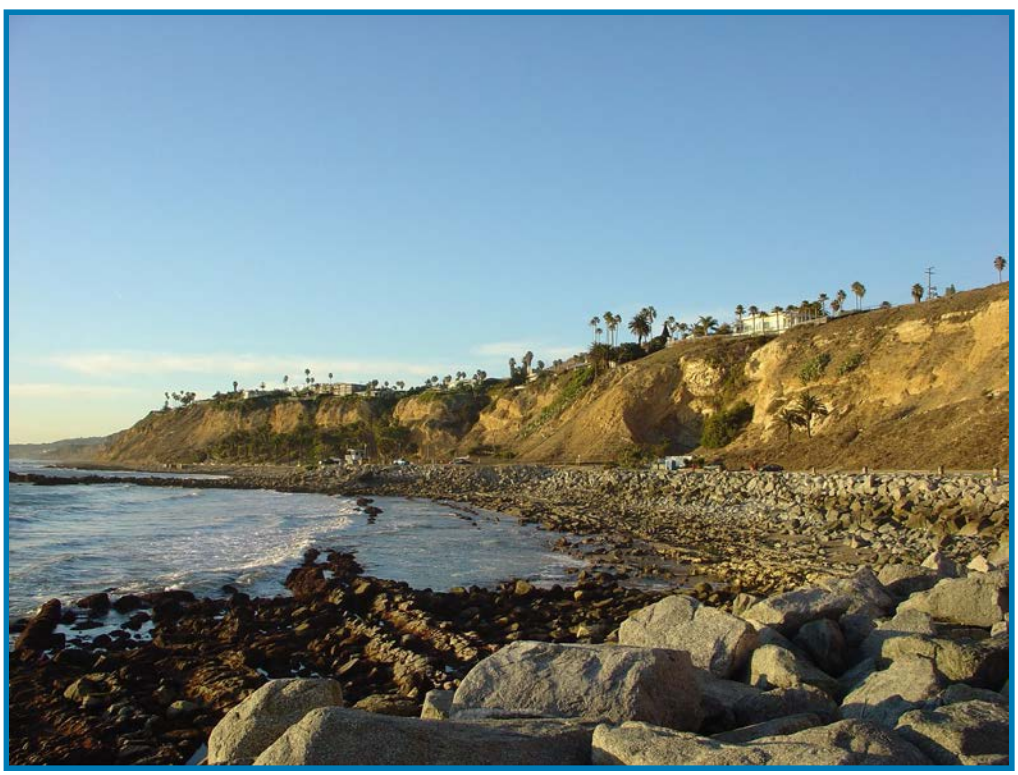
# X Safety Element

The residents of the Peninsula have historically dealt with the various natural and human-induced hazards affecting the area, including earthquakes, land movements (landslide and debris flow), wildfires, and tsunamis. The increase in population on the Peninsula over the years means more people are exposed to these risks, resulting in a need to update disaster preparations, communication, and infrastructure plans.

In order to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards, the Cities of Rancho Palos Verdes and Rolling Hills Estates developed a Joint Hazards Mitigation Plan in 2004 and updated it in 2014. Hazard mitigation is defined by the Federal Emergency Management Agency (FEMA) as "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." The primary goal of the 2014 Joint Hazards Mitigation Plan was to create a collaborated effort among the agencies, organizations, and citizens to work toward mitigating risks from natural hazards. The mitigation plan provides a list of activities that may assist the cities in reducing risk and preventing loss from future natural hazard events. The list of activities addresses multi-hazard issues, including earthquakes, wildfires, earth movements (landslide and debris flow), and tsunamis.

Similar to the 2014 Joint Hazards Mitigation Plan, this element of the General Plan identifies hazards; assesses vulnerability; analyzes risk; and contains goals, policies, and objectives to reduce risk and prevent loss from future natural hazard events within the City of Rancho Palos Verdes (City). This Element first discusses the various hazards that may impact the City, including wildfire hazards, flood hazards, geologic hazards, and other hazards. This discussion is followed by Emergency Services available to the City in addressing these hazards, including risk assessment, leading to policies to help address these impacts.



# 1 Goals

1. Provide for the protection of life and property from both natural and human-made hazards within the community.
2. Provide for the protection of the public through effective law enforcement and fire protection programs and volunteer programs such as Neighborhood Watch and the Community Emergency Response Team.
3. Develop and enforce health and sanitation requirements and develop emergency communications and disaster preparedness programs to ensure the overall health and safety of all residents.
4. Protect life and property and reduce adverse economic, environmental, and social impacts resulting from any geologic activity.

# 2 Policies

1. Promote education and safety awareness pertaining to all hazards that affect Rancho Palos Verdes residents and adjacent communities.
2. Adopt and enforce building and fire codes, ordinances, and regulations using best practices that include design and construction standards based upon appropriate levels of risk and hazard.
3. Continue to require that all structures and facilities in the City adhere to City, State, and National regulatory standards such as the California Building and Fire Codes and other applicable fire safety standards.
4. Coordinate with the Los Angeles County Fire Department's Prevention Services to ensure that proper defensible space and an adequate fuel modification program is actively being implemented and enforced on properties within the Very High Fire Hazard Severity Zone.
5. Expedite reviews for reconstruction of fire-damaged structures.
6. Encourage cooperation among adjacent communities to ensure law enforcement and fire protection mutual aid in emergency situations.
7. Cooperate with the fire protection agency and water company to ensure adequate water flow capabilities with adequate back-up throughout all areas of the City.
8. Continue to cooperate with fire protection agencies in utilizing public facilities for water and refueling location.
9. Develop and implement stringent site design and maintenance criteria for areas of high fire hazard potential in coordination with fire protection agencies.
10. Implement reasonable and consistent house numbering and street naming systems.
11. Coordinate with the Fire Department to provide adequate emergency access to all streets, including the end points of cul-de-sacs, and along the sides of structures.
12. Coordinate with local, state, and federal agencies to update emergency, evacuation, and hazard mitigation plans, as necessary.
13. Ensure that services are available to adequately address health and sanitation issues.

14. Work with other jurisdictions to ensure that local, county, state, and federal health, safety, and sanitation laws are enforced.
15. Ensure that adequate emergency treatment and transportation facilities are available to all areas of the City.
16. Develop and maintain relationships with various levels of health, safety, and sanitation agencies.
17. Ensure the availability of paramedic rescue and fire suppression services to all areas of the City.
18. Maintain and implement a current Standard Emergency Management Systems (SEMS) Plan to cope with major disasters.
19. Regulate the activities, types, kinds, and number of animals and balance the interest of animal owners and persons whose welfare is affected.
20. Ensure the protection of compatible levels of wild animal populations, which do not adversely impact humans and their domestic animals.
21. Work with adjacent jurisdictions with respect to animal regulation activities.
22. Consider alternative animal control and enforcement methods and facilitate shelter, medical treatment, and training classes where needed.
23. Avoid or minimize the risks of flooding to new development.
24. Evaluate whether new development should be located in flood hazard zones, and identify construction methods or other methods to minimize damage if new development is located in flood hazard zones.
25. Maintain the structural and operational integrity of essential public facilities during flooding.
26. Locate, when feasible, new essential public facilities outside of flood hazard zones, including hospitals and healthcare facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities or identify construction methods or other methods to minimize damage if these facilities are located in flood hazard zones.
27. Establish cooperative working relationships among public agencies with responsibility for flood, fire, and climate change protection.

## Climate Change Policies

### Public Facilities and Developments

28. Continue to work with South Bay Cities Council of Governments to develop an Energy Efficient Climate Action Plan and a Climate Action Plan that would include strategies that consider the unique characteristics and conditions of the City.
29. Promote new energy efficient buildings and retrofit existing public facilities to be as energy efficient as feasible.
30. Continue to manage the City transportation fleet's fueling standards to achieve the greatest number of hybrid and alternative fuel vehicles.
31. Support development of publicly accessible alternative fuel infrastructure.

32. Encourage utility companies to provide informational literature about energy conservation for the public at City facilities.
33. Improve pedestrian, bicycle, and public transportation routes and amenities to serve the travel needs of residents and visitors. Where feasible, connect major destinations such as parks, open spaces, civic facilities, retail, and recreation areas with pedestrian, bicycle, and public transportation infrastructure; promote shared roadways; and require new development and redevelopment projects to provide pedestrian, bicycle, and public transportation amenities and streetscape improvements.
34. Continue to support the preservation of natural resources and open spaces throughout the City.
35. Implement policies and programs identified in the City's Emissions Reduction Action Plan (ERAP) in order to improve air quality in the City.
36. Promote transit improvements or facilities that are powered by electricity and alternative fuels.

### Private Developments

37. Continue to review development proposals for potential regional and local air quality impacts per the California Environmental Quality Act, and if potential impacts are identified, require mitigation to reduce the impact to a level that is less than significant, where technically and economically feasible.
38. Continue to enforce Title 24 of the California Code of Regulations[1] building construction requirements and apply standards that promote energy conservation.
39. Continue to promote and encourage participation in the City's Voluntary Green Building Construction Program and award participating developers with a streamlined entitlement process and up to 50% rebate on permitting fees.
40. Continue to implement the required components of the Congestion Management Plan (CMP) and continue to work with Los Angeles County on annual updates to the CMP.[2]

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[1] Title 24 of the California Code of Regulations, also titled the Energy Efficiency Standards for Residential and Nonresidential Buildings, was created and is periodically updated by the California Building Standards Commission in response to a legislative mandate to reduce California's energy consumption.

[2] A CMP was enacted by the State Legislature to improve traffic congestion in California's urban areas. In accordance with the state statute, the Los Angeles County Metropolitan Transportation Authority adopted and updated several CMPs. Cities are required to continue adopting an annual self-certified conformance resolution for conformance with the CMP requirements.

# 3 Wildfire Hazards

Wildfire hazard areas are commonly identified in regions of the wildland/urban interface, presenting a substantial hazard to life and property, especially in communities built within or adjacent to hillsides and mountainous areas. Such fires can burn large areas and cause significant damage to structures, valuable watersheds, and result in an increased risk of mud flows. Ranges of the wildfire hazard are further determined by the fire ignition susceptibility resulting from natural or human conditions, as well as the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression and control, such as the surrounding fuel load, weather, topography, and property characteristics.

While the hazards are not as great in the City of Rancho Palos Verdes as in other cities, the area does have a propensity for major fires, especially during its long, hot summers. On the other hand, several assets tend to minimize the potential number and degree of damage of these fires. The low density of the built-up areas, the quality of the fire control agencies, and high standards of fire prevention all contribute to creating a safer community.

The following subsections describe the various wildfire hazards and protection measures within the City:

- Wildland Fire;
- Interface Fire;
- Urban Fire;
- Other Factors Leading to Fires; and
- Fire Hazard Zone.

## 3.1 Wildland Fires

Wildland fires are uncontrolled, non-structure fires other than prescribed fires that occur in the wildland area. They are often considered beneficial to wildlands, as many plant species are dependent on the effects of fire for growth and reproduction. However, large wildfires often have detrimental atmospheric consequences.

The causes of wildland fires are numerous and include lightning, human carelessness, arson, and utility sparks either by transformer failure or wildlife shorting live lines. Nine out of ten wildfires are reportedly caused by some human interaction. Heat waves, droughts, and cyclical climate changes such as increased vegetation due to heavy rainy seasons such as with El Niño can also dramatically increase the risk and alter the behavior of wildfires.

The marine influence and the local geology on the Palos Verdes Peninsula have played significant roles in shaping the terrestrial ecology and wildfire hazards potential. Two geographical factors important in this discussion include (1) the composition of the local soils and (2) the topography of the Peninsula. The soils in the Peninsula have been derived from the parent metamorphic and sedimentary materials. Soils of this type are usually very clay-like and not particularly conducive to the establishment of well-developed plant communities.

Development in some localities has extended into canyon areas and in some cases has reduced the fire hazard by removing the vegetation. However, development has also introduced the human element into more outlying locations, sometimes upslope from the fuel, thus increasing the fire hazard.

Fire records maintained by the California Department of Forestry and Fire Protection between the years 1932 and 2018 identify the 20 largest California wildland fires that were 100 acres or larger in area. Of the 20 wildland fires, the US Geological Survey identifies 2 fires that burned more than 100 acres within the City in the past. In 2005, the San Clemente Fire burned 180 acres of the Upper Filiorum Reserve and in 2009, the Palos Verdes Fire burned approximately 234 acres of the Portuguese Bend Reserve, both of which are subareas of the Palos Verdes Nature Preserve.

Of all the fires recorded on the Peninsula, only 1 was caused by natural events such as lightning. Most fires are caused by human influences and can vary, including children playing with matches, electrical malfunctions, transformer malfunctions, furnace malfunctions, arson, downed power lines, cigarette butts, and vehicle accidents.

## 3.2 Interface Fires

In many communities, an increasing number of homes are being built on the urban/wildland interface, with a growing population expanding further into the hills and mountains. Rancho Palos Verdes is a hillside community containing a variety of land uses ranging from high-density apartments and condominium developments to very low-density hillside units. The increased "interface" between urban/suburban areas and the open spaces caused by expansion has produced a significant increase in threats to life and property from fires, pushing existing fire protection systems beyond their original design and capability.

The most common conditions that cause significant interface fires include hot, dry, and windy weather; the inability of fire protection forces to gain access to the burn areas, and to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; large fuel loads (dense vegetation); and homeowners not complying with brush clearance requirements. Additionally, human activities increase the incidence of fire ignition and potential damage. Of the local fires in Palos Verdes, 90% have resulted from human activities near the interface of wildland areas and urban locations. Once a fire has ignited, fuel topography, weather, drought, and development may influence its behavior.

## 3.3 Urban Fires

Urban fires usually result from sources within the structures themselves. Smoking in bed, faulty wiring, children playing with matches, and appliance malfunctions are often causes of structural fires. Additionally, cinders from wood-burning fireplaces that remain alive and travel considerable distances have also been blamed for starting fires near residential locations.

Buildings with open stairwells, substandard electrical wiring, improper storage, or faulty heating systems are considered hazardous. Upon ignition, a fire will spread rapidly through a building. A common example of a fire-hazardous building is an older, multi-story structure. However, there are no major clusters of this type of building in Rancho Palos Verdes. Single-family detached houses form the major portion of the housing stock in the area.

More lives are lost in residential fires than in any other type of fire. One particularly dangerous hazard in residential fires is the use of untreated wood shingles for roof construction. Windy conditions could spread the fire to a large number of other houses where this type of roof is common. Another concern to firefighters has been identified as the response time to certain residential areas within the City. This is particularly true in neighborhoods with long cul-de-sacs (in excess of 700 feet) and in areas with limited ingress/egress points (Schneider, pers. comm. 1975).

Public assembly facilities are defined as those in which large numbers of people congregate in generally unfamiliar surroundings. They include schools, theaters, churches, temples, and a variety of recreational facilities. There are a number of these buildings in the City, including several schools. Gathering of large numbers of people in these buildings create conditions conducive to mass panic in a crisis, which only worsens and increases the casualties. Administering medical aid is made more difficult in these situations as well.

Potentially hazardous industrial operations encountered in the Rancho Palos Verdes area include utility lines, such as gas lines and overhead electrical power lines. While the normal construction of utility lines provides a good degree of safety, breaks in gas lines and falling power lines may cause fires.

**Secondary Effects:** A result of both wildfires and urban fires is the partial or total depletion of vegetation, which may result in potential erosion and/or dangerous mudflows. Furthermore, in areas with chaparral, a chemical condition known as the hydrophobic effect causes soil to become relatively impermeable to water, thereby reducing water absorption and increasing runoff. However, if a slope is burned over by fire of intense heat, the near-surface zone is purged of hydrophobic compounds. The vaporized compounds condense in a cooler zone just below the surface. Rainfall could then penetrate the surface layer and reduce its shear strength. Any excess water would travel downslope just above the impervious layer, carrying away the weakened material as a debris flow (California Geologic Survey 2007).

## 3.4 Other Factors Leading to Fires

**Human Proximity:** Human proximity tends to increase the activity of off-road vehicles, such as motorcycles, in nearby open areas. This activity is becoming a more frequent source of brush fires, as the trend accelerates toward such recreational pursuits.

**Vegetation:** The density and distribution of vegetation can define the overall hazard of fire and its intensity in a particular area. The vegetation of an area determines the fuel and spreading potential, while helping to identify the recurrence intervals one can anticipate between outbreaks of fire. In the Palos Verdes area, three major plant communities determine the various fuel potentials of the area: coastal sage scrub, riparian, and types of woodland–grass.

**Fuel:** Fuel feeds a fire and is a key factor in wildfire behavior. Diverse fuels in the landscape, such as natural vegetation, human-made structures, and combustible materials may increase the risk of fire. For example, a house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. Fuel is classified by volume ("fuel loading," or the amount of available vegetative fuel) and by type. The type of fuel, along with moisture content, can greatly influence the dynamics of wildfire. Chaparral is a primary fuel of Southern California wildfires. Chaparral communities experience long, dry summers and receive most of their annual precipitation from winter rains. Fire has been important in the life cycle of chaparral communities, which have evolved to a point it requires fire for spawn regeneration. In general, chaparral community plants have adapted to fire through fire-induced flowering, bud production and sprouting subsequent to fire, in-soil seed storage and fire-stimulated germination, and on-plant seed storage and fire-stimulated dispersal.

**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 susceptible. 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. Although the Peninsula has a predominant westerly breeze flow, the bulk of the local fire outbreaks tend to accompany the "Santa Ana" winds, which are heated by compression as they flow down to Southern California from Utah, creating a particularly high risk, as they can rapidly spread what might otherwise be a small fire. Therefore, those areas that lie to the west of potential ignition points or fire sources become even more hazardous. The Santa Ana wind system occurs in the drier fall season, and for residents of Southern California, the season of the Santa Ana winds is synonymous with fire danger.

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

**Access:** Access is a fire hazard factor that describes the relative difficulty of delivering both equipment and personnel to a fire. Containment being a key objective, those areas of limited accessibility have a greater potential for fire spreading than the more accessible locations.

In the Palos Verdes area, the factor controlling access is slope. The degree of slope in a burn area can determine the type of heavy equipment and strategy that can be used.

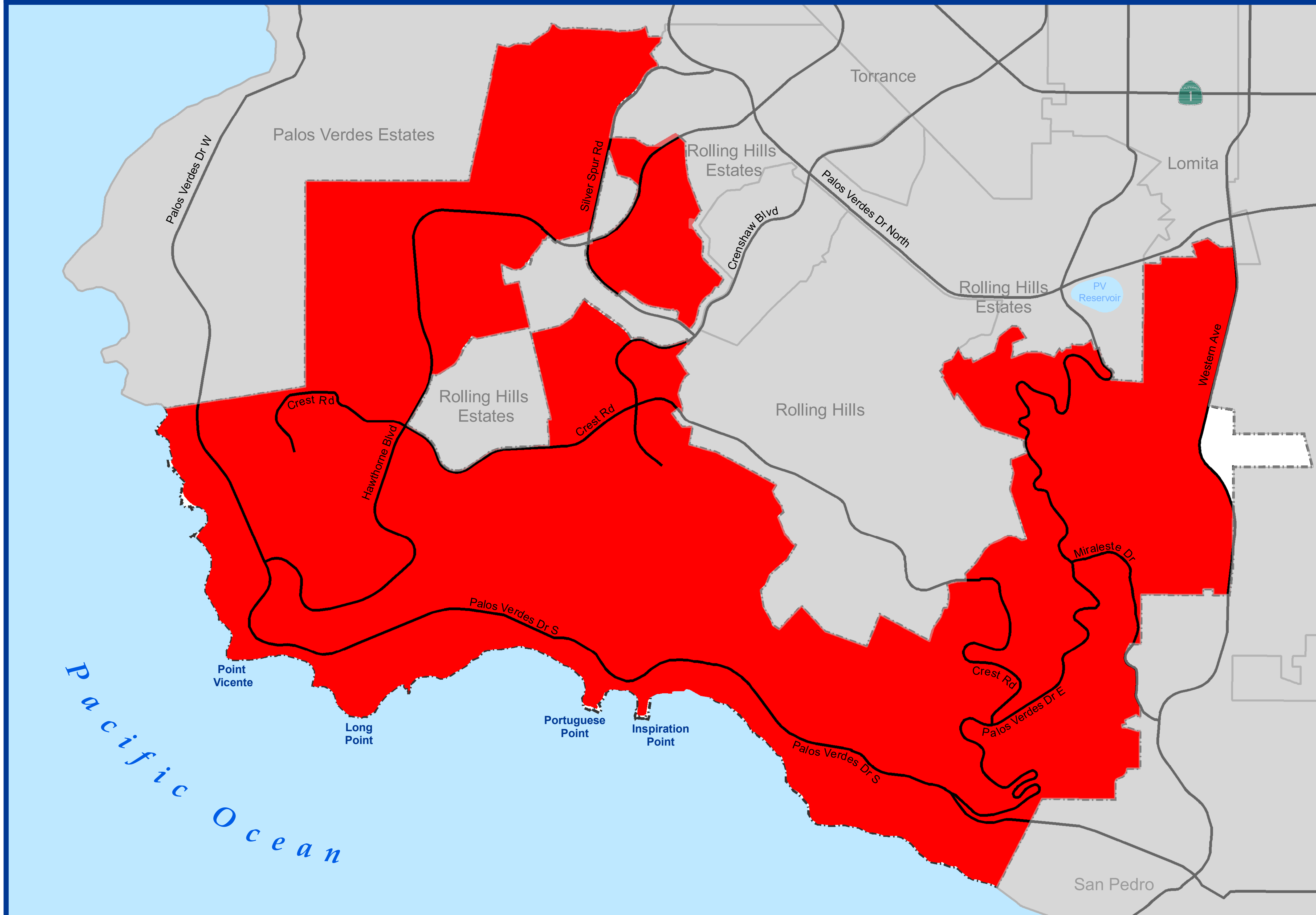
**Topography:** Topography influences the movement of air, thereby directing a fire course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, intensifying fire behavior and causing the fire to spread faster. Solar heating of dry, south-facing slopes produces up-slope drafts that can complicate fire behavior. Entire canyons have been engulfed in flames from the superheated conditions resulting from the combination of fire and wind drafts.

## 3.5 Fire Hazard Zone

In 2008, the California Department of Forestry and Fire Protection, together with input from the local Los Angeles County Fire Stations, updated the City's Fire Hazard Severity Zone Map (Figure 1, Fire Hazard Severity Zone), indicating that the entire City, excluding portions of the City located east of Western Avenue (approximately 98 acres involving 322 single-family and 123 multifamily units) is classified as a Very High Fire Hazard Severity Zone. Planned development within the Very High Fire Hazard Severity Zones are required to comply with the California Fire Code and obtain Fire Department approval for provision of adequate emergency access, sprinklers, distance between buildings, etc.

Pursuant to the State Government Code, properties located within a Very High Fire Hazard Severity Zone must maintain certain defensible space through specific fuel modification (brush clearing) requirements. These fuel modification requirements are enforced wholly by the Los Angeles County Fire Department. Furthermore, property owners located within a Very High Fire Hazard Severity Zone must disclose that their property is located within such a zone at the time of sale. These requirements have been in place since the original State Government Code dealing with Very High Fire Hazard Severity Zones was adopted in 1995.

# Figure 1: Fire Hazard Severity Zone




**Fire Hazard Severity Zone**

- VHFHSZ
- City Boundary

Miles
0 0.5 1

Source:
City of Rancho Palos Verdes &
County of Los Angeles Fire Dept.

Figure 1

# 4 Flood Hazard

In general, three distinct types of flood inundation hazards are known to exist: flood inundation, dam inundation, and debris flows. Flood inundation hazards are those associated with major atmospheric events that result in the inundation of developed areas, due to overflows of nearby stream-courses or inadequacies of local storm drain facilities. While none in the City, dam inundation hazards are those associated with the downstream inundation that would occur given a major structural failure in a nearby impoundment. Such failures would most likely be caused by geologic phenomena, including slope instability or seismic failure.

Another inundation hazard relative to Palos Verdes is debris flows that can occur during the rainy season and, in addition to impacting structures and roadways, can have an adverse effect on sensitive inter-tidal areas along the coastline. Flooding and debris flows can occur during storm events. These flows can occur in and below the areas denuded of vegetation and altered topsoil. The extent and amount of flows will depend on the rainfall intensity and duration of the storm event. These flows can be highly destructive and move large quantities of soil, rocks, brush, and trees into neighborhoods, causing property damage, blocking streets, and endangering properties. For areas with denuded vegetation as a result of a fire, it can take about 4 to 5 years for vegetation to significantly recover, and about 10 years to fully recover.

The location of the Peninsula helps insulate the City from most aspects of flood hazard. The City is not located near any major streamway, and large-scale inundations related to over-flow are not expected to occur. In the past, there have been only two occasions when the City declared a local flood-related emergency, both of which related to earth movement caused by excessive rain during severe weather conditions. On March 8, 1979, the City experienced earth movement resulting from heavy and unusual rains, and again on January 17, 1995 due to El Niño rainstorms that caused flooding and sliding throughout the community. In recent years, the City has taken a proactive approach in addressing flood hazards such as adopting the floodplain management ordinance in 2006. The floodplain management ordinance has enabled the City to take part in the National Flood Insurance Program that provides property owners within flood-prone areas to qualify for federally subsidized flood insurance protection and the City to receive funding for flood mitigation projects.

FEMA identifies the Lunada and Agua Amarga Canyons, Portuguese Bend and Forrestal Nature Reserves, and other public and private properties as flood zone category D (Figure 2, Potential Flood and Inundation Maps). Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. Flood zone D is defined as areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted in these areas and therefore these areas are designated as undetermined risk areas.

Although the chances of a flood hazard are minimal, as identified by FEMA, a definite flooding problem does exist in the form of temporary flash floods related to heavy winter rains. Most of this flash flood activity is isolated along the canyons, the floors of which provide the runoff channels for the hilly, steep terrain. The amount of runoff during a storm is increased by the high runoff characteristic of the local soils. Most flash flood conditions in Palos Verdes are short-lived in nature, due to the limited size of the available watershed, and the damage resulting from flash floods is more erosive than inundative in nature. However, substantial damage can occur if developments encroach into the canyon bottoms or where roadways are too close to canyons, as with San Ramon Canyon.

Much of the area in flood zone D is designated as Hazard Area or Open Space Preserve in the Land Use Element. Therefore, the development potential within flood zone D is generally limited. However, a few vacant residential lots remain that may be developed in the future. Prior to development, these lots will be subject to the City's development guidelines; geotechnical review; and/or compliance with current California Building Codes related to anchoring, building materials, construction methods and practices to minimize, resist, and prevent flood damage.

**US Army Corps of Engineers:** Under Flood Control and Coastal Emergency Act, the US Army Corps of Engineers (USACE) provides disaster preparedness and response services and advanced planning measures designed to reduce the amount of damage caused by an impending disaster. The Los Angeles District, which the City is part of, is one of four District offices in the South Pacific Division that includes 222,000 square miles area, including 420 miles of coastline, 14 harbors, and the highest, lowest, and hottest spots in the contiguous 48 states. When disasters occur, it is not just a local USACE district or office that responds. Personnel and other resources are mobilized across the country to carry out response missions.

## 4.1 Water Storage Facility Failure

Palos Verdes Reservoir is the largest water impoundment owned by the Metropolitan Water District on the Peninsula, located near Palos Verdes Drive East in the City of Rolling Hills Estates. Palos Verdes Reservoir is an earth-fill type facility that has a surface area of 27 acres and a maximum storage capacity of 1,100 acre-feet. This compacted-fill dam was constructed in 1939 to the engineering specifications of the period. The relative effects of earthquake shaking on the reservoir have not been determined.

There are 12 other water impoundments located throughout the Peninsula (City of Rancho Palos Verdes, Rolling Hills, and Rolling Hills Estates), as shown on Figure 2, Potential Flood and Inundation Hazards (California Water Service Company 2004). These facilities are either aboveground or belowground water tanks of lesser capacity than the Palos Verdes Reservoir. Although such facilities are smaller in capacity than Palos Verdes Reservoir, they could present locally hazardous inundation situations if they were to fail.

Each of the water storage facilities may be subject to severe ground shaking, given a major seismic event on the San Andreas, Newport-Inglewood, or Palos Verdes Faults. The ability of the water storage facilities to withstand the anticipated ground shaking is not known. Other hazardous geologic phenomena, particularly landslides, are most likely to be the cause of the structural failures of water impoundments. Fortunately, none of the existing active reservoirs are located within the City-designated landslide areas.

In general, the direct threat to public safety resulting from a water storage facility failure will not be great, with the possible exception of Palos Verdes Reservoir. However, other results indirectly related to a water storage failure could be quite severe, including the shortage of water for both domestic and fire prevention uses. Shortages of that nature could be extremely critical in a real disaster situation. Especially, in consideration of both domestic water and firefighting needs during particular seasons and times of day when demand on the water system is at its peak. Acknowledging this potential, the California Water Service Company has an emergency contingency plan that includes damage assessment, water retention, transporting water, transporting generators, and mutual aid. Currently, the California Water Service

# Figure 2: Potential Flood & Inundation Hazards

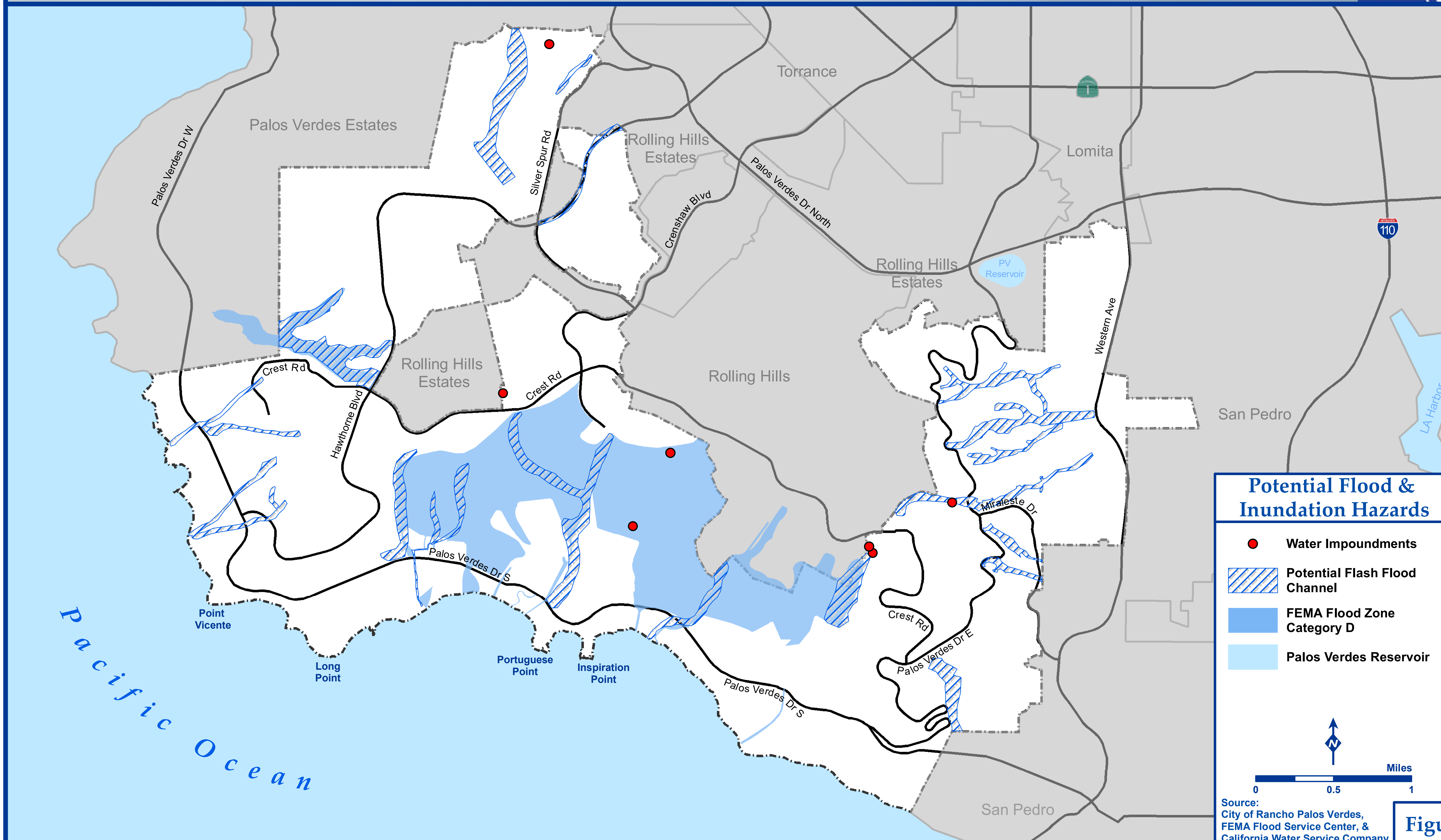



Figure 2

Company uses an electronic telemetric method to monitor the capacity, pressure, and the distribution system of various reservoirs. Should there be any damage to the piping system, the water company staff can easily detect the source of the problem. Depending on the damage, the first priority of the water company is to isolate main leaks and retain water in the reservoirs to prevent any landsliding or flooding that may occur. In situations facing water shortage, the water company activates their emergency contingency center and works with the local emergency regional center, Los Angeles County Office of General Management and/or Southern California Region Emergency Centers, based on the significance of the situation for the delivery of bottled water. In cases of power outage in the two lift stations that pump water to the Peninsula, the Water Service Company will transport large generators to restore power.

# 5 Geologic Hazards

The Palos Verdes Peninsula is composed of a sequence of sedimentary and metamorphic rock that has been folded and uplifted along the Palos Verdes Fault on the north and an unnamed fault in the offshore area to the south (See Conservation and Open Space Element for a geologic profile of Palos Verdes Peninsula.) The folding and up-lifting of the Peninsula has produced an anticlinal structure in which the sedimentary rocks are inclined generally to the north on the northerly flanks of the Palos Verdes Hills and inclined to the south on the southerly side. This particular structural relationship is one of the major factors responsible for the large-scale landslides present on the Peninsula.

The Palos Verdes Peninsula bedrock is composed of a metamorphic core blanketed by sequences of younger sedimentary rock. Five geologic formations are present on the Peninsula, including the Catalina Schist, Monterey Formation, San Pedro Formation, intrusive volcanic rocks, and marine terrace deposits. The Palos Verdes Peninsula is tectonically uplifted and folded as a result of the Palos Verdes Fault. The complex folding generally represents a northwest–southeast trending double-plunging anticline. The sedimentary rocks are inclined generally to the north on the northerly flanks of the Palos Verdes Hills and inclined to the south on the southerly side. The 13 staircase marine terraces surrounding the Palos Verdes Peninsula are one of the most complete sequences of emergent marine terraces in Southern California.

Geologic hazards include seismic hazards, active and potentially active faults, landslides (including debris and mud flows), liquefaction, tsunamis, seiches, settlement and subsidence, expansive soils, and coastal bluff retreat. These geologic hazards are detailed in the following sections.

## 5.1 Seismic Hazards

The City of Rancho Palos Verdes is located in a seismically active area and near several of the many active and potentially active faults in Southern California (see exhibit below). This section analyzes the earthquakes that should be expected in the future and the effects that will be experienced with the area.

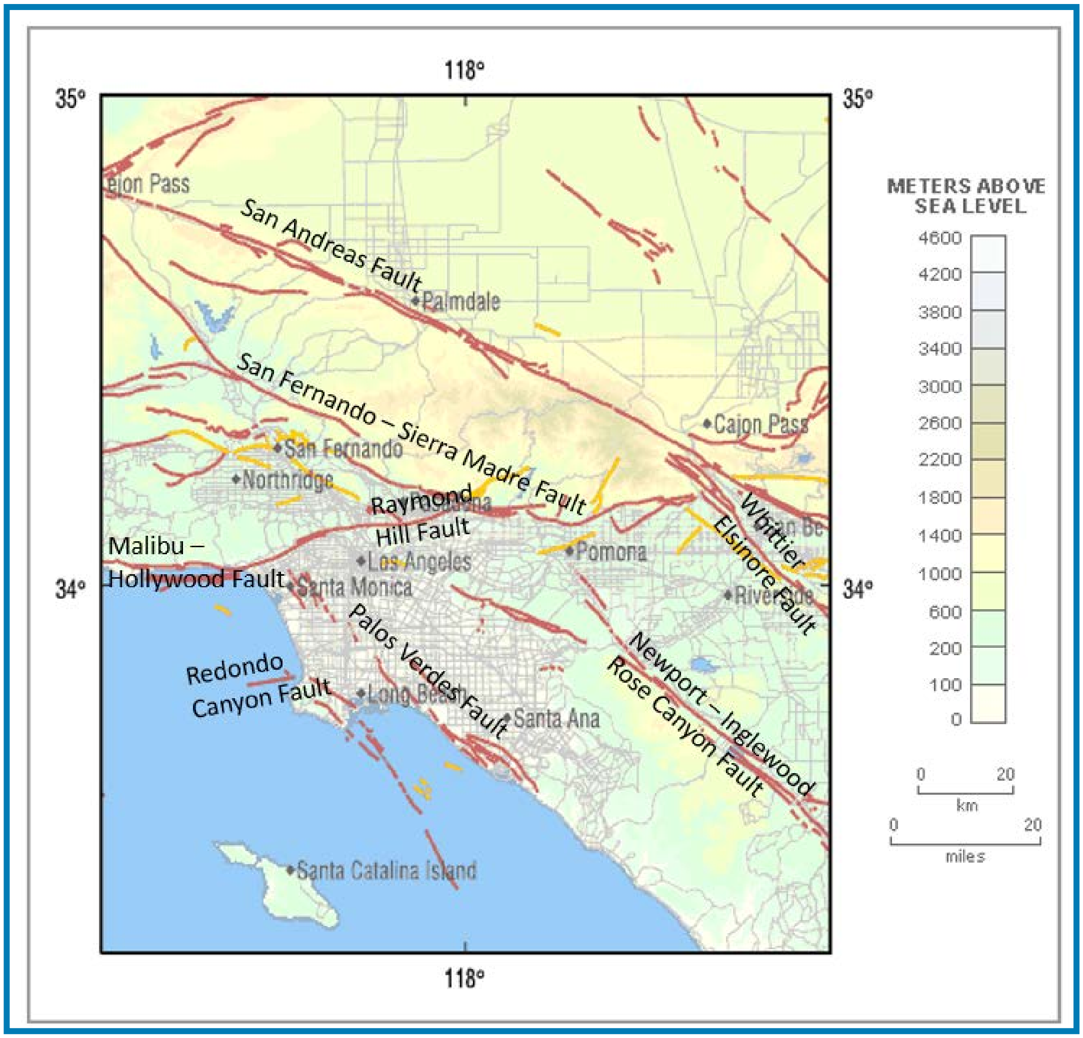
A fault is defined as a fracture in the crust of the Earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. Active and potentially active faults within Southern California are those capable of producing seismic shaking that may cause damage to structures. An active fault is defined by the State of California as a well-defined fault that has exhibited surface displacement during the Holocene Epoch (to about 11,000 years ago) and a potentially active fault is defined as having a history of movement within the Pleistocene Epoch (between 11,000 to 1.6 million years ago).

Two faults are present on the Peninsula: the Palos Verdes and Cabrillo Faults. The active Palos Verdes Fault trends northwest–southeast and marks the eastern termination of the Palos Verdes Hills. The potentially active Cabrillo fault also trends northwest–southeast and extends from Cabrillo Beach to near the center of the Peninsula. The

Palos Verdes Fault is considered a source of significant earthquake hazard and the Cabrillo Fault is a potentially moderate earthquake hazard for reasons discussed in detail below.

The seismic hazards to the City are not limited to the faults located in the Peninsula. The active Newport–Inglewood Fault and the Puente Hills Blind Thrust are located east of the Palos Verdes Peninsula within the Central Plain of the Los Angeles Basin. The Newport–Inglewood Fault marks the boundary between the Southwestern and Central Blocks and the Puente Hills/Whittier Fault marks the boundary between the Central and Northeastern Blocks. Earthquakes generated on these faults pose a significant earthquake hazard to the Palos Verdes Peninsula.

The active San Andreas Fault marks the boundary between the North American and Pacific Tectonic Plates. The San Andreas is the most active fault system in California and is considered a primary source of significant earthquake hazards in Southern California. However, the effects on the Palos Verdes Peninsula are only considered moderate due to the distance from the San Andreas Fault. Additional secondary impacts to the Palos Verdes Peninsula will be felt due to the damage that may be suffered by other areas and damage to lifeline and infrastructure in Southern California.



For the purposes of defining the problem, the principal active and potentially active faults in the region and their earthquake-generating capabilities are listed in Table 1. The latter is expressed as the magnitude of the largest earthquake that can reasonably be expected, and also as the level of shaking (ground acceleration) that could result within the City. In addition, the estimated slip rate, recurrence interval, and most recent rupture are included in the table.

Three items in the table are of particular interest. First, earthquakes generated by the Newport–Inglewood Fault will result in high ground accelerations due to the proximity of the fault to the City. Second, an earthquake on the San Andreas Fault is important because it has a high probability of occurrence (as of 2018, the San Andreas is “overdue” for an occurrence). The 2008 magnitude 7.8 Shakeout Scenario indicates that shaking from this earthquake is expected to last between 45 and 60 seconds, but the ground accelerations in the area will not be unusually high (less than half that of the estimated acceleration anticipated for an earthquake on the Newport–Inglewood Fault). This is mainly because the nearest point on the fault is over 50 miles to the northeast.

Third, the Palos Verdes Fault, although not zoned as active by the California Geological Survey, is now generally considered as having Holocene activity along the southern offshore section. It is the source for the largest ground accelerations shown in Table 1. However, maximum magnitude and recurrence interval is generally poorly understood.

## TABLE 1
## FAULTS IN THE REGION

| Fault | Approximate Distance (Miles) | Estimated Maximum Earthquake Event | | |
|---|---|---|---|---|
| | | Maximum Earthquake Event Magnitude (Mw) | Peak Site Acceleration (g) | Estimated Site Intensity Modified Mercalli Scale |
| Palos Verdes | 1–4 | 7.3 | 0.691 | XI |
| Newport-Inglewood | 10 | 7.1 | 0.337 | IX |
| Puente Hills Blind Thrust | 19 | 7.1 | 0.264 | IX |
| Santa Monica | 22 | 6.6 | 0.181 | VIII |
| Malibu Coast | 23 | 6.7 | 0.185 | VIII |
| San Joaquin Hills | 24 | 6.6 | 0.173 | VIII |
| Upper Elysian Park Blind Thrust | 24 | 6.4 | 0.154 | VIII |
| Hollywood | 25 | 6.4 | 0.151 | VIII |
| Whittier | 26 | 6.8 | 0.149 | VIII |
| Newport-Inglewood (offshore) | 26 | 7.1 | 0.170 | VIII |
| Raymond Hill | 28 | 6.5 | 0.145 | VIII |
| Verdugo | 30 | 6.9 | 0.171 | VIII |
| Northridge | 30 | 7.0 | 0.179 | VIII |
| San Andreas | 57 | 8.0 | 0.152 | VIII |

Notes:

The following is an abbreviated version of the 12 levels of Modified Mercalli intensity scale.

I. Not felt except by a very few under favorable conditions.

II. Felt only by a few persons at rest, especially on upper floors of buildings.

III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

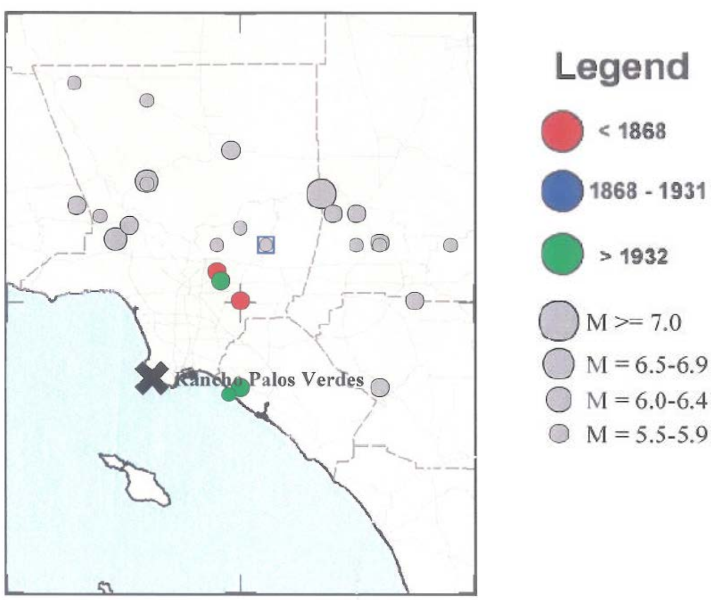
IX. Damage considerable in specially designed structures; well=designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Significant earthquakes can and probably will occur on other faults. However, available evidence indicates that their effects in the Palos Verdes Peninsula will be significantly less than the effects of the Newport-Inglewood, Palos Verdes, or San Andreas Faults. Known active or potentially active faults that could be the site of ground rupture resulting from movement on the fault are limited to the Palos Verdes Fault zone, which traverses the extreme northeastern corner of the Palos Verdes Peninsula. Evidence bearing on the activity of this fault is discussed in detail in a following section. No other potentially active faults are known within the Palos Verdes Peninsula. There are no significant trends of earthquake epicenters or groundwater conditions indicating a buried active fault within the City. The exhibit on the next page presents a plot of all recorded earthquake epicenters in the area from 1932 through 2008.




**Note:** Earthquakes more than 50 kilometers from selected location are shown in gray.

## 5.2 Active and Potentially Active Faults

The following describes known faults and their impacts in the Palos Verdes Peninsula: Palos Verdes Fault, Newport-Inglewood Fault, Puente Hills Blind Thrust, San Andreas Fault, and Cabrillo Fault.

**Palos Verdes Fault:** The Palos Verdes Fault is within a mile of the Palos Verdes Peninsula and poses the most significant earthquake hazard to the City due to its proximity. Although Holocene activity has been demonstrated in the southern offshore segment of the fault, the recurrence interval and magnitude of the most recent displacement is still not well characterized and as such the California Geological Survey considers it a "Potentially Active" fault. The fault strikes northwest–southeast, dips steeply to the southwest, and is a reverse fault with a minor right-lateral strike slip component. Compression translated along the fault produces the uplift and folding of Palos Verdes Hills and marks the boundary between the Palos Verdes Hills and the rest of the Southwestern Block of the Los Angeles Basin. This fault is considered an active "B" type fault with slip rates of approximately 1 to 5 millimeters per year (mm/yr) (USGS 1999) and a maximum credible earthquake magnitude of 7.3 (Petersen et al. 1996).

The effect a maximum credible earthquake from the Palos Verdes Fault would have to Southern California is considerable. This potential scenario is estimated to cause losses of $30 billion in building damage, 80 to 1,050 deaths, and 2,400 to 19,000 injuries (OES 2007).

**Newport–Inglewood Fault:** The Newport–Inglewood Fault is 7 to 10 miles from the Palos Verdes Peninsula and poses a significant earthquake hazard to the City. The vertical fault strikes northwest–southeast and is a right-lateral strike slip fault with a minor reverse component. Compression translated along the fault produces the Newport–Inglewood uplift from Beverly Hills to the San Joaquin Hills. The fault separates the Southwestern Block from the Central Plain of the Los Angeles Basin. This fault is considered an active "A" type fault with slip rates of approximately 1.0 to 1.5 mm/yr and a maximum credible earthquake magnitude of 7.1 (Petersen et al. 2008).

The effect a maximum credible earthquake on the Newport–Inglewood Fault would have to Southern California is significant. This potential scenario is estimated to cause losses of $49 billion in building damage, 150 to 1,900 deaths, and 5,200 to 33,000 injuries (OES 2007).

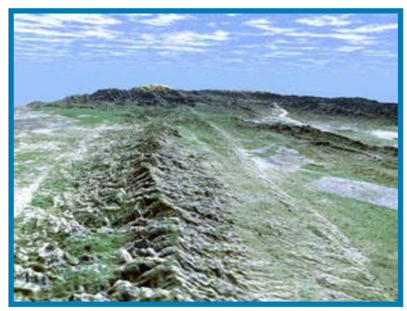

The earthquakes that have had a significant effect on the Palos Verdes Peninsula, in historic times, have originated principally as the result of movement on segments of the nearby Newport-Inglewood Fault zone. The most notable are the Long Beach earthquake (March 10, 1933, with a magnitude of 6.4), the Signal Hill earthquake (October 2, 1933, with a magnitude of 5.4), the Gardena earthquake (October 21, 1941, with a magnitude of 5.0), and the Torrance-Gardena earthquake (November 14, 1941, with a magnitude of 5.5). The epicenters of these earthquakes, as well as others along or in the vicinity of the Newport-Inglewood Fault, are shown on the exhibit above. Records of the smaller earthquakes (generally less than magnitude 3.9) are not available for years prior to 1963, so the number of smaller quakes shown is considerably less than that which would be expected had they been recorded for the full period from 1932 to 2006.

The relative intensity of ground shaking in the vicinity of the Palos Verdes Peninsula during each of the four notable earthquakes described above is estimated to have been between IV and VI on the Modified Mercalli Scale (Neamann 1935, 1943). The levels of intensities were deduced from the accounts of witnesses and by the severity of damage to different types of construction.

**Puente Hills Blind Thrust:** The Puente Hills Blind Thrust fault is farther than 15 miles from Palos Verdes Peninsula and poses a moderate earthquake hazard to the City. The fault strikes northwest–southeast and dips approximately 25 degrees to the southwest (Petersen et al. 2008). Compression translated along the fault produces the uplift and folding of Puente Hills and cuts the Central Plains of the Los Angeles Basin. This fault is considered an active "B" type fault with slip rates of approximately 0.7 mm/yr and a maximum accredited earthquake magnitude of 7.1 (Petersen et al. 2008).

The effect a maximum credible earthquake on the Puente Hills Blind Thrust would have to Southern California is considerable. This potential scenario is estimated to cause losses of $69 billion in building damage, 40 to 700 deaths, and 1,700 to 11,000 injuries (OES 2007).

**San Andreas Fault:** The San Andreas Fault is the greatest earthquake hazard in Southern California. The fault is located more than 50 miles from the Palos Verdes Peninsula and poses a moderate earthquake hazard to the City. The vertical, right-lateral strike slip fault strikes northwest–southeast. The San Andreas fault cuts through most of California and marks the boundary between the North American Plate to the northeast, and the Pacific Plate to the southwest. This fault is considered an active "A" type fault with slip rates of approximately 23 to 37 mm/yr and a maximum credible earthquake magnitude of 7.8 (Petersen et al. 2008).



The effect a maximum credible earthquake on the San Andreas Fault would have to Southern California is great. This potential scenario would cause losses estimated at $150 billion in building damage, 60 to 900 deaths, and 2,200 to 15,000 injuries (OES 2007). However, the effect on City residents and infrastructure would be less due to the distance from the Palos Verdes Peninsula. The effect on the City due to the damage that may be suffered by other areas and damage to lifeline and infrastructure in Southern California may be substantial. For example, disruption to the movement of water, petroleum products, telecommunications, and general transportation may have a dramatic effect on the peninsula in the short term.

The San Andreas Fault has generated two great earthquakes in recorded history: the 1856 Fort Tejon earthquake (magnitude 7.5–8.5), and the 1906 San Francisco earthquake (magnitude 8.3). Ground-shaking intensities in the vicinity of this study were not recorded for the 1856 event, but reached a level of III–IV on the Mercalli Scale for the 1906 earthquake (Lawson et al. 1908).

**Cabrillo Fault:** The Cabrillo Fault, which bisects a portion of the Palos Verdes Hills, is considered potentially active and poses a potentially significant earthquake hazard to the City. The normal fault strikes northwest–southeast and dips northeast. Tension translated along the fault drops the northeast side relative to the southwest side. This fault is considered a potentially active type fault with undetermined slip rates and a maximum probable earthquake magnitude of 6.8 (SCEDC 2015). The effect a maximum accredited earthquake on the Cabrillo Fault would have to Southern California has not been evaluated (OES 2007).

## 5.3 Landslides

Landslides represent only one step in the continuous, natural erosion process. They demonstrate in a dramatic way the tendency of natural processes to seek a condition of equilibrium, and various erosion processes act to gradually reduce them to a base level. Landslides are an important agent in this cycle. Several types of landslides commonly encountered are described below (USGS 2004).

**Translational or Block Slides:** These slides are the largest, most impressive type of landslide. They involve a single coherent mass that translationally moves down-slope with little rotation or backward tilting. The basal failure plane (rupture surface) is controlled by planar zones of weakness, such as bedding, foliation, jointing or a formation contact, or fault. These failures typically occur in layered rocks of sedimentary or metamorphic origin where lateral support is removed by erosion or grading. The Portuguese Bend Landslide is a complex version of a translational landslide. The Portuguese Bend Landslide has been conductive to ground failure for approximately 250,000 years and has been officially mapped as a landslide complex before the 1950s. While the history of landslides dates back, the current slippage began in 1956, coincident with the construction of the Crenshaw Boulevard extension, south of Crest Road, along the top of the ancient landslide complex. Another possible contributing cause of the sliding was the construction of hundreds of homes on and above the unstable rock and soil in the early 1950s prior to the slide.

**Rotational Slide:** Rotational failures are common in massive, unstructured material with relatively little resistance to shearing. These materials include thick sections of clayey soils and poorly compacted artificial fills. The surface of rupture is curved concavely upward, and the movement of the mass is partly rotational. Small arcuate failures, called slumps, are a type of rotational slide common along steep-banked streams and canyons in Rancho Palos Verdes, where a stream has cut through an existing soil zone.

**Rock Falls:** This phenomenon is an abrupt movement of rock and boulders that have detached from steep slopes or cliffs. Rock falls may be influenced by the height of the slope, size of rock, and slope geometry. Rock falls are prevalent where natural slope gradients exceed 50%, and where natural weathering produces angular fragments of material with little soil cover. An initial separation occurs along fractures, joints, or bedding and is highly influenced by mechanical weathering and interstitial water. Interstitial water is defined as water occupying interstices or pore volumes in rocks. The debris typically free-falls, bounces, and rolls down slope and may impact areas tens to hundreds of feet from the bottom of the slope. Rock falls are typical in the Forrestal Canyon area and along many of the sea bluffs of the City.

**Topples:** Similar to rock falls, they represent forward rotation of rock or boulders that are separated by gravity or the buildup of water pore pressure in cracks from the surrounding rock materials.

**Debris Flows:** Debris flows, also known as "mudflows," are potentially serious hazards to life and property in the hillside areas of the Palos Verdes Peninsula. Rainfall, steep slopes, and loose soil are the primary controlling conditions that generate debris flows. Debris flows are more likely to occur during rainy seasons after wildfires. Vegetation naturally binds the topsoil and absorbs precipitation. The removal of vegetation by fire lowers the stability of exposed topsoil and lessens the water-holding capability of the watershed. Following a wildfire, sediment yields and peak discharges of watersheds can increase up to 35-fold, and potentially inundate drainage systems. Debris flows typically start within swales or small, steep drainages or as small failures on the sides of steep slopes, usually greater than 15 degrees. The flows typically originate in loose soils that become saturated due to the introduction of water. The saturated soil liquefies into slurry of loose soil, rock, organic matter, air, and water. These flows may coalesce into larger canyons or stream channels intensifying the flow and increasing the volume of material. Debris flows can travel faster than about 10 miles per hour (mph) or approximately 25 yards in about 5 seconds. Speeds in excess of 20 mph are not uncommon, and speeds in excess of 100 mph, although rare, do occur locally (California Geologic Survey 2007). In general, hillsides become saturated and susceptible to debris flows after heavy seasonal rainfall (10 inches of seasonal), or during intense rainfall events (approximately 2 inches within a 6-hour period). Large mudflows have the energy to uproot trees, move large boulders, severely erode canyon walls, and deposit large volumes of material. Because of the speed with which they move, mudflows can be quite destructive and pose a threat to life and property, especially along the bottom and at the mouths of canyons. Silt and debris can also impact sensitive coastal inter-tidal zones.

Human activity can impact the occurrence of debris flows as a result of improper drainage and maintenance. Introduction of excess water into soils from a broken water pipe or improper functioning drainage can create a saturated soil condition. Altered and excavated slope areas, such as road cuts, are more prone to debris flows than natural slopes if not properly maintained. To mitigate potential debris flows, care should be taken that all runoff is properly channeled to engineered drainage systems.

Landslides are basically controlled by four factors: the rock type, the fabric or structure of the rock, the amount of available water, and the topographic conditions. The geologic formation or rock type is a reasonably good indicator of the strength of the rock and its resistance to failure. The geologic structure or the orientation of potential failure planes is important in determining the size and type of failure. The amount of available water greatly influences the strength of a potential failure surface. It can add to the weight of the unstable mass, lower the co-efficient of friction, and increase pore pressure, all of which contributes to land movement. Topographic slope gradient is also a contributing factor in controlling the force that causes failure. The relative importance of these four factors varies from place to place, but rock type, geologic structure, and available water are probably the most important. Some degree of slope is necessary to initiate failure, but if the other factors are present, failure can occur on slopes with a gradient of less than 5%.

Landslides in the City can be grouped into two major landslide systems that represent complex groups of smaller coalescing landslides: the Portuguese Bend and the South Shores. Smaller, isolated landslides are scattered throughout the City, outside the two major systems (Figure 3, Landslide Inventory Map).

The Portuguese Bend is the most studied and publicized landslide in the area, and perhaps in the Los Angeles Basin. The Portuguese landslide has been mapped as a large ancient complex that extends from close to the top of the ridge of the city to the ocean. The most recent movement began in 1956, apparently as the result of grading operations, and involved movement in about one-third of the system. The recently active portion is shown on Figure 19. This area includes the Abalone Cove and the Portuguese Bend Landslides.

The upper limit of the landslide has been under debate for many years. The Landslide Inventory Map (Figure 3) places the ancient landslide scarp at the Valley View Graben adjacent to Crest Road. The Valley View Graben is a narrow valley interpreted as the remnant of the original pull-away at the top of the slide mass. Previous maps by Dibblee (1999) and others place the top of the landslide much further down slope from the Valley View Graben.

# Figure 3: Landslide Inventory

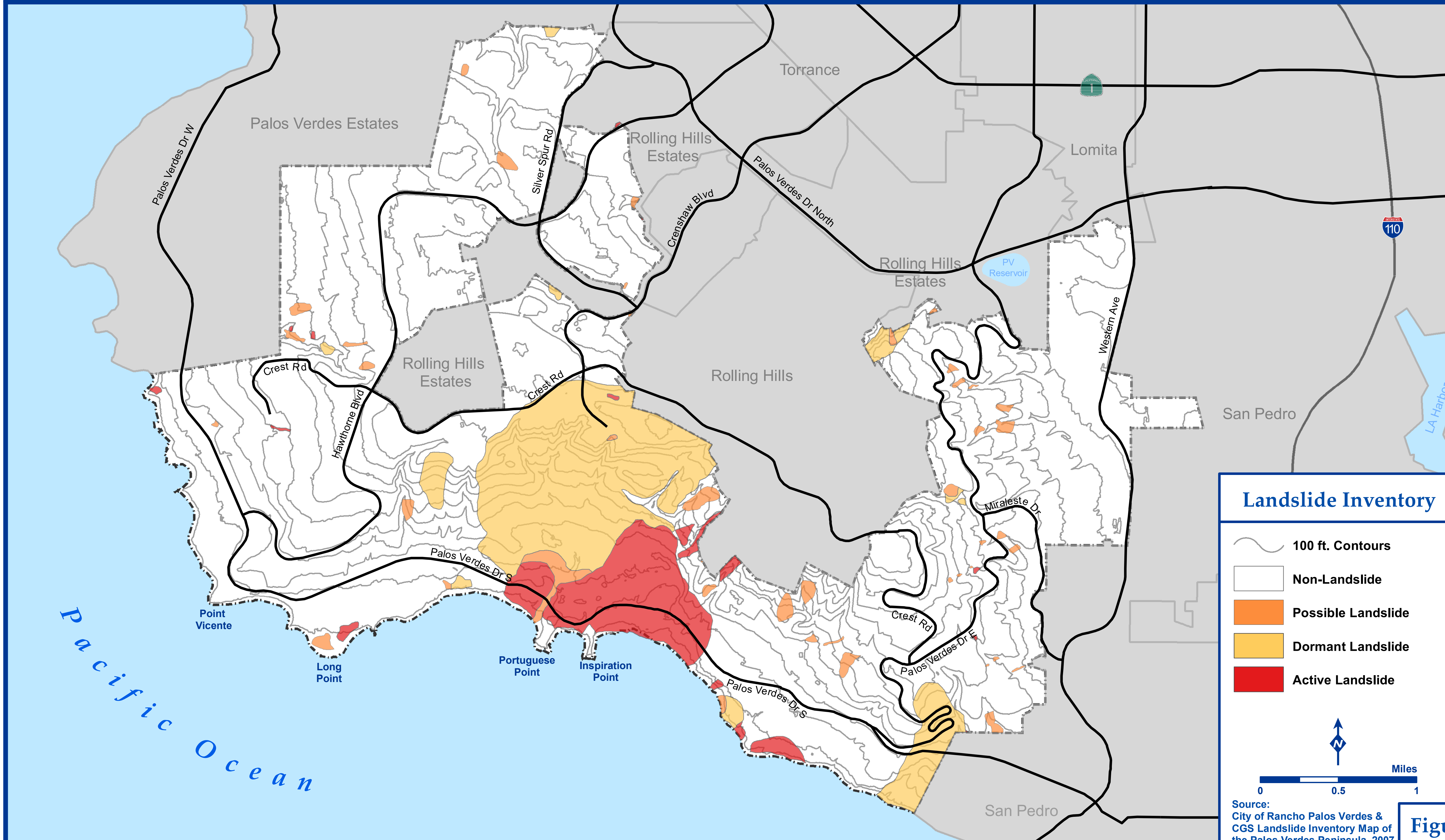



Figure 3

In the lower portion of the landslide, Palos Verdes Drive South transverses the landslide along with water and sewer lines. The roadway and pipelines are under constant scrutiny to determine areas in need of repair. The roadway is modified as necessary by minor grading and pavement repair. The pipelines have all been placed aboveground so that easy observation and maintenance can be performed. The risk to the roadway and pipelines is significant should portions of the Portuguese Bend landslide accelerate.

No historic movement has been recorded within the main mass of the South Shores landslide system. The last movement of the main landslide has been determined to be approximately ±16,200 years ago. This system is apparently at equilibrium for the present, but renewed activity may occur if existing conditions are modified. Along the eastern flank of the landslide, erosion and subsequent down cutting within San Ramon Canyon has triggered a new landslide, now known as the Tarapaca landslide that drops into the canyon from the east. The Tarapaca landslide threatens many of the over-steepened slopes in the canyon as well as road stability along the switchbacks of Palos Verdes Drive East. As discussed in Chapter 4, Circulation Element, the City is undertaking a drainage project to help protect Palos Verdes Drive East.

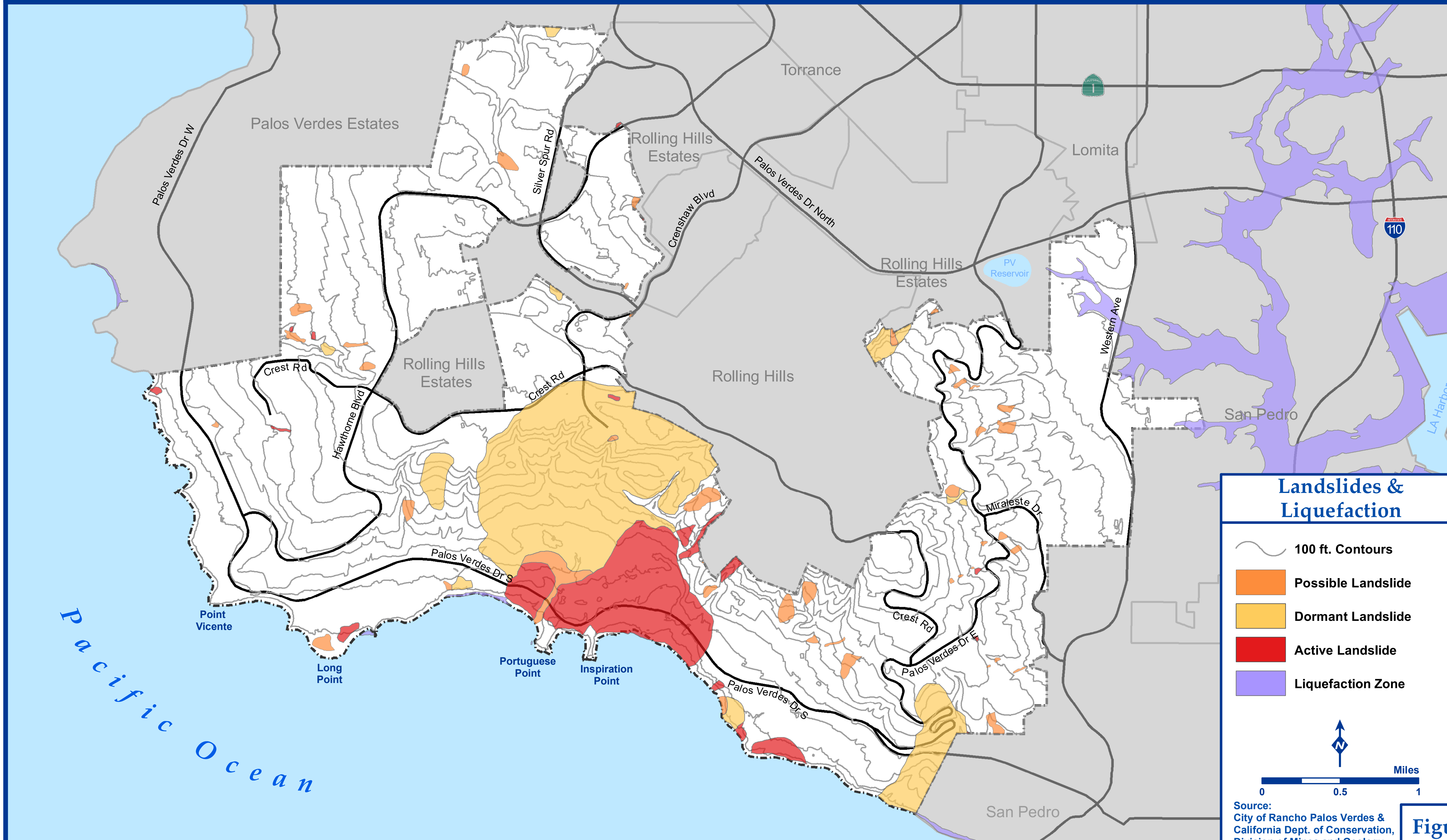
The Silver Spur Graben, located northwest of the Valley View Graben and partially within Rolling Hills Estates and Rancho Palos Verdes, was postulated by Envicom (1975) as being part of a much larger landslide complex they called the Silver Spur System. Ehlert (2000) reviewed the evidence to date and postulated that the graben might be associated with a tectonic (fault) origin rather than a landslide origin. He suggested that the area, although a graben, would need further work to determine its origin. He states that the age of the graben formation is on the order of a maximum of one million years old and may be several hundred thousand years old. The Landslide Inventory Map (Figure 3) does not include the Silver Spur Graben as a known landslide or landslide complex.

## 5.4 Liquefaction

Liquefaction occurs when earthquake waves cause water pressure to increase in the sediment and the sand grains to lose contact with each other, leading the sediment to lose strength and behave like a liquid. The soil can lose its ability to support structures, flow down even very gentle slopes, and erupt to the ground surface to form sand boils. Many of these phenomena are accompanied by settlement of the ground surface—usually in uneven patterns that damage buildings, roads, and pipelines. For liquefaction to occur, three factors must be present: loose granular sediments, saturation of the sediment by groundwater, and strong ground shaking. If the liquefying layer is near the surface, the effects are like that of quicksand for any structure located on it. If the liquefying occurs below a competent layer, translation, rotation, or liquefaction may occur.

The potential for liquefaction in Rancho Palos Verdes is very low since the local soil deposits are relatively thin and cohesive and groundwater is usually at depth. Liquefaction is not considered to be a significant hazard in the City. The mapped potential liquefaction zones on the Palos Verdes Peninsula are located in the drainage area east of the Palos Verdes Reservoir, along the shores of Royal Palm Beach Park and along the shoreline adjacent to some of the beach areas, as shown in Figure 4, Landslides and Liquefaction (California Division of Mines and Geology 1999).

# Figure 4: Landslides & Liquefaction




**Landslides & Liquefaction**

- 100 ft. Contours
- Possible Landslide
- Dormant Landslide
- Active Landslide
- Liquefaction Zone

N

Miles 0 0.5 1

Source:
City of Rancho Palos Verdes &
California Dept. of Conservation,
Division of Mines and Geology

Figure 4

Nearby effects of liquefaction were noted in the San Pedro area following the 1933 Long Beach earthquake (California Division of Mines and Geology 1998). During the 1994 Northridge earthquake, significant damage was reported in the Los Angeles–Long Beach Harbor areas, including lateral spreading, settlement, and sand boils that suggested liquefaction occurred (California Division of Mines and Geology 1998).

## 5.5 Tsunamis

Tsunamis are sea waves generated by earthquakes, landslides, or volcanic eruptions. It has also been postulated that large meteor impacts hitting the ocean have caused very large sea waves. The destructive power of tsunamis is due to the fact that they travel at velocities approaching 500 mph. While they are generally imperceptible on the open sea, as they approach land and as the ocean shallows, these waves slow down, making them grow in height (amplitude) and thus impact inland areas greater than normal wave action. Tsunamis have been recorded that crested to heights of more than 100 feet before slamming into shore. These great heights are rare and depend on several factors, such as offshore topography, tide phase, and coastline orientation and configuration. Hazardous tsunamis may occur along the coastline of Rancho Palos Verdes as the result of submarine faulting or landslide.

Faulting at great distance is the most common source of tsunamis along the California coast. Typical source areas are the great submarine trenches off Chile and Alaska. The latter was the source area for the tsunami that struck Crescent City in 1964 with 13-foot waves, claiming 11 lives and causing over 11 million dollars in damage. The Seismic Sea-Wave Warning System administered by the U.S. Coast and Geodetic Survey detects incoming tsunamis and supplies the endangered localities with the expected arrival times of the waves. The warning times vary with distance from the source, but for most tsunamis approaching the coast, several hours are available to evacuate the citizens and to make emergency preparations. The largest recorded tsunami heights in California were in Venice and Santa Monica in 1930 and were about 6.1 meters, or 20 feet, in height (California Geologic Survey 2015).

Recent studies have indicated the potential for large-scale landslides and slumping off the Palos Verdes Peninsula coast capable of producing tsunamis. Modeling indicates that tsunamis on the order of 3 to 6 meters (10 to 20 feet) high with velocities of up 10 meters (33 feet) per second could occur. Due to the height of the bluffs within City boundaries, the impact from these potential tsunamis would be limited (ASCE 2005.).

## 5.6 Seiches

Seiches are long-period water-level oscillations within closed or open bodies of water, such as a lake or harbor basins that can be created by seismic waves or landslides. Seiches are not considered a significant hazard in Rancho Palos Verdes.

## 5.7 Settlement or Subsidence

Settlement may occur in unconsolidated and unsaturated soils as the result of a more efficient rearrangement of the individual soil particles. This arrangement is typically due to additional overburden pressures from foundation loads or grading, or due to earthquake shaking. Settlements of sufficient magnitude to cause structural damage are normally associated with rapidly deposited alluvial materials, secondary settlement within subsurface peat deposits, improperly founded or poorly compacted fills, or highly fractured landslide deposits. Regional or local groundwater withdrawal from the Los Angeles Basin could cause subsidence within adjacent cities.

## 5.8 Expansive Soils

Expansive soils contain sensitive clay minerals that are capable of absorbing water and increasing in volume. The more water they absorb, the more their volume increases. Sensitive clay minerals will also shrink when they dry out and remove support from structures and buildings and result in subsidence and/or desiccation cracks at the ground surface. The shrink and swell cycle of highly sensitive clay minerals in expansive soils can exert enough force on footings or foundations to cause damage to structures and buildings.

Expansive soils tend to have a greater effect near the surface since expansion pressures are counteracted by soil overburden pressures at depth. Cracked foundations, floors, and basement walls are typical types of damage done by expansive soils. Expansive soils can cause post-construction damage to building foundations or interior slabs, or exterior hardscape, such as patio slabs, garden walls, driveways, and sidewalks, as well as structure framing and plaster walls.

Soils of the Rancho Palos Verdes area are typically various combinations of Diablo and Altamont soils (USDA 1969), which produce dark grey, neutral clay. All of these combinations have a high shrink-swell potential. While these soils are highly expansive, they should not be a factor in precluding development. Modern soil engineering procedures, coupled with present-day foundation designs, can effectively and inexpensively mitigate the effects of most expansive soils.

## 5.9 Coastal Cliff Retreat

The Palos Verdes Peninsula coastal cliffs are exposed to wave energy and subject to erosion and cliff retreat. Cliff retreat is the landward migration of the cliff face as a result of erosion processes, including ocean, wind, and gravity. This chronic coastal evolution plagues the City’s infrastructure and threatens the communities that are situated above and adjacent to these cliffs. Cliff retreat rates from the Point Vicente area north are approximately 0 to 0.77 meters (2.5 feet) per year, and has locally retreated more than 50 meters (180 feet) within a 65-year period (Hapke and Reid 2007). Cliff retreat rates in the Point Fermin area are estimated at between 0 to 0.95 meters (3 feet) per year, and has locally retreated more than 60 meters (197 feet) in 65 years (Hapke and Reid 2007). Along the Portuguese Landslide Complex, shoreline erosion removes stabilizing support.

# 6 Climate Change

Global climate change refers to changes in average climatic conditions on Earth as a whole, including changes in temperature, wind patterns, precipitation and storms. Historical records indicate that global climate changes have occurred in the past due to natural phenomena; however current data increasingly indicate that the current global conditions differ from past climate changes in rate and magnitude. Global climate change attributable to anthropogenic (human) Greenhouse Gas (GHG) emissions is currently one of the most important and widely debated scientific, economic and political issues in the United States and the world.

## 6.1 GHG Emissions

GHGs are those compounds in the Earth's atmosphere which play a critical role in determining temperature near the Earth's surface. More specifically, these gases allow high-frequency shortwave solar radiation to enter the Earth's atmosphere, but retain some of the low frequency infrared energy that should radiate back from the Earth towards space, resulting in a warming of the atmosphere. The extent to which increased concentrations of GHGs have caused or will cause climate change and the appropriate actions to limit and/or respond to climate change are the subject of significant and rapidly evolving regulatory efforts at the federal and state levels of government.

As a member of the South Bay Cities Council of Governments (SBCCOG), the City collaborated with the SBCCOG on the development of the Emission Reduction Action Plan (ERAP). The City has conducted two inventories of community-wide greenhouse gas emissions, one for the baseline year of 2005 (future emissions reductions will be measured aainst this year) and another for 2007. Additionally, the SBCCOG calculated inventories for 2010 and 2012 (South Bay Cities Council of Governments 2011). Table 2 is a summary of the City's emissions from each sector for the years 2005 and 2012 and the percent change from the same period. As shown in Table 2, the City's community and municipal GHG emissions decreased 8 percent from 2005 to 2012, falling from 289,289 Metric Ton(MT)$CO_2$e in 2005 to 266,176 MT$CO_2$e in 2012.

**TABLE 2**
**GHG EMISSION BY SECTOR (2005-2012) (MT$CO_2$e)**

| Sector | 2005 | 2012 | Percent Change (2005 to 2012) |
|---|---|---|---|
| On-road Transportation | 150,564 | 136,175 | -9.6% |
| Residential Energy | 88,941 | 86,129 | -3.2% |
| Commercial/Industrial Energy | 20,377 | 25,304 | 24.2% |
| Water | 18,156 | 11,653 | -8% |
| Solid Waste | 8,674 | 4,158 | -52.1 |
| Off-road Sources | 157 | 340 | 116.7% |
| Wastewater | 156 | 117 | -25% |
| Municipal Emissions | 2,264 | 2,291 | 1.2% |
| Total | 289,289 | 266,176 | -8% |

The City's Community emissions were categorized in seven sectors: Commercial/Industrial Energy, Residential Energy, On-road Transportation, Solid Waste, Water, Wastewater, and Off-road Sources. The Municipal emissions were added as one sector.

- Commercial/Industrial Energy includes emissions from electricity and natural gas consumption in nonresidential buildings and facilities (including outdoor lighting) in the City.
- Residential Energy includes emissions from electricity and natural gas consumption in residential buildings in the City.
- On-road Transportation includes emissions from vehicles traveling (wholly or partially) within the City.
- Solid Waste includes emissions from waste that is generated in the community and sent to landfills.
- Water includes emissions from the electricity used to source, treat, and deliver imported water in the community that is not accounted for in the community utility data.
- Wastewater includes emissions from treating wastewater generated in the community.
- Off-road Sources include emissions from operating equipment for construction, commercial, light industrial and agricultural activities; lawn and garden equipment; and recreational vehicles such as all-terrain vehicles.

As shown in Table 2, the transportation sector was the largest contributor to emissions in both 2005 (53%) and 2012 (52%) by producing 150,564 MTCO2e and 136,175 MTCO2e, respectively. This change represents almost a 10% decrease in emissions over the seven-year time period. Residential energy is the second-largest contributor to emissions, representing 31% in 2005 and 33% in 2012. Residential energy emissions decreased by about 3% from 2005 to 2012, from 88,941 MTCO2e to 86,129 MTCO2e. Commercial energy consumption represented 7% of emissions in 2005 and 10% in 2012, and its total emissions increased by about 24%, from 20,377 MTCO2e to 25,304 MTCO2e over the time period. Water comprised 6% of the total, 18,156 MTCO2e, in 2005, but was reduced to 4% of the total, 11,653 MTCO2e, in 2012. Solid waste, wastewater, and off-road sources made up the remaining emissions in each year. Solid waste and wastewater emissions declined from 2005 to 2012; however, off-road sources increased 117%, from 157 to 340 MTCO2e, in the same period. Off-road Sources comprise a very small percentage of overall emissions, but are variable primarily due to construction-related emissions, which are based on the level of development estimated in the City each year. Municipal emissions increased slightly from 2,264 MTCO2e to 2,291 MTCO2e, a 1.2% increase.

## 6.2 Effects of GHG Emissions

The scientific community's understanding of the fundamental processes responsible for global climate change has improved over the past decade, and its predictive capabilities are advancing. However, there remain significant scientific uncertainties in, for example, predictions of local effects of climate change, occurrence, frequency, and magnitude of extreme weather events, effects of aerosols, changes in clouds, shifts in the intensity and distribution of precipitation, and changes in oceanic circulation. Due to the complexity of the Earth's climate system and inability to accurately model all climate parameters, the uncertainty surrounding climate change may never be completely eliminated. Nonetheless, the potential impacts in California due to global climate change may include: loss in snow pack; sea level rise; more extreme heat days per year; more high ozone days; more large forest fires; more drought years; increased erosion of California's coastlines and sea water intrusion into the Sacramento and San Joaquin Deltas and associated levee systems; and increased pest infestation. Below is a summary of some of the potential effects, reported by an array of studies that could be experienced in California as a result of global warming and climate change (California Environmental Protection Agency 2006).

**Air Quality:** Higher temperatures, conducive to air pollution formation, could worsen air quality in California. Climate change may increase the concentration of ground-level ozone, but the magnitude of the effect, and therefore, its indirect effects, are uncertain. If higher temperatures are accompanied by drier conditions, the potential for large wildfires could increase, which, in turn, would further worsen air quality. However, if higher temperatures are accompanied by wetter, rather than drier conditions, the rains would tend to temporarily clear the air of particulate pollution and reduce the incidence of large wildfires, thus ameliorating the pollution associated with wildfires. Additionally, severe heat accompanied by drier conditions and poor air quality could increase the number of heat-related deaths, illnesses, and asthma attacks throughout the State (California Energy Commission 2006). According to the Cal-Adapt website, which provides projections on climate change scenarios and impacts, the City could result in an average increase in temperature of approximately 5% to 9% (about 3.1 to 5.5°F) by 2070-2090, compared to the baseline 1961-1990 period (California Energy Commission 2017).

**Water Supply:** Uncertainty remains with respect to the overall impact of global climate change on future water supplies in California. The California Department of Water Resources report on climate change concludes that "climate change will likely have a significant effect on California's future water resources…[and] future water demand." It also reports that "much uncertainty about future water demand [remains], especially [for] those aspects of future demand that will be directly affected by climate change and warming. While climate change is expected to continue through at least the end of this century, the magnitude and, in some cases, the nature of future changes is uncertain." It also reports that the relationship between climate change and its potential effect on water demand is not well understood, but "[i]t is unlikely that this level of uncertainty will diminish significantly in the foreseeable future." Still, changes in water supply are expected to occur, and many regional studies have shown that large changes in the reliability of water yields from reservoirs could result from only small changes in inflows (California Department of Water Resources 2006).

**Hydrology and Sea Level Rise:** As discussed above, climate changes could potentially affect: the amount of snowfall, rainfall and snow pack; the intensity and frequency of storms; flood hydrographs (flash floods, rain or snow events, coincidental high tide and high runoff events); sea level rise and coastal flooding; coastal erosion; and the potential for salt water intrusion. Sea level rise can be a product of global warming through two main processes: expansion of seawater as the oceans warm, and melting of ice over land. A rise in sea levels could result in coastal flooding and erosion and could jeopardize California's water supply. Increased storm intensity and frequency could affect the ability of flood-control facilities, including levees, to handle storm events.

**Agriculture:** California has a $30 billion agricultural industry that produces half the country's fruits and vegetables. Higher $CO_2$ levels can stimulate plant production and increase plant water-use efficiency. However, if temperatures rise and drier conditions prevail, water demand could increase; crop-yield could be threatened by a less reliable water supply; and greater ozone pollution could render plants more susceptible to pest and disease outbreaks. In addition, temperature increases could change the time of year certain crops, such as wine grapes, bloom or ripen, and thus affect their quality (California Climate Change Center 2006).

**Ecosystems and Wildlife:** Increases in global temperatures and the potential resulting changes in weather patterns could have ecological effects on a global and local scale. Increasing concentrations of GHGs are likely to accelerate the rate of climate change. Scientists expect that the average global surface temperature could rise by 2-11.5°F (1.1-6.4°C) by 2100, with significant regional variation (National Research Council 2010). Soil moisture is likely to decline in many regions, and intense rainstorms are likely to become more frequent. Sea level could rise as much as two feet along most of the U.S. coast. Rising temperatures could have four major impacts on plants and animals: (1) timing of ecological events; (2) geographic range; (3) species' composition within communities; and (4) ecosystem processes such as carbon cycling and storage (Parmesan & Galbraith 2004).

## 6.3 GHG Mitigation

The Business-as-Usual forecasts estimate future emissions consumption patterns and emission factors with the anticipated growth in the City. Anticipated growth is estimated using data from regional planning scenarios developed by Southern California Association of Governments, the City, and other relevant sources. The most relevant growth factors are used to project emissions by sector. Compound annual growth rates were developed using the growth projections from 2012 to 2020 and from 2021 to 2035. The City's community and municipal Business-As-Usual emissions in 2020 are estimated to be 262,363 $MTCO_2e$, or approximately a 9.5% decrease from the 2005 baseline emissions of 289,289 $MTCO_2e$. By 2035, emissions are estimated to decrease by approximately 9.4% from the baseline level to 262,083 $MTCO_2e$. The City's greenhouse gas inventory is summarized in Table 3, Citywide Greenhouse Gas Inventory ($MTCO_2e$), below.

**TABLE 3**
**CITYWIDE GREENHOUSE GAS INVENTORY ($MTCO_2e$)**

| Category | 2005 Baseline | BAU 2020 | 2035 | Adjusted BAU 2020 | Adjusted 2035 |
|---|---|---|---|---|---|
| Municipal Emissions | 2,291 | 2,291 | 2,291 | 2,177 | 2,177 |
| Community Emissions | 287,025 | 260,072 | 259,792 | 229,481 | 190,653 |
| *Total Citywide Emissions* | *289,289* | *262,363* | *262,083* | *231,658* | *192,830* |
| Reduction from 2005 Baseline | __ | -9.5% | -9.4% | -20% | -33% |

Numerous State measures, have been approved and/or adopted that will reduce GHG emissions in the City, once implemented. These measures do not require additional City action, but are accounted for in the City's emissions forecasts to provide a more accurate picture of future emissions and the level of action needed to reduce emissions to levels consistent with State recommendations. This forecast is called the Adjusted Business-As-Usual forecast.

Under the Adjusted Business-As-Usual scenario, City emissions were estimated to be 231,658 $MTCO_2e$ in 2020 and 192,830 $MTCO_2e$ in 2035. These emissions levels are 20% lower in 2020 than 2005 levels and 33% lower than 2005 levels by 2035. In 2020, the City is expected to meet the State-aligned reduction target through existing efforts and legislation. In 2035, the City would need to reduce 44,270 $MTCO_2e$ emissions below the 2035 Adjusted Business-As-Usual scenario to meet the State-aligned target.

Therefore, the City has started implementing new reduction measures and/or augmenting existing efforts as outlined in the City's Emissions Reduction Action Plan (ERAP) to meet the State-aligned target. Ongoing implementation of reduction measures provides additional reductions that will further help mitigate climate change and provide additional coverage if State measures do not achieve their anticipated reductions. The ERAP measures primarily focus on ways to reduce energy as energy usage accounted for 42% of all City GHG emissions in 2012. Additionally, residents emit more

GHGs from natural gas consumption than electricity consumption and residential and commercial/industrial energy use is increasing, with the exception of Residential natural gas use. Therefore, as outlined in the ERAP, the City plans on focusing on increasing energy efficiency and reducing GHG emissions from energy to meet attainment goals.

The City is implementing energy efficiency strategies, as outlined in the ERAP, to increase energy efficiency in both existing and new residential and commercial development, increase energy efficiency through water efficiency, and decrease energy demand through reducing the urban heat island effect. The City, through its partnership with the SBCCOG, will obtain and distribute educational content, energy audit services, and assistance identifying potential funding sources to help implement strategies. These City actions, combined with state measures, will lead to a 24% reduction from 2005 levels by 2020 and 54% reduction from 2005 levels by 2035 (Atkins 2015).

## 6.4 Climate Change Adaptations

The various implications of climate change are identified throughout this element, along with the Joint Hazards Mitigation Plan, with feasible methods to avoid or minimize the associated risks. In addition, a number of goals, policies, and implementation actions in the General Plan address sustainability and the reduction of the carbon footprint of the City. Specifically, the City will continue active participation in cooperative regional efforts to reduce pollutant emissions, as well as focus more attention on improvements at the local level. Implementation of these goals, policies, and programs would reduce impacts related to climate change associated with the General Plan which were incorporated in the following elements.

- Conservation and Open Space: Climate change policies for public/private facilities and development that recognize the sensitivity of the natural environment, as well as conservation policies specific to protecting and enhancing the natural communities
- Land Use: Residential and institutional land use policies that consider future growth, capacity limitations, and environmental factors of the city and Peninsula
- Circulation: Policies across transportation, infrastructure, resources, disposal/recovery, flood control/storm drain systems that provide guidance on plans and programs that would foster environmental conservation and promote hazard mitigation measures,
- Fiscal: Policies related to reducing the cost of operations through energy efficient methods, equipment, and infrastructure

## 6.5 Vulnerabilities in the City

Changes in weather and climatic conditions affect biological systems, ecosystems, and infrastructure. Anticipated vulnerabilities include an increased rate of fires, loss of natural resource, decreased water supply, and deteriorating public health.

**Rising Sea Levels:** Sea levels are projected to rise approximately 40 to 55 inches by year 2100. Most of the properties in the coastal zone are over 100' above sea level. Although flooding may not be of a high risk in the City, the rising sea levels may permanently damage beaches, tide pools, and increase the erosion rate of the cliffs that may lead to instability of developed properties along the coast.

Temperature Variability: Increased average temperature and extreme weather will lead to longer heat waves, reduced air quality, and changes in vegetation patters. There may be an increased risk in wildfires as a result of dry heat, drought, and increased evapotranspiration rates. Water supply may decrease, resulting from the impacts of drought, due to reductions in surface water and ground water. Residents may experience more heat-related illnesses, especially the elderly and children.

# 7 Other Hazards

## 7.1 Falling from Coastal Bluffs

The coastal bluffs that rise from the ocean are indeed an impressive and beautiful geologic phenomenon. The bluffs and associated seascape draw people from all over Southern California. This attraction causes visitors and residents alike to wander too close to the point of danger and fall, causing injury, and, in some cases, death. Weathering and other factors often leave the geologic structure weak and subject to breakage by the person who comes too close. Also, people have been known to fall due to stumbling while walking parallel to the bluff. In addition, people are often hurt while trying to descend or ascend the cliffs. This usually occurs when the person is "blazing" an unauthorized trail of his or her own instead of using an established trail access point. To prevent injuries or death, the City requires visitors use designated trails, avoid bluffs after dark, and wear appropriate shoes. In many areas, the City posts signage to warn visitors of the dangers near a cliff edge and to stay on authorized trails.

## 7.2 Wild and Domestic Animals

The historic development of the Peninsula has slowly eliminated several species of wildlife, such as the deer and eagle. However, many of the more adaptable species have remained. At the present time, wildlife populations consist of skunks, rabbits, small rodents, a variety of birds, reptiles, coyotes, and fox (see Conservation and Open Space ElementBiotic Resources). Peninsula wildlife does not pose a major health or safety problem to area residents; however, mixing wild animals, domestic animals, and humans create potential incidents of snake bites, rabies, etc.

Along with the usual domestic dogs and cats, the nature of development on the Peninsula has and will continue to allow for the keeping of certain large domestic animals, such as horses, in some areas. While no major safety or health concerns currently exist, occasionally isolated cases are reported. These cases most generally require preventative measures rather than specific health or medical measures.

# 8 Emergency Services

This section deals with various programs and services designed to avoid hazards, help during hazardous conditions, and/or provide assistance after a hazardous condition has occurred.

## 8.1 Emergency Medical Aid and Rescue

The City subcontracts ambulance service from a private company regulated by the Los Angeles County Fire Department. The ambulance vehicles are based in fire stations (Station Nos. 53, 56, 83, and 106) and an Ambulance Station (Red Cross Station No. 7) within the City of Rancho Palos Verdes.

Aside from the subcontracted ambulance service, a paramedic rescue squad (Los Angeles County Fire Department) serves the contracted areas on the Palos Verdes Peninsula. The City is served by one Paramedic Rescue Squad at Fire Station 106 on Indian Peak Road. The paramedic rescue program provides 24-hour service, ranging from aiding heart attack victims to assisting victims who may have fallen from one of the coastal bluffs, to aiding persons stuck in an elevator.

An additional form of rescue operation is provided for water-oriented activities. The Los Angeles County lifeguards are responsible for lifesaving operations at County beaches. Rescue operations for boats in distress off the Rancho Palos Verdes coast are currently provided by Los Angeles County, Los Angeles City, and the U.S. Coast Guard. Although each has its own jurisdiction, in an emergency, jurisdiction is rarely considered, but rather who can get there first. In particular, a base of the U.S. Coast Guard, which is a unique branch of the military responsible for saving lives and protecting the environment among other related duties, occupies the grounds of the Point Vicente Lighthouse within the City. In the past, the Coast Guard monitored international distress frequencies with a radio station and radio navigation beacon added to the lighthouse in 1934 until the task was transferred to another station in 1980. At present, the former radio center serves as the Coast Guard Auxiliary, composed of local civilians, who track distress calls from boaters, perform search and rescue duties in local waters, and maintain radio communication networks in Southern California (Palos Verdes on the Net).

## 8.2 Healthcare

The Palos Verdes Peninsula has the following acute care ("short-term") hospitals in Torrance and San Pedro, located approximately 15 minutes away (see Table 4, Area Hospitals).

**TABLE 4**
**AREA HOSPITALS**

| Hospital | Location |
|---|---|
| Del Amo Hospital | Torrance |
| Harbor - UCLA Medical Center | Torrance |
| Providence Little Company of Mary Medical Center | Torrance |
| Providence Little Company of Mary Medical Center | San Pedro |
| Torrance Memorial Medical Center | Torrance |

The Los Angeles County Department of Health Services (LACDHS) created a map in 2004, illustrating designated medically underserved areas and populations. The existing nearby hospitals are adequately meeting the needs of the City since the LAC DHS 2004 map excludes the City of Rancho Palos Verdes from areas that are designated medically underserved.

Basic health services, such as communicable disease control, public health administration, and enforcement of refuse collection ordinances, nursing, clinical services, and related activities are provided at no cost to the City by the LAC DHS.

## 8.3 Flood Control

The City of Rancho Palos Verdes is within the Los Angeles Flood Control District. The Flood Control District encompasses more than 3,000 square miles, 85 cities, and approximately 2.1 million land parcels. It includes the vast majority of drainage infrastructure within incorporated and unincorporated areas in every watershed.

The Flood Control District was established to provide flood protection, water conservation, recreation, and aesthetic enhancement within its boundaries and is the responsibility of the County of Los Angeles Department of Public Works. The Watershed Management Division is the planning and policy arm of the Flood Control District. The Public Works Flood Maintenance and Water Resources Divisions, respectively, oversee its maintenance and operational efforts.

The County Public Works Flood Maintenance and Water Resources Divisions are responsible for the operation and maintenance of County-owned storm drains and catch basins within the City. The County Department of Public Works monitors and prepares flooding and mudflow forecast prior to and during significant storms for impacts to the County-owned storm drains. The storm drains are generally inspected in a 5-year cycle, while catch basins are maintained more frequently.

While the County-owned storm drains are maintained by the County Public Works Flood Maintenance and Water Resources Divisions, the City-owned storm drains are the responsibility of the City's Public Works Department. The City Public Works Department is responsible for the operation and maintenance, including the cleaning of all City-owned storm drain catch basins at least twice per year and on a complaint basis.

In order to fund the operation and maintenance of City-owned storm drain systems, the City Council determined that a dedicated funding source was needed. Accordingly, in 2005, property owners approved the Storm Drain User Fee, which provides funding for the City's storm drain improvement and maintenance program. The Storm Drain User Fee is dedicated for the repair, reconstruction, and maintenance of City-owned storm drain systems throughout the City and for the installation of filtration devices to reduce polluted runoff and protect coastal water quality. Property owners pay the Storm Drain User Fee for parcels that use the City's storm drain system.

On November 6, 2007, the voters approved Measure C, an amendment to the user fee ordinance to include a voter enacted Oversight Committee and a 10-year sunset of the user fee. When the user fee rate was established by the property owners in 2005, the total user fees to be collected over 30 years was estimated to be about $50 million to pay for known construction projects, storm drain lining, maintenance, staffing, and engineering. The Storm Drain User Fee ended in 2016.

## 8.4 Police Protection

The City is part of a joint-contract with Los Angeles County Sheriff's Department for police protection. The Lomita Station opened in 1975 and provides police protection to the Peninsula Region, which is identified as the Cities of Rancho Palos Verdes, Rolling Hills Estates, and Rolling Hills.

The Sheriff's Department has three response categories: Emergency, Priority, and Routine for each city within the Peninsula Region. Table 5 provides annual response time for the City compared to the Sheriff's Department's targeted response time.

**TABLE 5**
**PALOS VERDES RESPONSE TIMES**

| Area<br>Response Time | Rancho Palos Verdes (minutes) | Los Angeles Sheriff's Department<br>Target (minutes) |
|---|---|---|
| Emergency | 5.5 | 7 |
| Priority | 9.7 | 20 |
| Routine | 23.7 | 60 |

Source: Los Angeles County Sheriff's Department 2014.

During emergency situations, back-up assistance can be provided by additional Sheriff's units normally assigned to nearby contract cities (Rolling Hills Estates, Rolling Hills, Lomita) and unincorporated areas of the County.

The Sheriff's Department provides assistance and information to the Rancho Palos Verdes Neighborhood Watch, which provides additional crime prevention and emergency preparedness resources for local homeowners participating in the program.

## 8.5 Fire Protection

Currently, the County of Los Angeles provides fire protection to the City through the operation of the fire stations in Table 6.

**TABLE 6**
**CITY FIRE STATIONS**

| Fire Station No. 53 | |
|---|---|
| Address | 6124 Palos Verdes Drive South, Rancho Palos Verdes |
| Equipment | 1 Fire Engine, 3 Personnel |
| **Fire Station No. 56** | |
| Address | 12 Crest Road West, Rolling Hills |
| Equipment | 1 Fire Engine, 1 Patrol Unit, 4 Personnel |
| **Fire Station No. 83** | |
| Address | 83 Miraleste Plaza, Rancho Palos Verdes |
| Equipment | 2 Fire Engines (active & reserve), 1 Patrol, 4 Personnel |

### TABLE 6
### CITY FIRE STATIONS

| Fire Station No. 106 | |
|---|---|
| Address | 413 Indian Peak Road, Rolling Hills Estates |
| Equipment | 1 Fire Engine, 1 Truck, 1 Paramedic Rescue Squad, 1 Battalion Chief, 1 Patrol, 1 Reserve Wagon, 1 Utility Vehicle, 12 Personnel |

The helicopter has also proven to be a very effective tool in fighting brush fires. The occasional brush fire in Rancho Palos Verdes frequently requires helicopter assistance, which has the capability of responding to a call within 20 minutes. Based in Pacoima, the Air Operations Section has a fleet of aircraft consisting of eight helicopters, with the newest models equipped with a 1,000-gallon water tank that uses a "constant flow" delivery system. Los Angeles County has designated the helicopter pads at the Nike Site (53 Alpha) and the Palos Verdes Coastguard Station (53 Charlie) to be used for water refueling.

Fire hazards can be minimized in two basic ways. The first method involves the reduction of fire starts. Preventative fire control emphasizes safety in the design, maintenance, and use of structures. Proper safety measures can effectively reduce the possibility of fire. The California Fire Code requires 20' to 26' minimum road widths, depending on the design, for adequate emergency vehicle access and a 3' to 5' minimum clearance around and between structures for adequate emergency personnel access around properties.

The second method of hazards reduction emphasizes the effective response aspect of fire control. Effective response can be assisted by providing necessary access and adequate amounts and pressures of water. The 2015 International Fire Code provides guidelines and standards for fire protection in urban settings and is enforced by the Local Fire Departments to reduce fire deaths, injury, and property loss.

## 8.6 Disaster Preparedness and Response

The Cities of Rancho Palos Verdes and Rolling Hills Estates developed a Joint Hazards Mitigation Plan in 2004. Based on the recently adopted 2010 Multi-Hazard Mitigation Plan for the State of California, the Joint Hazards Mitigation Plan was updated in 2014. Hazard mitigation is different from other disaster management functions as its purpose is to articulate measures that make development and the natural environment safer and more disaster-resilient. Mitigation generally describes a long-term prevention method involving alteration of physical environments, significantly reducing risks and vulnerability to hazards by altering the built environment so that life and property losses can be avoided or reduced. Mitigation measures also make it easier and less expensive to respond to and recover from disasters. Disaster preparedness is different from hazard mitigation in that it focuses on activities designed to make a person, place, organization, or community more prepared to take appropriate action in a disaster with emergency response, equipment, food, shelter, and medicine. Disaster preparedness is important because when time constraints or resources may delay or prevent certain long-term mitigation measures, emergency preparedness are short-term actions that can make it possible to respond and recover from disasters despite losses that may be unavoidable.

The City of Rancho Palos Verdes has been a member of the South Bay Office of Disaster Management's Area G since 1974. Area G covers all 14 cities in the South Bay and provides services to the City for disaster planning and training, as well as representation and liaison services to the Los Angeles County Operational Area, the Governor's Office of Emergency Services, and FEMA. The City has a joint powers agreement with the South Bay Office of Disaster Management for services. The Area G Coordinator is the on-call local expert who provides information and assistance to the City during an emergency or disaster.

The City has an Emergency Operations Plan that is based on Incident Command System principles and concepts within the Standardized Emergency Management System (SEMS). The SEMS and the National Incident Management System (NIMS) are compatible approaches, and the City recognizes these policies and uses the SEMS/NIMS as a basis for the Incident Command System structure. The SEMS/NIMS create a standard incident management system that is scalable and modular, and can be used in incidents of any size/complexity. These functional areas include command, operations, planning, logistics, and finance/administration. The SEMS/NIMS incorporate such principles as Unified Command and Area Command, ensuring further coordination for incidents involving multiple jurisdictions or agencies at any level of government.

Preparedness activities are necessary to the extent that mitigation measures have not, or cannot completely, prevent disaster. In the preparedness phase, governments, organizations, and individuals develop plans to save lives and minimize disaster damage. These activities serve to develop the response capabilities needed in the event of an emergency. The Emergency Operations Plan identifies many of the preparedness efforts that the City has undertaken or plans to undertake, such as preparedness plans, emergency exercises/training, emergency communication systems, evacuation plans/training, resource inventories, emergency personnel/contact lists, mutual aid agreements, public education/information, and improving evacuation routes (Figure 5, Disaster Routes).

The Emergency Operations Plan also details response activities the City will follow pending the occurrence of an actual disaster or emergency. These activities help to reduce casualties and damage, and speed recovery. Response activities could include public warning, notification of public authorities, evacuation, rescue, assistance, activation of the Emergency Operations Center, declarations of disaster, search and rescue, and other similar operations addressed in the updated Emergency Operations Plan.

## 8.7 Emergency Communications

In times of emergency, a dependable and flexible communications system is essential. The telephone is the fastest and most reliable form of communication available. The "911 Telephone System" provides a single emergency telephone number (911), which, when called, will be routed to the correct agency (e.g., fire, police, etc.). In 2007, an Emergency Communications Center was constructed at the City Hall complex to support the City's normal emergency communication systems. When activated due to the loss of the normal communication methods, the Emergency Communications Center provides emergency communications by utilizing amateur radio operators.

The amateur radio operators that would staff the Emergency Communications Center during times of emergency are part of the Los Angeles Disaster Communications Service (DCS). DCS is administered by the Sheriff's Department Emergency Operations Bureau. DCS is an element of the federal government's Radio Amateur Civil Emergency Service (RACES), which was established under the Federal Communications Commission Rules.

# Figure 5: Disaster Routes

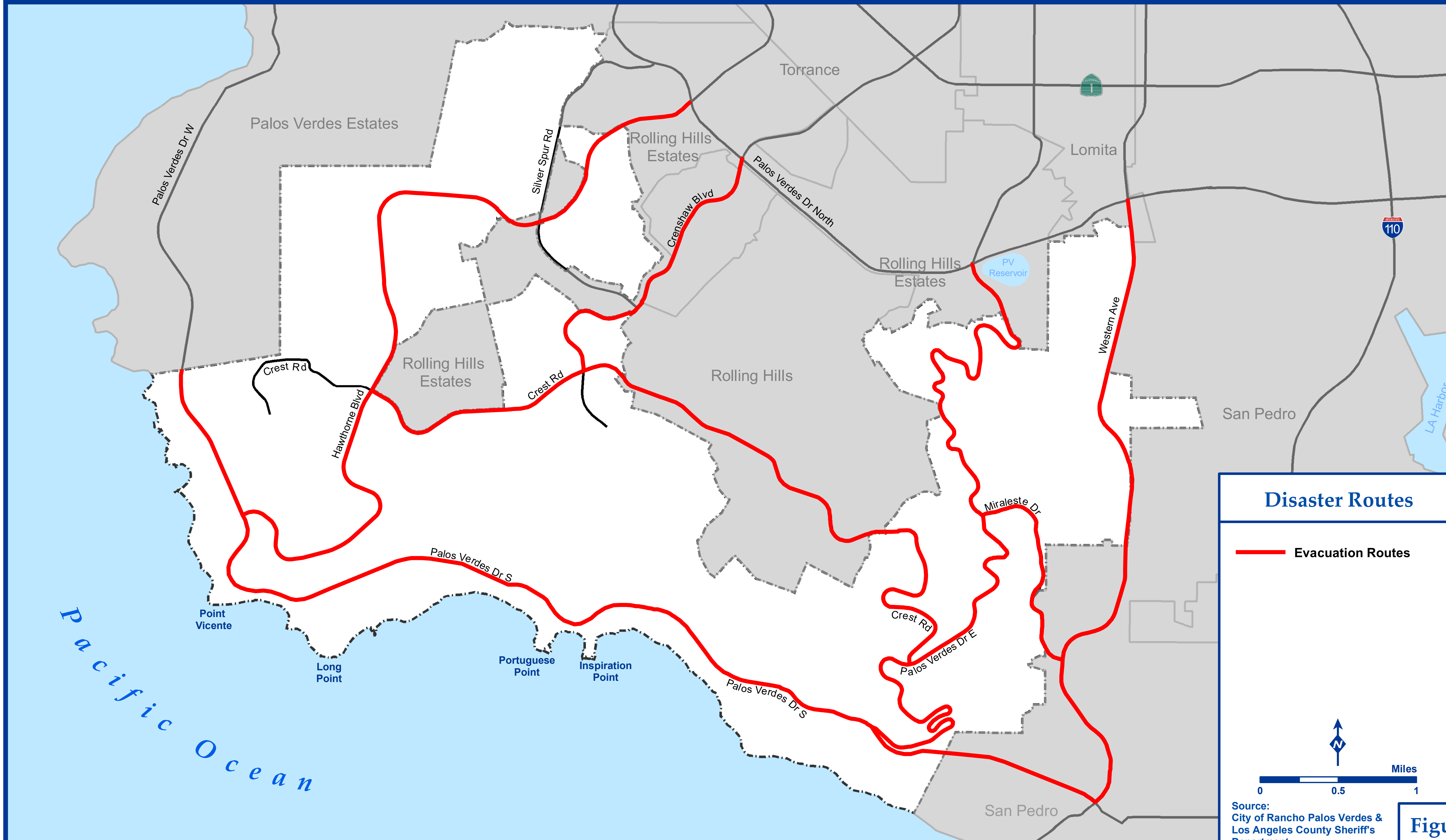



Figure 5

Regulations as part of the amateur radio service. RACES supports emergency management entities throughout the United States. During major incidents, DCS amateur radio operators coordinate, transmit, and receive command and liaison traffic for the County, City, Sheriff's Department, and Fire Department, as well as other disaster relief agencies.

In 2005, the City established the Peninsula Volunteer Alert Network with the goal of providing emergency communications at the neighborhood level. The Volunteer Network operators communicate to and from the City through the Emergency Communications Center. When completely staffed, there will be a Volunteer Network operator in each neighborhood supporting members of the Community Emergency Response Team (CERT) and Neighborhood Watch block captains.

# 9 Other Safety Services

## 9.1 Animal Control

Currently, the Los Angeles County Department of Animal Care and Control is contracted to enforce the provisions of the City's Animal Control Ordinance (Chapter 6.04), as well as to provide other animal-related functions. The animal control program consists of the following major operations:

- Enforcement:
  - Respond to allegations of code violations, such as leash law violations, the feeding of prohibited wildlife, etc.
  - Canvass for expired animal licenses, as needed or requested.
  - Investigate allegations of animal cruelty.
  - License and inspect animal-related businesses, as needed or requested.
  - Dog barking complaints
- Field Services and Outreach:
  - Renew animal licenses.
  - Provide low-cost vaccination clinics, as needed or requested.
  - Respond to service calls, such as stray and dead animal pickup.
  - Return identifiable animals to owners in field, when possible.
  - Provide educational materials and programs upon request, when available.
- Shelter Services:
  - Provide impounded animals with appropriate care, including food, shelter, and medical treatment.
  - Impound animals for at least the state-mandated holding period.
  - Vaccinate impounded animals, when necessary.
  - Provide adoption and fostering opportunities, when possible.
  - Post the photographs of impounded animals on the County's website to help owners find their lost pets.
  - Provide low-cost spay/neutering and free microchipping of all adopted animals.

In cases of natural disasters, such as fire and earthquakes, the Lomita Sheriff's Department implements an emergency evacuation plan to relocate animals to safety. The Lomita Sheriff's Department sponsors the Palos Verdes Peninsula Equine Rescue Team, which is a group of volunteers that is trained to conduct emergency rescue, evacuation, and sheltering services for horse and other large domestic animals during local emergencies, such as brush fires and inclement weather. According to the Los Angeles County Department of Animal Care and Control, the Carson shelter is designated as an emergency shelter for animals evacuated during disastrous events on the Peninsula. Additionally, the City has a Memorandum of Understanding with the Area G Veterinary Disaster Team, a California nonprofit corporation that assists in providing temporary housing for animals and emergency veterinary medical care by setting up a temporary triage animal center. The Veterinary Disaster Team also assists in supplying lost and found animal information services to the public.

## 9.2 Air Pollution Control

South Coast Air Quality Management District (AQMD) is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino Counties, the smoggiest region of the United States. Rancho Palos Verdes is part of the Western Region of AQMD's four-county jurisdiction. AQMD is responsible for controlling emissions primarily from stationary sources of air pollution, including anything from large power plants and refineries to the corner gas station.

AQMD develops and adopts an Air Quality Management Plan, which serves as the blueprint to bring areas into compliance with federal and state clean air standards. Permits are issued to many businesses and industries to ensure compliance with air quality rules. AQMD staff conducts periodic inspections and continuously monitor air quality from different locations throughout the four-county area. This allows AQMD to notify the public whenever air quality is unhealthy.

## 9.3 Codes and Ordinances

There are numerous codes and ordinances that set safety standards, specifications, and regulations. Although the City has developed certain safety regulations, contracts and service agreements with the County currently set most safety standards. The Building Code, Zoning Ordinance, and Subdivision Ordinance are enforced by the City's Community Development Department, while the Fire Code is enforced by the Los Angeles County Fire Department.

While the various codes and ordinances cannot be expected to be perfect for all situations, they should: "(1) reflect the concept of risk and uncertainty; (2) be dynamic in allowing for amendment resulting from new knowledge and improved understanding; (3) be rationally interrelated and tied to a plan which considers probable forms of natural disasters among its elements; (4) be based on a logic which the legislator, administrator, and citizen can fully comprehend; thus, allowing for effective participation in the decision-making process" (Petak et al 1973., p. 145).

One of the most significant and important documents relating to safety are the building codes. The City's Building and Safety Division uses the most up-to-date codes to implement and enforce construction standards. In addition to these codes, the Building and Safety Division coordinates with the City's geotechnical consultants on the review of geology and soils reports for various construction projects, primarily due to the area's physical characteristics, such as slope, soils, and geologic structure. Specifically, the primary purpose of the California Building, Plumbing, Mechanical, and Electrical Codes are to protect the public health, safety, and welfare by setting minimum construction and building standards that minimize hazard impacts.

The City adopted its original Development Code, Zoning, and Subdivision Ordinances in December 1975. As with most other codes and ordinances, the zoning ordinance is principally designed to protect the public health, safety, and general welfare. Within the numerous zoning districts (based on land use), regulations generally specify: the use or function of a structure; the density of population; the lot coverage (e.g., structure and open space); structure height, soil stability investigation; and the minimum setbacks of a structure. Over time, new and amended code sections have been added for a more effective implementation of the City's goals and objectives.

# 10 Hazard Potential and Risk

Analysis of the hazards inventory indicate that, while all hazards are of concern, geologic hazards (earthquakes and landslides, primarily), fire, and flood are potentially the most destructive in terms of life and property. Of these three, earthquakes and associated secondary effects are capable of the most widespread damage. Fire and floods are generally confined to isolated areas. This is due to the diverse topography and the ability of humans to prevent and/or deal with flooding and fires. This section discusses earthquakes and associated hazards in terms of potential destruction and risks.

The census indicates that fewer than 220 residential structures were constructed on the Peninsula prior to 1933. A majority of these older structures appear to be within the Palos Verdes Estates and Miraleste areas. In a larger earthquake, it is assumed that the major structural damage might result in buildings constructed before 1933, when building code requirements for seismic resistance were adopted. Furthermore, due to vintage and construction techniques, it is expected that the most vital public buildings (administrative, fire, police) will withstand major quakes and recover quickly enough to function as emergency operation assistance centers.

Estimates of infrastructure damage due to a major earthquake will vary from negligible to widespread. In the event of a significant earthquake, major supply lines (water, gas) may be subject to serious damage. Within Rancho Palos Verdes, the major concern lies with vital services located on landslide areas. An earthquake could trigger landslides, which could result in severe damage to the roadway, water, communications, and power networks. Furthermore, based on the condition of some of the water storage facilities and pipelines in the City, their ability to withstand a major earthquake is unclear.

The level of risk associated with each event caused by a fault is indicated by the recurrence interval in much the same manner as the risk from other natural hazards. For example, it is common practice to design flood-prevention works to accommodate the flows from a 100-year storm. Where a higher level of protection is desired, as, for example, along the Santa Ana River in Orange County, the design levels are increased to accommodate the flows from storms occurring at roughly 300-500 year intervals.

The risk of earthquake should be considered in a similar manner. Design for the 100-year event is considered minimum; where a higher level of protection is desired, such as for hospitals, design levels should be increased to protect against earthquakes with longer recurrence intervals. The levels in Table 7 are recommended for earthquakes expected from the Newport-Inglewood Fault zone.

**TABLE 7**
**RISK OF EARTHQUAKE**

| Use | Recurrence Interval | Expected Magnitude |
|---|---|---|
| Limited occupancy (warehouses, automated manufacturing facilities, etc.) | 100 years | 5.2 |
| Normal occupancy (residences, stores, etc.) | 150 years | 5.6 |
| Critical facilities (hospitals, fire and police stations, schools, critical utilities, etc.) | 300 years | 6.5 |

The risk of an earthquake from the San Andreas Fault is a special case. As discussed in the previous section, a major or "great" earthquake is considered imminent. As a result, it is recommended that tall structures, except possibly limited occupancy, be designed for an earthquake of magnitude 8.5 on the San Andreas Fault (Envicom).

# 11 Impacts

The intent of this element is to identify potential hazards and hazard areas, and to provide policies and recommendations by which to increase safety and reduce hazards. Although the principal impact of this section is, for the most part, expected to be beneficial to both humans and natural systems, some adverse economic conditions may arise.

The financial impact will probably be the City's greatest concern. The development of future safety programs and the possible expansion of existing programs may or may not require some public financing. If required, the initial costs of such programs, however, are expected to be largely offset by federal, state, and county assistance programs, and through the ultimate reduction of damage caused by hazards.

Costs to individuals may also increase in the form of construction costs, due to future building standards, and in the form of hazard prevention costs due to landscaping and services; however, these too are expected to be offset in the long term by reduction of damage and/or loss of possessions and individuals.

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