Safety Element

Thousand Oaks General Plan

City of Thousand Oaks

City of Thousand Oaks

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Chapter I

Introduction

CHAPTER 1: INTRODUCTION

A. Overview

The City of Thousand Oaks has prepared this revised Safety Element of the General Plan in compliance with California State law. This document supersedes the Safety Element prepared for the City in 1996 by Rincon Consultants. It complements and is consistent with the goals and policies and other elements that make up the City of Thousand Oaks General Plan.

The focus of the Safety Element is to adopt policies that will reduce death, injuries, property damage, and the economic and social dislocation resulting from natural hazards. Although the emphasis is on fire, flooding, geologic, and seismic hazards, other relevant issues include emergency preparedness, hazardous materials spills, terrorism, and critical and lifeline facilities. Section 65302 (g) of the Government Code specifies that:

The general plan shall include a safety element for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence and other geologic hazards known to the legislative body; flooding; and wildland and urban fires. The safety element shall include mapping of known seismic and other geologic hazards. It shall also address evacuation routes, peakload water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards.

An updated Safety Element assists the City in planning for hazards and responding to disasters by serving the following functions:

- Provide an accurate and updated assessment of natural and human-related hazards in the City Planning Area;
- Provide a framework by which safety considerations are introduced into the land use planning process;
- Provide policies that identify and reduce hazards;
- Strengthen preparedness concerning hazards specific to Thousand Oaks;
- Integrate this Element with the City's Hazard Mitigation Plan to ensure consistency with adopted policies and implementation measures.

The Safety Element became a mandatory part of the general plan in 1975 when the State Legislature adopted SB 271 (Chapter 1104). The initial legislation focused on the adoption of policies relating to fire safety, flooding, and geologic hazards. In 1984 the State revised the Legislation (AB 2038; Chapter 1009) expanding the list of safety element issues and combining the Safety Element and Seismic Safety Element into a single document. The adoption or amendment of a general plan is a legislative act.

B. Relation to Other Elements of the General Plan

The Safety Element and all elements of the General Plan have equal legal status. The Safety Element must also be consistent with the other elements of the General Plan, supporting and complementing the goals and policies of the related elements. For example, the Land Use Element establishes use and density designations, and controls zoning for all land citywide. Therefore, the Safety Element informs questions of use and density based on the degree of hazard that may be present. Open space designations are commonly linked to areas of geologic or flood hazard. The Circulation Element emphasizes transportation, which relates to the provision of emergency response in the event of a disaster.

This Safety Element is designed to provide the input necessary to assist the City of Thousand Oaks in achieving balanced planning decisions. It recognizes the importance of public safety, and the need to integrate safety concerns with other local issues.

C. Relation to City's Hazard Mitigation Plan

On October 12, 2004, the City adopted a Hazard Mitigation Plan. The Hazard Mitigation Plan is required by the Federal Mitigation Act of 2000 in order to prepare for and reduce the potential impacts of natural hazards, and is a pre-requisite to Federal hazard mitigation funding. The City's Hazard Mitigation Plan (HMP) was prepared according to Federal guidelines, and has been approved by the State Office of Emergency Services and the Federal Emergency Management Agency.

The HMP was based in part on the 1996 version of the Safety Element. It updated maps and data from the previous Safety Element, and provided additional background information. Both documents address the same type of natural and man-made hazards, and both identify goals and policies to reduce these hazards.

All of the policies from the 1996 Safety Element were included in the 2004 HMP. The HMP, however, incorporates policies from other General Plan Elements that relate to hazard prevention, i.e. certain Conservation Element and Open Space Element policies, and includes additional mitigation activities that are operational in nature, such as periodically inventorying emergency supplies. The HMP also provides a detailed risk assessment and loss estimates of each hazard.

The Safety Element therefore focuses on hazards in the context of land use planning per State requirements for General Plan adequacy, while the HMP provides an analysis of hazards per Federal requirements, including risk assessment and loss estimates.

D. Planning Area Setting

The City of Thousand Oaks is situated in the Conejo Valley of eastern Ventura County. The City includes the community of Newbury Park and part of the community of Westlake Village. It does not include the neighboring City of Westlake Village, which is in Los Angeles County. The City's Planning Area also includes unincorporated islands and adjacent unincorporated areas such as Lynn Ranch, Casa Conejo, Ventu Park, Kelly Estates, Miller Ranch and Rolling Oaks.

The Conejo Valley has distinctive geomorphic features comprised of mountains, artificial lakes and rolling hills with clearly defined access points to the City. The Valley is about nine miles long and seven miles wide and is situated at an elevation of about 800 feet above sea level. The Valley is rimmed by Mountclef Ridge and the Simi Hills to the north and east, the Santa Monica Mountains to the south, and Conejo Mountain to the west. The developed portions of the City are located primarily on the Conejo Valley floor and on slopes of less than 25% gradient.

Access to the City is primarily via seven major arterials. From the east, entrance to the Valley is via U.S. Route 101 (Ventura Freeway), Thousand Oaks Boulevard, and Agoura Road. From the west, access is via U.S. Route 101 over the Conejo Grade. Access from the north is via State Route 23 (Thousand Oaks Freeway), Moorpark Road and Olsen Road. From the south, access is available from State Route 23 at the east end of the City and from Potrero Road at the west end of the City.

The City provides police protection service by contract with the Ventura County Sheriff's Department. The main police station is located on Olsen Road near the northern City limits. Fire prevention and suppression services are provided within the City and adjacent unincorporated areas by the Ventura County Fire Protection District. Water is provided by three retail purveyors, including the City itself, each with its own service area. The retailers purchase water from Calleguas Municipal Water District which in turn purchases water from the Metropolitan Water District. Bard Reservoir, located northeast of the City, stores much of the water used by the City.

As of 2012, the City is served by two acute care hospitals: Los Robles Hospital and Medical Center (359 beds) and the Thousand Oaks Surgical Hospital (17 beds). The Los Robles Hospital and Medical Center operates the only trauma center in Thousand Oaks. There are also several urgent care facilities.

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Chapter 2

Geology & Seismicity

CHAPTER 2: GEOLOGY AND SEISMICITY

A. Faulting and Seismic Hazards

The City of Thousand Oaks lies in a seismically active area. No active faults have been mapped within the city limits, but two potentially active faults, the Boney Mountain and Sycamore Canyon faults, traverse parts of the City. Seismically induced ground shaking has affected the City in the past and is expected to affect the City in the future.

Ground shaking caused by the magnitude 6.7 Northridge Earthquake of January 17, 1994 resulted in the single most costly natural disaster in U.S. history. In the City of Thousand Oaks, located about 20 miles from the epicenter, over 850 building permits were issued to repair earthquake damage.

Based on seismic modeling, the Simi fault, located about one mile north of the Planning Area boundary (see Figure 1), is anticipated to be capable of generating the highest peak ground accelerations for the City. A maximum credible earthquake of 6.9 on the Simi fault would be capable of generating peak ground accelerations of 0.6 g and a Modified Mercalli Intensity (MMI) of X (see Table 1-1). Seismic experts believe that within the next 30 years, there is about a 40% chance of peak ground accelerations exceeding 0.2 g for the Thousand Oaks area, which corresponds to a MMI of VIII or greater.

Photo 1: Northridge Earthquake, Calif., January 17, 1994; Buildings, cars and personal property were destroyed when the earthquake struck. Approximately 114,000 residential and commercial structures were damaged and 72 deaths were attributed to the earthquake. Damage costs were estimated at $25 billion. (FEMA News Photo)

B. Regional Geology

Stratigraphy

Conejo Volcanics of Miocene age are found in the south and western parts of the City. These rocks are hard and generally stable. Softer marine sediments of the Topanga and Monterey formations of Miocene age are found within the eastern and southern areas of the City, and the Sespe, Llajas, Santa Susana, and Chatsworth formations of Oligocene to Cretaceous age are found near the northeast part of the City. Unconsolidated alluvial sediments are found within canyons and the Conejo Valley bottom.

The major rock sequences of the Thousand Oaks area [compilation of sources including, Weber (1973) and (1984), French (1980), and Diblee (1990) and (1993)] are described by age group from oldest to youngest as follows:

Chatsworth Formation (Kcs), Upper Cretaceous (99.6 to 65.5 mya) - Thick, mostly north dipping sequence of very resistant marine, arkosic sandstone, siltstone, and conglomerate. Outcrop restricted to small area in the eastern part of Conejo Valley.

Santa Susana Formation (Ts), Paleocene (65.5 to 55.8 mya) or Early Eocene (55.8 to 48.6 mya) - North dipping, marine claystone, siltstone and conglomerate. Outcrops in northeastern part of the valley.

Llajas Formation (Tll), Eocene (55.8 to 33.9 mya) - North dipping, claystone siltstone and sandstone. Outcrops in northeastern part of the valley.

Sespe Formation (Tsp), Oligocene (33.9 to 23.0 mya) - Non-marine sandstone and conglomerate with outcrops restricted to small exposure in the northeastern part of the valley.

Conejo Volcanics (Tcv), Middle Miocene (16 to 11.6 mya) - Mostly north dipping sequences of volcanics consisting of andesitic to basaltic flows, breccias, and agglomerates, tuffs, and dikes with a total thickness of 13,000 feet. These rocks crop out over much of the valley.

Topanga Formation (Tt), Middle Miocene (16 to 11.6 mya) - Marine clay shale, siltstone and sandstone that is time equivalent to the Conejo Volcanics and occurs both interbedded with it and in fault contact with it. Crops out over eastern half of the valley with total thickness of 9,000 feet.

Monterey Formation (Tm), Middle (16 to 11.6 mya) and Late Miocene (11.6 to 5.3 mya) - Described previously as the Modelo Formation (Weber, 1984). This unit is described as marine biogenic thinly bedded to finely laminated siliceous shales. This unit crops out over much of the eastern third of the valley.

Alluvium (Qal), Quaternary (2.6 mya to present) - Alluvium covers much of the floor of the Conejo Valley and the bottoms of stream channels. The alluvium is comprised of unconsolidated deposits of boulders, cobbles, pebbles, sand, silt, and clay deposited by streams. It is typically 100 feet or less in thickness.

Structural Geology

The City of Thousand Oaks lies within the very southern part of the west-central portion of the Transverse Ranges geologic province of southern California. This province is characterized by east-west trending folds, faults, and mountain ranges -- which is transverse to the northwest trend of most of the geologic features in California Structural geology of the region has been described in several reports including Weber (1973 and 1984), AEG (1981), and Yeats (1988 and 1994).

Hilly and mountainous areas within the Transverse Ranges are referred to as structural highs, whereas valley areas generally reflect structural lows (Weber, 1984). The Conejo Valley forms a structural low known as the Conejo-Las Virgenes low (roughly coincident with U.S. Highway 101). South of the Conejo Valley, the north edge of the Santa Monica Mountains forms a structural high. This structural high area comprises the southern margin of the Transverse Ranges province. North of the Conejo Valley is the Simi Hills structural high and further to the north lies the Simi-Tierra Rejada-Santa Rosa valleys structural low .

The Santa Monica and Conejo Mountain areas had their beginning in the Cretaceous period (over 75 million years ago). During this time, marine and non-marine sediments began accumulating in the subsiding Ventura Basin. Following the emplacement of the sediments, the area was affected by volcanic activity, faulting, and folding. The latest period of major tectonics occurred during the middle of the Pleistocene (about 1 million years ago), when most of the present land forms were formed.

Regional east to west trending folds have been accompanied by simultaneous reverse faulting (Weber, 1984). The Malibu Coast Fault (to the south) and the Simi-Santa Rosa fault zone (to the north along the northern edge of the Tierra Rejada and Simi valleys) are the major reverse faults in the vicinity of the site. These faults are considered the most likely sites for nearby possibly damaging earthquakes that could affect the Thousand Oaks area. Figure 1 shows the location of these faults.

No active faults have been mapped within the City of Thousand Oaks. Two Quaternary age faults (faults with movement in the last.1.6 million years), the Boney Mountain and Sycamore Canyon faults, cross within the city limits (Diblee and Ehrenspeck, 1990).

C. Seismic Setting

The regular occurrence of earthquakes in the southern California area serves as ongoing evidence that the area is seismically active. Although nothing can be done to prevent the occurrence of earthquakes, through proper construction design and planning, their destructive effects can be reduced. Within the last several decades, there has been a recognition that structures should not be built over active fault traces. Ongoing earthquake research has resulted in improved construction standards for buildings, roadways, and other structures. Another approach to increasing awareness of seismic hazards has been the State requirement that local governments address seismic safety issues in their General Plans [Government Code Section 65302(g)]. This

Safety Element meets the requirement to consider the goals, programs, and policies that are to be followed to reduce the danger of earthquakes.

Earthquake hazards are manifested in many ways, including ground rupture, ground shaking, landslides, tsunamis, liquefaction, and seiches. Secondary hazards that can be caused by earthquakes include flooding due to dam failure, urban fires, and toxic chemical releases. The Seismic Hazards section of this document focuses on the hazards of ground shaking, liquefaction, and ground rupture that could occur within the City of Thousand Oaks.

Regional Seismicity and Earthquake History

Earthquakes occur along active faults. One of the tools used in the evaluation of seismic risk is the historical earthquake record. These records list when an earthquake occurred, its epicenter and depth below ground surface, and strength (Modified Mercalli Intensity or Magnitude). Seismic records in southern California date back about 200 years -- to the time of Spanish colonization. Earthquake recurrence along an individual fault can be on the order of thousands of years, so the historical record alone is not sufficient to fully determine the seismic risk that an area may experience. Despite these limitations, a review of historical seismicity has value in evaluating the seismicity that an area may undergo. The accuracy of the database increases with time; events before about 1940 are based on colloquial data and are not instrumentally recorded. These events, therefore, may not accurately locate the recorded event.

Historical Seismicity of the Thousand Oaks Area

Records of historical earthquakes that have affected southern California are maintained by the United States Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). A NOAA data base search was performed for the City of Thousand Oaks (34° 10.5' North, 118°50' West) which is in the vicinity of Hillcrest Drive and Hampshire Road. Earthquakes greater than magnitude 4 and within 50 miles of the site were plotted. Earthquakes with magnitudes of less than 4 were eliminated from the record because earthquake damage occurs from larger magnitude events (typically events greater than magnitude 5). Elimination of the smaller magnitude events thus serves to screen out seismic noise and minor events that pose an insignificant seismic risk. A 50-mile radius was selected to focus on faulting that has the greatest potential to cause damaging ground shaking. Because the strength of ground shaking diminishes with distance, events beyond 50 miles pose a minor ground shaking risk to the Thousand Oaks area.

A total of 612 earthquakes, including duplicated events, are listed on the NOAA earthquake file. The data base includes the Northridge (1994, magnitude 6.7), Whittier (1987, magnitude 5.9), Point Mugu (1973, magnitude 5.9), San Fernando (1971, magnitude 6.5), Arvin-Tehachapi (1952, magnitude 7.7), Santa Barbara Channel (1812, magnitude 7.2, 1941, magnitude 5.9, and 1968, magnitude 5.7) and Long Beach (1933, magnitude 6.3) earthquakes. The recorded earthquake nearest to the City of Thousand Oaks occurred in 1911. This event occurred 5 miles from the search location, had a magnitude of 4 and a MMI of IV. Ten events (two of which are suspected duplicates) have been recorded within 10 miles of this site. Of these 10 events, the one with the greatest magnitude (4.7) was recorded in 1976 and was located about 9 miles from the site search point. Two hundred and three events (including duplicates) have been recorded within 20 miles of the site. This distance includes the Northridge earthquake (1994, magnitude 6.7, MMI IX, located about 17 miles from the search point) and related aftershocks, and aftershocks associates with the San Fernando (1971, magnitude 6.5) earthquake.

The greatest magnitude event listed in the NOAA search is a magnitude 7.2 event which occurred in 1812. This earthquake was located in the Santa Barbara Channel, and was located about 50 miles from the site. Ten earthquakes having a magnitude of 6 or greater are listed in the NOAA data base. The nearest magnitude 6 or greater event was the Northridge (1994, magnitude 6.7) earthquake, located about 17 miles from the site.

Summary

The Thousand Oaks area is in a seismically active region. The NOAA data base of historical seismicity listed 612 events within 50 miles of the project area. The nearest recorded earthquake occurred 5 miles from the project search area. This event had a magnitude of 4. The greatest recorded earthquake within 50 miles of the site was a magnitude 7.2 event within the Santa Barbara Channel which occurred in 1812. Ten earthquakes having a magnitude of 6 or greater were listed in the NOAA data search. The nearest magnitude 6 or greater was the Northridge (1994) earthquake, having a magnitude of 6.7 and located 17 miles from the site.

D. Geologic Hazards

Geologic hazards that pose the greatest concern to the City of Thousand Oaks include seismically induced ground shaking, fault rupture, landslides, debris flows, mudslides, rockfalls, expansive soils, and flooding (Weber, 1984). All of these hazards have affected Thousand Oaks to some extent since the mid-1950s, when rapid development began. An awareness of these potential geohazards is needed with increased population density and encroachment into the hills and mountains.

Ground Shaking

Earthquake-generated ground shaking is the greatest cause of widespread damage in an earthquake. The California Seismic Safety Commission (1993, 1994) estimates that ground shaking causes 99% of the earthquake damage to residences and other structures in California. Local conditions can greatly influence the intensity of ground shaking. Types of soil depth to bedrock, depth to groundwater, and orientation of the fault movement all influence the intensity of ground shaking.

Ground shaking is the shock wave produced when there is a sudden movement created by an earthquake rupture. Seismic energy is lost and the intensity of the wave diminishes as the shock wave travels away from the point of rupture (epicenter). In general, ground shaking diminishes as the distance from the earthquake epicenter increases. This attenuation relationship has been studied by numerous scientists, resulting in several attenuation models. Distance from the epicenter also affects the form of the ground shaking. Near (within about 10 miles) the epicenter, one may feel a sharp, high frequency shock wave. This type of shock wave tends to affect short (one to two story) structures. At greater distances, the high frequency shock wave is attenuated and one feels a rolling motion. This rolling motion tends to affect higher structures (multi-story structures, towers, large tanks).

A common scale used to measure the magnitude of an earthquake is the Richter scale. Richter magnitude is a logarithmic measurement of the maximum motion of the earthquake event as recorded on a seismograph. Richter magnitude is defined as the logarithm of the maximum amplitude on a seismogram written by an instrument of a specified standard type calculated to be at a distance of 62 miles (100 km) from the epicenter. By definition, Richter magnitude is fixed to an event and does not vary with distance. Seismically induced ground shaking can also be measured quantitatively as ground surface acceleration (acceleration with respect to the force of gravity-[g]), and qualitatively by the modified Mercalli scale (see Table 1). Because of the attenuation of ground shaking with distance, modified Mercalli intensities (MMIs) vary depending on distance from the earthquake, soil type, resonance of the underlying sediments, and other site specific phenomena.

One way that geologists classify faults is on their movement history. As defined by the California State Mining and Geology Board (Hart, 1994), faults that have had surface displacement within the last 11,000 years (Holocene age) are considered active faults. Faults are considered potentially active if they show evidence of surface displacement during Quaternary time (within the last 1.6 million years).

When designing a structure, it is important to consider the likely earthquake that a fault can produce. A maximum probable earthquake is the largest earthquake that is expected to be produced within a 100-200 year time frame. Because the life of most structures is on the order of this range, maximum probable earthquakes are commonly used as design criteria for a structure. A maximum credible earthquake is the largest event that can be produced by a particular fault, regardless of time span. For critical structures, such as dams, emergency operation centers, fire stations, nuclear power plants, and other similar buildings, the maximum credible earthquake is often used as the seismic design criteria.

Table 1: Modified Mercalli Intensity Scale

Intensity	Description
I	Not felt. Marginal and long-period effects of large earthquakes.
II	Felt by persons at rest, on upper floors, or favorably placed.
III	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV	Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frames creak.
V	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
VI	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle).
VII	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII	Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Frame structures, if not bolted, shifted off foundations. Frames cracked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas, sand and mud ejected, earthquake fountains, sand craters.
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud horizontally on beaches and flat land. Rails bent slightly.
XI	Rails bent greatly. Underground pipelines completely out of service.
XII	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Definition of Masonry A, B, C, D:

Masonry A: Good workmanship, mortar and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.

Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.

Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.

Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

Hazard Analysis

No active faults have been mapped within the City of Thousand Oaks planning area boundary. However, because of the proximity of active faults, ground shaking has affected and will continue to affect the Thousand Oaks area.

Ground shaking caused by the magnitude 6.7 Northridge Earthquake of January 17, 1994 resulted in the single most costly natural disaster in U.S. history (Earthquake Engineering Research Center, 1994). Over 33 fatalities and 7,000 injuries were attributed to the earthquake (Science, 1994). Damages were widespread and included six sections of collapsed highway structures, thousands of damaged or destroyed residential and commercial structures, widespread disruption of utilities and other lifeline facilities, and numerous landslides and soil embankment failures (Earthquake Engineering Research Center, 1994). In all, over 14,000 structures in 28 cities were damaged by the earthquake. In the City of Thousand Oaks, located about 20 miles from the epicenter, over 850 building permits were issued by the City to repair earthquake damage.

As stated previously, ground shaking attenuates with distance, thus, active faults near the City of Thousand Oaks have the potential to produce the greatest ground accelerations. The 1994 Northridge earthquake resulted in accelerations (rock sites) of up to about 0.5 g near the epicenter and accelerations of about 0.25 to 0.3 g near the City of Thousand Oaks (EERC, 1994).

Table 2 provides a listing of the closest and most significant faults that are modeled herein to predict ground shaking within the planning area. This information is taken from the City of Thousand Oaks Local Hazard Mitigation Plan (2004).

Table 2: Estimated Ground Accelerations and Intensities

Faults	Design Magnitude	Distance In Miles	Peak Ground Acceleration[4]	Modified Mercalli Intensity
Regional Faults				
Simi - Santa Rosa	6.9[1]	1-8	0.28-0.6	IX-X
Chatsworth	6.3[1]	6-16	0.12-0.3	VIII-IX
Malibu Coast	7.3[2]	8-16	0.2-0.3	VIII-IX
Oak Ridge	7.3[2]	8-17	0.2-0.3	VIII-IX
Santa Monica Mtns. Thrust	7.2[1]	9[2]	0.26	IX
Santa Susana	6.9[2]	9-20	0.13-0.23	VIII-IX
Northridge Hills	6.6[1]	9-20	0.11-0.21	VIII-IX
San Fernando	6.8[2]	18-29	0.08-0.15	VII-VIII
San Gabriel	7[1]	19-30	0.1-0.15	VII-VIII
San Andreas	8.25	39-50	0.11-0.15	VIII
Local Faults				
Boney Mountain	6[3]	0.6-7	0.2-0.5	VIII-X
Sycamore Canyon	6.2[3]	0.6-7	0.21-0.51	IX-X

1-Wesnousky (1986)
2- Dolan et al (1994)
3- Slemmons (1977)
4- Idriss (1985)
5- Evernden and Thomson (1985)

Table 2 also lists maximum credible earthquake (MCE) magnitudes, peak ground accelerations and modified Mercalli intensities for each fault. Attenuation relationships developed by Idriss (1985) – which are applicable for rock sites - were used to calculate peak ground accelerations. MMIs were calculated for each fault using the relationship between ground shaking intensity and MMI (Evemden and Thomson, 1985). MMIs can be influenced by site specific features, such as the thickness of loosely consolidated alluvium and the depth to groundwater. These factors have not been included in the calculation of expected MMIs, thus, the actual intensities that are felt at a site could differ from the levels calculated here. Figure 1 and Figure 2 show the locations of faults in close proximity to Thousand Oaks.

Photo 2: Northridge Earthquake, Calif., January 17, 1994 (FEMA News Photo)

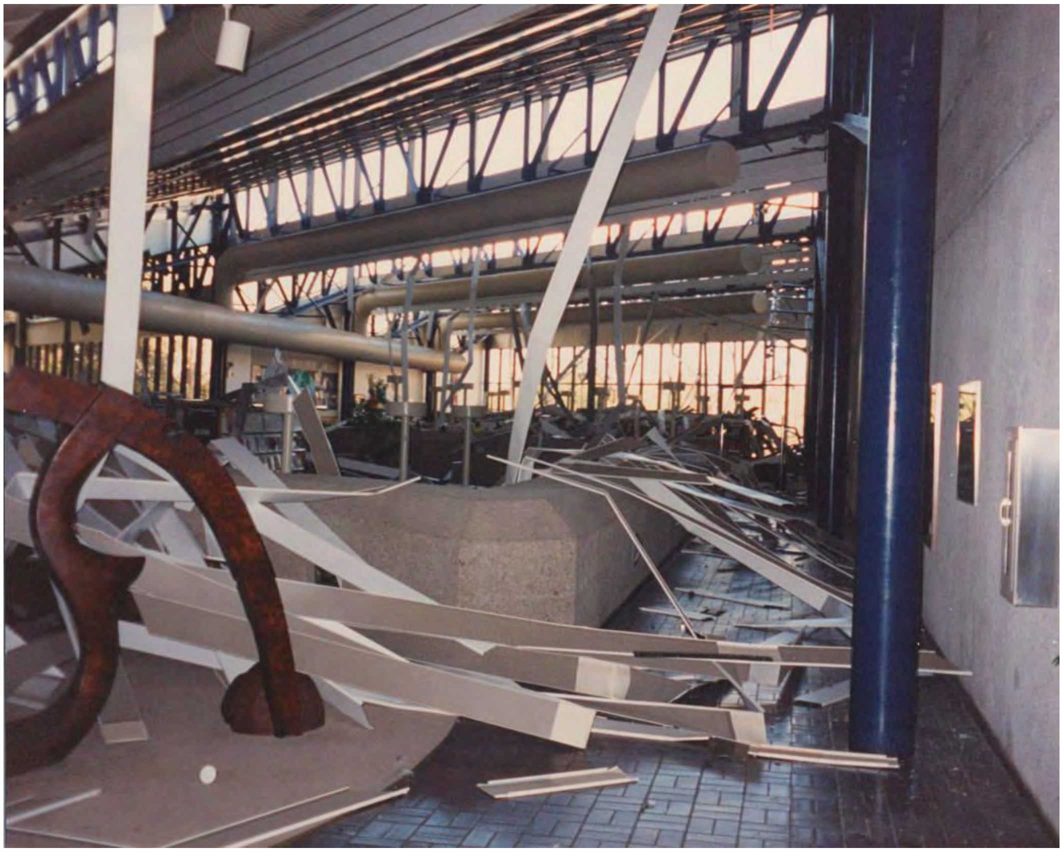
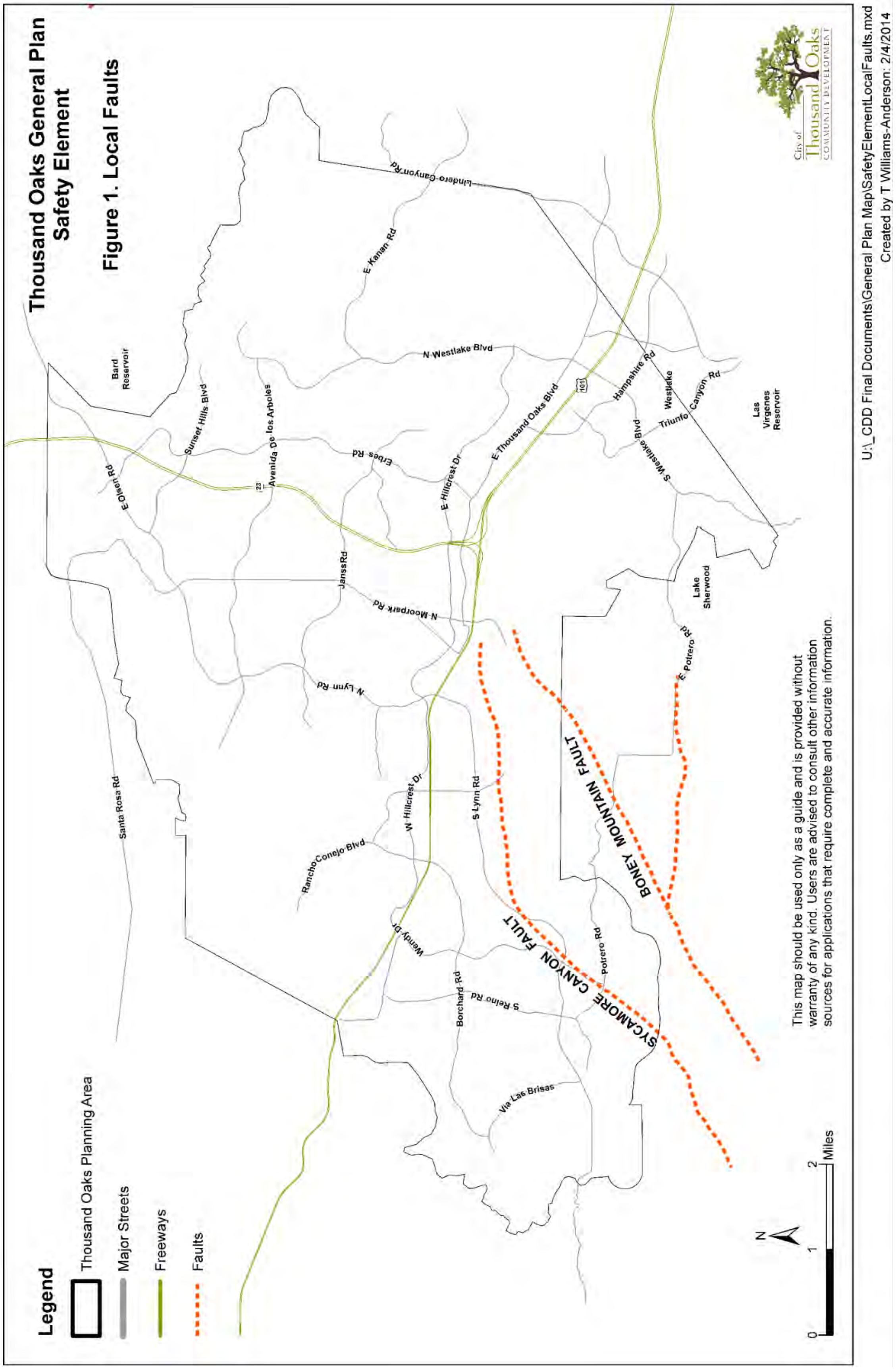
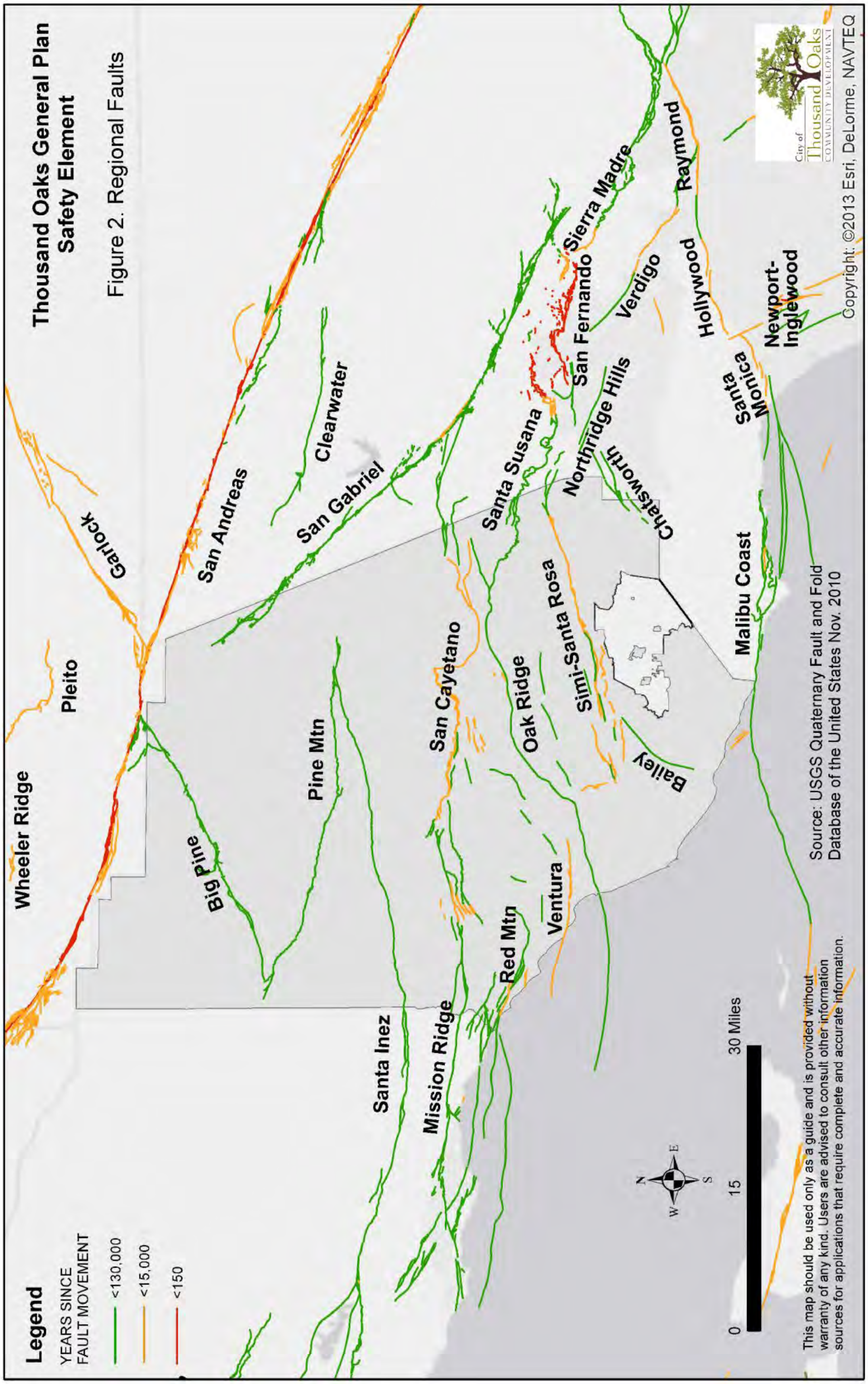


Photo 3: 1994 Northridge Earthquake Damage to Thousand Oaks Library


Thousand Oaks General Plan
Safety Element
Figure 1. Local Faults
Legend
Thousand Oaks Planning Area
Major Streets
Freeways
Faults
SYCAMORE CANYON FAULT
BONEY MOUNTAIN FAULT
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Bard Reservoir
Sunset Hills Blvd
Avenida De los Arboles
E Olsen Rd
Erbes Rd
E Hillcrest Dr
E Thousand Oaks Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
Las Virgenes Reservoir
Lake Sherwood
Janss Rd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
Potrero Rd
Borchard Rd
S Reino Rd
Via Las Brisas
101
23
N
0
1
2
Miles
This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require complete and accurate information.
City of Thousand Oaks
COMMUNITY DEVELOPMENT
U:_CDD Final Documents\General Plan Map\SafetyElementLocalFaults.mxd
Created by T Williams-Anderson: 2/4/2014



U:_CDD Final Documents\General Plan Map\SafetyElementRegionalFaultMap.mxd

Following is a description of the faults located within or near to Thousand Oaks, as well as faults of regional significance:

Sycamore Canyon Fault: As shown on the Fault Activity Map of California (Jennings, 1994), the Sycamore Canyon fault has Quaternary but not Holocene offsets (i.e., offsets occurred between 11,000 and 1.6 million years ago). This fault, therefore, is considered potentially active. The Sycamore Canyon fault has a mapped length of about 13 miles (Jennings and Strand, 1969) and extends from the Pacific Ocean northeast to Thousand Oaks. The Sycamore Canyon fault crosses within the city boundary. If this fault were to be active, it would be expected to create a maximum credible earthquake of 6.2 (Slemmons, 1977) and could potentially produce ground accelerations of 0.21-0.51. Because this fault is so close, ground shaking would be a sharp, high frequency wave.

Ground shaking intensities from a Sycamore Canyon fault earthquake range from MMI IX to X. The peak ground level acceleration attenuates as distance from the fault increases, resulting in a decline in intensity away from the fault.

Boney Mountain Fault: The Boney Mountain fault is also shown on the Fault Activity Map of California (Jennings, 1994) as having Quaternary but not Holocene activity (i.e., offsets between 11,000 and 1.6 million years ago). Thus, this fault is considered potentially active. The Boney Mountain fault has a mapped length of about 9 miles (Jennings and Strand, 1969) and extends from the coastline northeast towards Thousand Oaks. This fault is modeled to produce a maximum credible earthquake of 6 (Slemmons, 1977). Ground accelerations could range from 0.2-0.5 and:MMI could range from VITI-X. Because this fault is so close, ground shaking would be a sharp, high frequency wave.

L-I Lineament: The L-I bedrock fault, located in the southwestern portion of the City, is a near vertical fault located within the Conejo Volcanics. The L-I fault was originally mapped as a prominent lineament defined by vegetation alignments. As part of the proposed Dos Vientos development project in the southwestern portion of the City, the lineament was trenched at numerous locations and was judged to be a bedrock fault that does not penetrate the overlying pre-Holocene (12,000 to 15,000 year old) surficial deposits (Keith W. Ehlert Consulting Engineering Geologist, 1994). The fault is, thus, not believed to be active. Because no sediments or soil profiles older than 15,000 years old overlie the Miocene Conejo Volcanics, which are about 15 million years old, it is possible that the L-I fault could be Quaternary in age and, thus, potentially active. Quaternary activity on this fault is thought to be unlikely, though (Keith W. Ehlert Consulting Engineering Geologist, 1994), for the following reasons: 1) this fault is thought to be a vertical fault in contrast to contemporary seismicity and associated active faults in the Transverse Ranges which are almost exclusively associated with north-dipping reverse faults, and 2) the fault does not appear to be a major feature that extends for any great distance. Because of the questionable history of activity on this fault, this fault is not depicted on Figure 1 and an acceleration or intensity has not been assigned herein.

San Cayetano Fault: The San Cayetano fault is part of a series of north-dipping reverse faults extending from Santa Barbara County into Los Angeles County. The maximum likely earthquake magnitude for the San Cayetano Fault system is 6.7 with a recurrence interval of 2,908 years (Source: Ventura County Hazard Mitigation Plan, 2010).

Simi – Santa Rosa Fault: The Simi- Santa Rosa fault is the nearest active fault to Thousand Oaks crossing within about 1 mile of the City (Jennings, 1994). This fault extends from the Las Posas Hills area near Camarillo (where it is mapped by Jennings and Strand [1969] as the Santa Rosa fault) eastward through the southern flank of Big Mountain (the northern edge of Simi Valley). This fault aligns with the Northridge Hills fault which continues eastward into the San Fernando Valley. The Simi fault (including the Santa Rosa fault) has a mapped length of about 28 miles (Jennings and Strand, 1969) and is described by Irvine (1991) as a northern dipping reverse fault. Although offset along this fault is late Quaternary in age, there also appears to some evidence of Holocene fault activity (Ziony and Yerkes, 1985 and Blake, 1991) and, thus, for purposes of this study is considered active. A magnitude 6.7 earthquake is projected for this fault with a recurrence interval of approximately 933 years (2010 Ventura County Hazard Mitigation Plan, URS, 2010).

Malibu Coast Fault: The Malibu Coast fault is mapped by Jennings and Strand (1969) as an east-west trending reverse fault. The fault is located within about eight miles south of Thousand Oaks with a fault length of 18 miles. The Malibu Coast fault extends from west of Point Dume near the Ventura-Los Angeles County line, eastward to the City of Santa Monica. There, it is aligned with the Santa Monica-Raymond Hill fault. Jennings (1994) describes this fault as having Late Quaternary to Holocene displacement and is thus, classified as an active fault. The maximum likely earthquake magnitude for the Malibu Coast Fault is 6.7 with a recurrence interval of 2,908 years (Source: Ventura County Hazard Mitigation Plan, URS, 2010).

Oakridge Fault: The Oak Ridge fault is an east-west trending fault that traverses much of the Santa Clara River Valley about 8 miles north of the City of Thousand Oaks.. There is little evidence of surface rupture along this fault. Only short sections of this fault have been identified in the Moorpark Quadrangle, Special Studies Zones map prepared by the California Geological Survey. This fault is a steeply dipping reverse fault that has an onshore length of about 25 miles (SCEC, 1995). As described by Yeats and Huftile (l995), the 1994 Northridge earthquake may have occurred on a continuation of the Oak Ridge fault system. The maximum likely earthquake magnitude for the Oak Ridge fault is 6.7 with a recurrence interval of 299 years (Source: Ventura County Hazard Mitigation Plan, URS, 2010). The Oak Ridge fault is located within about eight miles north of the City of Thousand Oaks.

San Andreas Fault: The San Andreas fault is mapped by Jennings (l994) as a northwest-southeast trending active fault with a length of over 600 miles. This fault forms the plate tectonic boundary between the Pacific plate to the west and the North American plate to the east. Numerous earthquakes have been recorded along the San Andreas fault. Of the faults discussed here, the San Andreas fault has the highest possibility of future rupture. Because this fault is located about 40 miles from Thousand

Oaks at its closest approach, ground shaking from a San Andreas fault event would be somewhat attenuated by the time it reached the City.

The maximum likely earthquake magnitude for the San Andreas Fault is 8.0 with a recurrence interval of 300 years (Source: Ventura County Hazard Mitigation Plan, URS, 2010).

Blind Thrust Faults

Low angle thrust faults, known as blind thrust/faults, have recently been recognized as a seismic risk in southern California. Blind thrust faults are low angle features that do not reach the ground surface but do have surface expressions in the form of overlying folds that grow during large earthquakes. The seismic hazard from blind thrust faults has been demonstrated by the Northridge (1994) and the Whittier Narrows (1987) earthquakes. The magnitude 6.7 Northridge earthquake was produced by a south dipping blind thrust fault extending northward from beneath the San Fernando Valley to the Santa Susana Mountains (Jackson et al, 1995). The magnitude of an earthquake that a blind thrust can produce is dependent on the fault's area and characteristic displacement. Earthquakes ranging in size from m = 6.4 to m = 7.5 can be expected on individual blind thrust segments.

The Santa Monica Mountains blind thrust (Petersen and Wesnousky, 1994) underlies the Santa Monica Mountains, extending inland from the Malibu coastline area. This thrust system may extend below the City of Thousand Oaks as identified in recent publications by Dolan et al (1995) and others. Rupture of the Santa Monica Mountains blind thrust fault is believed to be active and is estimated to be capable of producing a magnitude 7.2 earthquake every 740 years (Dolan et al, 1995). Slip rate on this blind thrust fault is estimated to be about 4 mm per year. Based on a near distance (beneath the City) of 9 miles, peak ground accelerations could be on the order of 0.26 and a MMI of IX.

In 2003, California Geological Survey developed an updated map of earthquake shaking potential for California. Figure 3 indicates the level of earthquake hazard based on the 2003 California Geological Survey data (Source: City of Thousand Oaks, Local Hazard Mitigation Plan, 2004). Regions near major, active faults (shown in red and pink) experience stronger and more frequent shaking. Regions that are far from active faults (shown in orange and yellow) experience weaker and less frequent shaking.

Summary

The City of Thousand Oaks lies in a seismically active area. Although no active faults have been mapped within the city limits, two potentially active faults (Boney Mountain and Sycamore Canyon faults) do traverse parts of the City. Five earthquake events were modeled to determine peak ground accelerations and MMIs that could affect the City. Based on the models, the greatest ground acceleration that the City would be subject to is a peak: ground acceleration of 0.6 g, which correlates to a MMI of X. Such an event could be produced from a maximum credible earthquake of 6.9 occurring along the Simi fault. In areas of loosely consolidated alluvium or areas with a water table within 30 feet from ground surface, MMI levels may be greater than the values calculated in the model.

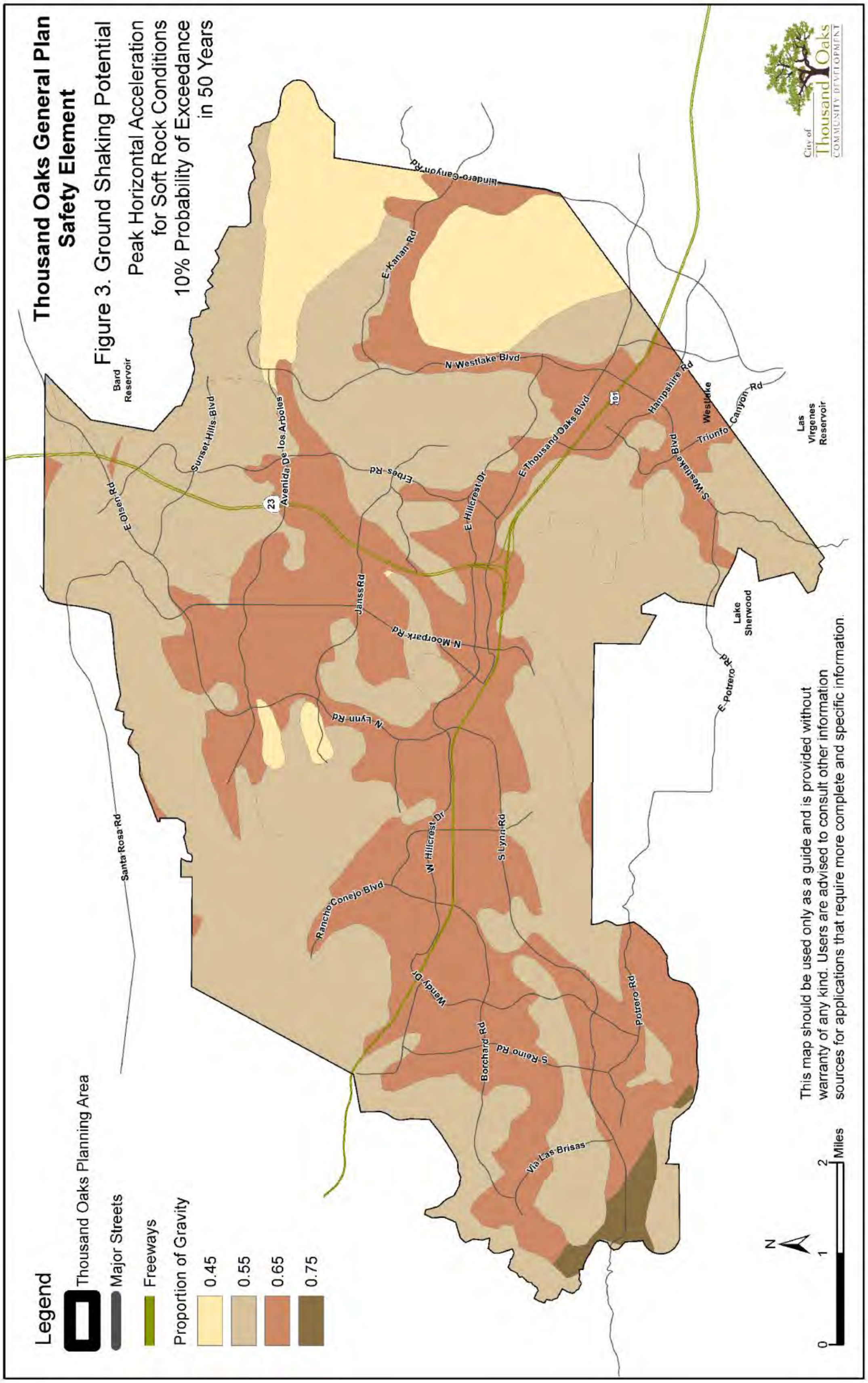
The most recent modeling efforts of seismic experts (probabilistic modeling) have attempted to evaluate earthquake potential for a given area by factoring all available potential fault sources. Jackson et al (1995) have estimated that by 2025, there is about a 40% chance of peak ground accelerations exceeding 0.2 g for the Thousand Oaks area. This corresponds to a MMI of VIII or greater.

Proper design of new structures and strengthening of existing structures can reduce or prevent damage associated with ground shaking. Conformance-with the California Building Code in the building of new structures helps reduce the likelihood of damage. In residences, most of the damage caused by ground shaking is the result of:

- Unbraced water heaters,
- Houses that have weak cripple walls, or are on pier-and-post foundation, and
- Houses not adequately anchored to their foundations
- Much of the life-threatening earthquake damage to commercial property is caused by:
    - Walls that are poorly anchored to the roof or floors,
    - Unreinforced masonry walls, and
    - Poorly reinforced concrete walls or columns.

The majority of buildings in the Thousand Oaks area were constructed from the 1950's on, and do not have unreinforced masonry walls. The California Seismic Safety Commission (1993, 1994) has published guidebooks that assist property owners with identifying structural weaknesses and provide recommendations for mitigating these problems. These guidebooks can be ordered directly through the Seismic Safety Commission (Sacramento) and are entitled:

- The Homeowners Guide to Earthquake Safety
- The Commercial Property Owner ~ Guide to Earthquake Safety


Thousand Oaks General Plan
Safety Element
Figure 3. Ground Shaking Potential
Peak Horizontal Acceleration
for Soft Rock Conditions
10% Probability of Exceedance
in 50 Years
Legend
Thousand Oaks Planning Area
Major Streets
Freeways
Proportion of Gravity
0.45
0.55
0.65
0.75
0
1
2
Miles
N
This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
Created by T Williams-Anderson: 2/4/2014
Bard Reservoir
Las Virgenes Reservoir
Lake Sherwood
Westlake
N Westlake Blvd
E Thousand Oaks Blvd
Hampshire Rd
Triunfo Canyon Rd
S Westlake Blvd
E Hillcrest Dr
Erbes Rd
Avenida De Los Arboles
Sunset Hills Blvd
E Olsen Rd
Janss Rd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
Rancho Conejo Blvd
W Hillcrest Dr
S Lynn Rd
Wendy Dr
Borchard Rd
S Reino Rd
Potrero Rd
Via Las Brisas
E Kanan Rd
Lindero Canyon Rd
23
101

The City of Thousand Oaks conducted a study of earthquake safety for existing steel water reservoirs in 1985 (Perliter & Ingalsbe Consulting Engineers, 1985). The purpose of the study was to determine the safety of reservoirs constructed prior to 1971 and to make recommendations for improving the safety of those reservoirs where appropriate. All of the listed reservoirs were seismically upgraded.

The City operated sixteen potable water storage reservoirs in 2012. The Pederson Reservoir received seismic retrofits in 2012. In 2012, HDR conducted a seismic evaluation and structural retrofit study of the remaining fifteen reservoirs (HDR, "Citywide Reservoir Seismic Evaluation/ Structural Retrofit, City of Thousand Oaks; MI 2094"; November 2012). The report included detailed recommendations for every reservoir including seismic safety recommendations to improve anchoring, providing more flexible couplings and lowering water levels to increase freeboard.

The private water purveyors in the City, California American Water and California Water Services Company also conduct seismic safety reviews of their water storage reservoirs. In 2012, California Water reported that it inspects its Thousand Oaks storage tanks (6 tanks) every 5 years. The tanks are inspected for structural integrity, seismic retrofits and other several other items. Tanks are also examined after major storms, seismic events, acts of vandalism and/or security breaches. Corrective measures are taken as needed. For example, the Harris reservoir, constructed in 1977, was replaced in 2011 to mitigate structural integrity concerns and stabilize the site geology.

California American also does periodic planning studies that include seismic safety reviews of its water storage reservoirs in Thousand Oaks. The company completed a planning study of its 22 water tanks in 2012.

<u>Fault Rupture Hazard</u>

Ground rupture occurs when displacement along a fault reaches the ground surface. Ground rupture capable of causing several inches or greater displacement could have a catastrophic effect on the integrity of a structure. Thus, setbacks from active fault traces are incorporated into determining areas that are suitable to develop. A difficulty in determining the fault rupture hazard is predicting where future ground rupture will occur. Fault displacement often is within a fault zone and not necessarily along exact traces of previous breaks. Also, movement typically is along more than one fault break.

The Alquist-Priolo Earthquake Fault Zoning Act, signed into law in 1972, addresses development in areas prone to faulting. Under the act, the State Geologist is required to delineate earthquake fault zones along known active faults in California. The act defines active faults as one which has "had surface displacement within Holocene time (about the last 11,000 years)" [Hart, 1994]. Cities and counties affected by the zones must regulate certain development within the zones. For proposed development within one of the fault zones, a geologic study must be performed to demonstrate that the sites are not threatened by ground rupture from future faulting.

Hazard Analysis

No mapped active faults have been identified within the city limits of Thousand Oaks. Thus, there are no Alquist-Priolo special study areas within the city limits. The lack of mapped active faults within the City does not preclude ground rupture from occurring within the City. However, until there is evidence of active faulting within Thousand Oaks, the risk of seismically induced ground rupture appears to be minor. Although the Alquist-Priolo Act pertains to active faults, a conservative planning approach would be to limit the development along traces of potentially active faults within the City (Sycamore Canyon and Boney Mountain faults).

Summary

No Alquist-Priolo Special Study Zones have been designated within the City of Thousand Oaks. As geologic studies are performed, there is the possibility that active faults may be identified. Thousand Oaks should follow the guidelines of the Alquist-Priolo act for proposed new development within the City. A setback from the mapped potentially active faults should be considered for all development, and especially for critical facilities. Setback distances should be determined through engineering geologic investigation.

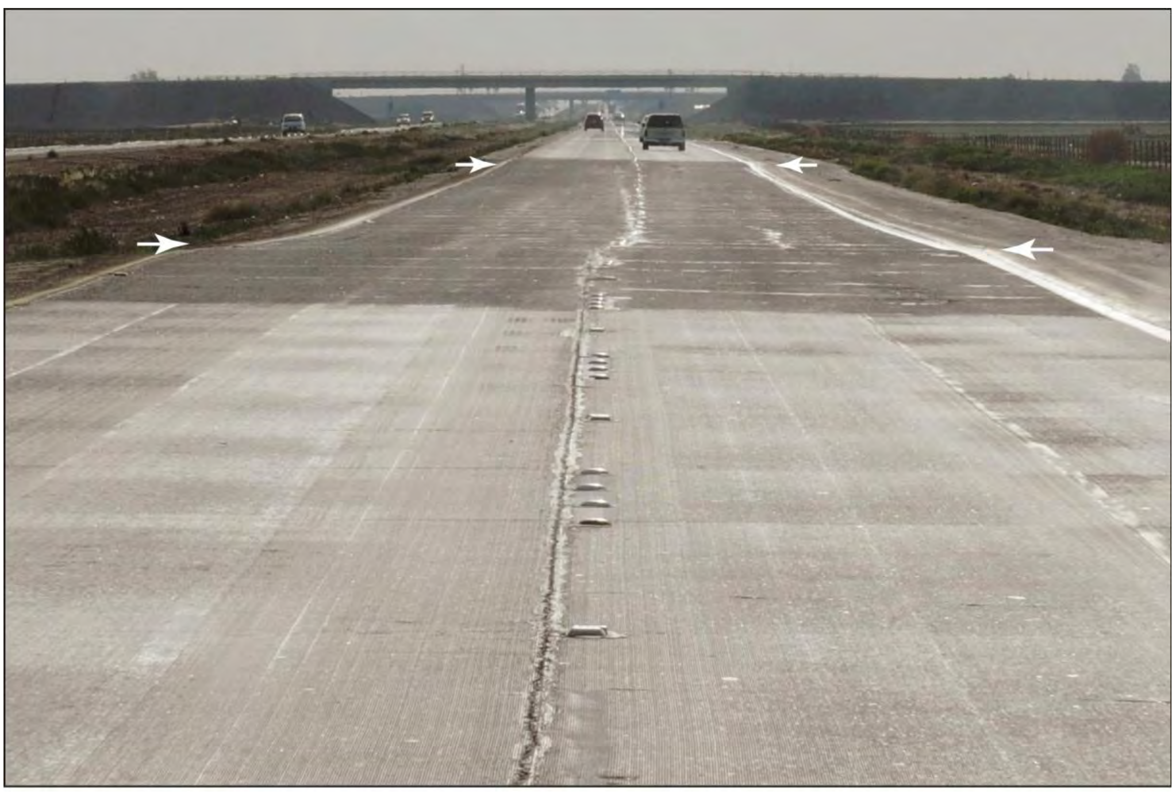


Photo 4: Road Displacement Due to Ground Rupture (USGS Open-File Report 2010-1333 and CGS Special Report 221, Fig. 14E)

Liquefaction

Liquefaction is a phenomenon that occurs when loosely consolidated soils lose their load bearing capabilities during shaking and flow in a fluid-like manner. Liquefaction typically occurs in water saturated loosely compacted fine to medium grained sand where the groundwater table is within about 50 feet below grade. When these materials are shaken, such as during an earthquake, pore pressure of the sediments increases, causing the sediment to behave as a liquid. Where the liquefied layer occurs near the ground surface, structures built on such a layer could sink into the ground. Other effects of liquefaction include lateral spread, flow failures, ground oscillations, and loss of bearing strength (Tinsley et al, 1985). Because liquefaction occurs in sediments, areas of bedrock are not considered liquefiable.

Lateral spread is the movement of blocks of ground as a result of liquefaction in a subsurface layer. During liquefaction of a subsurface layer of sediment into a fluid mass, gravity can cause the mass to flow down slope. Examples of this include movement into a cut slope such as a river channel, irrigation channel, or a storm drain. Lateral spread typically occurs on gentle slopes ranging from 0.3° to 3°. Ground movement of several feet to tens of feet is possible. Lateral spread is particularly destructive for pipelines, utilities, bridge piers, and other structures having shallow foundations.

Ground oscillation may take place where liquefaction occurs at depth and where the ground slope is too gentle for lateral spreading. When deeper zones liquefy, overlying sediment that are not liquefied can decouple and differentially move. The result is a ground wave; ground settlement and opening and closing of fissures are manifestations of ground oscillation.

Flow failure occurs when blocks of ground are decoupled from underlying sediment and move downslope. Flow failures occur on slopes greater than 3°. These blocks can be quite large, from tens of feet to several miles in length and width. Flow failures comprise the greatest hazard produced by liquefaction.

Loss of bearing strength can occur under a structure when the underlying soil liquefies. Large movement in the soil column is possible, allowing for structures to settle, tip, or float upwards.

Conditions that favor liquefaction include areas of young (recently deposited) sediments, the looseness of cohesionless soil, and the depth to groundwater. Because young sediments tend to be poorly consolidated, recently deposited material, such as river and flood plain deposits, are more susceptible to liquefaction than other types of sedimentary deposits. The distribution of sediment grain size also influence the susceptibility of liquefaction. Silty sand deposits have the greatest potential for liquefaction. Gravely sand or deposits having less than 15 percent clay are susceptible to liquefaction, whereas bouldery and cobbly gravels or deposits containing more than 15 percent clay are not known to liquefy (Tinsley et al, 1985).

Depth to groundwater influences the susceptibility for liquefaction. Where groundwater is within 10 feet from ground surface, the susceptibility is very high. For groundwater between 10 and 30 feet, the susceptibility is high. For groundwater at 30 to 50 feet below grade, the susceptibility is low, and for groundwater deeper than 50 feet, the susceptibility is very low.

The magnitude and duration of ground shaking also has an influence on the susceptibility of liquefaction. The larger the magnitude of an earthquake, the greater the distance at which liquefaction is observed. Similarly, the longer the duration of shaking, the greater the distance at which liquefaction is observed.

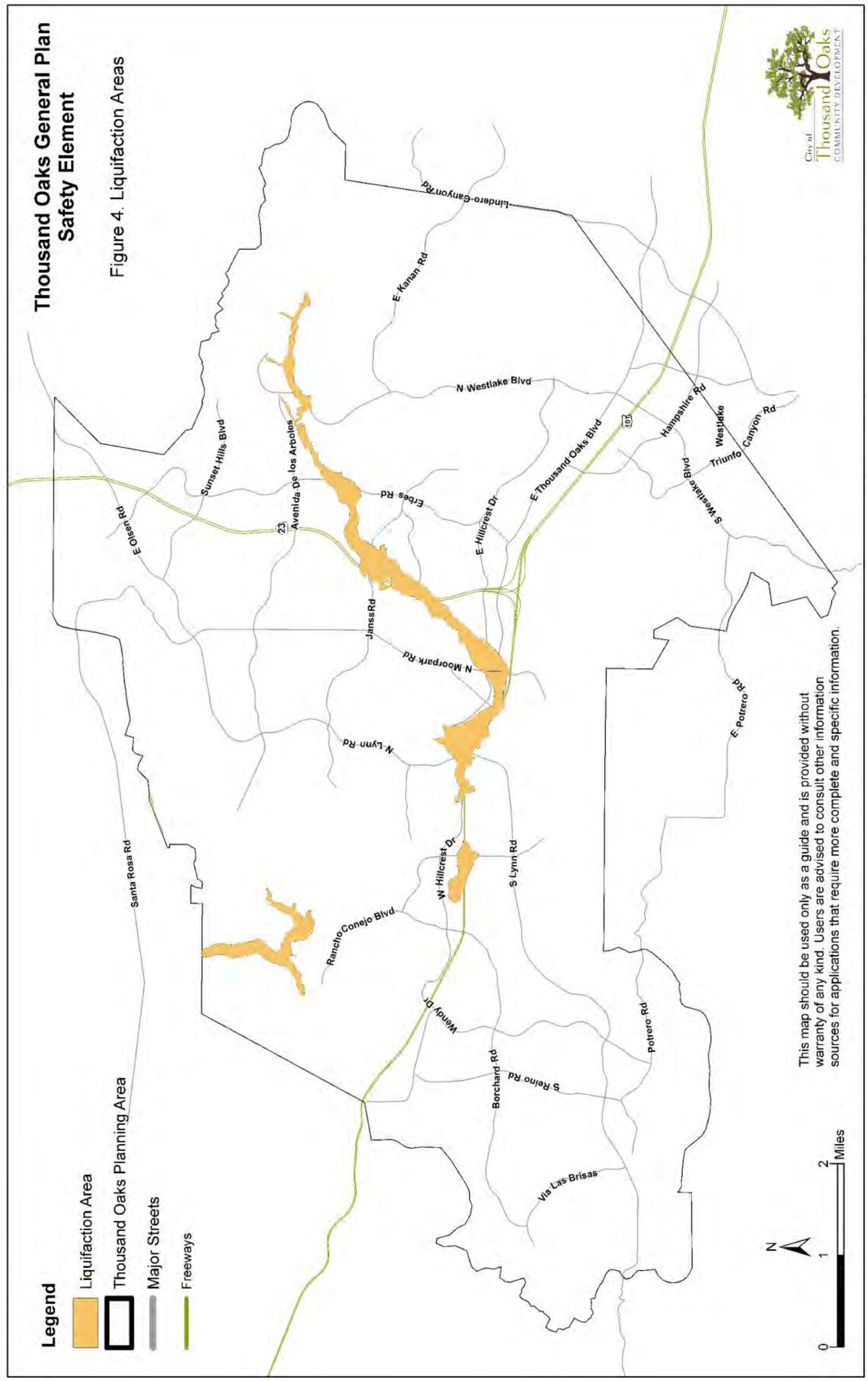
Hazard Analysis

Much of the City of Thousand Oaks lies on bedrock, thus, is not susceptible to liquefaction. Areas of the City underlain by unconsolidated alluvium, such as along canyons and the floor of the Conejo Valley, may be susceptible. Ground water levels in the Conejo Valley Basin fluctuate considerably -- being highly dependent on rainfall. In the past five years, it appears that much of the basin may have had ground water levels within about 10 to 20 feet from ground surface. Thus, based on groundwater depths only (and not taking into account soil composition), the entire alluvial basin may be susceptible to liquefaction during periods of relatively high rainfall. In areas where the subsurface sediments have a high clay content (greater than 15%) or are very coarse grained (cobbles or boulders), the susceptibility to liquefaction would be decreased. No detailed liquefaction studies have been performed for the Thousand Oaks area.

To more accurately determine the potential for liquefaction, site specific geologic studies are required. These studies should be performed in areas with a moderate to high liquefaction potential prior to new construction and for the retrofitting of critical facilities. The studies should include site specific depth to groundwater and stratigraphy of the underlying sediments. Areas having liquefiable sediments should be identified, and structures should be properly designed to withstand the conditions.

Summary

Areas of unconsolidated alluvium and shallow groundwater exist within the City of Thousand Oaks. In such a setting, there is a potential for liquefaction to occur. Factors that influence liquefaction include soil composition (sand, silt, clay, cobbles, boulders), seismically induced ground shaking intensity, duration of ground shaking, and depth to groundwater. Figure 4 depicts areas of liquefaction potential derived from Seismic Hazard Zones maps prepared by the California Department of Conservation, Division of Mines and Geology (Thousand Oaks Quadrangle, released Nov. 17, 2000; Newbury Park Quadrangle, released February 7, 2002). Detailed liquefaction analyses are necessary prior to development to evaluate the site specific liquefaction potential and determine what it needed to mitigate the hazard.


Thousand Oaks General Plan
Safety Element
Figure 4. Liquifaction Areas
Legend
Liquifaction Area
Thousand Oaks Planning Area
Major Streets
Freeways
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Miles
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This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
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City of Thousand Oaks
COMMUNITY DEVELOPMENT
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Sunset Hills Blvd
Avenida De los Arboles
Erbes Rd
E Hillcrest Dr
E Thousand Oaks Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
E Olsen Rd
Janss Rd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
Potrero Rd
Borchard Rd
S Reino Rd
Via Las Brisas
23
101

E. Slope Stability (Landslides, Debris Flows, Rockfalls, and Mudslides)

Landslides, debris flows, rockfalls, and mudslides all occur within the planning area. All are manifestations of gravity driven flows of earth materials due to slope instability. Hill slopes naturally have a tendency to fail. Unless engineered properly, development in hillside areas tends to increase the potential for slope failures. Slope modification by grading, changes in the infiltration of surface water, and undercutting slopes can create unstable hill slopes, resulting in landslides or debris flows.

Much of the City of Thousand Oaks is comprised of topographically pronounced areas. These hill slopes and mountains consist of sedimentary and volcanic rock outcrops that are locally covered with soil. Slope instability is of greatest concern in these topographically pronounced areas. The majority of landslide and slope wash problems in the Thousand Oaks area occur in geologic terrenes involving folded sequences of clay shale, siltstone, and very fine-grained sandstone of the Monterey (Modelo) and Topanga Formations - especially in north facing slopes. These fine-grained units are easily eroded, resulting in the undermining of slopes which then tend to fail. If the slopes are unstabilized, seismically induced ground shaking can trigger the landslide movement. Several landslides are depicted on geologic maps of the Thousand Oaks area (Weber, 1984- Diblee, 1990 and 1993; Yerkes, 1991). The largest ancient landslide mapped in the planning area is in the vicinity of Lang Ranch and is commonly referred to as the Erbes Road landslide. This bedrock landslide encompasses about 230 acres and involves slightly folded and contorted but mostly gently dipping shale bedrock of the Monterey (Modelo) Formation (Weber, 1984).

Debris and mud flows often occur after periods of precipitation. Water soaked soil and rock are destabilized by the weight of the water. Often compounding the added weight is erosion of the base of a hill slope. Once this slope becomes destabilized, the water. soil, and mud mass is driven downhill by gravity. Numerous mud and debris flows occurred during the very heavy rains of January 1969. One death was attributed to these incidents.

Rockfalls occur in virtually all types of rocks and especially on slopes steeper than 40°. Areas of primary risk from rockfalls are those located at the base of steep, high slopes where rock outcroppings (usually Conejo Volcanics) are susceptible to dislodgment of large boulders. These conditions are locally present along the northwest, west and south margins of the planning area. Rockfalls are usually triggered by seismically induced ground shaking or by erosional destabilization of a hill slope.

Hazard Analysis

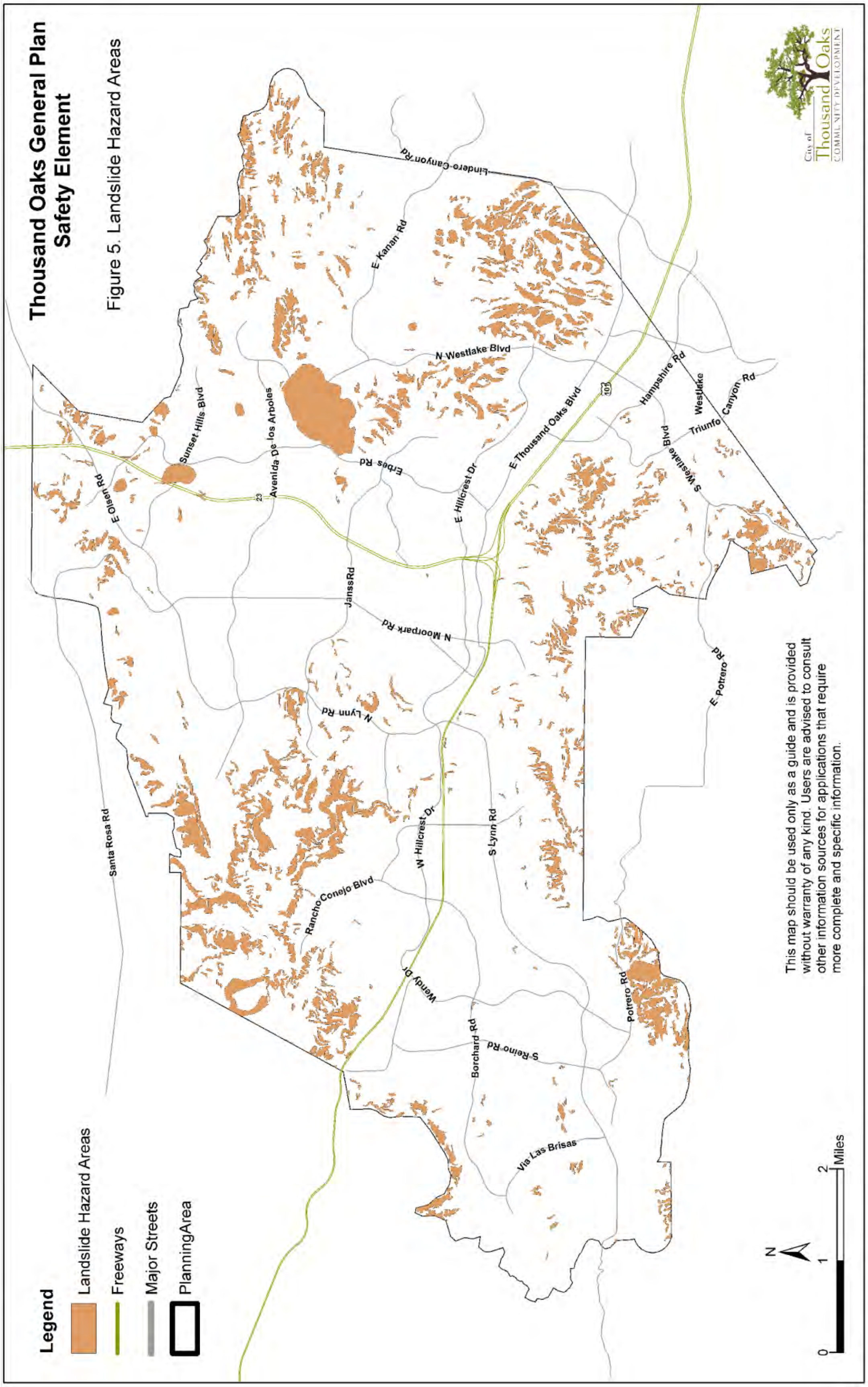
Numerous landslides have been mapped within the hillsides of the City of Thousand Oaks (Weber, 1984; Diblee, 1990 and 1993; Yerkes, 1991). The hillsides also are prone to rockfalls, mudflows, and debris flows. Because many factors contribute to the instability of hill slopes (precipitation, soil and rock lithology and in duration, seismic ground shaking, steepness of slope), the California Building Code requires that site specific investigations be performed for development on hillsides. These include:

- Requiring preliminary studies by qualified geotechnical engineers and engineering geologists
- Requiring developers to retain both engineering geologists and geotechnical engineers during construction
- Requiring certification as to the stability of the proposed building site to adverse effects of rain and earthquakes prior to the issuance of building permits
- Assuring the coordination between the civil engineer and the project engineering geologist/geotechnical engineer during the supervision of construction grading
- Requiring the mitigation of onsite hazards caused by grading that may affect adjacent properties, including erosion and slope instability.

Areas having the potential for earthquake induced landslides are depicted on Figure 5. This information was obtained from Seismic Hazard Zones maps prepared by the California Department of Conservation, Division of Mines and Geology (Thousand Oaks Quadrangle, released Nov. 17, 2000; Newbury Park Quadrangle, released February 7, 2002). Development within these areas should follow the appropriate CBC criteria and site specific studies should be performed prior to development.

Summary

Numerous landslides have been mapped within the hillsides of the City of Thousand Oaks. These hillsides also pose a high risk of debris flows, mudflows, and rockfalls. Land development near or at the base of canyons, cliffs, or landslides should take these hazards into consideration during the planning, construction and life of the development. Site specific geologic studies should be conducted and measures should be implemented, as appropriate, to mitigate potential impacts associated with these geohazards. Slope stability hazards encountered during the construction phase should be mitigated to minimize future problems.


Thousand Oaks General Plan
Safety Element
Figure 5. Landslide Hazard Areas
Legend
Landslide Hazard Areas
Freeways
Major Streets
PlanningArea
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Miles
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This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
U:_CDD Final Documents\General Plan Map\SafetyElementLandslideHazardAreas1.mxd
Created by T Williams-Anderson: 3/5/2014
City of Thousand Oaks
Community Development
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Sunset Hills Blvd
Avenida De los Arboles
E Olsen Rd
Erbes Rd
E Hillcrest Dr
E Thousand Oaks Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
JanssRd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
Borchard Rd
S Reino Rd
Potrero Rd
Via Las Brisas

F. Soil Related Hazards

Soil related hazards include expansive soils, settlement, subsidence, and hydrocompaction. This section focuses on areas within the City of Thousand Oaks that have the potential for these soil problems.

Expansive Soils

Expansive soils are characterized as having a high shrink-swell potential (U.S. Soil Conservation Service, 1970). The shrink-swell potential of a soil refers to the change in volume resulting from a change in moisture content. Soils with high shrink-swell potential generally have a high clay content and shrink when dry and swell when wet. Shrink-swell properties also vary with the type of clay in the soil. Expansive soils can cause considerable damage to building foundations, roads, and other structures.

In the early 1960's, many homes in Thousand Oaks were damaged due to soil expansion and other factors. Soil expansion cracked concrete slabs in the area west of Route 23 in the vicinity of Avenida de las Flores and Avenida de los Arboles. By 1965, State law (Health and Safety Code 17953-18955) was amended to require soil reports and construction techniques to prevent damage due to expansive soils for every subdivision where a tentative and final map is required. In addition, the Thousand Oaks Municipal Code (Sec. 801.16) requires all building foundations to be designed to account for the soil expansion.

Detailed studies of soil properties, including shrink-swell potential, were conducted in the soil survey of Ventura County (U.S. Soil Conservation Service, 1970). Figure 1-6 depicts areas with potentially highly expansive soils as described in the Soil Survey of Ventura County (U.S. Soil Conservation Service, 1970). However, due to the variability within each soil type, the map should be used for planning purposes only. Detailed site specific investigations are required to fully evaluate the shrink-swell characteristics of the soils at a given site.

Settlement

Settlement is the downward movement of a soil or of the structure which it supports, resulting from a reduction in the voids in the underlying strata. Inadequately emplaced fill material, if not compacted properly, can subside when a structure is built on the fill. It is important that fills be engineered so that the density of the material can be controlled. This will result in a lesser chance that the material will compact following development on the fill. Natural soils that are potentially susceptible to settlement can be found in the alluvial valley areas and where old pits or gullies have been filled in with trash and loose soil (Leighton and Associates, 1974).

Settlement hazards can occur in areas with alluvial deposits. Large-scale settlement problems have generally not been an issue in the study area provided that adequate soils and foundation studies are performed prior to construction and that CBC guidelines are followed. Areas of poorly consolidated sediments should be engineered to support the weight of a structure that is to be built on the site. In areas of fill, the fill should be compacted to adequately support the proposed development.

Subsidence

Subsidence is the decrease in volume of a material as the result of an increase in the density of a material. It is generally related to the withdrawal of fluids such as water, oil, and gas from the subsurface. When fluids are removed from the subsurface, the overburden weight, which the water had previously help support through buoyant forces, is transferred to the soil structure. Subsidence typically occurs over a long period of time and results in a number of structural impacts. Facilities most impacted by subsidence are long, surface infrastructure facilities - such canals, sewers and pipelines.

No recognized subsidence has occurred within the study area even during periods of heavy ground water pumping (see ground water conditions section) in the 1950s and 1960s. Accordingly, the potential for subsidence in the study area is considered to be minimal. If present, these hazards would be manifested in areas of unconsolidated alluvium.

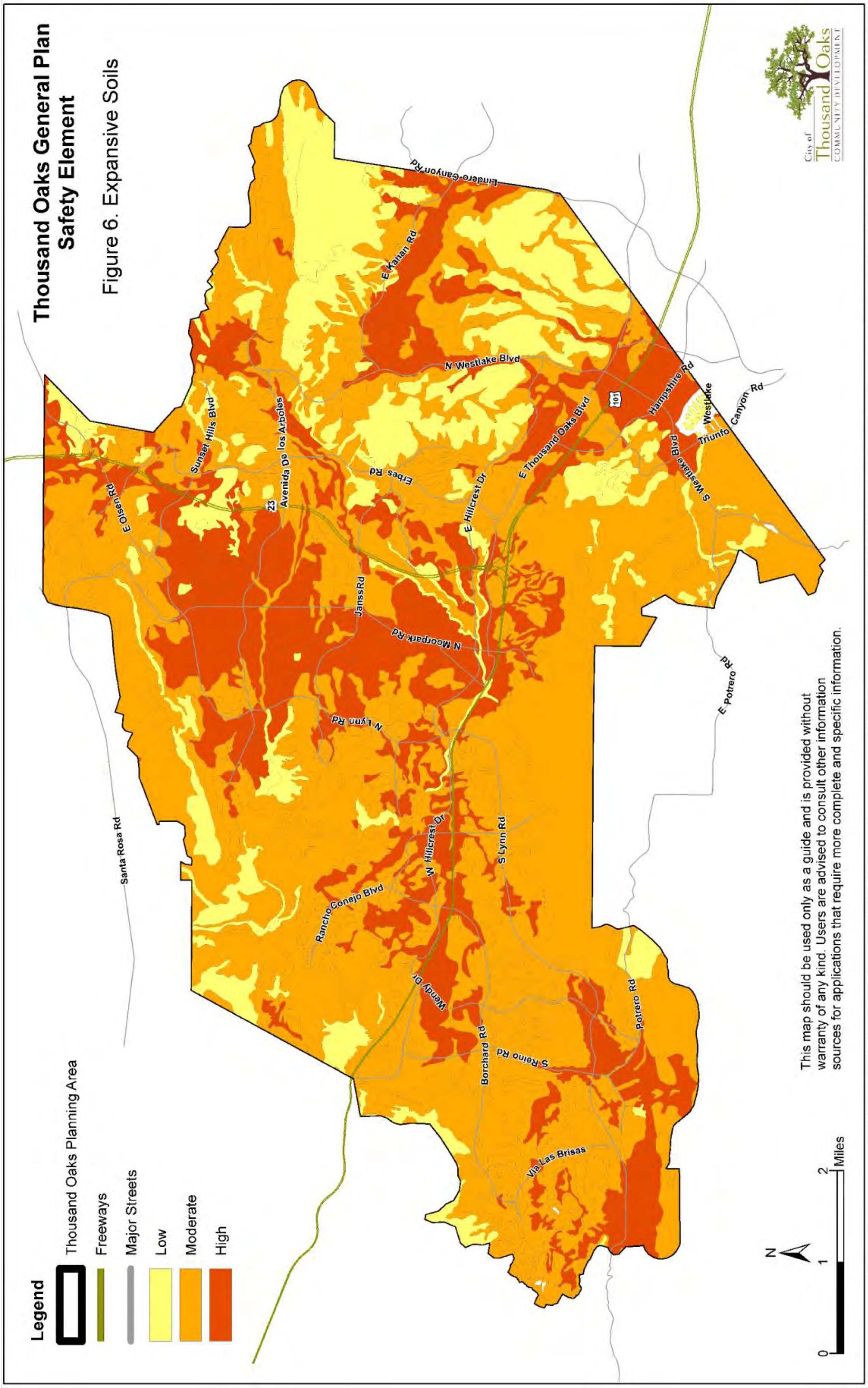
Hydrocompaction

Hydrocompaction occurs in relatively loose, open textured soils above the groundwater table. Once water is introduced, whether by heavy irrigation or a rise in the water table, the soil loses strength and consolidates under its own weight. Hydroconsolidation typically occurs in desert environments and has been noted in some semi-arid regions of southern California.

Areas of hydrocompaction have not been identified within the City of Thousand Oaks. If, during the preparation of a foundation study, soils susceptible to hydrocompaction are encountered, the condition should be mitigated prior to development. Mitigation measures should be designed by a civil or geotechnical engineer. Hydrocompaction could potentially occur in areas of unconsolidated soils

Summary

Soil problems are substantially mitigated by standard practice as required by Chapter 18 of the California Building Code. A soil report is required prior to issuance of a grading or building permit for most new construction. If soils are encountered that are susceptible to expansion, settlement, subsidence or hydrocompaction, the report must recommend corrective measures to prevent damage to any proposed structure. These corrective measures are incorporated into the plans for the proposed structure.


Thousand Oaks General Plan
Safety Element
Figure 6. Expansive Soils
Legend
Thousand Oaks Planning Area
Freeways
Major Streets
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Moderate
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This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
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Created by T Williams-Anderson: 2/5/2014
City of Thousand Oaks
Community Development
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Sunset Hills Blvd
Avenida De los Arboles
Erbes Rd
E Hillcrest Dr
E Thousand Oaks Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
E Olsen Rd
23
101
Janss Rd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
Borchard Rd
S Reino Rd
Potrero Rd
Via Las Brisas

Ground Water/Seepage

The ground water basin beneath the City of Thousand Oaks closely corresponds with the surface watershed basin of the Arroyo Conejo (French, 1980; Kennedy/Jenks, 1992). The ground water is unconfined and flows northward from the Santa Monica Mountains, westward from the Simi Hills, and eastward from the western ridges of the basin. Ground water exits the basin through base flow of the Arroyo Conejo. No problems have been reported due to groundwater seepage from the main aquifers in the floor of the Conejo Valley.

The 1996 Safety Element identified surfacing ground water problems in two locations (Leighton and Associates, 1974). One location was at the intersection of Lynn Road and Avenida De Las Flores. A second location was identified at the intersection of Gainsborough Road and Shadow Lake Drive (east of Lynn Road). These are no longer problem areas.

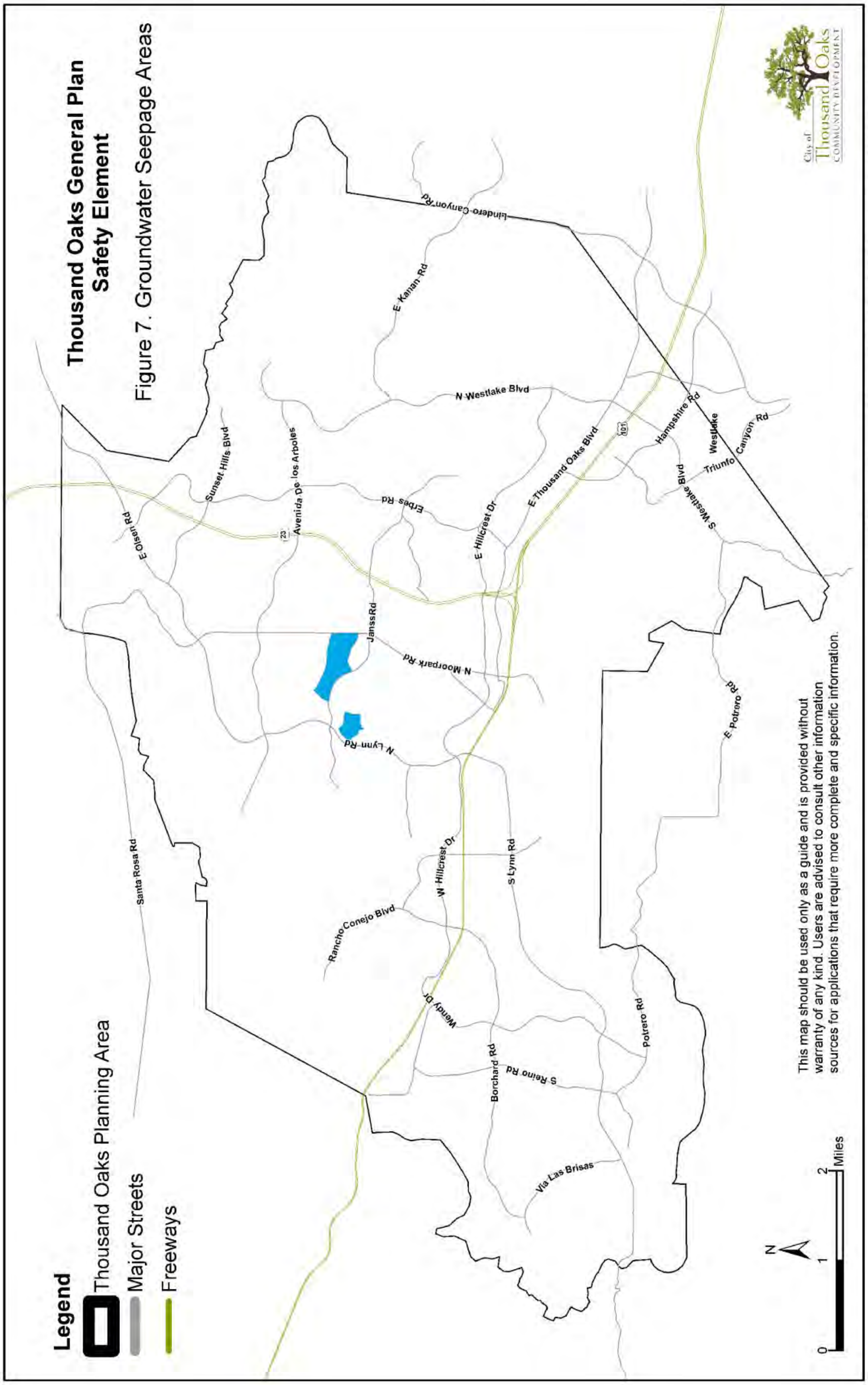
Surfacing groundwater problems, however, have occurred in two other areas shown on Figure 7. Groundwater seepage in these areas affects building foundations, landscaping and sidewalks.

Hazard Analysis

Areas with groundwater seepage problems are shown on Figure 7. Surfacing groundwater in these areas creates wet soil and nuisance water that adversely affects building foundations, landscaping, streets and sidewalks. Residents have installed drains around their homes and the City has installed sidewalk interceptor drains to alleviate problems in selected areas.

Summary

The potential for seepage problems should be addressed during geotechnical studies and appropriately minimized or corrected, as necessary, during construction. The groundwater seepage areas shown on Figure 7 were based on the February 10, 2005, report “Geotechnical Evaluation of Shallow Groundwater, Kevin Street and Surrounding Area, Thousand Oaks, California” (Prentice. L.E., 2005). Subsurface tests were not performed to confirm that every property within the mapped areas is subject to groundwater seepage or that properties outside of the mapped areas are not affected. Therefore, the map does not meet disclosure requirements for real estate transactions or for regulatory purposes.


Thousand Oaks General Plan
Safety Element
Figure 7. Groundwater Seepage Areas
Legend
Thousand Oaks Planning Area
Major Streets
Freeways
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Hampshire Rd
Westlake
Canyon Rd
Triunfo
S Westlake Blvd
E Thousand Oaks Blvd
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Sunset Hills Blvd
Avenida De los Arboles
Erbes Rd
E Hillcrest Dr
E Olsen Rd
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Janss Rd
N Moorpark Rd
N Lynn Rd
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Santa Rosa Rd
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Rancho Conejo Blvd
Wendy Dr
Potrero Rd
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This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
City of Thousand Oaks
Community Development
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Created by Jeff Specter

Chapter 3

Flooding

CHAPTER 3: FLOODING

Development within the Thousand Oaks Planning Area is primarily on the Conejo Valley floor and on slopes less than 25% (Hawks and Associates, 1992). The watershed is bound by the Santa Monica Mountains to the south and the Simi Hills on the north and east. The major drainages in the Planning Area are shown on Figure 8. The Arroyo Conejo is the main drainage feature through the City. This watercourse and the South Branch tributary drain from the eastern and southwestern limits of the watershed, northwesterly to the Santa Rosa Valley. Flow proceeds westerly to Conejo Creek and then to Calleguas Creek and on to the Pacific Ocean. Major tributaries of the Arroyo Conejo include Olsen Channel, North Fork Arroyo Conejo and Lang Creek. Southeastern portions of the City, including the Westlake area, drain into Westlake Lake and Malibu Creek in Los Angeles County via Lindero Creek, Schoolhouse Canyon and Potrero Creek.

Certain areas of the Thousand Oaks Planning Area are subject to periodic inundation from flooding which can result in destruction of property and improvements, loss of life, health and safety hazards, and disruption of commerce and governmental services. Encroachment into floodplains, such as artificial fills and structures, reduces the capacity of the floodplain and increases the height of flood water upstream of the encroachments. Floodplain management involves the balancing of economic gain associated with land development within the floodplain against the increased flood hazard.

A. Dam Inundation

Five dams in the Thousand Oaks Area have the potential to result in inundation (in the event of a dam failure) to the City or in a serious disruption of water supply. These include dams at Lake Sherwood and Lake Eleanor. Failure of any of these dams during a catastrophic event such as an earthquake is considered possible, though unlikely. Failure of Lake Sherwood Dam would cause significant flooding between Lake Sherwood and Westlake Lake, and would cause the level of Westlake Lake to rise several feet. Failure of Lake Eleanor Dam would impact the Westlake Boulevard area to Westlake Lake.

B. Historic Flooding

Table 3 provides a listing of major non-coastal flood events that have occurred in Ventura County over the previous 50 years.

Table 3: Major Flood Events in Ventura County

Date	Disaster Description
01/13/95	Severe winter storms, flooding, mud/landslides
03/95	Severe winter storms, flooding, mud/landslides
10/28/93	Fires, mudslides, flooding, soil erosion
02/25/92	Severe winter storm
02/09/83	Flood/winter storms
02/09/83	Flood, severe storm
02/21/80	Flood
02/15/78	Severe storm
01/26/69	Flood, storms
12/7/65	Flood, severe storm

Source: City of Thousand Oaks, Local Hazard Mitigation Plan (2004)

During the February 10-12, 1992 storms, heavy rainfall in Calleguas Creek Watershed produced runoff in Conejo Creek which rose to bank full stage (Ventura County Public Works Agency, 1986). Within the City of Thousand Oaks, a box culvert that crosses under Erbes Road (Lang Ranch area) was unable to adequately convey the storm flow (communication with County of Ventura, Watershed Protection District). This resulted in flooding of the Conejo Recreation and Park District Offices, an area adjacent to the Old Meadows Park, threatening some of the nearby homes. During this same event, a clogged drain in the vicinity of Newbury Road and Ventu Park Road resulted in 4 to 5 feet of ponding and localized flooding.

During storms of early 1995, there was extreme high flow of Potrero Creek (between Lake Sherwood and Westlake Lake). The high flows damaged a wing wall adjacent to a bridge on Triunfo Canyon Road (personal communication - Curt Reithmayr, City of Thousand Oaks Public Works Department). Floodwaters also washed away a section of sewer trunk main and released raw sewage into the Arroyo Conejo (City of Thousand Oaks Local Hazard Mitigation Plan: 2004).

Photo 5: Flooding on Newbury Road (1992); (Courtesy of "Conejo Through the Lens" Thousand Oaks Library)

C. Flood Hazards

Flood hazard areas of the City of Thousand Oaks are subject to periodic inundation which can result in destruction of property and improvements to the property, loss of life, health and safety hazards, and disruption of commerce and governmental services. Encroachment onto floodplains, such as artificial fills and structures, reduces the capacity of the floodplain and increases the height of flood water upstream of the obstructions. Floodplain management involves the balancing of economic gain associated with land development within the floodplain against the increased flood hazard.

The Federal Emergency Management Agency (FEMA) establishes base flood elevations and inundation areas for 100-year and 500-year flood zones. The 100-year flood zone is defined as the area that could be inundated by the flood which has a one percent probability of occurring in any given year. The 500-year flood is defined as the flood which has a 0.2 percent probability of occurring in any given year. Figure 8 illustrates areas of the City that could be inundated by the 100-year flood (FEMA, 2010).

A Master Plan of Drainage was prepared for and adopted by the City in 1974 (Koebig and Koebig, Inc., 1974). The original study encompassed about 29,000 acres lying entirely within the watershed of the Arroyo Conejo. To account for ensuing geographic expansion of the City, an updated Master Plan of Drainage was prepared and adopted by the City in 1992 (Hawks and Associates, 1992). The updated study (encompassing about 45,000 acres) expanded easterly toward the Ventura-Los Angeles County line, southerly to include portions of Westlake within the City limits, and northerly to Moorpark Road and Read Road. The updated study proposed a planned program of drainage facilities required to provide a reasonable degree of protection from flooding with respect to existing anticipated land uses, including no inundation of building pads in a 100-year storm and underground system carrying capacity for a 10-year storm. In 2007, another updated Storm Drain System Master Plan was adopted by the City that incorporated detailed infrastructure data into a geographic information system (GIS) and identified specific deficient drain reaches. Phase 2 of the 2007 Master Plan remains unfunded to date, and will identify and prioritize recommended drainage improvement projects to reduce or eliminate city-wide flood hazards.

Both the Master Plan of Drainage and the update to the Master Plan of Drainage (Koebig and Koebig, Inc., 1974 and Hawks and Associates, 1992) identified citywide improvements necessary to alleviate existing and future problems with flooding. One of the more prominent "problem areas" identified was the Lang Creek and proposed development upstream at Lang Ranch. Lang Creek has a history of flooding problems, notably at the El Monte and Las Flores drains, and at the Erbes Road undercrossing (Michael Brandman Associates, 1994). Flood waters have reportedly backed up onto the roadway and adjacent residential properties at the latter location as a result of deficient drainage capacity. A master environmental impact report prepared for the Lang Ranch development in 1988 concluded that the existing downstream flood control channels had inadequate hydraulic capacity, and that continued development would exacerbate the problem. Under a federal judgment, the developers of Lang Ranch funded a stormwater retention and debris basin in the lower portion of Oakbrook Community Park between Erbes Road and Westlake Boulevard. The project was managed by the Ventura County Watershed Protection District and funded through the City’s Community Facilities District 88-1.

A follow-up study to the Master Plan of Drainage indicated that there are some deficiencies in the existing flood control system (Clearpoint Engineering, 1994). The Erbes Road Drain, Thousand Oaks North Drain and Arroyo Conejo Red Line Drainage facilities between Lynn Road and Westlake Boulevard comprise the backbone drainage system for the Thousand Oaks area, totaling approximately 35,000 feet in length (see Figure 8). These facilities were constructed during the period of 1966 to 1988, with the majority of the facilities constructed before 1976. Portions of these facilities have been identified as being deficient in carrying capacity for a 10-year storm. In 2011, the Ventura County Watershed Protection District commissioned a flood damage assessment by CDM-Smith for the Upper Calleguas Creek Watershed. The study area included the Arroyo Conejo, South Branch of the Arroyo Conejo and Lang Creek sub-watersheds in Thousand Oaks. It provided estimates of flood inundation and flood damage due to 100-, 50-, 25-, and 10-year flood events. The study also identified a range of alternatives for mitigating the flood hazard. The alternatives will need to be studied further to ensure that they are technically and economically feasible (CDM Smith, 2012).

Photo 6: Casitas Springs CA, January 15, 2005; Residents attempt to salvage belongings and clean up mud and water remaining in homes where winter storms caused flooding that damaged private property and roads. (Photo by John Shea/ FEMA News Photo)

D. Flood Control and Prevention

Flood hazards may be alleviated through a variety of measures, some corrective and some preventive. Corrective measures include warning and relief programs, flood-proofing of existing structures, and the construction of flood control works. Preventive measures include public acquisition of flood plain lands, public information programs, development policies and regulations.

Protecting life and property from flood damage is primarily the responsibility of the Ventura County Watershed Protection District. The District has the authority to maintain and construct flood control facilities on all major channels. The network of tributary storm drain trunks and laterals that collect and convey surface water from the urban areas to the major channels is the responsibility of the City.

On the Federal level, the regulations of the National Flood Insurance Program (NFIP), which is administered by the Federal Insurance Administration (a component of the Federal Emergency Management Agency), require that communities adopt land use restrictions for the 100-year flood plain in order to qualify for Federally-subsidized flood insurance. The 100-year floodplain is shown on Figure 8. The program requires that residential structures be elevated above the level of the l00-year flood and that other types of structures be flood-proofed. The NFIP was established by Congress with the passage of the National flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. Section 4-7.05 of the Municipal Code prohibits encroachments, including fill, new construction, substantial improvements, and other development unless certification by a registered professional or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the 100-year flood.

To provide for early flood warning, the Ventura County Watershed Protection District has been operating an automated flood warning system since 1979. The system is known as “ALERT” (Automated Local Evaluation in Real Time) and was developed by the National Weather Service in Sacramento, California. The system is comprised of self-reporting rain gages and stream gages that collect data and transmit signals to a flood warning center computer system located in the County Government Center Administration Building in Ventura. Operators of the system compare rainfall forecasts with the runoff forecasts from the hydrologic models and notify proper authorities in threatened areas to initiate evacuation warnings as appropriate. In the Thousand Oaks area, self reporting stations are located at Lang Ranch (wind, precipitation, humidity, and temperature) and at Conejo Creek above Highway 101 (stream level and precipitation).

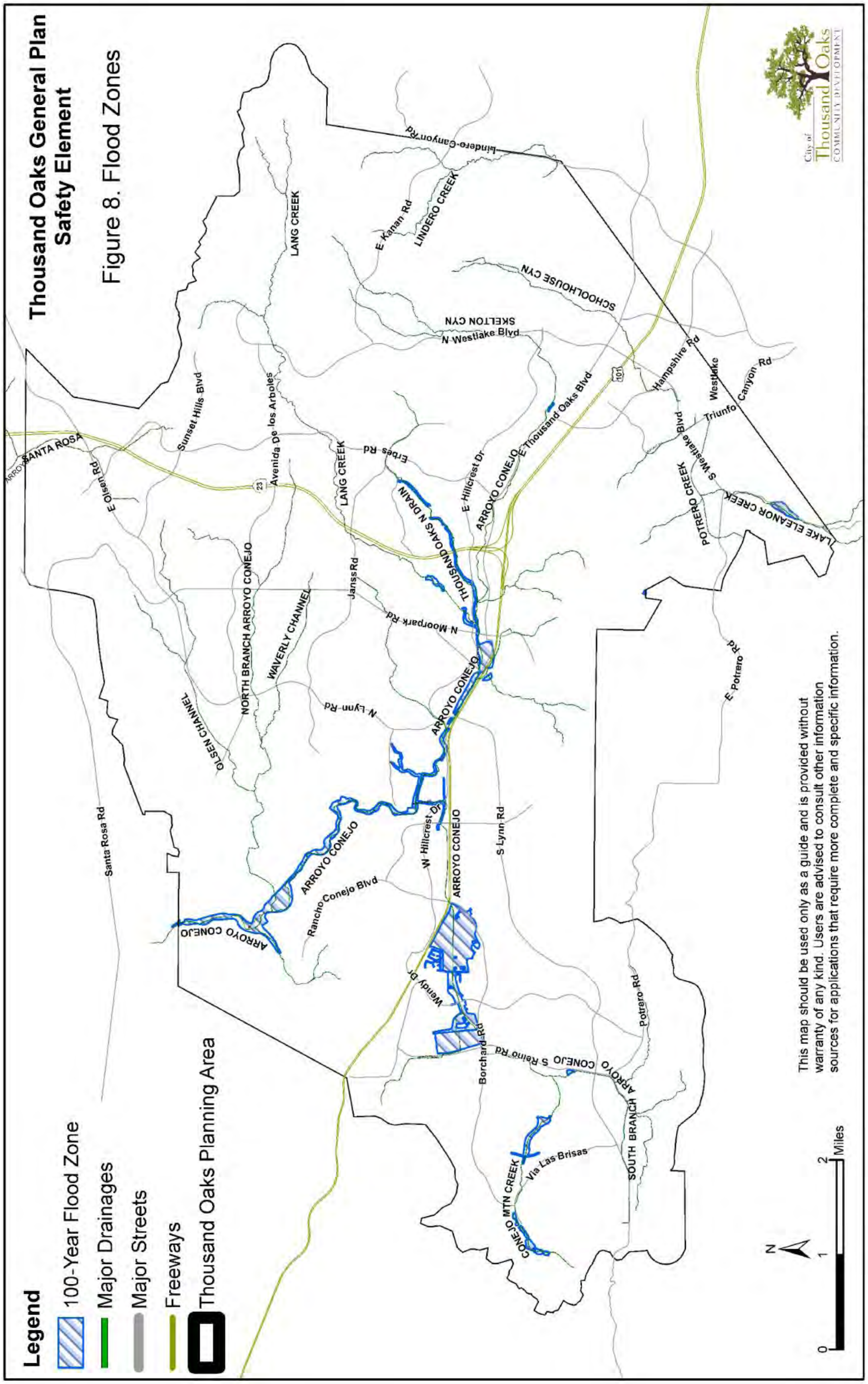
E. Potential Inundation Due to Dam Failure

The State of California has been responsible for supervising dams since August 14, 1929 for the purpose of safeguarding life and protecting property (California Department of Resources, 1995). The legislation was enacted following the failure of St. Francis Dam in March 1928. In 1965, legislation was revised to include off stream storage reservoirs as result of the failure of Baldwin Hills Reservoir in December of 1963. In March 1973, Senate Bill 896 was adopted by the State of California amending the Government Code. This law required dam owners, under the direction of the Office of Emergency Services, to show the possible inundation below their dam in the event of a failure.

Lake Sherwood and Lake Eleanor have the potential to result in inundation (in the event of a dam failure) to the City or in a serious disruption of water supply. General information for each of these dams is discussed below and is summarized in Table 4. Areas of dam inundation (California Department of Water Resources, 1974, 1976a, and 1976b) are depicted on Figure 9. Following is a brief description of each dam:

Lake Sherwood Dam is a constant radius concrete arch dam operated by Lake Sherwood Ranch (Jensen Engineering, 1975). Lake Sherwood Dam is one of the oldest concrete dams in the State, constructed in 1902. The reservoir has a drainage area of 16.1 square miles. Normal operation is at 100% capacity. Storm inflows are not impounded, and are passed over the main arch dam to Potrero Valley Creek. Under a worst-case scenario, Lake Sherwood Reservoir could fail by sudden removal of the concrete arch dam, resulting in a very high discharge in a short period of time. The area impacted in the event of a failure would be the Westlake area of the City of Thousand Oaks.

Banning Dam (Lake Eleanor) is a constant radius arch dam operated by the Conejo Open Space Conservation Agency. The reservoir has a relatively small capacity of 128 acre-feet, although this capacity has been diminished with siltation (about 80% infilling). The area impacted in the event of a failure would be the Westlake Boulevard area to Westlake Lake.


Thousand Oaks General Plan
Safety Element
Figure 8. Flood Zones
Legend
100-Year Flood Zone
Major Drainages
Major Streets
Freeways
Thousand Oaks Planning Area
This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
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Created by T Williams-Anderson: 2/4/2014
City of Thousand Oaks
Community Development
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ARROYO CONEJO
NORTH BRANCH ARROYO CONEJO
WAVERLY CHANNEL
OLSEN CHANNEL
LANG CREEK
LINDERO CREEK
SCHOOLHOUSE CYN
SKELTON CYN
THOUSAND OAKS N DRAIN
POTRERO CREEK
LAKE ELEANOR CREEK
CONEJO MTN CREEK
SOUTH BRANCH
SANTA ROSA
Santa Rosa Rd
E Olsen Rd
Sunset Hills Blvd
Avenida De los Arboles
Erbes Rd
Janss Rd
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Hampshire Rd
Westlake
Triunfo Canyon Rd
E Potrero Rd
Potrero Rd
Rancho Conejo Blvd
S Lynn Rd
Wendy Dr
Borchard Rd
S Reino Rd
Via Las Brisas
23
101

Photo 7: Aerial view of Westlake Lake; (Courtesy of city-data.com)

Hazard Analysis

Failure of any of the above referenced dams during a catastrophic event, such as an earthquake, is considered possible but unlikely. According to the California Department of Water Resources (DWR), Division of Safety of Dams (letter dated September 28, 1995), Lake Sherwood Dam and Westlake Reservoir Dam are believed to be stable under seismic loading from a maximum credible earthquake of Magnitude 7.0 occurring on the Malibu Coast Fault, located about seven miles from these structures. According to the DWR, Wood Ranch Dam is believed to be stable under seismic loading from a maximum credible earthquake of Magnitude 7.0 occurring on the Santa Rosa-Simi Fault located two miles from the dam.

Table 4: Dams in the Thousand Oaks Area

Name	Year Built	Type of Dam	Storage Capacity (Ac-ft)	Height (Feet)
Lake Eleanor (Banning Dam)	1889	Concrete constant radius arch	104	37
Lake Sherwood	1904	Concrete constant radius arch	2,600	45
Wood Ranch (Lake Bard)	1965	Earth embankment	11,000	146
Potrero Dam (Westlake Lake)	1967	Concrete gravity	791	40
Westlake (Las Virgenes) Reservoir	1972	Earth embankment	9,200	158

Dept. of Water Resources, Division of Safety of Dams, 2012

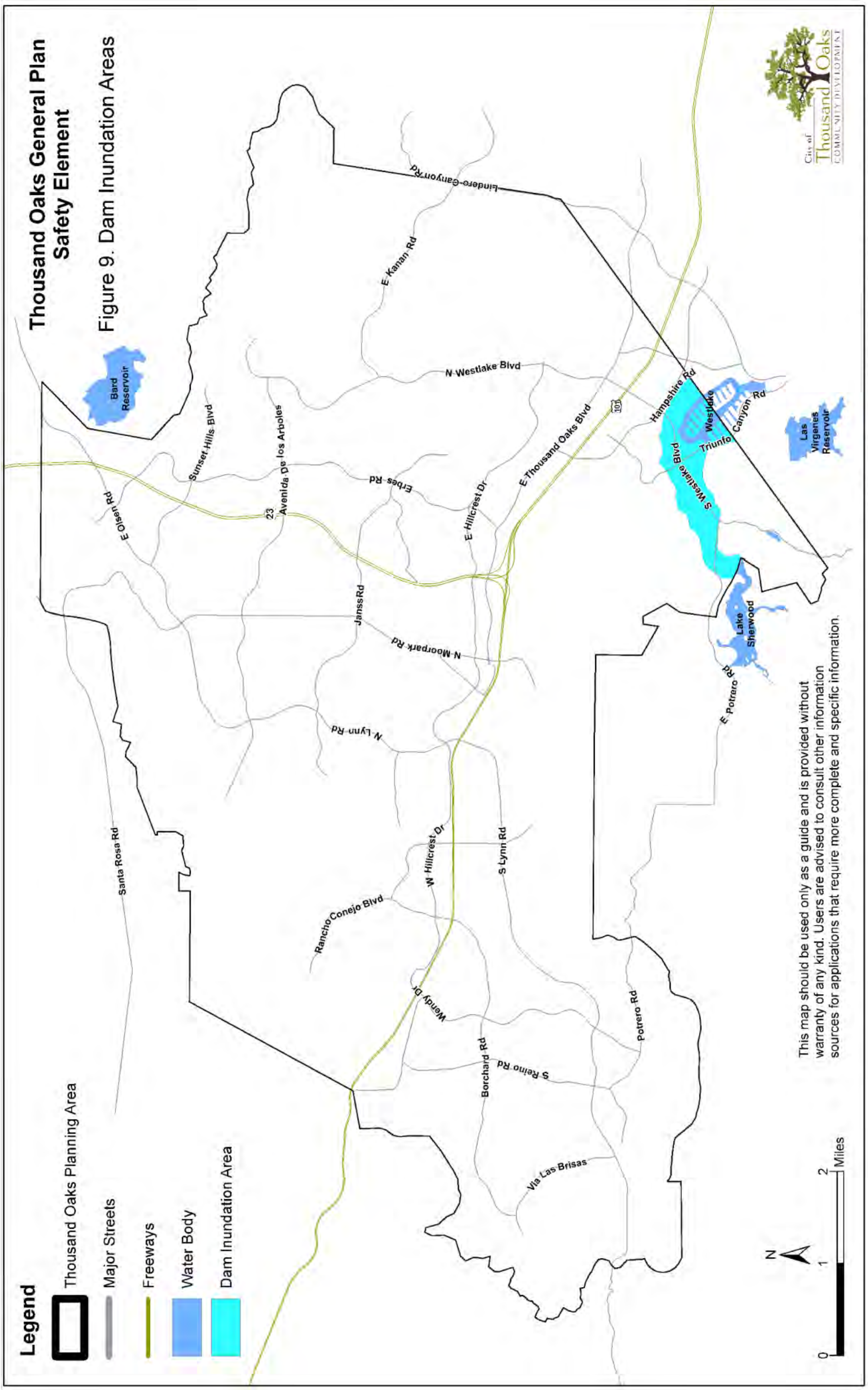
Failure of the dams associated with Westlake, Bard Reservoir and Las Virgenes Reservoir would result in flows away from the City of Thousand Oaks and would not be expected to inundate the City's Planning Area.

Failure of Lake Sherwood Dam would cause significant flooding between the dam and Westlake Lake, and would cause the level of the lake to rise. Failure of the dam would potentially expand the perimeter of the lake by about 1,000 feet (City of Thousand Oaks, Emergency Operations Plan). Water levels could rise by 16 feet in the event of a sudden and total failure.

Failure of Banning (Lake Eleanor) Dam would impact the Westlake Boulevard area to Westlake Lake. A critical facility located in the inundation path of Lake Sherwood Dam is Westlake Elementary School, which is located at Westlake Boulevard and Potrero Road.

Summary

Failure of Lake Sherwood Dam, Westlake Reservoir Dam, or Lake Eleanor Dam could have significant inundation impact on the Westlake area of Thousand Oaks. One of the best criteria for evaluating dam/reservoir safety and inundation risk is compliance with State Standards. Annual safety inspections are conducted by the State. Operational and maintenance recommendations must be adhered to by the dam owner in order to remain in compliance with State safety standards. Emergency response actions associated with a dam failure are specified in the City's 2008 Emergency Operations Plan.


Thousand Oaks General Plan
Safety Element
Figure 9. Dam Inundation Areas
Legend
Thousand Oaks Planning Area
Major Streets
Freeways
Water Body
Dam Inundation Area
Bard Reservoir
Las Virgenes Reservoir
Lake Sherwood
Westlake
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Hampshire Rd
Canyon Rd
Triunfo
S Westlake Blvd
E Thousand Oaks Blvd
Sunset Hills Blvd
Avenida De los Arboles
Erbes Rd
E Hillcrest Dr
E Olsen Rd
Janss Rd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
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Borchard Rd
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City of Thousand Oaks Community Development
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Chapter 4

Fire Hazards

CHAPTER 4: FIRE HAZARDS

The City of Thousand Oaks experiences fires from a number of sources. These include wildland, structural, vehicle, refuse, and human-generated incidents. Wildland fires are a result of a combination of three primary factors: vegetation, climate, and people. The native plant communities of greatest concern include the coastal sage scrub and chaparral that cover the natural hillside areas. These plant communities have evolved to incorporate burning into their ecological cycle. Mediterranean climate characterized by hot dry summers and hot dry winds in the fall turn this vegetation into a major source of fire fuel. These fuel sources are most commonly ignited by man, either directly through careless action or arson, or indirectly through accidents.

Fire prevention and suppression services are provided within the Thousand Oaks Planning Area by the Ventura County Fire Protection District. The Fire Protection District has instituted a number of programs to minimize the potential for hazards including fire safety and fire prevention training, site inspections, and urban/wildland interface hazard mitigation programs.

A. Urban Fire Hazards

Fire Prevention and Suppression

Fire prevention and suppression services are provided to the City of Thousand Oaks by the Ventura County Fire Protection District. The Fire Protection District is responsible for enforcing the following:

- California Health and Safety Code, Division 12, Part 2. 7 (Fire District Law) and Part 5 (Abatement of Hazardous Weeds and Rubbish).
- Ventura County Fire Protection District Ordinance. (Adopting the California Fire Code and portions of the International Fire Code).

The District has a number of mutual aid agreements with other fire services agencies within Ventura and Los Angeles Counties. If the resources of these agencies are depleted, assistance can also be obtained through various state and federal agencies including the Office of Emergency Services, the Department of Forestry and Fire Protection (Cal Fire), the State Fire Marshal, the U.S. Forest Service, the National Park Service and Bureau of Land Management, and the Department of Defense. Urban fire hazard abatement is discussed in this section and wildland fire hazard abatement is discussed in the following section.

The District has a goal of responding to emergencies within 5 minutes. The 5-minute response time includes 1 minute to dress into protective gear and 4-minutes to drive to the incident. This is consistent with the National Fire Protection Association's response time standard of 4 minutes (2010 edition of NFPA 1710) for the initial arriving company. The initial response time standard described in Sec. 5.2.4.1.1 of NFPA 1710 reads as follows: "The fire department's fire suppression resources shall be deployed to provide for the arrival of an engine company within a 240-second travel time to 90 percent of the incidents as established in Chapter 4."

The Fire Department responded to 9,633 incidents in the City of Thousand Oaks Service Area in 2011 as shown in Table 5. The number of calls for service increased from 8,590 in 2008.The service area includes unincorporated areas in the vicinity of Thousand Oaks. The vast majority of calls for service are for medical emergencies.

Photo 8: Structure Fire on Thousand Oaks Boulevard;
(Courtesy Ventura County Fire Protection District)

B. Existing and Proposed Fire Stations

The Ventura County Fire Protection District currently operates 32 fire stations throughout Ventura County. Eight stations serve the Conejo Valley (Battalion 3). The Valley is well served by fire stations, with virtually all developed areas within two miles of a station. Table 6 provides a summary of the local fire stations capabilities (personnel and equipment). In addition, depending on the nature of the emergency, four other stations may be called into service for the Thousand Oaks area. These include two stations north of the City of Thousand Oaks (Station 40-Mountain Meadows in Moorpark and Station 44 Wood Ranch in Simi Valley) and two stations west of the City (Station 52-Mission Oaks and Station 54 Camarillo, both in Camarillo). Additionally, in the event of a very large incident, all available equipment and manpower can be called into the Conejo Valley 24 hours a day.

Table 5: Incident Activity for Thousand Oaks Service Area (2011)

Fire/Incidents	Number of Incidents
Fires	281
Emergency Medical	6,918
Rescue	674
Public Service	876
Alarms	711
Hazardous Materials	173
Other	0
Total Incidents	**9,633**

Source: Ventura County Fire Protection District Calls for Service Report March 2, 2012

There are plans to relocate Fire Station No. 35 to a site on Mitchell Road. One additional station is proposed for the South Ranch area. However, there is presently no schedule for its construction.

Station 50 on Las Posas Road in Camarillo is the designated hazardous materials response station (2012). Personnel assigned to this station are specifically trained to respond to hazardous materials incidents. The station is equipped with a trailer with a workstation, a small laboratory, protective suits and specialized tools.

Table 6: Fire Station Capabilities

Station	Year Built	Name/Location	Personnel	Equipment
30	1974	Civic Center 325 W. Hillcrest Dr	8	engine, ladder truck, command vehicle
31	1977	Westlake 151 Duesenberg Dr	5	engine and a paramedic truck
32	1972	Potrero 830 S. Reino Rd	3	medic/engine, brush engine, patrol truck
33	1949	Lake Sherwood 25 Lake Sherwood Dr	3	engine, reserve engine, utility pickup
34	1961	Arboles 555 Avenida de Los Arboles	3	medic/engine, reserve engine, reserve paramedic truck
35	1962	Newbury Park 2500 W. Hillcrest Dr (Replacement station planned at 751 Mitchell Road, Newbury Park)	3	engine, reserve engine
36	1985	Oak Park 855 N. Deerhill Rd	3	medic/engine, reserve engine, brush engine
37	2001	North Ranch 2010 Upper Ranch Rd	3	engine, light and air supply truck, utility van

Source: Ventura County Fire Protection District website

Prior to construction of new developments, applicants must submit plans to the Ventura County Fire Department for the approval of the location of fire hydrants. The Fire Department should be contacted in advance of submitting these plans to evaluate hydrant locations and required fire flow for the specific development. In addition, all new single family homes must be fitted with an automatic fire sprinkler system in accordance with the Ventura County Fire Protection District Ordinance.

To help ensure adequate fire flow, the City and other water purveyors maintain reservoir storage for fire flow, have redundant reservoirs where possible and have developed looping systems.

<u>Peak Water Requirements</u>

Peak load water supply standards ensure that sufficient water flow is available to fight fires. The minimum fire flow required is determined by the type of building construction, proximity to other structures, fire walls, and fire protection devices as specified by the Ventura County Fire Protection District Ordinance. New residences, for example, are generally required to have fire flows of 1,000 gallons per minute. Exceptions are older in-fill industrial and commercial uses which are typically required to have higher fire flows. Applicants for new development projects in the City must verify that the water purveyor can provide the required volume at the project.

<u>Minimum Road Widths and Clearances around Structures</u>

Per City of Thousand Oaks municipal code requirements (9-3.1015 and 9-3.1016) roads shall be installed or improved to the standards specified in the City of Thousand Oaks Road Standards and construction specifications in effect at the time of construction (Ord. 744-NS. eff April 17, 1980). The improvement shall not begin until the City Engineer has approved the improvement plans or the proposed construction.

The Ventura County Fire Protection District, Fire Prevention Division has established Standard Planning Conditions pertaining to road widths and clearances for development projects -- including parcel maps, tracts (single and duplex dwelling units) apartments and condominiums, and commercial and industrial projects. Standard Planning Conditions include those pertaining to street widths; length, width, and percent grade of private access roads; number and type of turnaround areas and means of ingress and egress; minimum vertical clearances; and percent grade.

Section 9-4.3106 of the Thousand Oaks Municipal Code specifies minimum road widths in the HPD (Hillside Planned Development) zone which requires less width than any other residential zone. In the HPD zone, each new street shall have a right-of-way, roadway, and median widths conforming to the specified standards.

C. Wildfires

<u>Causes and Origins of Brush Fires</u>

Brush fire problems can be traced to three factors: vegetation, climate, and people (Leighton and Associates, 1974). The major types of vegetation found in the Thousand

Oaks area (coastal sage scrub and chaparral, etc.) provide a natural source of fire fuel. These vegetative associations contain many species of plants considered pyrophytic, plants which need the heat of the fire to germinate their seeds for reproduction. When these vegetation systems are burned over by a brush fire, the existing ground cover is destroyed, but in many cases the plant association survives and is regenerated by this means of natural selection.

The climate of the region is one of the critical factors influencing the occurrence and severity of our brush fires. The hot dry summers leave the area hillsides susceptible to a major fire. During the early fall, periods of "Santa Ana" winds occur, caused by a local weather phenomenon of a low pressure system developing off the coast while a high pressure system settles over the inland desert areas. The result is the hot dry winds which pour over the mountain areas into the Conejo Valley and other southern California subregions, aggravating the potential fire threat in the high brush areas, already dried out by the summer heat. Nearly 90 percent of the large southern California fires documented over the years have occurred between September and December - during the Santa Ana season (Crosby, 1992).

Wildland fires generate burning embers that are blown ahead of the main fire. These embers can spread a fire and catch buildings on fire when they encounter combustible materials.

Most wildland fires are ignited by man, through arson or careless action, or through accidents such as sparks from engine exhaust and falling power lines. Natural causes are now relatively minor causes of brush fires.

Historic Brush Fires

Table 7 provides a summary of brush fires which have occurred in or immediately adjacent to the City of Thousand Oaks area since 1952. The Ranch Fire consumed over 58,000 acres in 2007 and the Day Fire destroyed more than 162,000 acres in 2006.

Hazard Analysis

The principal effects of brush fires include loss of vegetative ground cover, increased erosion, loss of man-made improvements, and loss of life (Leighton and Associates, 1974). Loss of the vegetative ground cover results in damage to valuable recreational and open space areas. Many of the plant and animal associations in the natural communities have adapted themselves to a fire-climax cycle, and will naturally generate themselves through fire. Hence, they themselves may not be permanently impacted.

Loss of vegetative cover results in secondary erosional impacts, especially in areas that are sloped. When a slope is burned over by a fire of intense heat, a chemical reaction in the soil takes place which makes it less porous. As the rains of winter come, rain water runs off and causes mudslides arid mudflows. Properties not affected directly by the fire may be damaged or destroyed by the effects of increased runoff due to brush fire.

Table 7: Brush Fires Near Thousand Oaks (1952-2013)

Name	Date Started	Acres Burned
Springs	5/2013	24,251
Hampshire	9/2010	25
Ranch (Ventura & LA Co.)	10/2007	58,401
Topanga	09/2005	24,175
Wendy	8/24/2004	120
Westlake	6/29/2001	278
North Ranch	8/14/1998	108
Autumn	7/22/1997	47
Green Meadow	10/26/1993	38,152
Academy	7/20/1992	35
Westlake	10/30/1991	170
Sapra	7/5/1990	119
Sycamore	4/10/1988	367
Sherwood	6/30/1985	3,830
Hall	10/8/1982	2,627
Hill Canyon	10/28/1980	8,700
Conejo Grade	11/30/1979	100
Arroyo	12/16/1976	200
Decker	7/4/1976	146
Potrero Road	6/23/1976	80
Los Robles	6/22/1976	2,000
Guadalasca	1/17/1976	84
Potrero	12/28/1975	2,773
Conejo	11/11/1975	200
Santa Rosa	9/26/1973	437
Potrero	9/26/1973	12,800
Camarillo Grove	9/18/1971	440
Conejo Grade	9/22/1968	873
Parker	10/15/1967	25,000
Santa Rosa	12/29/1958	910
Conejo Grade	6/18/1957	1,000
Silverwood	12/28/1956	26,170
Ventu Park	11/7/1955	13,840

Source: Ventura County Fire Protection District

The loss of man-made improvements in the brush covered areas constitute most of the dollar loss from fires. Losses along this line include homes, barns and sheds, utility lines and facilities. The loss of valuable watershed area combined with the actual suppression costs also are major determinants of the total costs of any fire. The potential for loss of life is the most dangerous aspect of brush fires. Occasionally, trapped residents are injured or killed when there is no warning of the impending disaster, or when they simply refuse to evacuate their homes in the face of the fire. Unfortunately, the largest loss of life occurs to the professional fire fighters who are killed while fighting brush fires, which have a highly unpredictable nature, or in other accidents during the support operations necessary to suppress the fire.

As the population of California cities continue to grow, more and more people are encroaching on what firefighters call the urban/wildland interface -- the perimeter of urban areas adjacent to wildlands. According to California Department of Forestry and Fire Protection (Cal Fire) statistics, since 1980, more than 5,000 structures have been damaged in wildland fires -- triple the amount of damage that occurred in the previous 15 year period. Some of the more recent devastating examples of this phenomenon include:

Santa Barbara: Painted Cave Fire of June 1990 which swept across almost 5,000 acres of coastal hillsides, destroying more than 600 houses.

Oakland/Berkeley: 1991 Fire covering over 1,600 acres, decimated entire neighborhoods, killing 25 people, destroying 2,900 homes, and leaving more than $1.5 billion in property damage.

Malibu to Laguna Beach: A series of fires in the fall of 1993 which killed three people and destroyed over 1,000 homes.

A number of residential areas in Thousand Oaks which are located at the perimeter adjacent to large expanses of open space have been threatened by wildland fires in the past, including:

- The Ventu Park area adjacent to steep hillside areas covered with heavy chaparral brush,
- Residential areas adjacent to densely-vegetated steep canyons of the Arroyo Conejo system,
- Other developments located adjacent to large expanses of brush and grassland. (City of Thousand Oaks, Emergency Operations Plan).

Figure 10 is a map of very high wildfire hazard areas as determined by Cal Fire. The level of hazard is based largely on the type of ground cover and slope. It is important to maintain fire protection standards in these areas, such as brush clearance and building standards.

Fire Hazard Reduction

Experienced firefighters believe they can no longer protect homes and lives as well as they did in the past with fuel loading causing such catastrophic fires (Gilmer, undated); It is up to the homeowners living on the urban/wildland interface to establish defensible space. Defensible space describes a band of managed vegetation around a home which stops the movement of fire by denying fuel. The Fire Department does not recommend indiscriminate clearing of native chaparral and other vegetation. Natural vegetation plays an important role in erosion control. The goal is to obtain a balance between fire hazard reduction and erosion control. Defensible space also provides a place where fire fighters can do their jobs without unnecessary risk to themselves. According to Cal Fire, as many as 80 percent of the homes lost to wildfires in the past could have been saved if the owners had followed a few simple fire safe practices. Some of these fire safe practices include the following:

<u>Use fire resistant landscaping</u>. Fire resistant plants are those with low growth habit (generally less than 18 inches in height), low fuel volume, and high moisture content. Such plants offer far less fuel than upright woody shrubs.

<u>Irrigate and maintain landscaping</u>. A fire resistant plant will lose this quality if allowed to dry out. Maintenance insures the effectiveness of the fire resistant landscape by retaining proper spacing between plants and removing dead/dry vegetation.

<u>Have a fire-retardant roof</u>. Wood shake roofs provide fuel for an advancing fire. Class A roofs provide the most protection. These include: clay tile, concrete tile, fibrous cement shake, metal tile, and fiberglass composition shingles.

In response to the disastrous Oakland Hills Fire of 1991, the Bates Bill (AB 337) was passed in 1992. The Bates Bill is a State measure that requires the California Department of Forestry and Fire Protection (Cal Fire) to identify “Very High Fire Hazard Severity Zones” with consistent statewide criteria. Figure 10 depicts Very High Fire Hazard Severity Zones for the Thousand Oaks Planning Area based on computer modeling by CalFire (Sources: Ventura County Fire Hazard Severity Zones in SRA, adopted November 7, 2007; and Thousand Oaks Very High Fire Hazard Severity Zones in LRA, as recommended by CalFire, dated October 6, 2010).

Buildings within Very High Fire Hazard Severity Zones are required to maintain defensible space (vegetation clearance and management) around the perimeter of the buildings. The California Building Code, Chapter 7A requires special fire-resistive construction in these areas. It requires building products and construction methods for ignition-resistant roofing, attic vents, eaves, decks and exterior siding, doors and windows. All of these measures reduce the chance that a wildland fire will ignite buildings directly or through intrusion by burning embers.

The Ventura County Fire Protection District has developed a Fire Hazard Reduction Program with the goal of preventing the loss of life and property due to uncontrolled wildfire in the urban/wildland interface through the cooperation of the property owners of Ventura County (Ventura County Fire Protection District, undated). The stated objectives of the Fire Hazard Reduction Program are to:

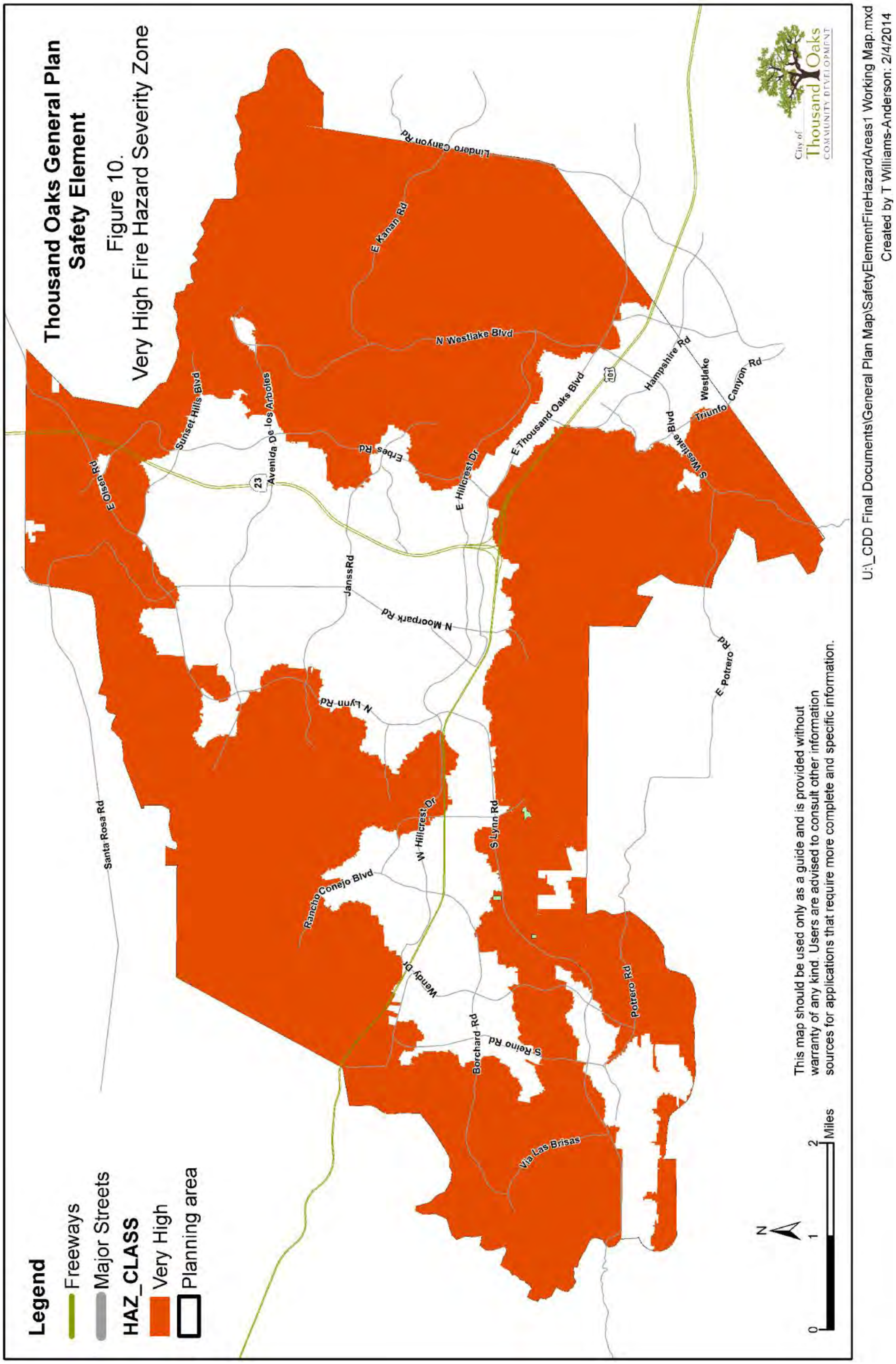
- Reduce significantly the incidence of destructive fires in the urban/wildland interface areas, and the resulting loss of life and property.

- Provide a defensive perimeter around urbanized areas of the Fire District.

- Provide for the protection of structures in the urban/wildland interface by establishing and maintaining a 100-foot defensible perimeter around each structure.
- Provide for the removal of annual fuels within the defensive perimeter.
- Provide any fire suppression resource from any agency the opportunity to successfully protect structures and other valuable properties during a wildfire threat.
- Protect the watershed fire areas from exposure to structure fires in the urban/wildland interface areas.

The Fire Hazard Reduction Program strives to establish defensive barriers in the urban/wildland interface in preparation for the potential for wildfire. Native vegetation is at its peak growth in the spring and fall seasons. An inspection program has been developed that targets hazard reduction in the spring and fall months. Within the 100-foot defensible perimeter, all brush, flammable vegetation, or combustible growth identified as a fire hazard by an inspecting officer is required to be mowed or cut. All cuttings from shrubs are required to be removed from the property. Single specimens of trees, ornamental shrubbery or ground covers are permissible provided that they do not form a means of rapidly transmitting fire from the native growth to any structure. Other specific clearance requirements pertain to roof surfaces, chimneys, propane tanks, access roads, and vacant parcels and are specified within the Fire Hazard Reduction Program guidelines (Ventura County Fire Protection District, undated).

If the Fire Department conducts an inspection of a property and determines fire hazard reduction is necessary, a "Notice to Abate Fire Hazard" is generated and mailed to the property owner. If the property owner fails to comply with the notice, the Fire Department retains a contractor to remove the hazardous vegetation from the property and places a tax lien assessment for the costs involved on the property owner's tax bill.


Thousand Oaks General Plan
Safety Element
Figure 10.
Very High Fire Hazard Severity Zone
Legend
Freeways
Major Streets
HAZ_CLASS
Very High
Planning area
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Sunset Hills Blvd
Avenida De los Arboles
E Olsen Rd
Erbes Rd
E Hillcrest Dr
E Thousand Oaks Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
JanssRd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
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Potrero Rd
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City of Thousand Oaks
COMMUNITY DEVELOPMENT
U:_CDD Final Documents\General Plan Map\SafetyElementFireHazardAreas1 Working Map.mxd
Created by T Williams-Anderson: 2/4/2014

The best defense against disastrous fires affecting the urban/wildland interface is a working partnership between property owners, their neighbors, and the Ventura County Fire Protection District. More detailed information pertaining to defensible space strategies and other fire hazard reduction approaches can be obtained from the Ventura County Fire Protection District.

The Ventura County Fire Protection District has developed a five year vegetation management plan with the goal of identifying and treating high fire hazard and risk areas that are found to constitute a threat to high value property. Treatment to remove and manage the hazardous accumulations of wildland vegetation is accomplished using prescribed burning and other means. Burning projects identified in the plan consider and protect the values of air quality, historical artifacts, endangered plants and species. The plan is reviewed and updated every three years.

The purpose of prescribed burning is:

- To provide a defense against wildfire destroying private property where the Fire Hazard Reduction Program cannot stand alone.
- To enhance rangeland productivity.
- To increase useful water yield.
- To protect and/or improve the wildland - carrying capacity and habitat diversity for wildfire.

Prescribed burning is the application of fire to wildland fuels when conditions such as weather, fuels and topography permit the specific objective to be accomplished safely. Prescribed burning is the most economical and environmentally sound approach to managing large blocks of fuel.

The Ventura County Fire Protection District approved a Fire Management Plan in July of 2005. The Fire Management Plan includes an assessment of wildland protection services and locations where there is a high risk of damaging wildfires. It recommended fuel reduction treatments in certain locations around the County to reduce the potential for fire damage. With respect to Thousand Oaks, the Fire Management Plan proposed fuel reduction treatments around the Lynnmere community in the vicinity of Wildwood Park.

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Chapter 5

Hazardous Materials

CHAPTER 5: HAZARDOUS MATERIALS

Hazardous materials are substances that are potentially harmful to human health or the environment. Hazardous materials can be liquids, solids, or contained gases. They include products and waste related to industrial, commercial and household uses, such as fuels, cleaning fluids and pesticides. Thousands of Ventura County businesses use or store hazardous materials, including pesticides, acids, caustics solvents, and heavy metals. These businesses include, but are not limited to, gasoline stations, automotive repair facilities, dry cleaners and a variety of industrial businesses.

More than 60,000 chemicals are produced in the United States. Over 11,000 of these chemicals are used for commercial purposes. Within the County of Ventura, over 5,000 manufacturing and service industries use or store hazardous materials, including pesticides, acids, caustics, solvents, and heavy metals (Ventura County, 1989). Because of the widespread use of hazardous materials in our communities, minor and major hazardous materials spills and incidents occur. Most of these incidents are related to the increasing transport of chemicals over roadways or through industrial accidents. U.S. Highway 101 and State Route 23 are major transportation corridors through the Conejo Valley. The California Highway Patrol estimates that about 105 trucks carrying hazardous materials or waste travel northbound through Thousand Oaks on a given day (number based on data obtained from inspection station at the top of the Conejo Grade). Accounting for southbound traffic and traffic on S.R. 23, the total number of trucks passing through the City is likely 200 or more.

In an effort to reduce impacts associated with a hazardous material Incident, Ventura County has developed a Hazardous Materials Emergency Response Plan. The goal of the plan is to protect life, property, and the environment from the effects of a hazardous material release to air, land or water or a hazardous material fire. Procedures to be used in the event of an incident and specific agency responsibilities are identified within the plan. The Plan is activated by the designated Incident Commander at the scene. Depending on the nature of the incident, this could be either the appropriate law enforcement authority (Ventura County Sheriff’s Department or California Highway Patrol) or the Ventura County Fire Department.

Because of the widespread use of hazardous materials in our communities, hazardous materials spills and incidents occur. Most of these incidents are related to the transport of chemicals over roadways (such as U. S. Highway 101 and State Route 23) or through industrial accidents. The Ventura County Environmental Health Division is the Certified Unified Program Agency that provides regulatory oversight over hazardous materials and hazardous waste programs in Thousand Oaks, unincorporated areas as well as other cities in Ventura County. The following programs are operated by the Environmental Health Division:

- Hazardous Materials Inventory and Business Plan
- Hazardous Waste Generator
- Onsite Hazardous Waste Treatment
- Underground Storage Tank
- Above-ground Storage Tank Spill Prevention Control and Countermeasure
- California Accidental Release Prevention

Every business that handles hazardous materials above certain thresholds must file a Hazardous Materials Business Plan and Emergency Response/Contingency Plan with the Ventura County Environmental Health Division. The Environmental Health Division provides this information to the Ventura County Fire Protection District for its use in responding to emergencies at these businesses.

Photo 9: Hazardous materials incident on Highway 118;
(Courtesy Ventura County Fire Protection District)

The County Hazardous Materials Emergency Response Plan is supplemented by individual Business Plans for businesses/facilities that store or handle hazardous materials and wastes. Under Chapter 6.95, Section 25503 of the California Health and Safety Code, Business Plans are required from California businesses that handle a hazardous material in quantities equal to or greater than the following:

- 55 gallons of a liquid,
- 500 pounds of a solid,
- 200 cubic feet of a compressed gas, or
- extremely hazardous substances above Federal threshold reporting quantities.

As part of the Business Plan, emergency response plans and procedures must be developed and training sessions must be provided to employees. Businesses are periodically inspected by local administering agencies (Ventura County Environmental Health Services Division) to ensure that handling, storage, and waste disposal practices conform with appropriate laws and regulations.

According to the Ventura County Environmental Health Division, in 2012 there were approximately 296 businesses in the City of Thousand Oaks using and/or storing hazardous materials. These businesses include gasoline stations, automotive repair facilities, dry cleaners, and miscellaneous commercial and industrial facilities. Industrial use of hazardous materials is centered in the Newbury Park industrial area (Rancho Conejo Industrial Park) north of Highway 101. Many of the commercial businesses that store or use hazardous materials are located on Thousand Oaks Boulevard or Moorpark Road. Specific information regarding the location of businesses and types and quantities of hazardous substances used or stored can be obtained through the County of Ventura Division of Environmental Health.

Hazardous waste refers to discarded materials that can potentially threaten human health or the environment. Planning for facilities for handling and disposing of hazardous waste is addressed in a separate element of the General Plan.

State Assembly Bill 2948 (Tanner 1986) mandates that each local government have a hazardous waste management plan for dealing with hazardous waste generated within the community. In 1986, the County Board of Supervisors adopted the Ventura County Hazardous Waste/Materials Management Plan (CHWMP). It identifies sources of hazardous waste, transportation routes needed to remove the waste and areas for potential treatment and disposal. On July 10, 1990, the City of Thousand Oaks adopted the Policy and Implementation Document of the CHWMP as a separate element of the Thousand Oaks General Plan.

Pipelines

A 10-inch diameter crude oil pipeline traverses the northeastern portion of the City. Crude oil pipelines are typically buried and are equipped with emergency shut off valves. This pipeline could potentially be damaged in an earthquake. If oil should leak from the damaged pipeline, there could be environmental contamination or a fire if the leaking material were ignited.

Hazard Analysis

The seriousness of a hazardous material incident is dependent on a number of factors including the type and quantity of material involved, the proximity to populated areas, the time of day, weather conditions and physical state of material (i.e., solid, liquid, vapor or gas). The greater the number of people exposed to the hazardous material, the greater the potential for significant impact. Because of their dispersion characteristics, vapors and gases tend to involve greater hazards. Under a worst case scenario, an incident could result in fatalities and injuries, destruction of private and public improvements, and contamination of the environment.

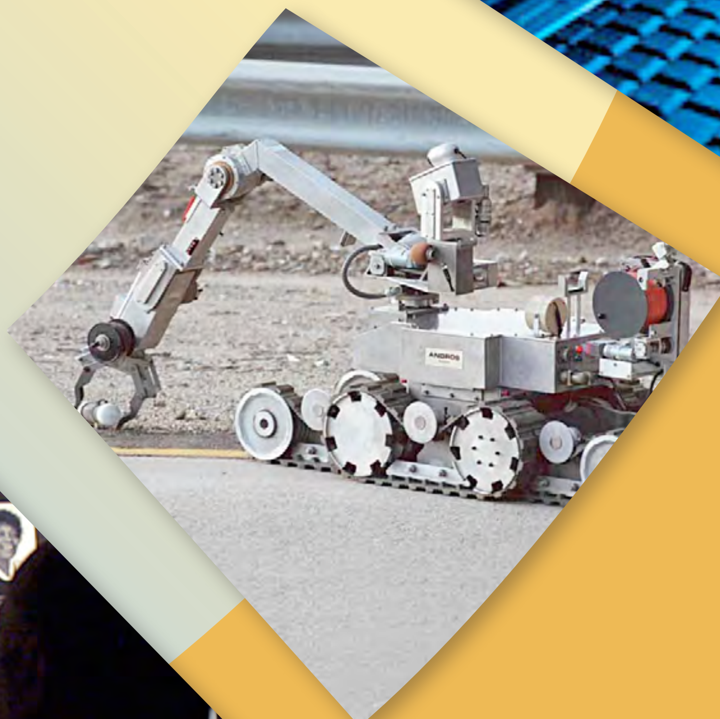
Although a hazardous materials release could occur anywhere within the City of Thousand Oaks, certain areas are at greater risk. These include the following:

- U.S. Highway 101 and State Route 23 are major transportation corridors through the Conejo Valley. A hazardous material spill involving transportation would most likely occur along one of these highways.

- Because of the high number of businesses that use or store hazardous materials on Thousand Oaks Boulevard or Moorpark Road, these major arterials and adjacent neighborhoods are potentially at greater risk than other areas of the City.

- Because of the concentration of industrial businesses north of Highway 101 in Ranch Conejo Industrial Park, this area is also potentially at greater risk than other parts of the City.

In addition to traffic related incidents, hazardous materials spills could be caused by ground shaking associated with a large earthquake or other soil related hazards (landslide, debris flow, liquefaction, etc.). Ground shaking related to the Simi Fault could cause major structural damage to facilities using hazardous materials. Hazardous material containers not properly secured could be felled and/or ruptured. Improperly segregated materials could result in toxic or explosive reactions.



Chapter 6

Terrorism

CHAPTER 6: TERRORISM

The Ventura County Sheriff's Office, serving as the Thousand Oaks Police Department, works with other law enforcement agencies and the private sector to combat terrorism. The Thousand Oaks Police Department is a conduit for the central reporting for our region and has Terrorism Liaison Officers who have been trained to identify suspicious activities.

Barriers and security systems can help deter terrorists, but no barrier or security system can provide complete protection. It is also important for all citizens to remember, if they "See something, Say something" as the slogan states.

Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (28 C.F.R. Section 0.85). The majority of Americans see terrorism as an assault on the most basic human right to life and security that cannot be justified on the basis of any political or social objective.

Internationally, terrorism is a controversial term. The international community, represented by the United Nations, has been unable to agree on a basis for determining when the use of violence (at whom, by whom, and for what purpose) is legitimate. However, it is generally agreed that certain terrorist activities are crimes. In 1994, the United Nations General Assembly condemned terrorism with the following statement: "Criminal acts intended or calculated to provoke a state of terror in the general public, a group of persons or particular persons for political purposes are in any circumstance unjustifiable, whatever the considerations of a political, philosophical, ideological, racial, ethnic, religious or any other nature that may be invoked to justify them."

The Federal Bureau of Investigation (FBI) maintains statistics on terrorist attacks in the United States (Source: Terrorism 2002-2005 U.S. Department of Justice, Federal Bureau of Investigation). FBI records show that 318 terrorist acts occurred in the United States between 1980 and 2005. Of these events, 209 were classified as bombings, 43 arsons, 20 malicious destructions, 16 shootings, 10 hostile takeovers, 8 robberies, 4 assaults, 2 hijackings, 2 kidnappings, 2 rockets, 1 assassination and 1 weapon of mass destruction (anthrax). The majority of these attacks can be attributed to individuals and groups who subscribe to specific ideologies.

The catastrophic attacks of September 11, 2001, illustrate the threat presented by terrorists with an agenda based on religious intolerance. Militant Islamic jihadists have demonstrated a commitment to use mass murder on a worldwide basis to advance their cause. They believe it is their religious duty to kill (or subjugate) people who do not follow their religion and way of life. The threat of massive attacks by militant jihadists is greatest in major metropolitan areas like New York and Washington, D.C. because they offer high-profile targets and the potential to harm large numbers of people.

Issue-based terrorists carry out attacks to express grievances and to compel change regarding a range of issues. Issue-motivated terrorists have used violence to compel change concerning issues such as animal rights, environmental damage, abortion, globalization and capitalism. The deadly bombing of the Federal Building in Oklahoma City, Oklahoma in 1995, for example, was carried out by anti-government, issue-based extremists. The bombing resulted in 168 deaths and 642 injuries. Animal rights and environmental extremist attacks, on the other hand, have tended to target property, primarily through fire-bombings and arsons, rather than people.

Photo 10: A visitor looks at the faces of some of the victims of the Oklahoma City bombing at the Oklahoma City National Memorial and Museum (www.time.com/time/photogallery)

Many acts of terrorism are simply motivated by hate. While hate might be the central motivation, hate-based terrorists often have extremist religious or anti-government motivations as well. Hate-based terrorist incidents have been attributed to individuals and groups who subscribe to extreme neo-Nazis, racist, anti-Semitic, anti-gay and anti-minority ideologies. For example, in 2009, a white supremacist and anti-Semite attacked the U.S. Holocaust Memorial Museum in Washington, DC, killing a security guard. In addition, on August 5, 2012, a white supremacist shot and killed six people and wounded four others at a Sikh temple in Oak Creek, Wisconsin.

The motivations behind terrorist attacks in the United States have changed over the years. Terror attacks in the 1970s were often motivated by extreme left-wing and ethno-national/separatist ideologies. Many attacks in the 1980s were religiously motivated. Anti-government terrorism was prevalent during the 1990s and issue-based terrorism was widespread during the 2000s (Source: LaFree, Gary, and Bianca Bersani. “Hot Spots of Terrorism and Other Crimes in the United States, 1970 to 2008,” Final Report to Human Factors/Behavioral Sciences Division, Science and Technology Directorate, U.S. Department of Homeland Security, College Park, MD: START, 2012).

The City of Thousand Oaks does not have high-profile targets or a history of terrorist attacks or extremist activity. Therefore, the probability of terrorist attacks is relatively low. However, it would be unrealistic to assume that the City is entirely immune from terrorism. There will be a risk of terrorism as long as there are people who are motivated by extremist ideologies. While the risk of terrorism is low in Thousand Oaks, government buildings and religious facilities are the most likely targets.

Terrorists often go for hard targets, but large public events are also vulnerable to terrorist attacks. For example, on April 15, 2013, two terrorists set off bombs with deadly results at the finish line of the Boston Marathon.

Security planning should to be considered when an organization is going to hold an event involving large numbers of people. Parades, walks, races, funeral processions, concerts, celebrations, festivals and fairs (e.g. Conejo Valley Days) can attract many people, but not all events will require the same level of security. Events of religious or political significance or involving high-profile or controversial public figures might pose an elevated risk. These kinds of events might require special security arrangements.

Terrorism cannot always be stopped by controlling access, erecting barricades or other security arrangements. Defeating terrorism requires finding and disrupting terrorists before they can strike. Among other things, this requires effective intelligence sharing among law enforcement agencies. Therefore, the Thousand Oaks Police Department participates in interagency initiatives to gather, analyze and disseminate information on suspected terrorists.

The Boston Marathon bombing in 2013 underscored the need to improve the sharing of information among law enforcement agencies on potential terrorist threats. Regional “fusion” centers were set up after the attacks of September 11, 2001, to allow federal, state, and local governments to share information on terrorist activities. However, this system was not able to track one of the Boston bombers despite documented warnings about his behavior. Breakdowns in information sharing allowed the Boston bombing plot to go undetected and slowed the identification and capture the bombers.

As a society we can combat terrorism by discrediting extremist ideologies and opposing organizations and regimes that encourage terrorism. Ultimately, our security depends on a world that promotes human rights and rejects intolerance and violence. Current and future generations must also learn the true history of terrorism, racism, slavery, religious persecution, the Holocaust and other genocides. It is up to all citizens to teach tolerance and to condemn hatred and terrorism.

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Chapter 7

Disaster Preparedness

CHAPTER 7: DISASTER PREPAREDNESS

The City of Thousand Oaks adopted an Emergency Operations Plan on May 27, 2008 that provides emergency guidelines for responding to disasters. The Plan focuses on potential large scale disasters requiring mutual aid from various agencies. It provides for the emergency organization, policies and procedures, and coordination among emergency personnel utilizing the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS). There are also mutual aid agreements in place for law enforcement, fire, medical, and public works services.

A. Emergency Operations Plan

The City of Thousand Oaks adopted an Emergency Operations Plan (EOP) on May 27, 2008. The EOP provides emergency guidelines for responding to disasters. The Plan focuses on potential large scale disasters that often require mutual aid from various agencies.

The EOP directs the City to use the State's Standardized Emergency Management System (SEMS). Local governments must use SEMS to be eligible for reimbursement of response-related costs under the state's disaster assistance programs. SEMS divides the emergency management organization into five functions: Management, Operations, Planning/Intelligence, Logistics and Finance.

The EOP also directs the City to use the National Incident Management System (NIMS). NIMS was developed by the Department of Homeland Security (DHS) to ensure that all levels of government across the nation have the capability to work together effectively to manage emergency incidents. NIMS requires, for example, standard operating procedures, standardized classes, interoperable communications systems, mutual aid agreements and interagency training exercises. The City must comply with NIMS to be eligible for federal emergency preparedness grants and emergency response relief.

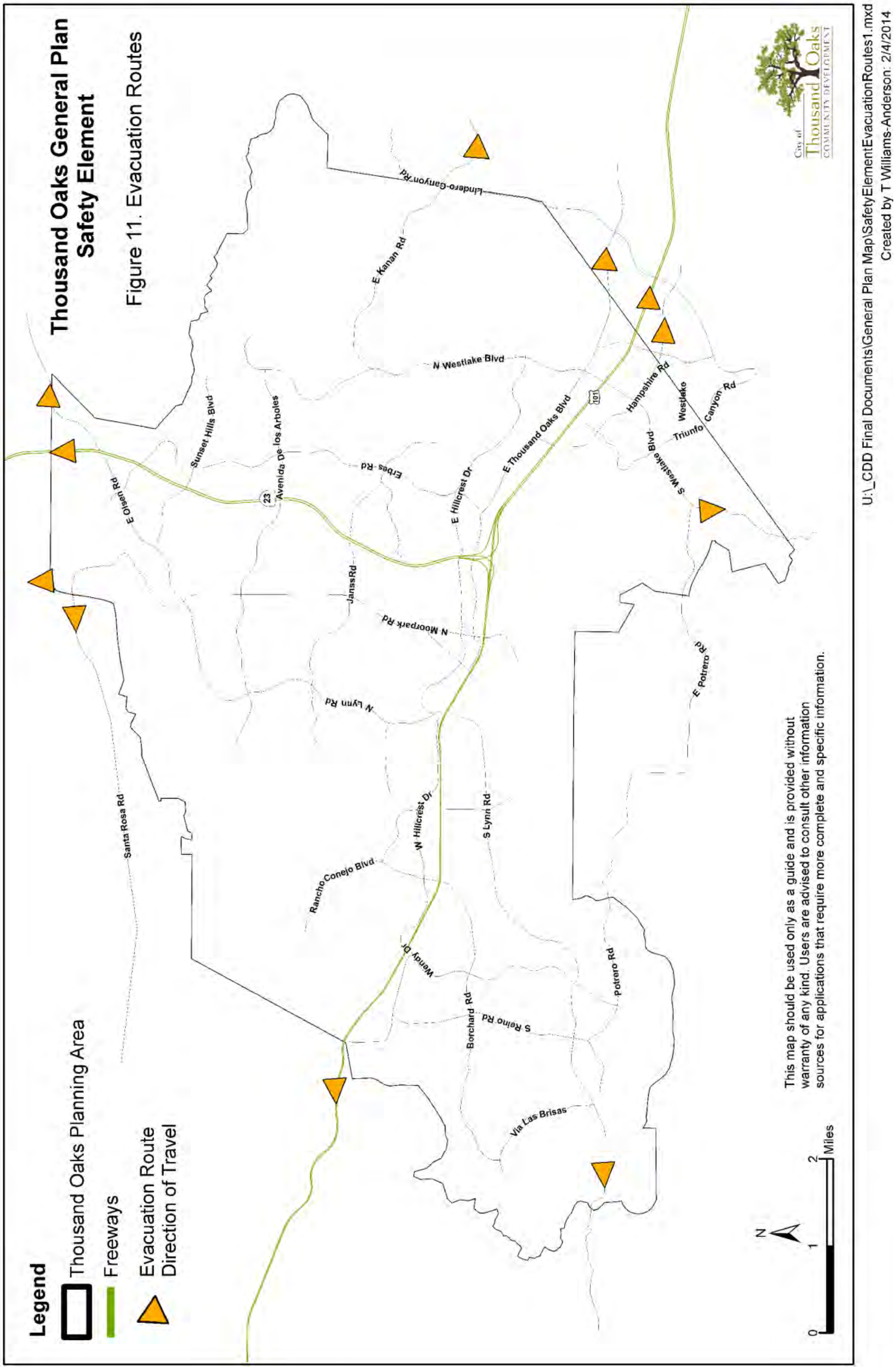
The Emergency Operation Center (EOC) is the City location where disasters are managed. The EOC is located at City Hall, 2100 Thousand Oak Boulevard. An alternative EOC will be selected if the EOC is damaged or inaccessible in an emergency.

Evacuation Routes

The Ventura County Sheriff's Department is ultimately responsible for coordinating evacuation necessitated by an emergency. If delayed during a large disaster, the Public Works Director for the City is responsible for coordinating evacuation efforts on an interim basis.

Evacuation routes are determined for each emergency based on the nature of the event and the location of evacuation shelters. Ventura County relays evacuation information to residents by telephone and, when possible, in person.

Annex H of the EOP provides a listing of freeways and streets to be used in the event of a disaster requiring evacuation. Detailed maps for evacuation routes are kept at the Municipal Service Center located in Newbury Park. Major evacuation routes are shown on Figure 11.


Thousand Oaks General Plan
Safety Element
Figure 11. Evacuation Routes
Legend
Thousand Oaks Planning Area
Freeways
Evacuation Route
Direction of Travel
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
E Thousand Oaks Blvd
E Hillcrest Dr
Erbes Rd
Avenida De los Arboles
Sunset Hills Blvd
E Olsen Rd
Janss Rd
N Moorpark Rd
N Lynn Rd
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
Potrero Rd
Borchard Rd
S Reino Rd
Via Las Brisas
101
23
This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
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Miles
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City of Thousand Oaks
COMMUNITY DEVELOPMENT
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Created by T Williams-Anderson: 2/4/2014

Evacuation Centers

The EOP describes the organizational and operational procedures to be used during a major natural disaster or incident in order to meet the food, shelter and clothing needs of large numbers of people. The American Red Cross is the lead agency involved in providing disaster relief during peacetime disasters. Authority is mandated by Federal Law 36-USC-3 arid reaffirmed in Public Law 930288 (Federal Disaster Relief Act of 1974). The Red Cross acts cooperatively with State and local governments, including the California Office of Emergency Services and the California Department of Social Services, and private relief organizations to provide relief services.

Evacuation centers to be used in the event of disaster vary depending on the location and nature of the disaster. The facilities most likely to be used are local colleges, public schools, churches and community centers because they can shelter large numbers of people.

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Chapter 8

Critical & Lifeline Facilities

CHAPTER 8: CRITICAL AND LIFELINE FACILITIES

A. Critical Facilities

Critical facilities are generally defined as those structures whose ongoing performance during an emergency is required or whose failure could threaten many lives. Type of structures vary but may include:

- Hospitals
- Urgent care centers
- Private ambulance companies
- Fire stations
- Police and emergency services facilities
- Assisted living facilities and nursing homes
- Schools

A map of selected critical facilities in the Thousand Oaks area is included as Figure 12. These facilities are described in Table 8.

Hazard Analysis

Based on information provided in previous sections of this report, there are a number of potential hazards that could affect existing critical structures in the City of Thousand Oaks. These include flood and dam inundation, seismic and geohazards and fire hazards. The following provides a summary of existing critical facilities located in potentially hazardous areas. No specific reference is made to geologic hazards because all of the facilities may be affected by such hazards – especially groundshaking caused a large regional earthquake. Measures that can be taken to reduce these hazards are addressed in previous sections of this document.

Hospitals and Emergency Care Facilities

The Thousand Oaks Planning Area is served by two hospitals, Los Robles Regional Medical Center and the Thousand Oaks Surgical Hospital. Neither of these facilities are located in areas subject to specific hazards other than ground shaking due to earthquake.

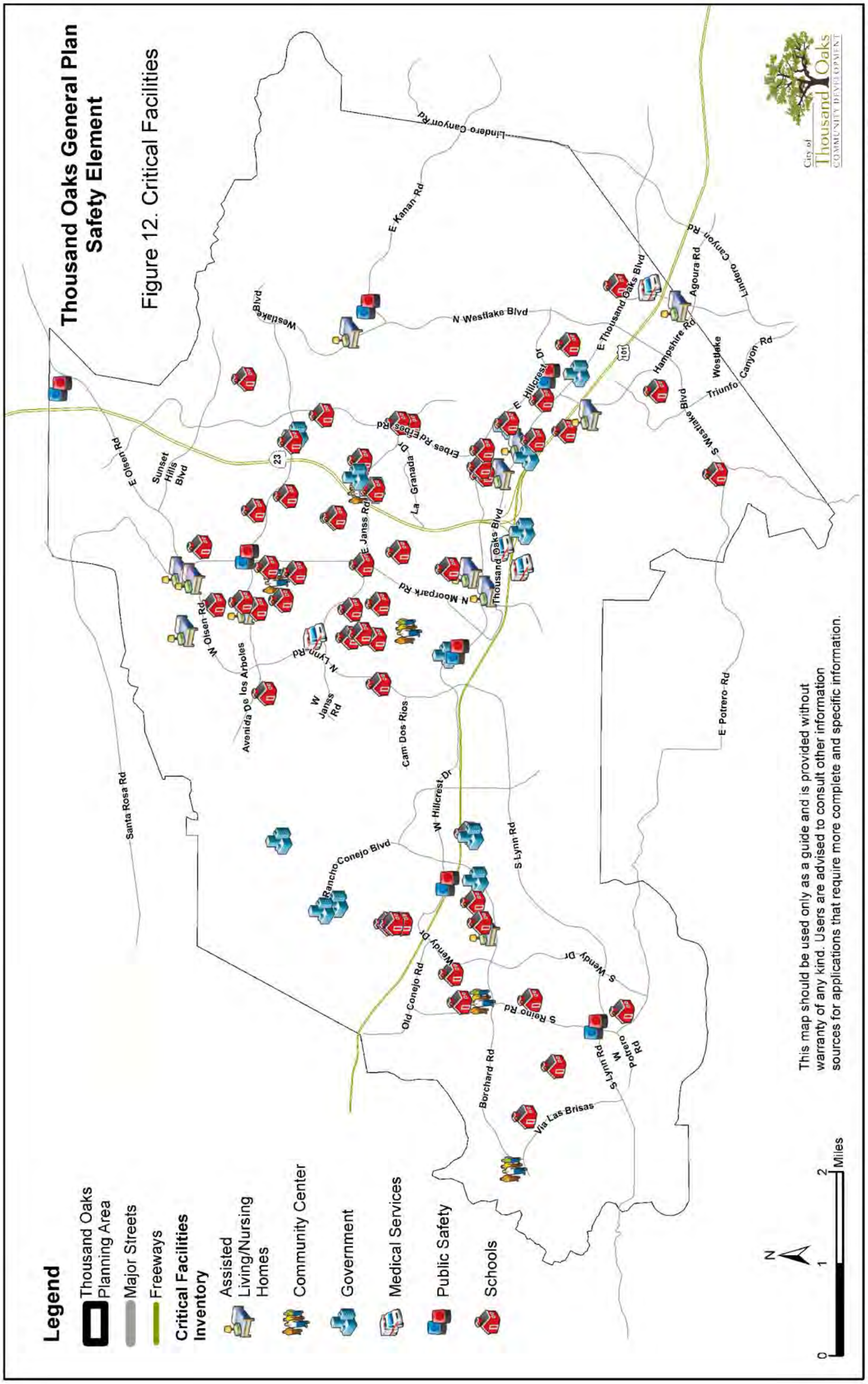
New hospitals are required to undergo stringent design and construction standards in conformance with the Hospital Act of 1972. This legislation was enacted following the 1971 San Fernando Earthquake of Southern California in which several hospitals in the vicinity of the epicenter were seriously damaged and unable to continue functioning during a critical period.

On January 13, 2010, the City approved an expansion of the Los Robles Regional Medical Center to increase the maximum bed count from 277 to 337 beds and to comply with Senate Bill 1935, which mandates that critical patient services be located within buildings that meet current seismic safety standards by January 2013. The approved project included the addition of a fourth floor to the 3-story wing completed in 2007, a new 659-space parking structure and a new 4-story patient care wing.

B. Schools

Existing schools are potentially susceptible to a number of hazards including:

- Newbury Park High School and EARTHS (Manzanita) Elementary School are located within or adjacent the 100-year flood zone.
- Walnut Elementary School is located in the 500-year flood zone (2010 Ventura County Hazard Mitigation Plan).
- Sequoia, Wildwood, Westlake, Conejo and Lang Ranch elementary schools and Westlake High School are located within or adjacent to areas of very-high fire hazard.
- Madrona, Cypress, Sycamore Canyon, Banyan and Maple elementary schools are in or adjacent to areas of high fire hazard.
- Westlake Elementary School is located within the dam inundation hazard area that would be caused by a failure of Lake Sherwood Dam.
- The proposed Conejo Community Learning Center (Continuation School) is within an area susceptible to liquefaction.


Thousand Oaks General Plan
Safety Element
Figure 12. Critical Facilities
Legend
Thousand Oaks Planning Area
Major Streets
Freeways
Critical Facilities Inventory
Assisted Living/Nursing Homes
Community Center
Government
Medical Services
Public Safety
Schools
0
1
2
Miles
N
This map should be used only as a guide and is provided without warranty of any kind. Users are advised to consult other information sources for applications that require more complete and specific information.
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Created by T Williams-Anderson: 2/4/2014
City of Thousand Oaks
Community Development
Lindero Canyon Rd
E Kanan Rd
Westlake Blvd
N Westlake Blvd
E Thousand Oaks Blvd
Agoura Rd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
E Hillcrest Dr
Erbes Rd
La Granada Dr
E Olsen Rd
Sunset Hills Blvd
E Janss Rd
Thousand Oaks Blvd
N Moorpark Rd
W Olsen Rd
Avenida De los Arboles
N Lynn Rd
W Janss Rd
Cam Dos Rios
E Potrero Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
S Wendy Dr
Old Conejo Rd
S Reino Rd
Borchard Rd
Via Las Brisas
W Potrero Rd
23
101

Table 8: Critical Facilities in Thousand Oaks

Assisted Living/Nursing Homes

- Altria Hillcrest
- Belmont Village
- CLC Oak View Health Care
- Grand Oaks Senior Living
- Hillcrest Royale
- Mary Health of the Sick
- Sunrise Assisted Living
- The Reserve at Thousand Oaks
- Thousand Oaks Health Care
- Thousand Oaks Royale
- United Cerebral Palsy
- University Village
- Westlake Health Care

Community Centers

- Borchard Community Center
- Conejo Community Center
- Dos Vientos Community Center
- Goebel Senior Adult Center
- Thousand Oaks Comm. Center
- Thousand Oaks Teen Center

Government Facilities

- City Hall
- CRPD Maintenance Yard
- CVUSD Admin. Offices
- CVUSD Maintenance Yard
- Dept. of Motor Vehicles
- Grant R. Brimhall Library
- Hill Canyon Treatment Plant
- Hillcrest Center
- MSC Household Hazardous Waste Facility
- Municipal Service Center
- Newbury Park Library
- Thousand Oaks Post Office
- Thousand Oaks Transit Center

Medical Services

- AMR Ambulance Service
- Los Robles Hospital East Campus
- Los Robles Regional Medical Center
- Thousand Oaks Surgical Center

Public Safety

- East Valley Law Enforcement Center
- Fire Station 30-Civic Center
- Fire Station 31-Westlake
- Fire Station 32-Portero
- Fire Station 34-Arboles
- Fire Station 35-Newbury Park (relocation planned)
- Station 37-North Ranch

Schools

- Acacia Elementary
- Adventist Academy Elementary
- Ascension Lutheran
- Aspen Elementary
- Banyan Elementary
- Bethany Christian
- BRIDGES (Park Oaks) Elem.
- California Lutheran University
- Carden Elementary
- Century Academy
- Colina Middle
- Conejo Community Learning Center (proposed)
- Conejo Elementary
- Conejo Valley High

Schools (Continued)

- Conejo Valley Waverly Adult
- Cypress Elementary
- EARTHS (Manzanita) Elementary
- First Baptist Academy
- Glenwood Elementary
- Hillcrest Christian
- Honey Tree Early Childhood Ctr
- Horizon Hills Adult & Preschool
- La Reina High
- Ladera Elementary
- Lang Ranch Elementary
- Little Oaks
- Los Cerritos Middle
- Madrona Elementary
- Maple Elementary
- MATES (Meadows) Elementary
- Montessori Children’s Place
- Neighborhood City Ctr Day Care
- Newbury Park Academy (HS)
- Newbury Park Academy
- Newbury Park High
- Pinecrest
- Redwood Middle
- Sequoia Middle
- St. Paschal’s Elementary
- St. Patrick’s
- Sycamore Canyon
- Thousand Oaks High
- Thousand Oaks Kinder Care
- University Early Childhood Center
- Walnut Elementary
- Weathersfield Elementary
- Westlake Elementary
- Westlake High
- Westlake Hills Elementary
- Westlake Montessori
- Wildwood Elementary

The State of California has the responsibility for ensuring that public school buildings are adequately constructed to meet seismic design standards.

Fire Stations and Law Enforcement Facility

Thousand Oaks has five fire stations and one law enforcement facility. The location of these facilities is shown on Figure 12. Some of these facilities are potentially susceptible to various hazards including:

As discussed in Table 6 of this document, Fire Stations 33, 34, and 35 were constructed prior to 1971 and could require seismic retrofitting to be in compliance with current guidelines.

Fire Station No. 32 is located adjacent to the I00-year flood zone.

Fire Station No. 35 is located within the 500-year flood zone (2010 Ventura County Hazard Mitigation Plan).

Fire Station No. 33 (Lake Sherwood) is within a landslide hazard area (2010 Ventura County Hazard Mitigation Plan).

Fire Station Nos. 31 (Westlake) and 37 (North Ranch) are within or adjacent to areas of very-high fire hazard (2010 Ventura County Hazard Mitigation Plan).

The East Valley Law Enforcement Facility is located within a high fire hazard area.

Other Facilities

Various other critical facilities are potentially susceptible to hazards including the following:

- The Newbury Park branch public library and the Borchard Community Center (and Conejo Valley Recreation and Park District Corporate Yard) are located within or adjacent the 100-year flood zone.
- The Alex Fiore Thousand Oaks Teen Center and the Goebel Senior Adult Center and the Grant R. Brimhall Library are within an area susceptible to liquefaction.
- The Municipal Service Center, Hill Canyon Wastewater Treatment Plant, CLC Oak View Health Care Center, Belmont Village (assisted living), Thousand Oaks Transportation Center, Dos Vientos Community Center and Calleguas Municipal Pumping, Filtration, and Treatment Plant are located within or adjacent to a high fire hazard area.

Photo 11: Hill Canyon Wastewater Treatment Facility

C. Lifeline Facilities

Lifeline facilities are vital utility corridors and associated facilities that may be damaged by catastrophic events such as earthquakes. These include: major gas lines, major power lines, crude oil pipelines, major communication stations, major water lines and water tanks. Figure 13 shows lifeline facilities in the Thousand Oaks area.

Electricity

The City of Thousand Oaks is supplied electrical power by Southern California Edison. The location of major electrical transmission lines are shown in Figure 13. Electrical transmission substations (Newbury, Thousand Oaks, and Potrero) are located at 1295 Lawrence Drive, 199 E. Wilbur Road and 2345 Townsgate Road. In 2008, Edison also proposed a new electrical substation on the south side of Olsen Road at the northern city boundary. As of February of 2014, the proposed project involved upgrades to the Potrero Substation in Thousand Oaks and the Royal Substation in Simi Valley instead of building a new substation. The California Public Utilities Commission has final authority to approve or deny the project. Substations are the most-vulnerable component of the electrical power delivery system.

Transformers, switches, circuit breakers, control equipment, and high-voltage porcelain insulators are especially susceptible to high-frequency ground motions which can be generated in earthquakes. A substation can be disabled by seismic intensities as low as

VII (Toppozoda et al., 1988). Newbury substation is located in an area of extremely high fire hazard. Buried electrical transmission lines may be susceptible to liquefaction in the event of a ground failure triggered by an earthquake. Many of the transmission lines (including those running along Reino Road, Moorpark Road, and Thousand Oaks Boulevard) are located in areas of older unconsolidated alluvium and may be susceptible to liquefaction and other soil related hazards.

If damaged during an earthquake, sections of the City may be without power. Critical facilities such as hospitals, the East Valley Law Enforcement Facility Emergency Operations Center and Fire Stations can function on backup generators. If only limited electrical service can be restored following a disaster, these facilities should be given priority.

Lack of electrical power can also impair designated evacuation centers, communication facilities, and water distribution systems. Evacuation centers that will most likely be used during a disaster and emergency communication facilities should be equipped with backup power systems, Gravity-fed water distribution systems should be incorporated into City-wide, fire suppression emergency programs.

Natural Gas and Oil

Natural gas is supplied to the City by Southern California Gas Company. The location of major distribution lines (12" to 20") are shown in Figure 13. Distribution lines between Olsen Road and Westlake Boulevard and along Lynn Road traverse areas of older alluvium and may be susceptible to liquefaction and other soil related hazards. Damage to these lines during an earthquake could result in an interruption of service or, in a worst case scenario, fires or explosions. Leaks would be expected to occur mostly at piping connections and valves. Another area of concern is the Erbes Road Landslide (along Westlake Boulevard). Three main gas lines pass through this feature. Movement of the landslide mass could result in rupture of a gas line which could cause fires or explosions.

A 10-inch diameter crude oil pipeline (Ventura- Wilmington Crude Line), traverses the northeastern portion of the City. Crude oil pipelines are typically buried within the upper 5 feet and are equipped with emergency shut off valves. This pipeline could potentially be damaged in an earthquake, resulting in disruption of service and contamination of surface waterways, soil, and underlying ground water. The pipeline passes through the Erbes Road Landslide and areas of older unconsolidated alluvium (between Olsen Road and Westlake Boulevard) and, thus, may be susceptible to landsliding, liquefaction and other soil related hazards.

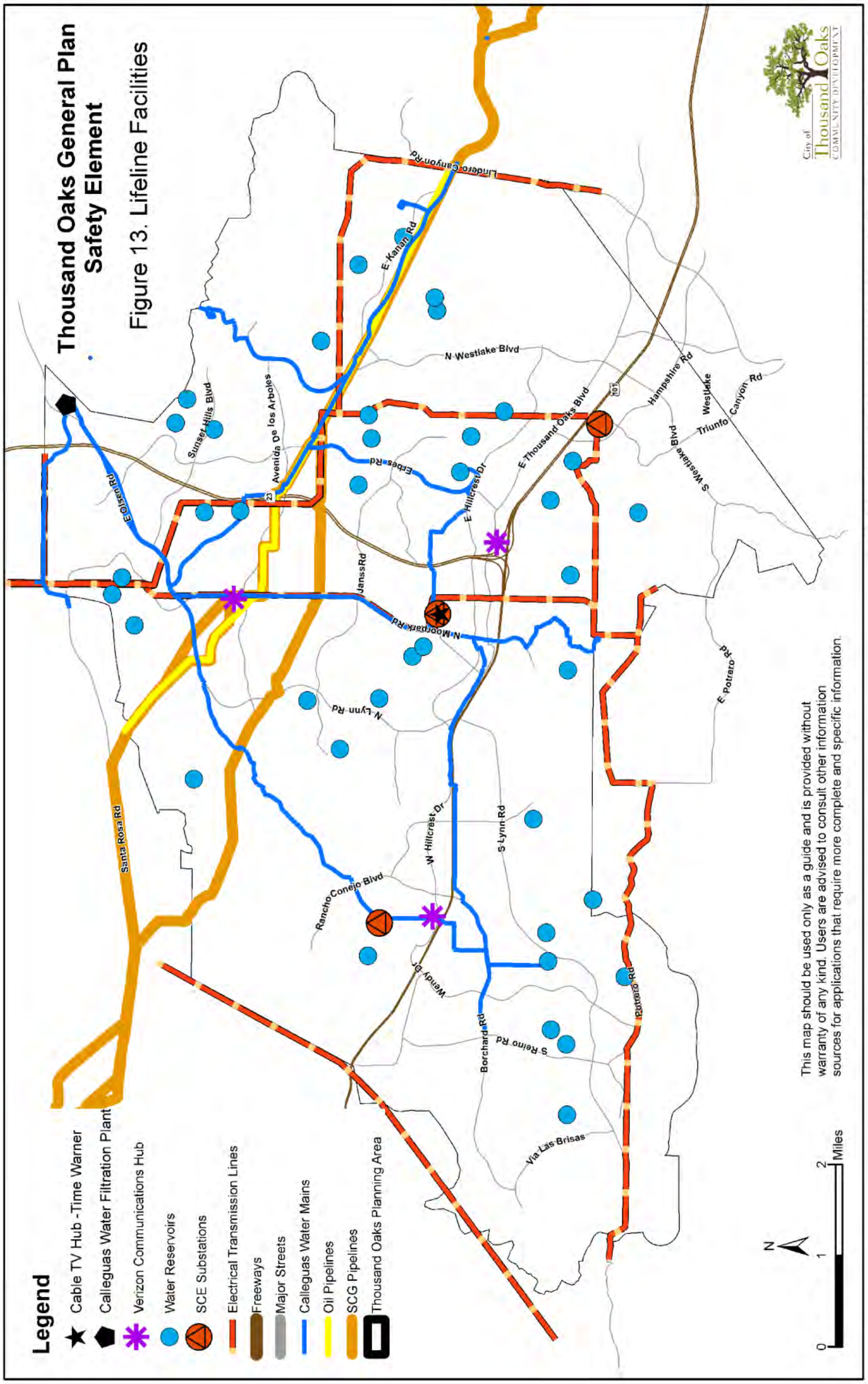
Water

Water is supplied to water purveyors within the City of Thousand Oaks by the Calleguas Municipal Water District (CMWD). The CMWD distribution lines and water filtration plant are shown on Figure 13. CMWD purchases water from the Metropolitan Water District of Southern California (MWD). Bard Reservoir, located north of the City and owned by CMWD, stores about 10,000 acre-feet of water. Area reservoirs include Newbury Park

Reservoir, Lake Sherwood Reservoir, and Thousand Oaks Reservoir. Four water retailers supply CMWD water to City residents. These include: 1) California-American Water Company, 2) California Water Service Company, and 3) City of Thousand Oaks and 4) Camrosa Water District. The location of local water tanks are shown on Figure 13.

Water distribution lines could be damaged in an earthquake as a result of liquefaction. Breaks in water distribution pipelines could result in disruption of service, loss of pressure, and localized flooding and associated impacts (erosion, sinkholes, etc.). A lack of adequate water pressure could result in inadequate flow for fire suppression. Areas of the City potentially susceptible to liquefaction and other soil related hazards include lines along Borchard Road, Lawrence Drive, U.S. Highway 101, Olsen Road, Moorpark Road, Paige Lane, and Erbes Road.

Water lines along Borchard Road and Highway 101, and lines crossing under Moorpark Road, Paige Lane, and the Thousand Oaks North Drain could be damaged by a I00-year flood event.


Thousand Oaks General Plan
Safety Element
Figure 13. Lifeline Facilities
Legend
Cable TV Hub - Time Warner
Calleguas Water Filtration Plant
Verizon Communications Hub
Water Reservoirs
SCE Substations
Electrical Transmission Lines
Freeways
Major Streets
Calleguas Water Mains
Oil Pipelines
SCG Pipelines
Thousand Oaks Planning Area
0
1
2
Miles
N
Lindero Canyon Rd
E Kanan Rd
N Westlake Blvd
Sunset Hills Blvd
Avenida De los Arboles
E Olsen Rd
Erbes Rd
E Hillcrest Dr
E Thousand Oaks Blvd
Hampshire Rd
Westlake
Triunfo Canyon Rd
S Westlake Blvd
Janss Rd
N Moorpark Rd
E Potrero Rd
N Lynn Rd
Santa Rosa Rd
W Hillcrest Dr
S Lynn Rd
Rancho Conejo Blvd
Wendy Dr
Borchard Rd
S Reino Rd
Potrero Rd
Via Las Brisas
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Created by T Williams-Anderson: 3/5/2014
City of Thousand Oaks
Community Development

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Chapter 9

Policies

CHAPTER 9: POLICIES

This chapter identifies the City's goals and policies for hazard reduction. Goals are intended to establish direction for an ideal future end condition related to public health, safety, or general welfare. In the context of a General Plan, goals are expressions of community values adopted by the City Council to guide the development and implementation of policy. A policy is a specific statement that guides decision-making. It indicates a clear commitment of the City Council. It is based upon the goals, as well as upon the technical background data. Programs are fundamental rules guided by the goals and policies. Programs are based on community values, generally-accepted planning practice, and current technology.

A. Faulting and Seismic Hazards

Goal

S-1 Minimize the risk of loss of life, injury, damage to property, and economic and social dislocation resulting from fault rupture and seismically induced ground shaking.

Policies

A-1 Require site-specific geologic and engineering investigations as specified in the California Building Code (International Building Code with California amendments) and Municipal Code for proposed new developments and/or when deemed necessary by the City Engineer and/or through the CEQA process.

A-2 Adopt the latest California Building Code (CBC) and enforce provisions relating to earthquake resistant design.

A-3 Enforce provisions of Title 7, Chapter 3 (Grading) and Title 8, Chapter 1 (Building Code) of the Municipal Code that incorporate the CBC with amendments specific to the City.

A-4 Continue to allocate a percentage of building permit fees (as specified in Chapter 8 of Division 2 of the Public Resources Code) to a trust fund (Strong Motion Instrumentation Program Fund) which is remitted to the State of California. The moneys are earmarked for seismic education pursuant to the Seismic Hazards Mapping Act of 1990.

A-5 Provide setbacks, as determined to be necessary, for any proposed development located on or near an active or potentially active fault. Appropriate setback distances will be determined through engineering geologic investigation. No active faults have been mapped within the Planning Area. Potentially active faults include the Sycamore Canyon and Boney Mountain Faults.

A-6 Require all developers and/or subdividers of a parcel or parcels in an area of known fault hazard to record a Notice of Geologic Hazards with the County Recorder describing the hazards on the parcel and the level of prior geologic investigation conducted.

A-7 Require project modifications, including but not limited to hazard mitigation, project redesign, elimination of building sites, and the delineation of building envelopes, building setbacks and foundation requirements, as deemed necessary, in order to mitigate faulting/seismic hazards.

B. Geologic Hazards

Goals

S-2 Safeguard life, limb, health, property, and the public welfare by establishing minimum requirements for regulating grading and procedures by which such requirements may be enforced (Municipal Code Section 7-3.01).

S-3 Provide minimum standards to safeguard life or limb, health, property and the public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location, demolition, and maintenance of all buildings and structures within the City and certain equipment specifically regulated therein (Municipal Code Section 8-1.02).

Policies

Grading/Building Construction

B-1 Require any alteration, grading, excavation or fill activity to comply with the City's Grading Ordinance.

B-2 Require that all construction be in accordance with the most current version of the California Building Code and Title 8, Chapter 1 of the Municipal Code which incorporates the CBC with specific amendments.

B-3 Perform site-specific geologic and engineering investigations for new developments as specified in the CBC and Municipal Code.

B-4 Prohibit grading or relocation of earth on land having a natural slope greater than 25% unless approval is obtained from the Planning Commission or City Council and a grading permit has been obtained from the City Engineer (Municipal Code Section 7-3.07).

B-5 Continue to regulate grading during the rainy season (November-April) in order to control erosion and protect life and property from damage due to flooding or erosion associated with grading activities.

Liquefaction

B-6 Conduct soils investigations to evaluate hazards potential for proposed developments in areas of potential liquefaction.

B-7 Require project modifications, including but not limited to project redesign, elimination of building sites, building envelopes and drainage and foundation requirements, as necessary in order to mitigate liquefaction hazards.

B-8 Require the developers and/or subdividers of a parcel or parcels in a Liquefaction Hazard Zone to record a Notice of Geologic Hazards with the County Recorder describing the potential hazards on the parcel and the level of prior geologic investigation conducted unless the condition has been mitigated.

Landslides and Debris Flows

B-9 Require that all development activities provide a setback from potentially unstable areas or from the margins of potential debris flow channels and depositional areas as identified through engineering and geologic studies.
B-10 Require drainage plans designed to direct runoff away from unstable areas.
B-11 Where washouts or landslides have occurred on public or private roads, require that road reconstruction meet the conditions of appropriate geologic and engineering reports and provide for adequate engineering supervision.
B-12 In general, prohibit building sites within the flowline or discharge areas of hillside swales or channels. Building may be able to occur near smaller swales and channels given appropriate mitigation measures.
B-13 In an area of known slope stability or debris flow hazards, require developers and/or subdividers of a parcel or parcels to record a Notice of Geologic Hazards with the County Recorder describing the potential hazards on the parcel and the level of prior geologic investigation conducted.
B-14 Require project modifications, including but not limited to hazard mitigation, project redesign, elimination of building sites and development of building and septic system envelopes, building setbacks and foundation and drainage requirements as necessary in order to mitigate landslide and debris flow hazards.

Soils Subject to Expansion, Settlement and Hydrocompaction

B-15 Require the preparation of a preliminary soils report, prepared by a registered civil engineer and based upon adequate test borings, for every subdivision and every individual lot where soils have been identified that are subject to expansion, settlement or hydrocompaction.
B-16 Require a soils report where there is inadequate soils information prior to issuance of permits for habitable structures and private wastewater disposal (septic) systems.
B-17 Require the developers and/or subdividers of a parcel or parcels in an area of known highly expansive soils hazard to record a notice of Geologic Hazards with the County Recorder describing the potential hazards on the parcel and the level of prior geologic investigation conducted.
B-18 Require project modifications, including but not limited to hazard mitigation, project redesign, elimination of building sites, building envelopes and drainage and foundation requirements as necessary in order to mitigate hazards associated with soils that may be subject to expansion, settlement or hydro-compaction.

C. Flood Hazards

<u>Goal</u>

S-4 Minimize the risk of loss of life, injury, damage to property, and economic and social dislocations resulting from inundation by dam failure or floods.

Policies

C-1 Restrict or prohibit uses which are susceptible to flood hazards (M.C. 4-7.01).

C-2 Require that uses vulnerable to floods, including flood control facilities, be protected against flood damage at the time of initial construction (M.C. 4-7.01).

C-3 Control the alteration of natural floodplains, stream channels and natural protective barriers which help accommodate or channel floodwaters (M.C.4-7.01).

C-4 Control filling, grading, dredging, and other development which may increase flood damage (M.C. 4-7.01).

C-5 Prevent or regulate the construction of barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas (M.C. 4-7.01).

C-6 Locate structures and additions outside of the 100-year floodplain unless such facilities are necessary to serve existing uses and construction of these structures will not increase the hazard to life or property within or adjacent to the floodplain. Location within the floodplain shall be governed by Title 4, Chapter 7 of the Thousand Oaks Municipal Code and shall require certification by a registered professional demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the 100-year flood.

C-7 Avoid development of new critical facilities within 100-year flood plain areas and dam inundation areas.

C-8 Comply with provisions of the Master Plan of Drainage for all new development within the City. The City shall update this document as necessary.

C-9 Implement drainage improvements to address deficiencies identified in the Master Plan of Drainage.

C-10 Endorse and support Ventura County's flood warning system for residents living in designated floodplains. Special precautions should be taken for critical facilities within floodplains and dam inundation areas [e.g., Westlake Elementary School (dam inundation area), Newbury Park High School and Manzanita Elementary School (100-year flood area)].

C-11 Update the City's Emergency Operations Plan (Multi-Hazard Function Plan) periodically to incorporate emergency preparedness procedures relating to flood hazards.

C-12 Require the developers and/or subdividers of a parcel or parcels in an area of known flood hazards to record a Notice of Geologic Hazards with the County Recorder describing the hazards on the parcel or parcels and the extent of prior hydrologic or geologic investigation conducted.

C-13 Require project modifications, including but not limited to: hazard mitigation, project redesign, building elimination, development of building and septic system envelopes and special foundation requirements as deemed necessary in order to mitigate potential flood hazards.

D. Fire Hazards

Goals

S-5 Provide minimum standards to protect life, limb, property, safety, and welfare of the citizens of the City by regulating and controlling the hazards of fire and *explosion arising from the storage, handling, and use of hazardous substances, materials, and devices.*

S-6 Prevent the loss of life and property due to uncontrolled wildfire in the urban/wildland interface through the cooperation of the Ventura County Fire Protection District and property owners living in these areas.

Policies

D-1 Continue to enforce the following:
- California Health and Safety Code
- Ventura County Fire Protection District Ordinance
- California Building Code (CBC), which is the International Building Code with California amendments

D-2 Continue to provide adequate fire protection and prevention services to meet the needs of the community and continue to support inter-jurisdictional fire protection agreements.

D-3 Inspect buildings susceptible to fire damage and abate hazardous conditions as necessary.

D-4 Conduct and encourage fire safety and fire prevention programs for schools and other critical facilities.

D-5 If it is determined that older fire stations do not meet seismic structural codes, upgrade or replace these facilities as necessary.

D-6 Continue to strive for 5-minute response time to all fire and life safety emergency responses.

D-7 Provide adequate fire flow for all new developments in accordance with the CBC and adopted Amendments (or the most current edition of the CBC as adopted).

D-8 Equip new buildings with an automatic fire sprinkler system in accordance with the CBC and Ventura County Fire Protection District Ordinance.

D-9 Continue to upgrade existing developments with deficient fire flows.

D-10 Provide for minimum road widths and clearances for new development projects in accordance with:
- Municipal Code requirements (Sections 9-3.1015 and 9-3.1 016);
- Standards specified in the City of Thousand Oaks Road Standards and construction specifications in effect at the time of construction; and
- Any other standard and specific conditions required by the Fire Department in the permit application.

D-11 Ensure that streets within the Hillside Planned Development zone are designed with right-of-way, roadway, and median widths conforming to the specified standards in Section 9-4.3108 of the Municipal Code.

D-12 Establish defensive barriers in the urban/wildland interface to protect against wildfire. Specifically this shall include:
- Establish maintain a 100-foot defensible perimeter around each habitable structure along the urban wildland interface. Provide for the removal of annual fuels within the defensive perimeter.

- Provide any fire suppression resource from any agency the opportunity to successfully protect structures and other valuable properties during a wildfire threat.
- Protect the watershed fire areas from exposure to structure fires in the urban/wildland interface areas.

D-13 Discourage the location of public facilities and above-ground utilities in extreme fire hazard areas. When unavoidable, special precautions should be taken to minimize potential impacts.

D-14 Encourage public participation in arson prevention programs.

D-15 Implement appropriate fuel management and prescribed burning programs on a selective basis in order to reduce the potential for devastating wildfires and the resulting damage they cause to both natural ecosystems and urban environments.

D-16 Coordinate with Ventura County Fire Protection District as determined to be necessary in order to identify suitable fuel management and prescribed burning areas.

D-17 Work with the Ventura County Fire Protection District, the Conejo Open Space Conservation Agency and other agencies, as appropriate, to implement fuel management and post fire recovery plans that conserve wildlife habitat while protecting public safety.

D-18 Review the very high fire hazard severity zone map with the Ventura County Fire Protection District in order to update City information.

E. Hazardous Materials

Goal

S-7 Protect life, property, and the environment from the effects of releases of hazardous materials into the air, land or water.

Policies

E-1 Manage hazardous wastes and materials in such a way that waste reduction through alternative technology is the first priority, followed by recycling and on-site treatment, with disposal as the last resort.

E-2 Continue to work with the County to implement the County Hazardous Materials Emergency Response Plan (developed by the Ventura County Environmental Health Department).

E-3 Strive to locate businesses that utilize hazardous materials in areas which will minimize risk to the public or the environment.

E-4 Coordinate with the Ventura County Environmental Health Department and the Regional Water Quality Control Board to encourage cleanup of sites that have been impacted by hazardous materials releases -- especially those that have impacted groundwater.

E-5 Implement programs to ensure proper disposal of household hazardous wastes. Educate the public about the importance of complying with such programs.

E-6 Continue to coordinate with the Ventura County Sheriff's Department, the California Highway Patrol, and the Ventura County Fire Protection District regarding regional plans for transportation corridors for hazardous materials.

F. Terrorism

Goal

*S-8 Protect life and property from the potential effects of terrorist act*s.

Policies

F-1 As part of the development review process, conduct vulnerability assessments of terrorist-sensitive facilities and, where practical, implement measures to protect these facilities against terrorist acts. Terrorist-sensitive facilities include places that are at-risk for terrorism, including, but not limited to, government offices and religious facilities.

F-2 Require any permit for a large or sensitive special event to include a security plan. The event organizer will be responsible for implementing the security plan.

F-3 Continue to share terrorist-related information with Federal, State and local law enforcement agencies and make use of the shared information to identify terrorist threats.

F-4 Encourage and assist property owners to evaluate their risks and vulnerabilities to terrorism and strengthen their level of protection against terrorist attacks.

G. Disaster Preparedness

Goal

S-9 Provide for the preparation and implementation of plans for the protection of persons and property within the City in the event of an emergency or a disaster and provide for the coordination of the emergency or disaster functions of the City with all other public agencies and affected private persons, corporations, and organizations (M.C.4-4.01).

Policies

G-1 Pursuant to the Municipal Code, City shall continue to review and recommend for adoption by the City Council, emergency and disaster and mutual aid plans and agreements, including such ordinances, resolutions, rules, and regulations as are necessary to implement such plans and agreements (M.C. 4-4.04).

G-2 Implement the City's Emergency Operations Plan as may be amended from time to time. Coordinate emergency response and preparedness efforts with the Ventura County Office of Emergency Services, the American Red Cross, and other appropriate agencies.

G-3 Provide on-going disaster preparedness training to all City employees. All inspectors and plan checkers within the Building Department shall receive training and certification in post-disaster assessment as provided by the California Building Officials Organization.

G-4 Support the American Red Cross and other applicable agencies to ensure that adequate shelter facilities are available in the event of an emergency.

G-5 Periodically inventory emergency relief supplies (sandbags, medical equipment, traffic control equipment, road-clearing equipment, water purification equipment, etc.) to ensure availability during an emergency situation. Coordinate with other agencies to provide supplies/services as appropriate.

G-6 Evaluate and provide emergency power generation capabilities at key City-owned critical facilities (including the East Valley Law Enforcement Facility, Municipal Service Center, City Hall, and the Wastewater Treatment Plants).

G-7 Promote public awareness of seismic, geologic, flood, fire, and other potential hazards to the public and prospective developers.

G-8 Critical facilities subject to City approval that are susceptible to safety hazards shall incorporate feasible hazard mitigation measures.

G-9 The 2004 City of Thousand Oaks Local Hazard Mitigation Plan and the 2010 Ventura County Hazard Mitigation Plan (as may be amended from time to time) are incorporated herein by reference.

GLOSSARY

Acceleration: The time rate of change of velocity of a reference point during an earthquake. Commonly expressed in percentage of gravity.

Active Fault: As defined by the State Mining and Geology Board, a fault which has had surface displacement within Holocene time (about the last 11,000 years).

Alluvium: Loosely compacted gravel, sand, silt, or clay deposited by streams.

Amplified-Shaking Hazard Zone: An area where historic occurrence of amplified ground shaking, or local geological and geotechnical conditions indicate a potential for ground shaking to be amplified to a level such that mitigation as defined in California Public Resources Code Section 2693 would be required. AS-Zones are characterized by soft sediments overlying hard rock and include the soil conditions described in CBC Soil Types S3 and S4.

Aquifer: A water-bearing body of porous and permeable rock or sediment.

Attenuation: A decrease in seismic signal amplitude as waves propagate from the seismic source.

Base Flood: A flood that statistically could occur once in 100 years on average, although it could occur in any year. For flood insurance purposes, 100-year flood and base flood have the same meaning.

Bedrock: Relatively hard, solid rock that commonly underlies softer rock, sediment, or soil.

Certified Engineering Geologist: An individual who is licensed by the State of California to practice engineering geology.

Cohesionless: Refers to a sediment whose shear strength depends only on friction, because there is no bonding between the grains.

Colluvium: Loose soil or rock fragments on or at the base of gentle slopes or hillsides. Deposited by or moving under the influence of rainwash or downhill creep.

Combustible Material: Under VCFPD Ordinance No. 20, seasonal and recurrent weeds, stubble, brush, dry grass, dry leaves or tumbleweeds; or rubbish, letter or flammable material of any kind.

Conflagration: A large and destructive fire, usually aggravated by strong winds which carry firebrands over natural or manmade barriers.

Conglomerate: A sedimentary rock composed of rounded, pebble, or cobble to boulder-size fragments, usually in a finer matrix of sand.

Critical Structures and Facilities: Structures and facilities which are subject to specified seismic safety standards because of their immediate and vital public need or because of the severe hazard presented by their structural failure. Type of structures vary but may include (1) structures such as nuclear power reactors or large dams whose failure might be catastrophic; (2) major communication, utility, and transportation systems; (3) involuntary- or high-occupancy buildings such as prisons or schools; and (4) emergency facilities such as hospitals, police and fire stations, and disaster-response centers.

Debris Flows: A fast-moving slurry of mud, rocks and organic debris; commonly termed mudflow. Debris flows occur during intense storm events.

Defensible Space: An area around the perimeter of structures or developed areas in the wildland which are key points of defense/attack against encroaching wildfires or escaping structure fires.

Epicenter: The point on the Earth's surface vertically above the point (focus or hypocenter) in the crust where a seismic rupture initiates.

Expansive Soil: A soil which undergoes a significant and reversible change in volume resulting from a change in moisture content.

Fault: A fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side. Strike-slip faults are chiefly vertical fractures along which rock masses have shifted horizontally. Dip-slip faults are chiefly inclined fractures along which rock masses have shifted vertically. If the rockmass above an inclined fault is depressed, the fault is termed normal slip, whereas the term reverse slip (or thrust) indicates that the side above the fault is elevated. Oblique-slip faults have significant components of both strike and dip slip along them.

Fault Trace: Intersection of a fault with the ground surface; also, the line commonly plotted on geologic maps to represent a fault.

Fill: The deposition of earth or any other substance or material by artificial means for any purpose.

Fire Hazard: Anything or act which increases or may cause an increase of the fire hazard or menace of fire to a greater degree than that customarily recognized as normal. Anything or act which may obstruct) delay) hinder. or interfere with the operations of the Fire District or the egress of occupants in the event of fire.

Flood Insurance Rate Map: Map used for insurance purposes on which the Federal Insurance Administration has delineated the special flood hazard area, base flood elevations and the risk premium zones applicable to the community.

Floodplain: The relatively level land area on either side of a stream's banks that is subject to flooding. The 100-year floodplain is used for planning purposes and is designated on Flood Boundary and Floodway Maps prepared by the Federal Insurance Administration.

Formation: A rock unit which can be recognized, named, and mapped, e.g., the Topanga Formation.

Geotechnical: Pertaining to geologic-soils engineering studies, features, conditions or events.

Grading: Excavating or filling land, or a combination thereof.

Hazardous Material: Pursuant to California Hazardous Waste Control Law (HWCL), a hazardous material (or waste) is defined as a material that, due to its quantity, concentration, or physical, chemical, or infectious characteristics, may: (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed.

Holocene: The most recent geologic epoch of time; the past 11,000 years.

Hypocenter: The point within the earth where an earthquake rupture initiates.

Incident Command System: A standard system for organizing response to hazardous materials incidents.

Intensity: A subjective numerical index describing the severity of an earthquake in terms of its effects on the Earth's surface and on humans and their structures. A condensed version of the Modified Mercalli intensity scale is included with this report.

Liquefaction: Process by which water-saturated sediment temporarily loses strength, usually because of strong shaking during a major earthquake, and behaves as a fluid.

Magnitude: A number that characterizes the size of an earthquake, based on measurement of the maximum motions recorded by a seismograph for earthquake waves of a particular frequency. The scale most commonly used is local magnitude commonly referred to as Richter magnitude.

Perched Ground Water: Ground water separated from the underlying main body of ground water by an unsaturated zone.

Period: The time interval required for one full cycle of a wave.

Potentially Active Fault: A fault which shows evidence of surface displacement during Quaternary time (last 1. 6 million years).

Recurrence Interval: The average time span between events (such as large earthquakes, ground shaking exceeding a particular value, or liquefaction) at a particular site.

Registered Geologist: A geologist who is licensed by the State of California to practice geology.

Registered Geotechnical Engineer: A civil engineer licensed by the State of California, experienced in the practice of geotechnical engineering.

Soils Engineer: A registered civil engineer licensed in the State of California, experienced in the practice of soils and foundation engineering:

Soils Investigation: A report prepared by a Registered Geotechnical Engineer or a Soils Engineer, including subsurface exploration and laboratory testing.

Sandstone: A sedimentary rock of cemented sand-size particles.

Saturated: A rock or soil whose interstices are filled with water.

Sedimentary Rock: The class of rocks made up of transported and deposited rock and mineral particles (sediment) and of chemical substances derived from weathering.

Seiche: Oscillation of the surface of an enclosed body of water owing to earthquake shaking.

Seismicity: The geographic and historical distribution of earthquakes.

Settlement: The downward movement of a soil or of the structure which it supports, resulting from a reduction in the voids in the underlying strata.

Shale: A thinly layered or stratified sedimentary rock of clay-size particles.

Siltstone: A sedimentary rock of cemented particles intermediate in size between sand and clay (silt).

Slip Rate: The average rate of displacement at a point along a fault as determined from geodetic measurements, from offset manmade structures, or from offset geologic features whose age can be estimated.

Soil: In engineering, all unconsolidated material above bedrock.

Stratigraphy: The study of the character, form, and sequence of layered rocks.

Subsidence: Downward settling of the Earth's surface with little or no horizontal motion. May be caused by natural geologic processes (such as sediment compaction or tectonic activity) or by human activity (such as mining or withdrawal of ground water or petroleum).

Subsurface Geologic Report: A geologic investigation conducted by a Registered Geologist or Certified Engineering Geologist that provides information on the distribution, nature, genesis and properties of subsurface materials through direct observation by means of trenches, test pits or borings.

Surface Faulting: Displacement that reaches the ground surface during slip along a fault. Commonly accompanies moderate and large earthquakes having focal depths to 20 km.

Tectonic: Refers to crustal-deforming processes that affect relatively large areas.

Tsunami: An impulsively generated sea wave that results from large-scale seafloor displacements associated with large earthquakes, major sea-floor slides, or volcanic activity.

Urban Interface: That line, area, or zone where structures and other human development meets or intermingles with undeveloped wildland and associated flammable vegetation.

Wildfire: An uncontrolled fire, usually spreading through vegetative fuels but. often consuming structures as well.

Wildland: An area in which development is essentially non-existent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered and are primarily for recreational purposes.

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