City of Orange

HAZARD MITIGATION PLAN

OCTOBER

2016

Record of Changes

Date of Revision	Revision Description	Section/Component	Revision Completed By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICIES

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CHAPTER 1 – INTRODUCTION

Natural hazards exist throughout time and have a life cycle of occurrence. This cycle is matched by a series of emergency management phases: preparedness, response, recovery, and mitigation. However, when natural hazards such as earthquakes, floods or windstorms are at their height, they pose severe risk to people and property. They can cause death, injuries or displace people from their homes, cause significant damage to the community, businesses, public infrastructure and environment, and cost tremendous amounts in terms of response and recovery dollars, further contributing to economic loss.

The City of Orange is located in central Orange County, California, between California State Route 91, and Interstate Highway 5, east of California State Route 22. The city is bordered by the cities of Anaheim, Fullerton, Garden Grove, Yorba Linda, Tustin, and Santa Ana. Orange's incorporated limits encompass 34.9 square miles, with a diverse mixed land use. The Santa Ana River generally forms the western boundary and Santiago Creek traverses the city from the northeast to the southwest. Orange was founded in 1869 and incorporated as a city on April 6, 1988. Many of the homes in its Old Towne District were built prior to 1920. Some homes have been preserved and are listed on the National Register of Historic Places.

The City of Orange is subject to wildland fires and there are two earthquake faults that run directly through the city. A small percent of the City of Orange is located in 100-year flood zones, which means there is a one percent annual chance that this area will be flooded during a storm. The Special Flood Hazard Areas are in the vicinity of Santa Ana River, Santiago Creek, and Handy Creek. The majority of the city lies within the 500-year flood zone. Also noteworthy is that the city is located in the Prado Dam inundation zone. A successful hazard mitigation plan includes a strategy that enables the implementation and sustaining of local actions that reduce vulnerability and risk from hazards, and reduce the severity of the effects of hazards on people and property. Historically, in many local jurisdictions, disasters are followed by repairs and reconstruction which simply restore the area to pre-disaster conditions, however, the replication of pre-disaster conditions results in a cycle of damage, reconstruction, and repeated damage. Such efforts may expedite a return to normalcy; hazard mitigation ensures that post-disaster repairs and reconstruction results in a true reduction of future hazard vulnerability.

While disasters cannot be prevented from occurring, their effects can be reduced or eliminated through a mitigation strategy that includes a well-organized public education and awareness effort, preparedness activities, and mitigation actions. For those hazards that cannot be fully mitigated, the community must be prepared to provide efficient and effective response and recovery. This Local Hazard Mitigation Plan (LHMP) outlines opportunities to increase Orange's resiliency in the face of future natural hazards.

1.1 PLAN PURPOSE

The City of Orange is working to identify effective ways to reduce vulnerability to disasters, as the costs from damage related to disasters are continually increasing. This Plan assists Orange in reducing vulnerability to disasters by identifying critical facilities, capabilities, resources, information, and strategies for risk reduction, while helping to guide and coordinate mitigation actions. The City of Orange has created this Plan to ensure that hazard conditions are reflective of current conditions, that

policies in the Plan are consistent with current City standards and/or other relevant federal, state, or regional regulations, and that the City has an updated Plan consistent with Federal Emergency Management Agency (FEMA) requirements.

The Plan provides a set of strategies intended to reduce risk from natural hazards through education and outreach programs; foster the development of partnerships; and implement risk reduction activities. The City of Orange Local Hazard Mitigation Plan:

- Establishes a basis for coordination and collaboration among participating agencies and public entities.
- Identifies and prioritize future mitigation projects.
- Assists in meeting the requirements of federal assistance programs.

The Orange LHMP works in conjunction with other plans, including the City's General Plan and Emergency Operations Plan.

1.2 AUTHORITIES

1.2.1 FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

This plan complies with the Federal Disaster Mitigation Act (2000), Federal Register 44 CFR Parts 201 and 206, which modified the Robert T. Stafford Disaster Relief and Emergency Assistance Act by adding a new section, 322 - Mitigation Planning. This law, as of November 1, 2004, requires local governments to develop and submit hazard mitigation plans as a condition of receiving Hazard Mitigation Grant Program (HMGP) and other Mitigation project grants.

Hazard mitigation planning is governed by the Stafford Act, as amended by the Disaster Mitigation Act of 2000 (DMA 2000), and by federal regulations implementing the Stafford Act. DMA 2000 revised the Stafford Act to require state, local, and tribal governments to develop and submit to FEMA a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the jurisdiction. Plan approval by FEMA is a prerequisite to receiving federal hazard mitigation grant funds. (See 42 USC § 5165(a).)

To implement the mitigation planning requirements of the Stafford Act, FEMA promulgated 44 CFR Part 201, the federal regulations governing the planning process, plan content, and the process for obtaining approval of the plan from FEMA. The planning requirements set forth in the CFR, including plan revision requirements, are identified through the FEMA Regulation Checklist in the Local Mitigation Plan Review Tool.

1.2.2 STATE OF CALIFORNIA

In addition to the requirements listed above, the State of California has also enacted revisions to both California Government Code Sections 8685.9 and 65302.6 (commonly known as AB 2140 [Chaptered 2006]). Descriptions of these government code sections are provided below:

Cal. Gov't. Code §8685.9.

Notwithstanding any other provision of law, including Section 8686, for any eligible project, the state share shall not exceed 75 percent of total state eligible costs unless the local agency is located within a city, county, or city and county that has adopted a local hazard mitigation plan in accordance with the federal Disaster Mitigation Act of 2000 (P.L. 106-390) as part of the safety element of its general plan adopted pursuant to subdivision (g) of Section 65302. In that situation, the Legislature may provide for a state share of local costs that exceeds 75 percent of total state eligible costs.

Cal. Gov't. Code §65302.6.

(a) A city, county, or a city and county may adopt with its safety element pursuant to subdivision (g) of Section 65302 a local hazard mitigation plan (HMP) specified in the federal Disaster Mitigation Act of 2000 (Public Law 106-390). The hazard mitigation plan shall include all of the following elements called for in the federal act requirements:

(1) An initial earthquake performance evaluation of public facilities that provide essential services, shelter, and critical governmental functions.

(2) An inventory of private facilities that are potentially hazardous, including, but not limited to, multiunit, soft story, concrete tilt-up, and concrete frame buildings.

(3) A plan to reduce the potential risk from private and governmental facilities in the event of a disaster.

(b) Local jurisdictions that have not adopted a local hazard mitigation plan shall be given preference by the Office of Emergency Services in recommending actions to be funded from the Pre-Disaster Mitigation Program, the Hazard Mitigation Grant Program, and the Flood Mitigation Assistance Program to assist the local jurisdiction in developing and adopting a local hazard mitigation plan, subject to available funding from the Federal Emergency Management Agency.

In accordance with these requirements, this LHMP includes the information required by California Government Code Sections §8685.9 and §65302.6.

1.3 PLAN ADOPTION

The City of Orange will adopt the LHMP via a resolution of the City Council following plan approval from FEMA. Figure 1.1 is the resolution used to adopt the 2016 Local Hazard Mitigation Plan.

Figure 1.1 City of Orange 2016 Local Hazard Mitigation Plan Resolution

1.4 PLAN USE

Each section of the Plan provides information and resources to assist plan users in understanding the hazard-related issues facing residents, businesses, and the environment. The structure of the Plan enables users to review each section as needed and allows the City of Orange to review and update sections as new data becomes available. The ease of incorporating new data into the Plan will result in a Plan that remains current and relevant to Orange. The LHMP is composed of the following chapters:

- Chapter 1: Introduction. The introduction describes the background and purpose of developing the Plan in addition to introducing the mitigation priorities and summarizing the planning process.
- Chapter 2: Community Profile. The community profile presents the history, geography, demographics, and socioeconomics of Orange. It serves as a tool to provide a historical perspective of natural hazards in the city.
- Chapter 3: Hazards Assessment. This chapter provides information on hazard identification, hazard profiles, vulnerability and risk associated with natural hazards, and a vulnerability assessment of critical facilities in relation to the identified hazards.
- Chapter 4: Mitigation Actions. This chapter provides strategies and mitigation actions to reduce potential risks to Orange's critical facilities, residents, and businesses.
- Chapter 5: Plan Maintenance and Capabilities. This chapter provides information on plan implementation, monitoring, and evaluation, and discusses the assets and capabilities available to achieve the proposed mitigation actions outlined in Chapter 4 as well as opportunities for continued public involvement.

1.5 MITIGATION PRIORITIES AND GOALS

The mission of the Orange LHMP is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss prevention, and identifying activities to guide the City toward building a safer, more sustainable community. The mission is a guideline that represents what the community wants to accomplish through the mitigation plan. Goals are broad statements that represent a long-term, community-wide vision. The planning team reviewed the goals from the County of Orange and Orange County Fire Authority Hazard Mitigation Plan and decided to align the goals for the City of Orange with those of the County. The following goals have been established for the Orange LHMP:

1) To protect life and property by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.
2) To increase public awareness through development and implementation of outreach programs focusing on the risks associated with natural hazards.
3) To improve natural systems by balancing watershed planning, natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment.

4) To develop partnerships by strengthening communication and coordinating participation among and within public agencies, residents, nonprofit organizations, business, and industry to gain a vested interest in implementation.

5) To enhance emergency services/response through establishment of policy to ensure mitigation projects for critical facilities, services, and infrastructure.

1.6 HAZARD MITIGATION PLANNING PROCESS

This Plan is a result of a process involving City departments, stakeholder agencies, businesses, residents, and the community at large. At the onset of the planning process, the City of Orange invited the community, and the public and private sector partners to participate in the development of this LHMP.

The LHMP planning team was comprised of the following City Departments:

- City of Orange City Manager's Office
- City of Orange City Clerk's Office
- City of Orange Police Department
- City of Orange Fire Department
- City of Orange Community Services Department
- City of Orange Community Development Department
- City of Orange Finance Department
- City of Orange Public Library
- City of Orange Human Resources Department
- City of Orange Public Works Department

Stakeholders included representation from local colleges, school districts, electrical power and fuel companies, local health care agency, and others organizations. A list of stakeholders and more information about their participation in the planning process can be found in Appendix A.

The LHMP team is responsible for the development, implementation, and maintenance of this Plan. A planning schedule was developed. Five meetings were held to discuss preparation and development of the LHMP. At these meetings, team members, stakeholders and members of the community discussed the objectives of the plan, identified the hazards that pose a threat to Orange, and prepared and reviewed mitigation strategies to reduce the City's vulnerabilities. All stakeholders and the community were provided an opportunity to provide comments, input, and feedback on the plan. The LHMP schedule is as follows:

- LHMP Kickoff Meeting: October 28, 2015
- LHMP Team Meeting 1: March 3, 2016
- LHMP Team Meeting 2: April 25, 2016
- LHMP Team Meeting 3: June 22, 2016
- LHMP Public/Team Meeting 4: June 30, 2016
- LHMP Public Review Period: September 17 – October 17, 2016

- LHMP to be Submitted to OES Review: October 19, 2016
- LHMP to be submitted FEMA for Approval: *Pending Approval by OES*
- LHMP to be adopted by City Council: *Pending Approval by FEMA*

Table 1.1 summarizes these meetings. Meeting materials and sign-in sheets from these meetings are provided in Appendix B.

Table 1.1: Meeting Summaries

Date	Purpose
October 28, 2015	Project Kickoff Meeting – Provided an introduction to the project, discussed overarching goals for the effort, discussed communication protocols, and identified points of contact.
March 3, 2016	LHMP Meeting #1 – Provided an overview of the LHMP process, identified hazards of concern, finalized critical facilities list, and prioritized hazards with LHMP team members.
April 25, 2016	LHMP Meeting #2 – Provided an overview of the hazard profiles and preliminary results of the risk assessment for each hazard and critical facility identified.
June 22, 2016	LHMP Meeting #3 – Reviewed survey results, Hazus & GIS Analysis, prioritized hazards and potential mitigation activities.
June 30, 2016	LHMP Meeting # 4- Public meeting held at the City Council Chambers. A review of the planning process was provided, the Hazus Analysis was distributed and reviewed along with the On-line Survey. Approximately 20 people attended including: The meeting was publicized on the City website, social media, and through the local newspaper.

Online Survey Outreach:

As part of the public engagement and outreach process for the LHMP, the City created an Online Survey for community members. A link to the survey was placed on the City's website, as well as distributed via its Facebook and Twitter pages. The survey asked about potential hazards facing Orange, and what steps community members have taken or are interested in taking to reduce the threat from these hazards. The survey produced the following key outcomes:

- *Community members identified the top four hazards of greatest concerns: 1) earthquake as the hazard that poses the greatest risk to their home or neighborhood, 2) drought coming in second, 3) fire hazards coming in third, and 4) terrorism ranked fourth.*
- *58% of respondents indicated their household was prepared to cope with a hazard event.*
- *48% of respondents indicated they had prepared a disaster supply kit.*
- *32% of respondents had purchased earthquake insurance.*
- *10% of respondents indicated that they had someone in their household with disabilities and / or access and functional needs that would require a specialized response to evacuate during a disaster.*
- *57% of respondents indicated that they had received first aid / CPR training.*

- *59% of respondents indicated that emergency preparedness information from a government source, such as federal, state or local government was the best source to help prepare for a hazard event.*
- *When respondents were asked how they felt about the following statement: "it is my personal responsibility to be educated and take actions that will reduce my exposure to the risks associated with natural disasters," 64% of the respondent strongly agreed.*

A detailed summary of the online survey is included in Appendix C.

In conjunction with the online survey, on March 4, 2016, the LHMP was discussed in a public forum at the monthly Orange County Emergency Management Organization (OCEMO) where participation and comments were invited. Members of OCEMO include representation from the cities in Orange County, State Regional Representatives, American Red Cross, OC Health Care Agency, representatives from special districts in the County, and other members of the community.

A public meeting was scheduled at City Hall to discuss the hazard mitigation planning process and invited participation from the community. These meetings were publicized using the City's standard protocol, which involved notification in the local newspaper, placement of public notices at designated locations throughout the City (City Hall, Community Center, etc.) and placement of noticing information on the City's website.

An overview of the LHMP was provided at the City CERT Training and at City staff meetings where feedback was requested.

Table 1.2 summarizes these meetings and the general information discussed. A copy of the meeting presentation used for these meetings is provided in Appendix B.

Table 1.2: Public Outreach/Involvement Opportunities

Date	Meeting Summary
March 4, 2016	Orange County Emergency Management Organization (OCEMO) Meeting – Provided an overview of the hazard mitigation planning process and provided information on upcoming meetings. No comments/questions from the public were received during the meeting. Approximately 48 attend this meeting. List of attendees can be found in Appendix B.
April 26, 2016	Community Emergency Response Team Meeting and Training – Provided an overview of the hazard mitigation planning process and hazards identified. No comments/questions from the members/community/public were received during the meeting. 30 members from the public attended this meeting.
June 27, 2016	Orange Fire Department Staff Meeting – An overview of the LHMP was provided. No comments received.
June 30, 2016	LHMP Public Meeting at City Hall – Provided an overview of the hazard mitigation planning process, and distributed the online survey and Hazus Analysis Report. General comments were received and clarification on the Hazus Analysis was provided. 20 members from the public attended this meeting.
July 3, 2016	100 flyers were distributed to attendees at this 4th of July celebration regarding the development of the Hazard Mitigation Plan and requesting their participation in the online survey. Two information booths were established to address comments and questions at this event in which approximately 5,000 people attended. No comments or questions were submitted.
September 17, 2016	Release of Public Review Draft LHMP for 30-day comment period. (No comments received from the public.)

1.7 PUBLIC REVIEW DRAFT

On September 17, 2016, the draft hazard mitigation plan was released for public review for a 30-day period. The City of Orange invited the public to review and provide comments on the plan. See Appendix H.

1.8 PLANS, STUDIES, AND TECHNICAL REPORTS USED TO DEVELOP THE PLAN

Table 1.3 shows the sections of the LHMP and the corresponding plans, studies, and technical reports (and websites, if applicable) used to develop certain discussions.

Table 1.3: Plans, Studies, and Technical Reports Used to Develop the Plan

LHMP Section	Corresponding Plan/Study/Technical Report
2.1 Physical Setting	- City of Orange General Plan (March 2010) - U.S. Census Bureau (http://factfinder.census.gov) - County of Orange and Orange Fire Authority Hazard Mitigation Plan (2016)
2.2 History	- City of Orange General Plan (March 2010) - City of Orange Emergency Operations Plan (2004) - City of Orange General Plan (March 2010) - County of Orange and Orange Fire Authority Hazard Mitigation Plan (2016) - California Multi-hazard Mitigation Plan 2013
2.3 Community Profile	- U.S. Census Bureau (http://factfinder.census.gov) - City of Orange General Plan (March 2010) - Center for Demographic Research CA State Data Center Affiliate Office, 2015 -http://www.fullerton.edu/cdr/about/
2.4 Economic Trends	- City of Orange General Plan (March 2010) - Economic Outlook and Forecasts (2014) - U.S. Census Bureau (http://factfinder.census.gov) - County of Orange & Orange County Fire Authority Local Hazard Mitigation Plan (2016) - http://zehnerdavenport.com/2016-orange-county-economic-forecast/ - http://www.fullerton.edu/cdr/_resources/pdf/progressreport/Orange.pdf
2.5 Existing Land Use	- City of Orange General Plan (March 2010)
2.6 Development Trends and Future Development	- City of Orange General Plan (March 2010)
2.7 Critical Facilities	- City staff/Hazard Mitigation Planning Team
2.8 Evacuation Routes	- City staff/Hazard Mitigation Planning Team
3.1 Hazard Identification and Prioritization	- City of Orange General Plan (March 2010) - City staff/Hazard Mitigation Planning Team - Orange County Emergency Operations Plan 2015 - County of Orange and Orange County Fire Authority Hazard Mitigation Plan 2016 - Orange County Essential Facilities Risk Assessment (OCEFRA) Project Report (April 2009) - California State Emergency Plan July 2009 - FEMA Local Mitigation Plan Review Guide 2011 - California Multi-Hazard Mitigation Plan 2013 - FEMA Local Mitigation Planning Handbook 2013

LHMP Section	Corresponding Plan/Study/Technical Report
3.2 Climate Change Considerations	- City of Orange General Plan (March 2010) - California Adaptation Planning Guide (September 2012) - Orange County and Orange County Fire Authority Hazard Mitigation Plan 2016 - California Multi-Hazard Mitigation Plan 2013
3.3 Vulnerability/Risk Assessment Method	- City of Orange General Plan (March 2010) - City staff/Hazard Mitigation Planning Team - FEMA Local Mitigation Planning Handbook 2013
3.4 Hazard Profiles	- City of Orange General Plan (March 2010) - City of Orange Emergency Operations Plan (2004) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (2016) - City of Orange Hazardous Materials Plan (2014)
3.4.1 Seismic Hazards	- City of Orange General Plan (March 2010) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (2016) - U.S.G.S. Richter Scale and Modified Mercalli Intensity Scale (2014) - U.S.G.S. Fact Sheet 2008-3027, http://pubs.usgs.gov/fs/2008/3027/ - U.S.G.S. Earthquake Hazards Program data, http://earthquake.usgs.gov/earthquakes/states/California/history.php
3.4.2 Wildland / Urban Fire	- City of Orange General Plan (March 2010) - Board of Forestry and Fire Protection Land Use Planning Program Review General Plan Safety - --Element Assessment Tier 2 (June 2015) - Hazardous Materials Area Plan, Orange City Fire (September 2014) - Orange County and Orange County Fire Authority Hazard Mitigation Plan (2016)
3.4.3 Extreme Heat	- Cal Adapt (2013) - Orange County and Orange County Fire Authority Hazard Mitigation Plan (November 2015)
3.4.4 Drought	- Orange Urban Water Management Plan (2010)
3.4.5 Severe Weather	- County of Orange and Orange County Fire Authority Hazard Mitigation Plan (October 2014) - National Weather Service, “A History of Significant Weather Events in Southern California Organized by Weather Type,” February 2010.
3.4.6 Hazardous Materials	- General Plan (March 2010) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (November 2015) - Cal EMA Regional Information Management System (RIMS) Spill Database, http://calema.ca.gov/HazardousMaterials/Pages/Historical-HazMat-Spill-Notifications.aspx - BNSF Railway 2015 Annual Review Report
3.4.7 Landslide/Expansive Soils/Erosion	- General Plan (March 2010) - City of Orange Emergency Operations Plan (2004) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (November 2015)
3.4.8 Flood Hazards	- General Plan (March 2010) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (November 2015) - California 2013 State Hazard Mitigation Plan (2013) - Megadroughts in North America (2009) - California Drought of 2007-2009 (2010) - Major Floods and Droughts in California (1990)
3.4.9 Terrorism	- City of Orange Emergency Operations Plan (2004) - Orange County Emergency Operations Plan
3.4.10 Dam Failure	- General Plan (March 2010) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (November 2015) - University of California, Davis, Engineering Department, http://cee.engr.ucdavis.edu/faculty/lund/dams/Dam_History_Page/Failures.htm

LHMP Section	Corresponding Plan/Study/Technical Report
3.4.11 Epidemic and Vector Borne Disease	- County of Orange and Orange County Fire Authority Hazard Mitigation Plan (2016) - California West Nile virus activity (2014) - California Public Health Department – Influenza (2015)
3.5 Summary of Vulnerability	- U.S. Census Bureau Source: http://www.census.gov/quickfacts/table/PST045215/0653980,00 - Hazard zone geospatial data (multiple sources)
3.5.1 Significant Hazards	- City of Orange General Plan (March 2010) - City of Orange Emergency Operations Plan (2004) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (2016) - City staff/Hazard Mitigation Planning Team - CDC Website: http://www.cdc.gov/ - HAZUS Website: https://www.fema.gov/hazus-mh-earthquake-model - USGS Website: http://earthquake.usgs.gov/
3.5.2 Facilities Most at Risk	- City staff/Hazard Mitigation Planning Team - Hazard zone geospatial data (multiple sources) - FEMA National Flood Insurance Program
3.5.3 Potential Losses	- City staff/Hazard Mitigation Planning Team - City insured values
4.1 Hazard Mitigation Overview	- City staff/Hazard Mitigation Planning Team - County of Orange and Orange County Fire Authority Hazard Mitigation Plan ((2016)) - FEMA National Flood Insurance Program (NFIP) - FEMA How-to Guides #3 and #5 (386-3 and 386-5), STAPLE/E criteria (Social, Technical, Administrative, Political, Legal, Economic, and Environmental)
4.2 Hazard Mitigation Actions	- City staff/Hazard Mitigation Planning Team - City of Orange General Plan (March 2010) - County of Orange and Orange County Fire Authority Hazard Mitigation Plan (2016)
4.3 Capabilities Assessment	- City of Orange General Plan (March 2010) - City staff/Hazard Mitigation Planning Team - Orange Urban Water Management Plan (2010) - FEMA LHMP Planning Guide

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CHAPTER 2 – COMMUNITY PROFILE

2.1 PHYSICAL SETTING

The City of Orange is located in the north-central portion of Orange County, approximately 32 miles southeast of Los Angeles. The city is predominately flat with hills surrounding Orange to the north and east. The Santa Ana River generally forms the western boundary, and Santiago Creek traverses the city from the northeast to the southwest. Orange is primarily urban, with the largest land use being residential. The 2010 Census reported that 95.4% of the population of Orange lived in 43,367 households, out of which 37.6% had children under the age of 18.

2.2 HISTORY

Members of the Tongva and Juaneño/Luiseño ethnic group long inhabited this area. After the 1769 expedition of Gaspar de Portolà, an expedition out of San Blas, Nayarit, Mexico, led by Father Junípero Serra, named the area Vallejo de Santa Ana (Valley of Saint Anne). On November 1, 1776, Mission San Juan Capistrano became the area's first permanent European settlement in Alta California, New Spain.

In 1801, the Spanish empire granted 62,500 acres (253 km2) to José Antonio Yorba, which he named *Rancho San Antonio*. Yorba's great rancho included the lands where the cities of Olive, Orange, Villa Park, Santa Ana, Tustin, Costa Mesa and Newport Beach stand today. Smaller ranchos evolved from this large rancho, including the Rancho Santiago de Santa Ana.

Don Juan Pablo Grijalva, a retired known Spanish soldier and the area's first landowner, was granted permission in 1809 by the Spanish colonial government to establish a rancho in "*the place of the Arroyo de Santiago.*" After the Mexican–American war, Alta California was ceded to the United States by México with the signing of the Treaty of Guadalupe Hidalgo in 1848, and though many Californians lost titles to their lands in the aftermath, Grijalva's descendants retained ownership through marriages to Anglo-Americans.

Since at least 1864, Los Angeles attorneys Alfred Chapman and Andrew Glassell together and separately, held about 5,400 acres along both sides of the Santiago Creek. Glassell also had a 4,000-acre parcel where Costa Mesa is today. Water was the key factor for the location of their town site, which was bordered by Almond Avenue on the south, Lemon Street on the west, Glassell Street on the east, & Maple Avenue on the north. Glassell needed a spot he could irrigate, bringing water down from the Santa Ana Canyon and the quality of the soil may have influenced his choice. Originally the community was named Richland, but in 1873 Richland got a new name. In the book, "Orange, The City 'Around The Plaza" by local historian Phil Brigandi, it states, "In 1873 the town had grown large enough to require a post office, so an application was sent to Washington. It was refused, however, as there was already a Richland, California in Sacramento County. Undaunted, the Richlanders proposed a new name – Orange."

Figure 2.1: Orange County Vicinity Map

2.3 COMMUNITY PROFILE

The City of Orange lies in the heart of north-central Orange County and is a high-quality community that boasts world class hospitals, educational institutions, and business diversity. Its parks and open spaces attract visitors from around the region, and its business environment has made the City a regional economic leader. Throughout its period of growth and redevelopment, the City has maintained its small town attitude.

Orange is connected to the surrounding region through a complex network of freeways; through Metrolink, a heavy rail commuter system; and through bus transit provided by the Orange County Transportation Authority (OCTA). Shopping centers in Orange include two regional malls. The Outlets at Orange is an open-air retail and entertainment center located on City Drive. The Village at Orange is located on Tustin Street and provides more traditional retail shopping facilities. Various shopping centers exist throughout the city.

The City of Orange is home to Chapman University located in the northern portion of Old Towne, and Santiago Canyon College, located on east Chapman Avenue, just west of Jamboree. Orange Unified School District has grades K-12 which includes a number of elementary, middle schools, and high schools. Numerous private and preschools are located within the city.

St. Joseph's Hospital and Children's' Hospital of Orange County, are located at Main Street and La Veta Avenue; UC Irvine Medical Center, located at Chapman Avenue, and The City Drive; Chapman Medical Center, located at Chapman Avenue, east of the 55 Freeway.

The City of Orange consist of a wide range of neighborhoods including Old Towne, the Presidential Tracts, El Modena, the Alphabet Streets, the Eichler Tracts, and Maybury Ranch to name a few. Each neighborhood has a distinctive character and personality ranging from the 1060s home designed by world-renowned developer Joseph Eichler to El Modena's Latino essence to Old Towne's Historic District, displaying an abundance of late 19th and early 20th century architectural styles. The city is mostly comprised of single-family homes with the majority built from 1960 to 1969. Housing in Orange has grown steadily throughout the decades and is projected to reach a total of 51,145 housing units by 2035, a 5,900 increase from 2015.

Tables 2.1, 2.2, and 2.3 provide an overview of the City's population, ethnicity, education levels, health, and economic data from the 2010 Census. Source: http://www.census.gov/quickfacts/table/PST045215/0653980,00 Accessed May 7, 2016.

Table 2.1: City of Orange Population and Median House Value

Population and Median House Value	Percent of Population
Total Population	139,812 estimated, July 1, 2014
Males	50.4%
Females	49.6%
Persons under 5 years, April 1, 2010	6.4%
Persons under 18 years, April 1, 2010	23.5%
Persons 65 years and over, April 1, 2010	10.7%
Median House Value	$515,000

Table 2.2: Orange Race and Ethnicity

Race and Ethnicity	Percent of Population
White (non-Hispanic)	91.5%
Black	2.2%
American Indian	0.7%
Asian	11.3%
Pacific Islander	0.3%
Hispanic or Latino (of any race)	38.1%
Two or More Races	4.0%

Table 2.3: Orange Education, Health, and Economy

Education, Health, and Economy	Percent of Population
High School Graduate	83.5%
Bachelor Degree	34.3%
With a disability, under age 65 years, percent, 2010-2014	4.3%
In civilian labor force, total, percent of population age 16 years+, 2010-2014	66.1%
Median household income (in 2014 dollars), 2010-2014	$77,086
Persons in poverty, percent	12.6%
Veterans	5,367

2.4 ECONOMIC TRENDS

The Economic Development section of Orange's General Plan (2010) indicates Orange is recognized as a desirable area in which to do business and therefore supports and sustains a diverse range of businesses in the City's distinct industrial, commercial, institutional, and office areas. This diversity in the business climate reflects the gradual transition of Orange from an agricultural community served by rail to its position for many years as an outer-ring suburb of the rapidly growing Los Angeles

metropolitan area, to its position today at a major crossroads of Orange County, at the convergence of major freeways, and serviced by a major commuter rail line. The City's economic environment cultivates and promotes both large corporate enterprises as well as smaller business entrepreneurs. At the onset of the 21st Century, Orange's economic development strategies focus on preserving jobs and maintaining a diverse economic base.

The City of Orange has a diverse economic base including a full spectrum of retail, office, and industrial uses, as well as major medical centers and educational institutions. The broad range of business activity in the city provides Orange with a local, national, and international presence. Access to the city is provided by four major freeways and the Metrolink commuter rail system also makes Orange a particularly convenient business location. "Fuel and Service Stations" and "Autos and Transportation" are the leading sales tax producing business groups in Orange, followed by "Consumer Goods". The City of Orange has steadily produced a higher sales per capita rate than Orange County and California itself.

To maintain the City's economic diversity. Orange encourages light manufacturing and industrial uses in the northwestern area, and larger institutional, corporate office and retail uses in the southwestern portion. The City provides opportunities for boutique and family-owned stores in Old Towne Orange, as well as in key commercial areas along Tustin Street, Katella Avenue, Chapman Avenue, and Lincoln Avenue, where regional and national retailers can also be found. The City also draws revenues from entertainment and hospitality industries.

Orange County has a population of 3.1 million people. It is the third largest county in California, behind neighboring Los Angeles and San Diego counties, which have populations of 10.1 million and 3.2 million, respectively. There are almost 1.5 million wage and salary jobs located in Orange County. The per capita income is $57,573, and the average salary per worker is $66,197. Across Southern California, employment increased by 2.6 percent in 2014. In orange county, 36,300 jobs were gained, representing a growth rate of 2.5 percent.

Historically, Orange has not been considered a prime office development location. The city, however, possesses a number of tactical attributes, which usually would support a greater level of prime office development within city limits, including a central geographic location to surrounding employment force and a circulation network serving Orange County and Southern California businesses; excellent freeway access from two major freeways (I-405 and State Route 22) bisecting the City along its western and northern boundaries; and close proximity to a variety of housing (specifically, executive housing).

According to projections published by California State University, Fullerton's Center for Demographic Research (OCP 2006), Orange County's population is projected to grow by approximately 15 percent between 2006 and 2030. The number of jobs within the County is projected to grow by approximately 22 percent within this same timeframe. To accommodate this anticipated regional growth, demand for both office and retail space will increase. According to OCP 2006, Orange's population is expected to increase 16 percent and employment is expected to increase by about 8 percent. Most of the new population will be distributed between higher density infill mixed-use developments within the western portions of the City, or in newer suburban environments in east Orange. Because most of the anticipated retail and commercial growth will result from intensification of existing commercial nodes, such projected residential development will strengthen the market.

According to California State University, Fullerton's Center for Demographic Research (OCP 2015), http://www.fullerton.edu/cdr/_resources/pdf/progressreport/Orange.pdf, one of the most notable positive developments in the Orange County region and the state of California overall is the remarkable improvement in home values leading up to the year 2014. The median single-family home price in Orange County was $642,000 in August 2014 compared to a low of $425,000 in December 2008 (during the depth of the recession). Although home values have not yet reached their July 2007 peak, the turnaround over the last several years has been quite spectacular for this region. The outlook for Southern California's labor market has also improved along with regional housing values.

2.5 EXISTING LAND USE

Existing land use information was taken from the City of Orange General Plan, along with the Land Use Map which indicates the location, density, and intensity of development for all land uses citywide. The General Plan is the principal policy documents that regulate land use in Orange.

The predominantly residential land use pattern in Orange reflects the City's history of transition from a citrus-growing center clustered near the railroad to a town core surrounded by residential neighborhoods and supporting businesses and services. Based on a land use inventory completed in 2004, residential development represented the predominant land use within Orange's city limits, with housing covering 46 percent of the City's land area. Commercial and industrial uses represented about 14 percent of the City's land area, while natural hillsides, parks, and open space represented 32 percent.

The Land Use Map Figure 2.2, identifies the General Plan land use designations and descriptions of the typical uses allowed within each designation that was adopted by the City of Orange. The General Plan addresses the use and development of private land, including residential and commercial areas.

The Land Use Element directs the location of current and future development that relies on available infrastructure. The Land Use Element establishes standards for use intensity, population density, and types of land uses that influence the design, layout, and funding sources for infrastructure. It serves as a guide for future development in the City and discusses how the City will grow and change over the next 20 years. Current and future land uses are categorized and mapped to identify where residential, commercial, industrial and community facilities are anticipated to be located.

Land Use Designations

The Land Use Element establishes 19 land use designations. The land use designations have been established to reflect: (1) development trends affecting the City's near and long-term futures; (2) opportunity areas associated with major institutional uses, shopping and employment centers, and access to transportation facilities; and (3) community interests and desires expressed during the General Plan update process. Four designations are established for residential development that allow for a range of housing types and densities. Three mixed-use activity center designations encourage creative mixes of commercial retail, office, housing, civic, and entertainment uses at key locations throughout the City. Five commercial and office designations and two industrial designations provide for a range of revenue- and employment-generating businesses. Five public and semi-public use categories provide locations for important public and private facilities and institutions, including parks, open space areas, resource lands, civic facilities, hospitals, and educational institutions.

Residential Uses

Four residential categories allow for a variety of housing types representing the diverse residential character of Orange. The City will continue to preserve and enhance existing single-family residential neighborhoods. Older neighborhoods, characterized by higher densities, are located throughout the western part of the City. Lower density housing, typical of newer residential development, is located principally on the City's eastern side.

The Estate Low Density Residential designation provides for single-family detached, estate-style homes on large lots, featuring a custom character of development. Estate Low Density Residential development is primarily found in Orange Park Acres and other similar parts of east Orange. Private, noncommercial equestrian and agricultural uses may be allowed if they are associated with the residential uses.

The Low Medium Density Residential designation provides for both detached and attached single-family homes on smaller lots, as well as duplexes and some mobile homes, multi-family townhouses, condominiums, and apartments. Low Medium Density residential uses are typically found adjacent to commercial or mixed-use activity centers, such as near South Main Street, Tustin Avenue, or El Modena. Low Medium Density residential uses are also found within newer development areas, such as Serrano Heights.

The Medium Density Residential designation provides for multi-family townhouses, condominiums, and apartments featuring some form of internal open space in areas with good access to major circulation routes, business districts, and public open space areas. Medium Density residential uses are typically found adjacent to commercial districts, such as near Lincoln Avenue, Katella Avenue, or La Veta Avenue. Medium Density residential uses are also found near major transportation corridors, such as the Santa Fe Depot or freeway interchanges along Chapman Avenue, Tustin Street, or Glassell Street.

Mixed-use Activity Centers: In response to recent development trends, the General Plan provides three designations for mixed-use activity centers. All of these designations promote creative mixes of commercial retail, office, housing, civic, and entertainment uses that vary in composition and intensity based upon location, accessibility, and the surrounding development context.

Old Towne Mixed-use designations provide for integrated commercial retail, professional office, housing, and civic uses designed to be contextually appropriate within a historic area. These areas are intended to be local- and neighborhood-supporting activity centers and corridors. Commercial retail is encouraged to be the primary use on the ground floor. Professional office and housing uses are also encouraged, particularly as adaptive reuse opportunities within historic structures. Transit-orientation, walkability, and pedestrian access are key considerations, as well as protection of the existing historic, residential-scale, and building character of the Spoke Streets outside of the downtown core. The lower end of the FAR range supports retail development, while the higher end of the range supports a combination of uses including commercial and office. Uses within this area are additionally subject to provisions of the Old Towne Design Standards and Santa Fe Depot Specific Plan, as applicable.

Neighborhood Mixed-use land use designation provides for integrated commercial retail, professional office, housing, and civic uses along the South Main Street corridor. This area is intended to be a local- and neighborhood supporting activity center and corridor. Commercial retail is encouraged to be the primary use on the ground floor. Professional office and housing uses are also encouraged, either

integrated with a commercial use, or as separate, freestanding uses. Walkability and pedestrian access are key considerations. The lower end of the FAR range supports retail development, while the higher end of the range supports a combination of commercial and office uses

Urban Mixed-use designation provides for integrated commercial retail, professional office, housing, and civic uses along West Katella Avenue, Town and Country Road, and within Uptown Orange. These areas are intended to provide for urban, high-intensity, regionally-oriented activity centers that define the character of surrounding areas. Commercial retail is intended to be the primary use on the ground floor. Convenient transit access, innovative housing options, and pedestrian-oriented design are key considerations.

Commercial and Office Designations: The commercial and office categories consist of four designations that provide for a range of revenue- and employment-generating businesses.

The General Commercial designation provides for a wide range of retail and service commercial uses and professional offices. This designation is found along many of the City's most highly-traveled roadway corridors, including Katella Avenue, Chapman Avenue, and Tustin Street. Regional shopping centers, mid- and high-rise office projects, corridor shopping districts, and neighborhood corner stores are all permitted uses.

Recreation commercial uses provide for the operation and development of resort or amusement oriented commercial and recreational uses. The designation refers to recreational uses of regional interest that will draw visitors from throughout the City, Orange County, and Southern California. The areas adjacent to the east and south sides of Irvine Lake in east Orange are proposed for this land use. Permitted uses include, but are not limited to, marinas, boat rental buildings, staging areas, conference centers, golf courses, clubhouses, hotels, resorts, restaurants, and other commercial sports facilities.

Neighborhood Office Professional: This land use designation provides for low-rise office and professional office park development in appropriate areas throughout the City, including portions of Chapman Avenue east of Old Towne and portions of the La Veta Avenue corridor. The principal use in this designation is intended to be professional offices; however, support retail and service commercial uses are permitted as necessary to serve adjacent professional office needs.

The Urban Office Professional designation encourages urban, high intensity, mid- and high-rise office centers located at the City's edges, away from established single-family residential areas. Urban Office Professional uses are located primarily north of the SR-22 Freeway and south of La Veta Avenue, concentrated around the hospital node at the southern end of Main Street. Professional office is intended as the primary use. However, support retail and service commercial uses are also permitted as necessary to serve adjacent professional offices. Hospitals and supporting uses are also permitted.

The Yorba North Commercial Overlay designation applies to the Chapman Hospital site. This designation allows for mixed uses compatible with a public facility or institutional use, such as a civic, college, or health care campus, including integrated retail, housing, office, and civic uses where a specific plan is approved for a public facility or institutional activity center. Innovative housing and pedestrian-oriented design are key considerations.

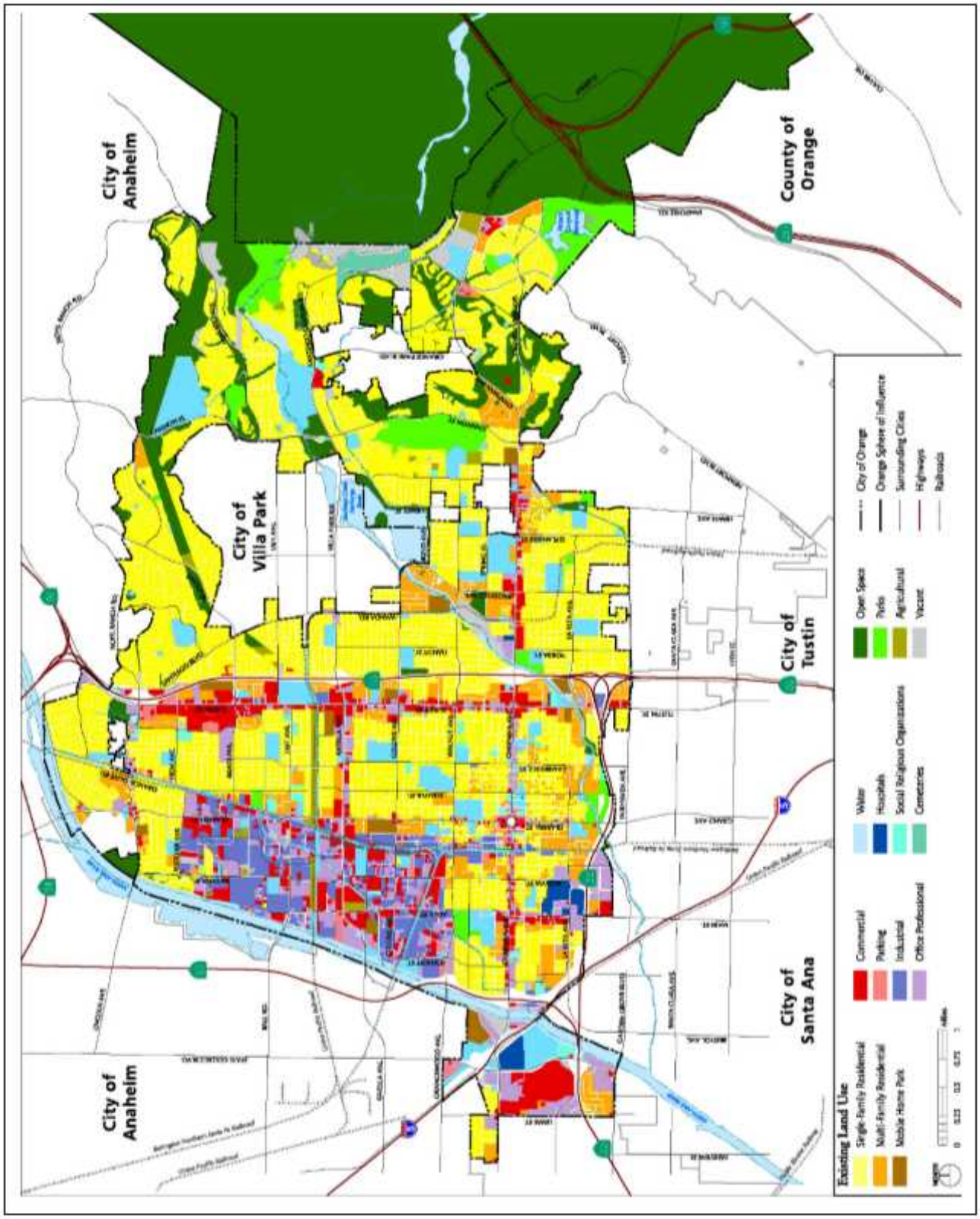
The Yorba South Commercial Overlay designation applies to the current Yorba Park site near Chapman Hospital, SR-55, and Chapman Avenue. This designation provides for a wide range of potential retail and service commercial uses, in conjunction with on-site parkland improvements, off-site parkland, and/or park improvements. Commercial use may only be activated through a Development Agreement with the City that identifies specific parkland obligations.

Industrial Designations
Two industrial land use designations provide locations for offices, manufacturing, warehousing, and distribution uses within the City. The principal difference between the designations is the permitted maximum intensity of development allowed within each area. Permitted uses within industrial areas will continue to be primarily determined using the City's Zoning Ordinance.

Public Facilities and Open Space
Five designations for public facilities and open space areas allow for important public and private facilities and institutions, including parks, open space areas, resource lands, civic facilities, hospitals, and educational institutions.

The Land Use Map Figure 2.2 graphically represents the planned distribution and intensity of land use citywide. The colors shown on the map correspond to the land use designations described above. Using these land use designations, the City of Orange has some capability to reduce risks to lives and property from natural and man-caused hazards. For example, more open space uses could be designated in areas of higher hazard risk to prevent damage to developed property. Similarly, understanding where residential and commercial land uses are in relation to hazard risk is a key component in implementing mitigation strategies.

Figure 2.2 City of Orange Land Use Map



2.6 DEVELOPMENT TRENDS AND FUTURE DEVELOPMENT

Although a majority of the city is considered built out, numerous development projects are under way or in the planning stages in the City. Most new development in Orange's planning area will occur as infill development or redevelopment of underutilized properties in the urbanized portion of the City (generally located west of SR-55), or in currently undeveloped areas located generally east of Jamboree Road. The area east of Jamboree Road within the City limits is already entitled for residential development and is expected to be developed in upcoming years.

This area is well served by the SR 241 and SR 261 toll roads, and future improvements to Santiago Canyon Road will provide arterial connections between the toll roads and future residential and commercial recreation areas. This circulation system provides beneficial connections to those living in east Orange who travel north to Riverside County or south to Irvine or other destinations in the South County. Growth management strategies for new development in east Orange focus on collecting transportation impact fees and ensuring that needed roadway improvements are completed in step with new development as new homes and businesses are occupied. Additional details can be found in the City's General Plan. Table 2.4 identifies current development activities in the city.

Table 2.4: Current Projects

Permit N0.	Address	Description	Area S.F.	Status
Under Construction or Obtaining Building Permits				
1504-193	1148 N Lemon St (Bldg. A)	22-unit Apartment Building	22,928	Framing
1504-194	1148 N Lemon St (Bldg. B)	24-unit apartment Building	23,076	Framing
1504-195	1148 N Lemon St (Bldg. C)	24-unit Apartment Building	25,776	Framing
1504-196	1148 N Lemon St (Bldg. D)	12 Unit Apartment Building	12,888	Framing
1505-011	1782 Windes Dr.	Commercial Building	1,941	Near Complete
1505-177	450 N Center St	Center for Science & Technology with parking below	133,124 & 145,769 parking	Foundation
1505-289	794 N Cypress St	Commercial Building	40,056	Near Complete
1506-102	1110 Town and Country Rd	250 Apartment Building with parking below	271,883 & 222, 177 parking	Foundation
1509-096	428 E Lincoln Ave	28-unit Motel	23,128	Framing
1512-186	20 City Blvd West Bldg. L	Retail Building	24,000	Near Complete
1512-187	20 City Blvd West Bldg. M	Retail Building	16,000	Near Complete
1512-188	20 City Blvd West Bldg. O	Retail Building	20,000	Near Complete
In Plan Check				
1506-212	130 N Lemon Ave	Parking Structure	202,182	Approved
1603-208	2005 N Orange Olive	35 residential units	Various	1st Submittal
SP-0756	2811 Villa Real DR	40 Single Family Residence	Various	1st Submittal
SP-0840	Washington St	38 Residential units	Various	1st Submittal
1607-183	630 The City Dr. South	Senior Housing	92,753	1st Submittal
SP-0831	130 S Hewes	Senior Apartments	6,842	1st submittal
1512-266	420 N State College Blvd	Parking Structure	107,350	3rd Submittal

Source: City of Orange. 2016

2.7 CRITICAL FACILITIES

The LHMP Team identified 17 critical facilities for incorporation in the hazard vulnerability/risk analysis (see Table 2.5, Orange Critical Facilities List). These facilities include police stations, fire stations, several City-owned properties, and other facilities that provide important services to the community. Damage to these facilities caused by a hazard event has the potential to impair response and recovery from the event and may lead to disruption of services. This list includes critical facilities owned and operated by the City.

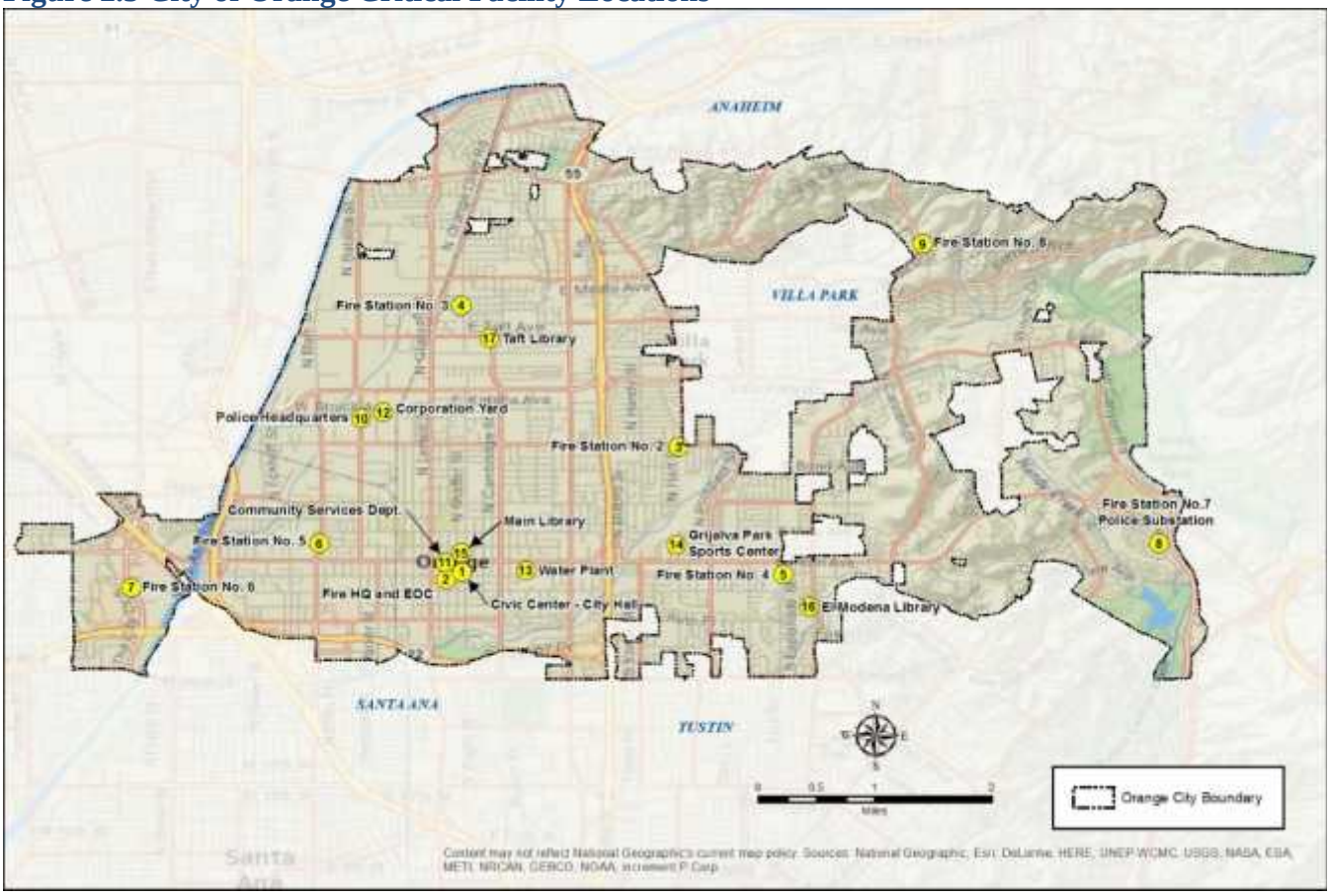
In addition to the Critical Facilities list, the LHMP Team also identified "Facilities of Concern", which are the schools located within the community, as well as "Facilities of Interest" which are private properties that may contain sensitive populations within the City. A list of all facilities identified by the LHMP Team is provided in the Hazus Analysis Study in Appendix D, which also includes maps showing critical facilities in vulnerable areas and facility replacement costs, among other information. The risk assessment prepared for this plan is based solely on the facilities listed in Table 2.6 that are under the City's control. The City did not conduct a risk assessment or potential losses for critical facilities that are outside of the City's control.

The LHMP Team identified replacement and contents values for a majority of the facilities based on the City's insured values; these represent the total loss value for each facility. If a facility is completely destroyed in a hazard event, the replacement and contents values indicate the cost to replace the facility. Depending on the year the facility was built, the cost to repair a damaged facility may be more than the replacement value. While replacement and content values are used throughout this plan to estimate potential losses, it is noted that the actual cost to recover from a hazard will depend on the type and magnitude of the event.

Table 2.5: Orange Critical Facilities List

Map #	Critical Facility	Map #	Critical Facility
1	City Hall	10	Police Headquarters
2	Fire Stations 1	11*	Community Services
3	Fire Station 2	12	Corporation Yard
4	Fire Station 3	13	Water Plant
5	Fire Station 4	14	Grijalva Park Center
6	Fire Station 5	15	Main Library
7	Fire Station 6	16	El Modena Library
8	Fire Station 7/ Police Substation	17	Taft Library
9	Fire Station 8		

Figure 2.3 City of Orange Critical Facility Locations



The City did not conduct a risk assessment or potential losses for critical facilities that are outside of the City's control.

Table 2.6: Orange Critical Facilities Costs

Map #	Facility	Replacement Value	Contents Value	Potential Loss
1	City Hall	$12,747,874	$3,305,813	$16,053,687.00
2	Fire Station 1	$4,345,220	$3,238,706	$7,583,926.00
3	Fire Station 2	$575,402	$1,843,341	$2,418,743.00
4	Fire Station 3	1,509,862	$1,902,321	$3,412,183.00
5	Fire Station 4	$563,402	$1,573,678	$2,137,080.00
6	Fire Station 5	$1,217,077	$2,221,822	$3,438,899.00
7	Fire Station 6	$1,577,350	$1,987,145	$3,564,495.00
8	Fire Station 7	$3,296,234	$1,690,602	$4,986,836.00
9	Fire Station 8	$1,577,350	$4,080,971	$5,658,321.00
10	Police Headquarters	$24,834,460	$4,637,691	$29,472,151.00
11*	Community Services	$2,014,526	$401,028	$2,415,554.00
12	Corporation Yard	$7,405,872	$1,951,232	$9,357,104.00

Map #	Facility	Replacement Value	Contents Value	Potential Loss
13	Water Plant	$2,788,500	$1,095,219	$3,883,719.00
14	Grijalva Park Center	$7,724,331	$20,000	$7,744,331.00
15	Main Library	$11,234,369	$7,403,458	$18,637,827.00
16	El Modena Library	$2,065,630	$2,000,186	$4,065,816.00
17	Taft Library	$1,644,473	$1,553,478	$3,197,951.00
	Total Potential Losses	$87,121,932.00	$40,906,691.00	$128,028,623.00

2.8 EVACUATION ROUTES

The City of Orange is served four State Route Freeways, One Interstate Highway and Two State Toll Roads.

- State Route 55 (Newport Freeway) runs north/south and bisects the city roughly in half providing an effective evacuation corridor for a large portion of the city.
- State Route 91 (Riverside Freeway) lays just outside the northern boundaries of the city but provides an east/west escape route for vehicles evacuating north on State Route 55.
- State Route 57 (Orange Freeway) passes through the south/west portion of the city and provides an escape route to the north and access to Interstate 5 (Santa Ana Freeway) either north or south.
- State Route 22 (Garden Grove Freeway) makes up a portion of the southern boundary and passes through a small portion of the south/west corner of the city. It provides a west bound escape route from the south/west portion of the city.
- Interstate 5 (Santa Ana Freeway) passes through the south/west corner of the city and provides a north or south escape route.
- Toll Road 241 provides escape routes from the south-eastern portion of the city north to State Route 91 or south into Irvine and South Orange County
- Toll Road 261 provides an escape route from the south-eastern portion of the city into the City of Tustin.

West Bound Evacuation Routes
Access across the Santa Ana River and State Route 57 limits evacuation west from the City of Orange to five major corridors.

- Lincoln Avenue
- Taft Avenue – Ball Road
- Katella Avenue
- Walnut Avenue – Orangewood Avenue
- Chapman Avenue

North Bound Evacuation Routes
Access across the Santa Ana River limits evacuation north for areas west of State Route 55 to two major corridors.

- Glassell Street
- Tustin Avenue

Areas north-east of State Route 55 have several small streets leading north out of the city with two major corridors being the most effective.

- Cannon Street
- Serrano Avenue

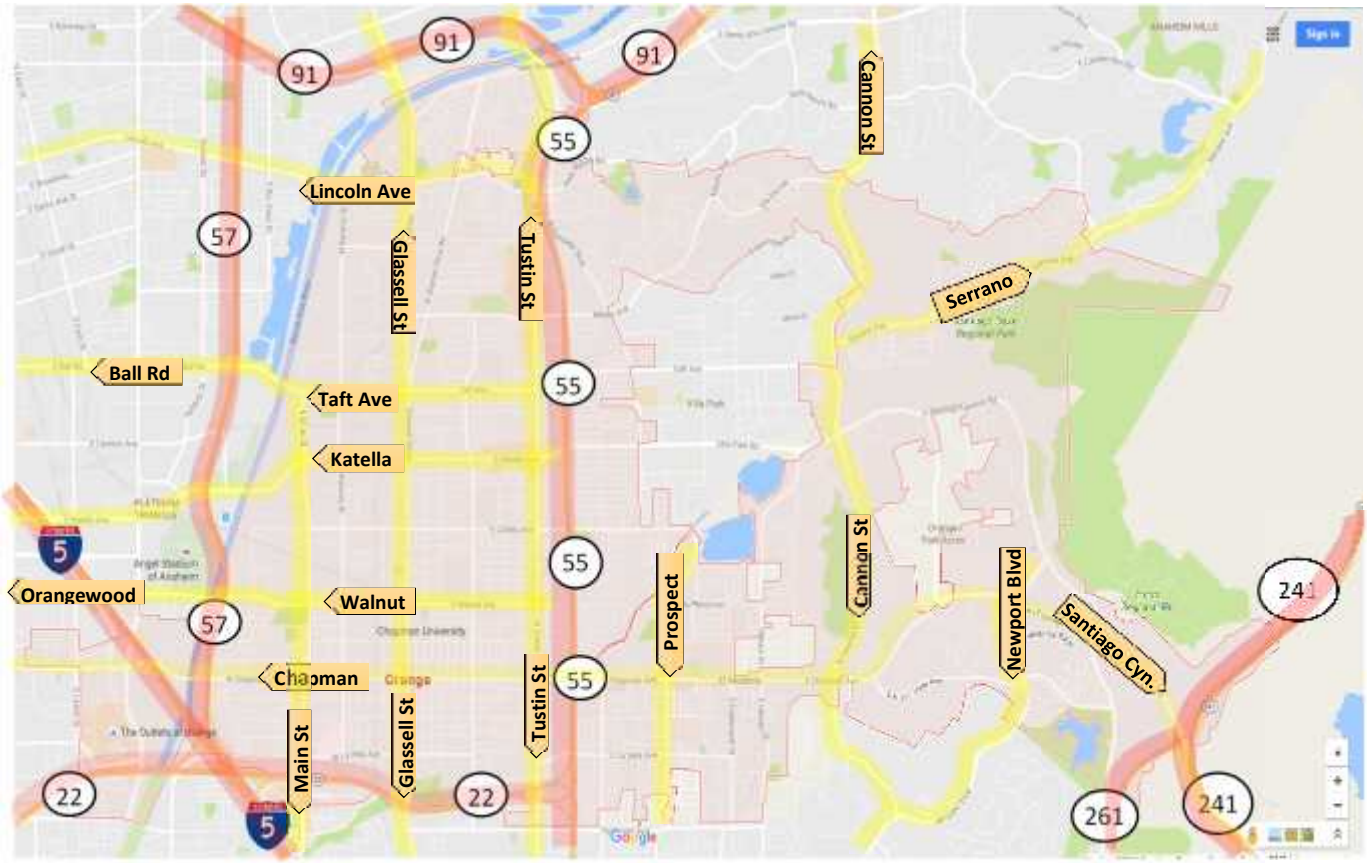
East Bound Evacuation Routes
East bound evacuation is limited.

- Santiago Canyon Road
- 241 Toll Road

South Bound Evacuation Routes
Evacuation south out of the city can be accomplished via any of several small streets with the nine major corridors.

- Interstate 5
- Main Street
- Glassell Street
- Tustin Street
- Prospect Avenue
- Cannon Street
- Newport Boulevard
- Jamboree Road
- Toll Road 261

Figure 2.4 Major Evacuation Corridors



CHAPTER 3 – HAZARDS ASSESSMENT

A number of resources were used in identifying and prioritizing the hazards for the City of Orange. Resources include: City of Orange Hazardous Material Plan and Emergency Operations Plan, the County of Orange and Orange County Fire Authority Hazard Mitigation Plan, 2016, the California Multi-Hazard Mitigation Plan, 2013, the FEMA Local Mitigation Handbook, and other FEMA Hazard Mitigation Planning Resources.

3.1 HAZARD IDENTIFICATION AND PRIORITIZATION

3.1.1 HAZARD IDENTIFICATION

The LHMP Team discussed a comprehensive list of natural hazards during the first milestone meeting on October 15, 2015. This discussion resulted in identification of the hazards that pose a potential risk to the City of Orange. Table 3.1 summarizes the LHMP Team's discussion for each of the natural hazards and shows which were identified for inclusion in this LHMP. Hazards that have been excluded from further consideration are shaded gray in Table 3.1. This table is consistent with the hazards identified as part of FEMA's hazard mitigation planning guidance.

Table 3.1: City of Orange Hazard Identification, 2016

List of Hazards	Identified in 2015 County Plan	Include in City LHMP	Discussion Summary
Agricultural Pests	No	No	There are no agricultural uses in the city.
Avalanche	No	No	Not applicable.
Coastal Erosion/Bluff Failure	No	No	Not applicable due to the distance from the coast.
Coastal Storm	No	No	Not applicable due to the distance from the coast.
Dam Failure	Yes	Yes	The city is susceptible to inundation caused by dam failure of Santiago, Villa Park and Prado Dam. The LHMP Team decided focus on the Prado Dam hazard, given the potential impact to the City.
Epidemic and Vector Borne Disease	Yes	Yes	Vectors, such as mosquitoes, are a growing issue of concern in Orange County.
Drought	Yes	Yes	The City depends on groundwater and imported surface water, both of which are susceptible to drought.
Seismic Hazards (Ground Shaking and Liquefaction)	Yes	Yes	Orange is located in an area susceptible to earthquake ground shaking and liquefaction.
Expansive Soils	No	Yes	The soils within the City have expansion potential.
Extreme Heat	Yes	Yes	Extreme temperature events, such as heat waves, are especially hazardous in Mediterranean climates like those experienced in Orange, as residents are generally unprepared for the extremes.
Flood	Yes	Yes	Flooding in Orange occurs as a result of surface water runoff from the mountainous areas northeast and southeast of the city.

List of Hazards	Identified in 2015 County Plan	Include in City LHMP	Discussion Summary
Hailstorm	No	No	There has been no significant damage from previous storms.
Hazardous Materials Spills	Yes	Yes	Properties in the city containing hazardous materials are medical facilities, pharmacies, hospitals, automotive-related uses (car wash, repair facilities); and industrial businesses (gas, welding and safety supply, etc.). The LHMP Team decided to include a discussion of this hazard given the amount of hazardous materials located within and transported through the City.
Hurricane	No	No	Not applicable.
Land Subsidence	No	Yes	Orange has no historical occurrences of land subsidence.
Landslide and Debris Flow	Yes	Yes	The City of Orange has experienced a landslide. In April 1999 the City proclaimed a local emergency due to heavy rain and earth movement.
Human Caused Hazards	No	No	Except for hazardous materials spills and terrorism, the intent of this plan is to focus on natural hazard risk, per FEMA requirements.
Terrorism	Yes	Yes	A discussion is provided on terrorism due to terrorist incidents around the world.
Severe Winter Storm	No	No	Not applicable.
Tornado	No	No	Tornados and water spouts are possible, but very rare. A discussion regarding severe weather has been provided and tornadoes are discussed within this profile.
Tsunami	Yes	No	Not applicable due to the distance from the coast.
Volcano	No	No	The city is not located within a region of active volcanism.
Wildland / Urban Fire	Yes	Yes	The City is prone to wildfires.
High Wind (Santa Ana Winds) Windstorm	Yes	Yes	The City is prone to severe Santa Ana winds that commonly cause downed power lines and trees.
Sea Level Rise	No	No	Not applicable due to the distance from the coast.
Climate Change	No	Yes	Climate change is not profiled as a distinct hazard, but rather a phenomenon that could exacerbate hazards. Climate change will be considered as a factor for relevant identified hazards.

3.1.2 HAZARD PRIORITIZATION

The LHMP Team used a Microsoft Excel-based tool to prioritize the identified hazards by assigning each hazard a ranking based on probability of occurrence and potential impact. These rankings were assigned based on group discussion, knowledge of past occurrences, and familiarity with the City's infrastructure vulnerabilities. Four criteria were used to establish priority:

- Probability (likelihood of occurrence)
- Location (size of potentially affected area)
- Maximum Probable Extent (intensity of damage)
- Secondary Impacts (severity of impacts to community)

A value of 1-4 was assigned for each criterion. The four criteria were then weighted based on the LHMP Team's opinion of each criterion's importance. Table 3.2 presents the results and includes only those hazards that achieved a "medium" or "high" score. Table 3.3 provides additional detail regarding how the probability, affected area, and impact categories are weighted and how the total score is calculated for this ranking worksheet

Table 3.2: Orange Hazard Ranking Worksheet

Hazard Type	Probability	Impact			Total Score	Hazard Planning Consideration
		Affected Area	Primary Impact	Secondary Impacts		
Seismic Hazards	4	4	4	4	64.00	High
Wildland / Urban Fires	4	3	4	4	57.60	High
Extreme Heat	4	4	2	2	44.80	High
Drought	4	4	2	2	44.80	High
Severe Weather (wind/rain/lightening)	4	3	2	2	38.40	Medium
Hazardous Materials	3	2	4	3	35.40	Medium
Landslide and Debris Flow	3	2	4	3	35.40	Medium
Flood	2	2	3	3	20.80	Medium
Terrorism	2	1	4	3	20.40	Medium
Dam Failure	1	2	4	4	12.80	Medium
Epidemic and Vector Borne Disease	1	4	1	3	10.80	Low

Note: Scores are based on a scale of 1 to 4, where 4 is the highest score, and 1 is the lowest score. See Table 3.3 for more information.

Note: Total score is based on an equation that weights categories by importance. See Table 3.3 for more information.

Table 3.3: Orange Hazard Ranking Worksheet Legend

Probability	Importance	2.0
Based on estimated likelihood of occurrence from historical data		
Probability		Score
Unlikely (Less than 1% probability in next 100 years or has a recurrence interval of greater than every 100 years.)		1
Somewhat Likely (Between 1 and 10% probability in next year or has a recurrence interval of 11 to 100 years.)		2
Likely (Between 10 and 100% probability in next year or has a recurrence interval of 10 years or less.)		3
Highly Likely (Near 100% probability in next year or happens every year.)		4

Affected Area	Importance	0.8
Based on size of geographical area of community affected by hazard		
Affected Area		Score
Isolated		1
Small		2
Medium		3
Large		4

Primary Impact	Importance	0.7
Based on percentage of damage to typical facility in community		
Impact		Score
Negligible - less than 10% damage		1
Limited - between 10% and 25% damage		2
Critical - between 25% and 50% damage		3
Catastrophic - more than 50% damage		4

Secondary Impacts	Importance	0.5
Based on estimated secondary impacts to community at large		
Impact		Score
Negligible - no loss of function, downtime, and/or evacuations		1
Limited - minimal loss of function, downtime, and/or evacuations		2
Moderate - some loss of function, downtime, and/or evacuations		3
High - major loss of function, downtime, and/or evacuations		4

Total Score = Probability x Impact, where:
Probability = (Probability Score x Importance)
Impact = (Affected Area + Primary Impact + Secondary Impacts), where:
Affected Area = Affected Area Score x Importance
Primary Impact = Primary Impact Score x Importance
Secondary Impacts = Secondary Impacts Score x Importance

Hazard Planning Consideration			
Total Score	(Range)	Distribution	Hazard Level
0.0	12.0	0	Low
12.1	42.0	6	Medium
42.1	64.0	3	High

Notes: The probability of each hazard is determined by assigning a level, from unlikely to highly likely, based on the likelihood of occurrence from historical data. The total impact value includes the affected area, primary impact, and secondary impact levels of each hazard. Each level's score is reflected in the matrix. The total score for each hazard is the probability score multiplied by its importance factor times the sum of the impact level scores multiplied by their importance factors. Based on this total score, the hazards are separated into three categories based on the hazard level they pose to the communities: High, Medium, and Low.

Based on this ranking exercise with the LHMP Team and follow-up discussion with City staff, City staff confirmed the following identified hazards and corresponding planning considerations for this Plan as listed in Table 3.4.

Table 3.4: Orange Prioritized Hazards

Identified Hazard	Hazard Planning Consideration
Seismic Hazards	High
Wildland / Urban Fires	High
Extreme Heat	High
Drought	High
Severe Weather (wind/rain/lightening)	Medium
Hazardous Materials	Medium
Landslide / Expansive Soil / Erosion	Medium
Flood	Medium
Terrorism	Medium
Dam Failure	Medium
Epidemic and Vector Borne Disease	Low

3.2 CLIMATE CHANGE CONSIDERATIONS

Climate change is expected to exacerbate existing hazards in the city. As such, the LHMP Team determined that it would be best to discuss climate change considerations throughout all applicable hazard profiles. To address potential climate change impacts, the City has identified climate change considerations within each hazard profile. This discussion is intended to supplement, but not replace, the Probability of Future Occurrence discussion.

3.3 VULNERABILITY/RISK ASSESSMENT METHOD

The critical facilities listed in Table 2.5 were mapped in GIS and overlaid with mapped hazard areas to determine which assets are located within each hazard area. Hazard area and critical facility overlays were conducted for seismic hazards (liquefaction), flood, hazardous materials, and dam failure. Hazard and critical facility overlays were not conducted for drought, extreme heat, severe storms, or epidemic and vector borne disease. These hazards affect the entire city and therefore all facilities listed in the critical facility inventory could be potentially susceptible to damage from them.

Each hazard profile in the following section includes a Vulnerability/Risk Assessment section that presents the results of the method described above. Replacement and contents values for the facilities that fall within the hazard areas are tallied in each vulnerability table to estimate the total potential losses to each facility. It should be noted that the actual losses will depend on the type and extent of the hazard event.

3.4 HAZARD PROFILES

This section contains City of Orange profiles for the hazards identified in Table 3.4 (seismic hazards, wildland /urban fires, extreme heat, drought, severe weather, hazardous materials, landslide/expansive soil/erosion, flood, terrorism, dam failure, epidemic and vector borne disease). For organizational purposes, liquefaction is examined as part of the seismic hazards section. The profiles include a vulnerability analysis and risk assessment using the methods described in the Vulnerability/Risk Assessment Section.

3.4.1 SEISMIC HAZARDS

Earthquakes are considered a major threat due to the proximity of several fault zones, notably the Newport-Inglewood and the San Andreas Fault Zones. Like many cities in Southern California, Orange faces geologic and seismic hazards, specifically earthquakes, earthquake-induced landslides, and liquefaction. A significant earthquake along one of the major faults could cause substantial causalities, extensive damage to the community. The effects could be aggravated by aftershocks and by secondary effects such as fire, landslide and dam failure.

The City of Orange planning area encompasses two general types of terrain: an alluvial plain that underlies the central and western parts of the City, and a series of low hills (foothills of the Santa Ana Mountains) characteristic of the east side of the City and the Sphere of Influence. Generally, the alluvial plain is underlain by many thousand feet of fluvial and floodplain sediments, and certain areas of the plain adjacent to major watercourses (the Santa Ana River and Santiago Creek) are susceptible to flooding and seismically induced liquefaction. However, the potential for landslides is low due to the limited relief of the alluvial plain. Conversely, the hilly section is underlain by bedrock (mostly late Tertiary marine and non-marine sediments); this area is generally less susceptible to liquefaction but certain areas may be prone to earthquake-induced landslides, depending upon the character of the underlying bedrock.

An earthquake is a manifestation of the constant movement and shifting of the earth's surface. Movement occurs along fractures or faults, which represent the contact point between two or more geologic formations. Earth movement, known as seismic activity, causes pressure to build up along a fault, and the release of pressure results in the ground-shaking effects we call an earthquake. Earthquake magnitude generally is measured on a logarithmic scale known as the Richter Scale. This scale describes a seismic event in terms of the amount of energy released by fault movement. Because the Richter Scale expresses earthquake magnitude in scientific terms, it is not readily understood by the general public. The Modified Mercalli Scale, on the other hand, describes the magnitude of an earthquake in terms of actual physical effects.

Both the Peralta Hills Fault and the El Modena Fault traverse the City of Orange and are classified as possibly active by the Southern California Earthquake Data Center. The Peralta Hills Fault runs from the crossing of Lincoln Avenue over the Santa Ana River on the northwest, easterly along the base of the Peralta Hills and into the City of Villa Park, then southerly into the hills west of Peters Canyon Reservoir. The El Modena Fault runs from its intersection with the Peralta Hills Fault at the base of the Peralta Hills, southeasterly to Chapman Avenue. Displacements along these two faults are smaller than

those along the more prominent regional faults, and the maximum probable earthquake magnitudes would be much less than those along the regional faults.

Seismic Hazards Explanation

Seismic hazards occur as the result of a sudden release of energy in the earth's crust. Caused by movement along fault lines, earthquakes vary in size and severity. The focus of an earthquake is found at the first point of movement along a fault line (which may be beneath the surface), and the epicenter is the corresponding point above the focus at the earth's surface.

Damage from an earthquake varies with the local geological conditions, the quality of construction, the energy released by the earthquake, the distance from the earthquake's focus, and the type of faulting that generates the earthquake. Earthquake-related hazards include primary impacts (ground shaking) and secondary impacts (liquefaction). This hazard profile discusses ground shaking and liquefaction, since these are the most likely impacts anticipated as a result of an earthquake.

Orange is vulnerable to ground shaking caused by seismic events along large regional faults in the area. These faults include the Newport-Inglewood Fault (located approximately 15 miles southwest of Orange along the coast near Newport Beach), the Elsinore Fault (which crosses the Santa Ana River Canyon about five miles northeast of Orange), and the San Andreas Fault (which is parallel to the Elsinore, located approximately 40 miles northeast of Orange). Each of these faults has numerous branches and associated faults and, therefore, has associated fault zones. Movement along any of these fault zones has the potential to cause widespread disruption in the area. The potential for ground shaking within the city depends on the distance to the fault and the intensity of a specific seismic event along the fault. Also, areas underlain by bedrock at shallow depths (as in the eastern part of the planning area) would tend to be less affected than areas underlain by thick sequences of unconsolidated alluvium. The maximum Mercalli intensity, IX, at the southwest corner of the city under a 7.5 magnitude Newport-Inglewood fault scenario, indicates potential for great damage to substantial buildings and damage to underground pipes even in specially designed structures.

Landslides can occur when strong ground movement such as an earthquake shakes loose soil and causes land and debris to lose stability and slide. Liquefaction occurs when moisture-saturated soils lose stability during seismic conditions. Structures built on such soils may collapse and result in damage and loss. Earthquake-induced landslides are most probable in poorly consolidated or semi-consolidated sedimentary rock, characteristic of the low hills of the northern and eastern parts of the planning area.

Portions of the City of Orange planning area susceptible to seismically-induced liquefaction include areas near the Santa Ana River and Santiago Creek. A smaller area of high liquefaction potential is present in the areas east of Panorama Heights, in Crawford Canyon. These alluvial plains are characterized by fluvial and loose, floodplain sediments.

Ground motion/shaking is the primary cause of damage and injury during earthquakes and can result in surface rupture, liquefaction, landslides, lateral spreading, differential settlement, building and infrastructure failure, which could lead to fire and other collateral damage. Typically, areas underlain by thick, water-saturated, unconsolidated material will experience greater shaking motion than areas

underlain by firm bedrock, but, in some cases, topographic relief may intensify shaking along ridge tops, where landslides may develop.

Fires and structural failure are the most hazardous results of ground shaking. Most earthquake-induced fires start because of ruptured power lines and gas lines or electrically powered stoves and equipment. Structural failure is generally a result of age, quality, and type of building construction. The size and magnitude (M) of an earthquake is measured in various ways. The Moment Magnitude scale determines the amount of ground displacement or shaking that occurs near the epicenter. This scale is shown in Table 3.5.

Table 3.5: Moment Magnitude Scale

Magnitude (M)	Earthquake Effects
3.4 or less	Recorded, but not felt or only felt by some at rest
3.5 to 4.9	Felt by most. Objects may be disturbed or broken.
5.0 to 5.9	Heavy furniture moved and plastic disturbed. Up to considerable damage in poorly built structures, up to slight to moderate damage in normal structures.
6.1-6.9	Considerable damage to ordinary buildings. Heavy furniture overturned
7.0-7.9	Considerable damage to specially designed structures, potentially including partial collapse. Buildings shifted off foundations. Rails bent.
8 or greater	Widespread to total damage. Few, if any, structures remain standing

The magnitude is a number that characterizes the relative size of an earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph. Many scales, such as the Richter scale, do not provide accurate estimates for large magnitude earthquakes. Today the moment magnitude scale, (abbreviated as MMS; denoted as M_w or M) is preferred because it works over a wider range of earthquake sizes and is applicable globally. The moment magnitude scale is based on the total moment release of the earthquake. Moment is a product of the distance a fault moved and the force required to move it. It is derived from modeling recordings of the earthquake at multiple stations. Moment magnitude estimates are about the same as Richter magnitudes for small to large earthquakes. But only the moment magnitude scale is capable of measuring M8 (read 'magnitude 8') and greater events accurately. The Modified Mercalli Intensity Scale for Earthquakes shown in Table 3.5 measures ground shaking intensity in terms of perception and damage and takes into account localized earthquake effects. The amount of shaking experienced at different locations varies based on not only the overall magnitude, how far you are from the fault that ruptured in the earthquake, and whether you are on rock or thick valley deposits that shake longer and harder than rock.

Table 3.6: Modified Mercalli Intensity Scale for Earthquakes

Scale	Intensity	Earthquake Effects
I	Instrumental	Detected only on seismographs
II	Feeble	Some people feel it
III	Slight	Felt by people resting; like a truck rumbling by
IV	Moderate	Felt by people walking
V	Slightly Strong	Sleepers awake; church bells ring
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves
VII	Very Strong	Mild alarm; walls crack; plaster falls
VIII	Destructive	Moving cars uncontrollable; masonry fractures; poorly constructed buildings damaged
IX	Ruinous	Some houses collapse; ground cracks; pipes break open
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves

Liquefaction

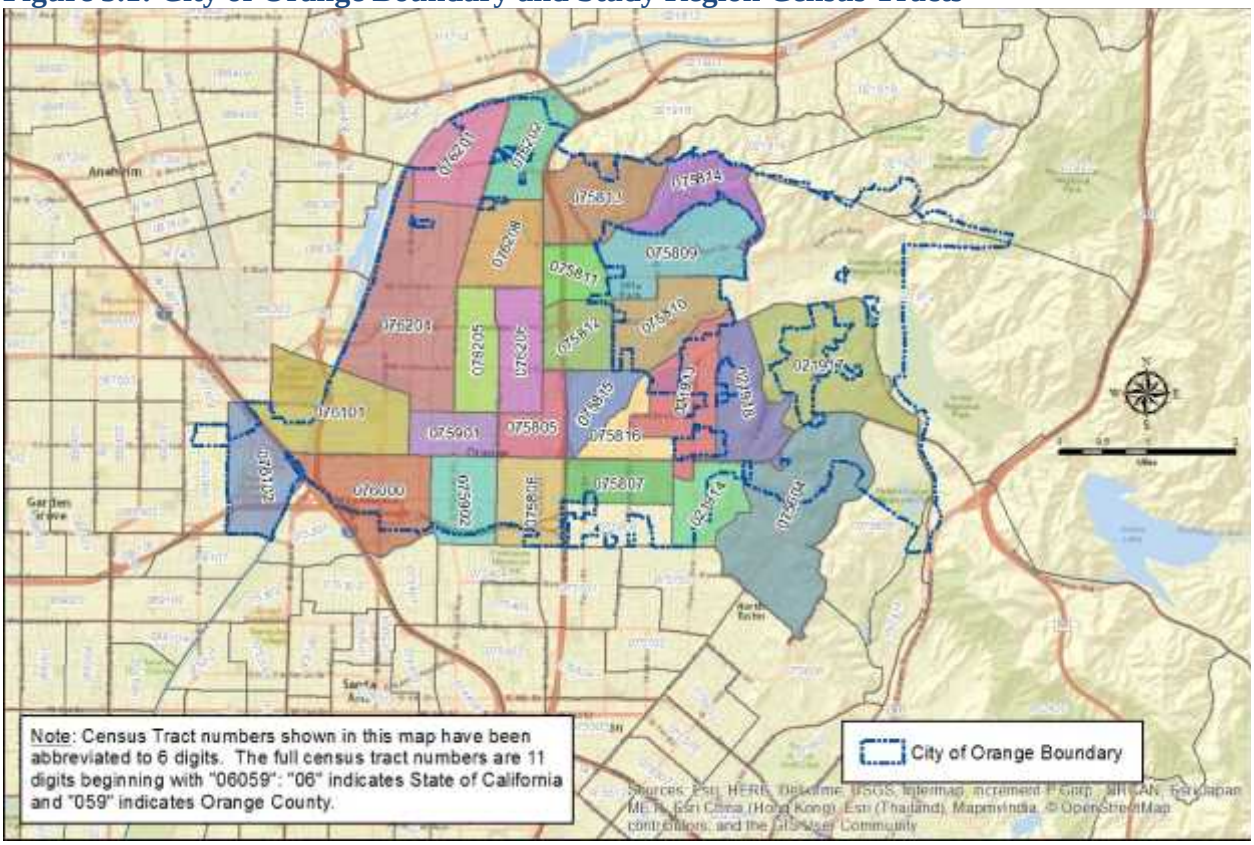
Liquefaction is the transformation of loose, water-saturated granular materials (such as sand and silt) from a solid to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures.

Hazard Profile

Due to the major earthquake faults near the City of Orange, a HAZUS study was done on the Newport-Inglewood and the San Andreas earthquake faults since they had the highest likelihood of an earthquake occurring. Two earthquake scenarios were developed: a Magnitude 7.0 on the Newport-Inglewood Fault and a Magnitude 7.0 on the South San Andreas Fault.

A number of USGS Earthquake Planning Scenario ShakeMaps were included in the study. A HAZUS analysis was conducted and data was compiled for the region of interest from a larger database that included the entire state of California. Data for the City of Orange was aggregated by census tract. Twenty-seven census tracts were identified for the City of Orange study region. The geographical size of the region of study is 25.7 square miles as shown in Figure 3.1. The population of the HAZUS Study Region prepared for this analysis is 145,164 (2010 Census).

Figure 3.1: City of Orange Boundary and Study Region Census Tracts



Location and Extent of Seismic Shaking

Seismic-induced ground shaking can result in secondary effects such as landsliding, rockfall and liquefation. Only a limited portion of the City is subject to liquefaction hazards. One additional seismic-related hazard is flooding due to seiches or, more significantly, dam failure. A seiche is an oscillation, or a wave, in a land-locke body of water which is caused by ground shaking. An earthquake may produce vibrations which cause water to slosh back and forth in a lake or reservoir. If the ground vibrations are strong enough to occur at a resonant frequency, water may spill over a dam in a reservoir, flooding areas below the dam.

Figure 3.2 identifies two faults classified as potentially active by the Southern California Earthquake Data Center.

Figure 3.3 identifies a number of small active faults within the City of Orange.

Figure 3.4 identifies major Southern California earthquake faults.

Figure 3.2: El Modena and Peralta Hills Faults

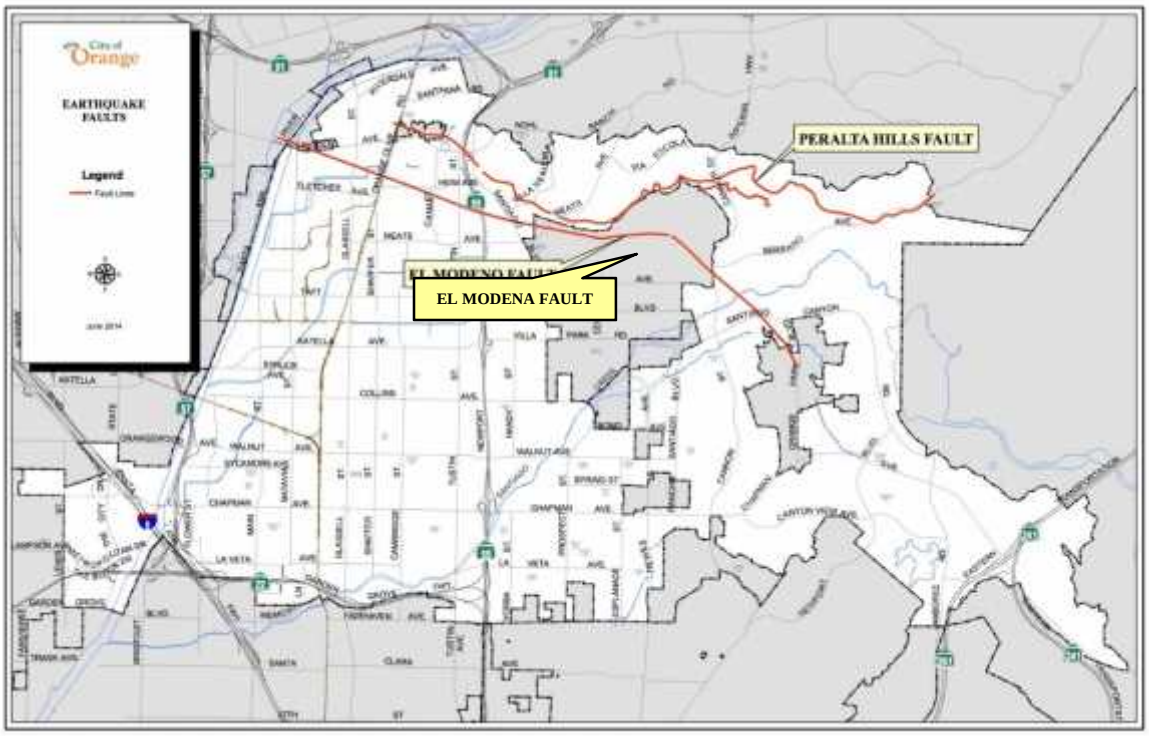


Figure 3.3: Active Faults in the City of Orange

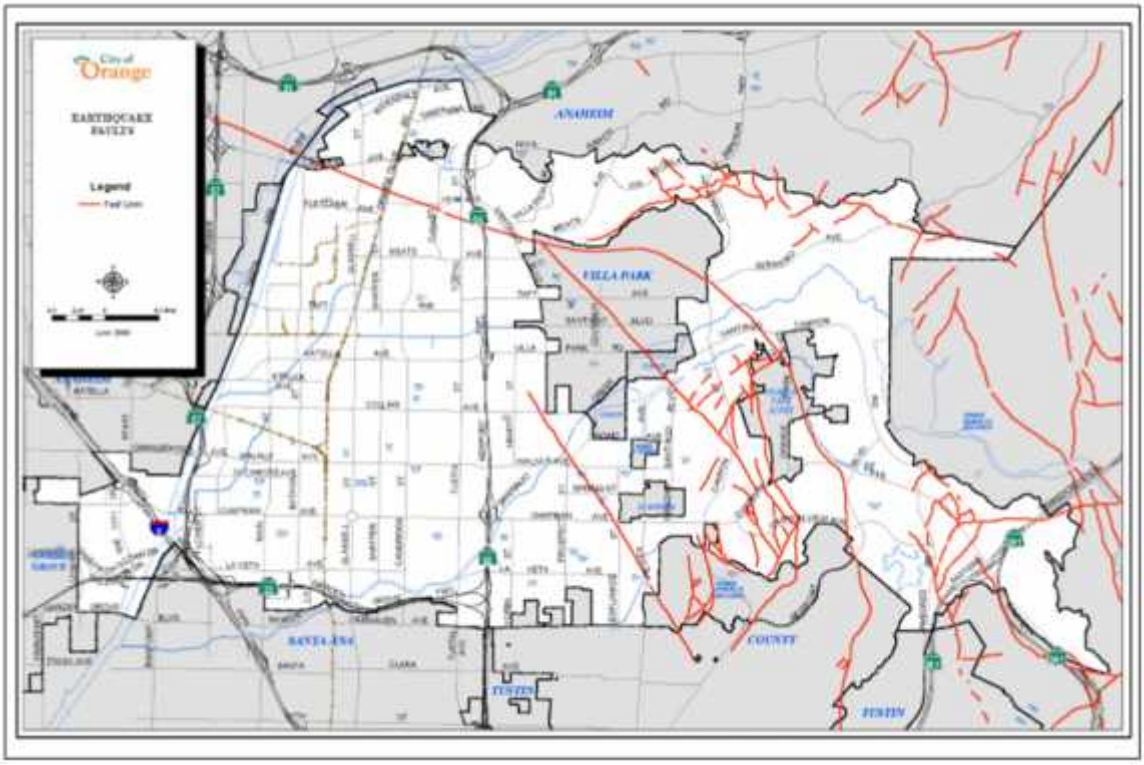


Figure 3.4: Major Southern California Earthquake Faults

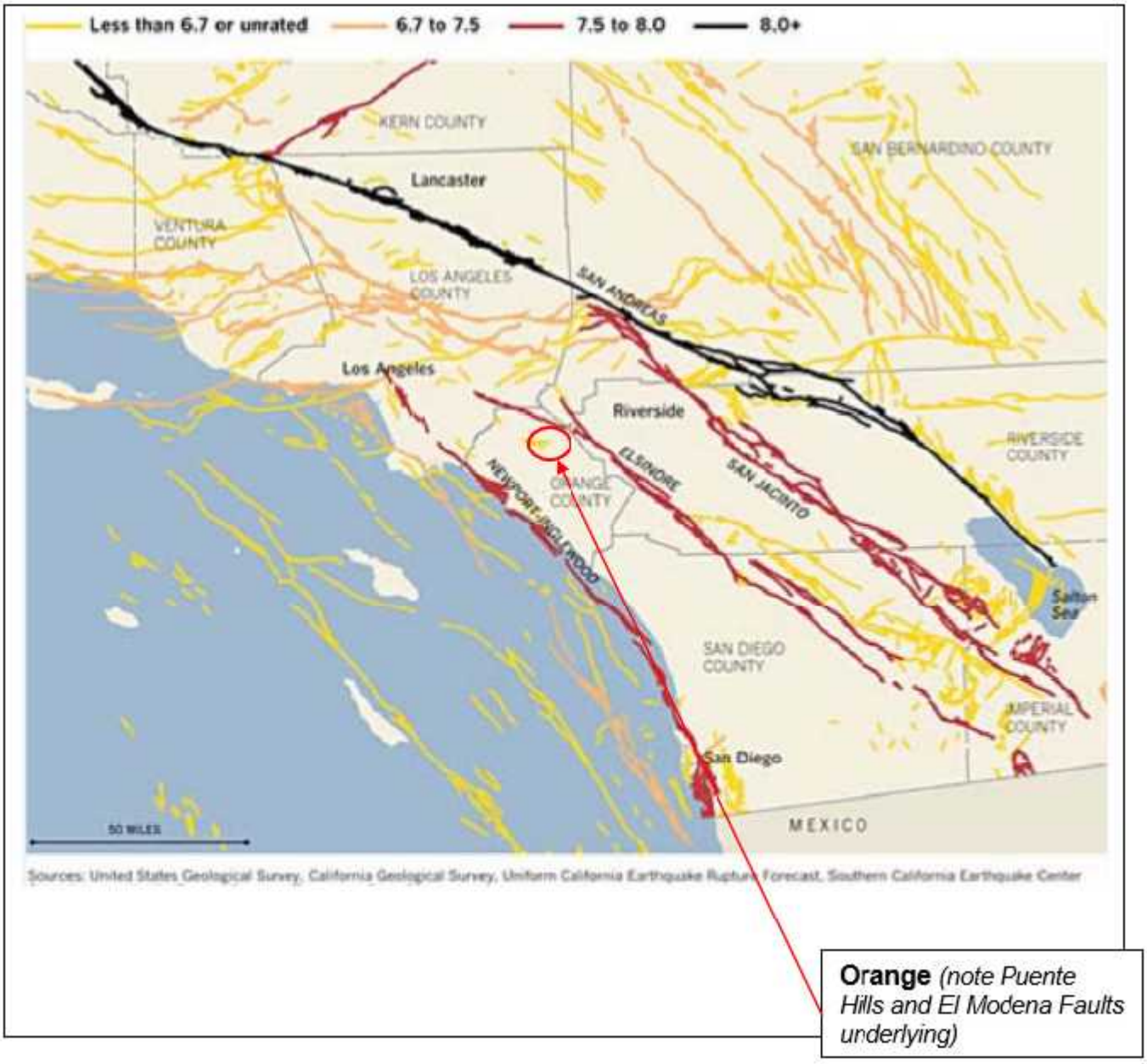
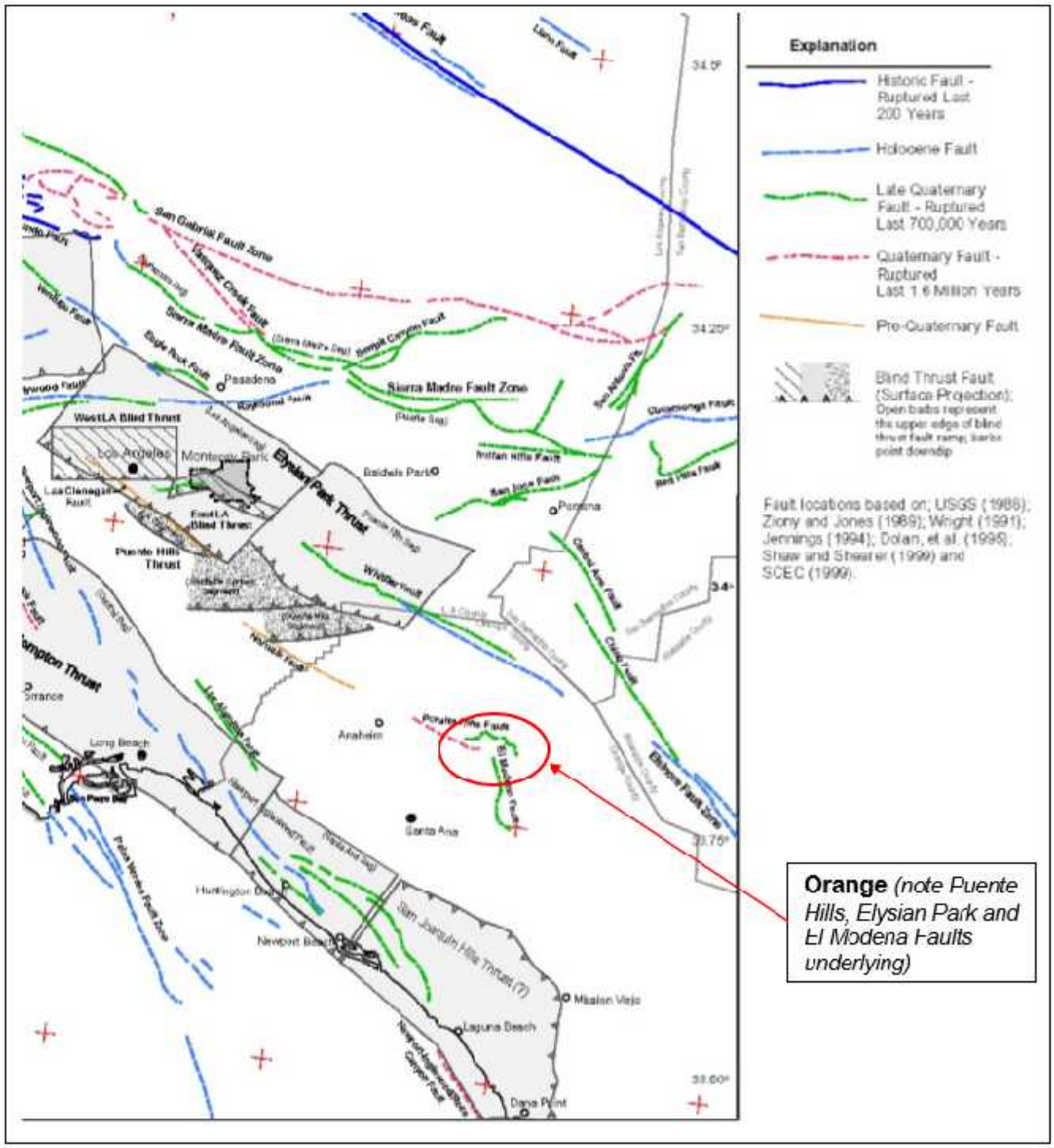


Figure 3.5: Puente Hills, Elysian Park and El Modena Faults



Past Occurrences – Seismic Shaking

Past seismic events indicate that the city has been free of major damaging earthquakes for at least 80 years. However, a number of historic earthquakes affecting Orange County, and Southern California in general, have impacted Orange in varying degrees from nonstructural damage (toppling of building contents) to minor structural damage. Table 3.7 shows the historical earthquakes that have occurred in Southern California from 1855 through the present.

Table 3.7: Historic Earthquake Events

Date	Fault/Location	Impact/Property Damage
July 11, 1855	Newport-Inglewood	Magnitude 6.0. This earthquake was felt from San Bernardino to Santa Barbara.
January 9, 1857	San Andreas	Magnitude 7.9 (largest earthquake in California history). Heavy property loss at Ft. Tejon, one death, was felt from Marysville south to San Diego and east to Las Vegas, Nevada. Strong shaking lasted from 1 to 3 minutes.
June 21, 1920	Newport-Inglewood	Magnitude 4.9. Minor property damage to a limited area of Inglewood.
June 29, 1925	Santa Barbara	Magnitude 6.3. Property damage estimated at $8 million. 13 deaths, was felt as far north as the central coast region between Santa Maria and Nipomo, and as far east as Corona and San Bernardino.
March 11, 1933	Newport-Inglewood (Long Beach)	Magnitude 6.4, Intensity VIII. Property damage estimated at $40 million. 115 deaths, was felt almost everywhere in the 10 southern counties of California and at some points farther to the northwest and north in the Coast Range, the San Joaquin Valley, the Sierra Nevada, and the Owens Valley, as well as Baja, California.
October 21, 1941	Torrance-Gardena	Magnitude 4.8, Intensity VII. No deaths reported; property damage estimated at $100,000.
February 9, 1971	San Fernando (Sylmar)	Magnitude 6.6, Intensity XI. Property damage estimated at $505 million. 65 deaths, more than 2,000 injuries, felt throughout Southern California and into western Arizona and southern Nevada.
July 8, 1986	North Palm Springs	Magnitude 6.1, Intensity VII. Property damage estimated at $6 million. 40 injuries in the North Palm Springs area. The earthquake disrupted electrical and telephone service and caused failure of two pumping stations in the Metropolitan Water District.
October 1, 1987	Whittier Narrows	Magnitude 5.9, Intensity VI-VIII. Property damage estimated at $358 million. 8 deaths and several hundred injuries. A large aftershock registering magnitude 5.6 occurred three days later, causing one additional death and additional property damage.
January 17, 1994	Northridge	Magnitude 6.7, Intensity IX. Responsible for at least 61 deaths, 6,500 injuries, destroying/seriously damaging more than 1,000 buildings, and moderately damaging 11,000 structures throughout the Los Angeles Basin, and leaving 20,000 people homeless. Estimated damages as high as $20 billion; one of the costliest natural disasters in American history.
July 29, 2008	Chino Hills	Magnitude 5.5, Intensity VI. Felt at cities in Orange and Los Angeles Counties. No deaths, but considerable damage to numerous structures throughout the area.
March 28, 2014	La Habra	Magnitude 5.1, Felt at cities in Orange and Los Angeles Counties. No deaths, but moderate damage to structures throughout the area. 10.5 million in damage and cost. No State Emergency Proclamation,

Source: USGS Earthquake Hazards Program data. http://earthquake.usgs.gov/earthquakes/states/historical_state.php#california accessed 4-22-13.

Probability of Future Occurrence- Seismic Shaking

There are several major faults and fault systems within Southern California and in close proximity to the city, placing them in an area of high seismic risk and high probability of occurrence. Of these faults, the Newport-Inglewood Fault Zone presents the highest risk of damage to the City of Orange. Table 3.8

identifies the active faults that could impact the City as a result of an earthquake. Earthquakes can cause severe damage over a long distance and, therefore, Southern California and Orange remain at risk from seismic activity along these active faults.

Table 3.8: Active Faults in Proximity to the City of Orange

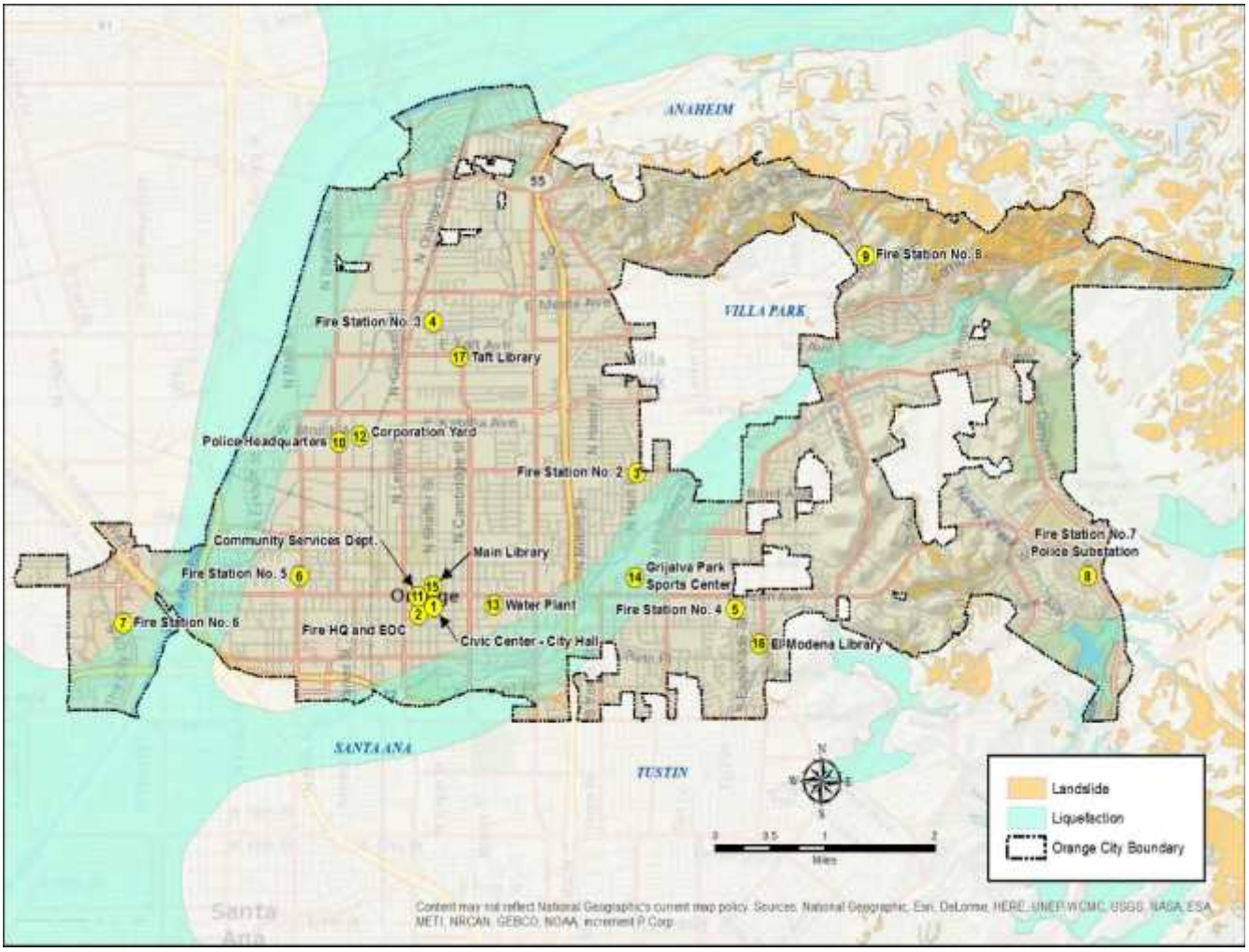
Fault Name	Description	Distance to Orange	Magnitude Range
San Andreas Fault Zone	The San Andreas Fault is the dominant active fault in California; it is the main element of the boundary between the Pacific and North American tectonic plates. The longest and most publicized fault in California, it extends approximately 650 miles from Cape Mendocino in northern California to east of San Bernardino in southern California. This fault was the source of the 1906 San Francisco earthquake, which resulted in some 700 deaths and millions of dollars in damage. It is the southern section of this fault that is currently of greatest concern to the scientific community. Geologists can demonstrate that at least eight major earthquakes (Richter magnitude 7.0 and larger) have occurred along the Southern San Andreas Fault in the past 1200 years with an average spacing in time of 140 years, plus or minus 30 years. The last such event occurred in 1857 (the Fort Tejon earthquake). Based on that evidence and other geophysical observations, the Working Group on California Earthquake Probabilities (SCEC, 1995) has estimated the probability of a similar rupture (magnitude7.8) in the next 30 years (1994 through 2024) to be about 50%.	Approximately 35 miles (Northeast)	6.8-8.0
Newport-Inglewood Fault Zone	The Newport-Inglewood Fault is considered the second most active fault in California. It extends from the Santa Monica Mountains southeastward through the western part of Orange County to the offshore area near Newport Beach and was the source of the destructive 1933 Long Beach earthquake (magnitude 6.4).	Approximately 17 miles (Southwest)	6.0-7.4
Whittier-Elsinore Fault	The Whittier-Elsinore Fault is a right-lateral northwest trending strike-slip fault approximately 40 km in length with some reverse slip. located in the northeast part of Orange County. The fault is located about four and one-half miles north of the Lincoln Avenue/Costa Mesa Freeway Interchange. In the vicinity of Orange, this fault has not produced major earthquakes within historic times, although a number of tremors in the 3.0 to 4.5 Richter magnitude range have been measured. In September of 1987, a 6.1 earthquake occurred near this fault about 35 miles north of Orange, in the City of Whittier. Due to is distance from the epicenter, Orange experienced a sizeable jolt but relatively minor damage. Geologic studies indicate that any portion of the fault is capable of producing an earthquake up to 6.9 Richter magnitude which could result in "sever" damage in Orange The last major earthquake on this fault occurred in 1910 (magnitude 6.0).	Approximately 4 1/2 miles (Northwest)	6.0-7.5
San Joaquin Hills Fault	The California Division of Mines and Geology stated that the San Joaquin Hills blind-thrust fault appears to be active and runs approximately 24 miles south of Huntington Beach to north of Dana Point beneath coastal mesas and the San Joaquin Hills. A measure event on this fault would be expected to cause significant damage with the County, somewhat similar to that caused by an event on the Newport-Inglewood fault.	Approximately 20 miles (Southeast)	Up to 7.3
Elysian Park Fold and Thrust Belt	The Elysian Park belt was the site of the 1987 Whittier Narrows earthquake. This fault is located approximately 6 to 10 miles underground and approximately 10 miles to the north under the City of Brea. The 1987 earthquake was a magnitude of 6.7.	Approximately 10 miles (North)	6.0-7.0
Santa Fe Springs-Elsinore Fault	The fault has historically experienced moderate activity having produced numerous magnitude 4 earthquake and a few magnitudes 5. The largest historical earthquake on this fault occurred in 1976 and had a Richter magnitude of 4.2. The maximum credible earthquake for this fault is estimated to be magnitude 7.0	Approximately 27miles (East)	4.0-7.0

To clarify the extent of future earthquake risk, a partnership between the United States Geological Survey, California Geologic Survey, and Southern California Earthquake Center was formed in September 2004 to provide a uniform forecast. Known as the Working Group on California Earthquake

Probabilities, this group evaluated and systemized currently available historic and paleoseismic information to produce a probabilistic seismic hazards analysis to indicate the type of future earthquakes. One product of this analysis is a method of estimating the probability of ground shaking. The 30-year probability of an M ≥ 6.7 earthquake on the southern segment of the San Andreas Fault in Southern California is 97 percent, and a probability of 50% that a M7.8 earthquake could occur. See the California Geological Survey website at http://gmw.consrv.ca.gov/shmp/pdf_maps_so.html

Location and Extent of Liquefaction

Figure 3.6: Liquefaction Zone Within the City of Orange



Past Occurrences – Earthquake/Liquefaction

Prior instances of earthquakes and liquefaction have not occurred within the city; however, Orange is situated primarily on soil with high liquefaction potential. The most recent damaging earthquake event affecting Southern California was the1994 Northridge Earthquake. At 4:31 A.M on Monday, January 17, a moderate, but very damaging earthquake with a magnitude of 6.7 struck the San Fernando Valley. In the following days and weeks, thousands of aftershocks occurred, causing additional damage to affected structures. Fifty-seven people were killed and more than 1,500 people seriously injured.

Probability of Future Occurrences

The City of Orange is located in an area susceptible to a high potential for shaking intensity and liquefaction damage. The probability that liquefaction will occur in the future in Orange is dependent on many factors including the intensity of ground shaking, location of the earthquake, and subsurface conditions (including groundwater elevation). For those areas of the city identified with a high and very high liquefaction potential, it should be anticipated that potential damage could occur under future earthquakes.

Climate Change Considerations

While precipitation is expected to decrease the link between climate change impacts and seismic hazards is indirect. One possible consideration is that anticipated changes to precipitation regimes and hydrological patterns could result in a change to groundwater levels. Since liquefaction is dependent on the presence of shallow subsurface water, an increase in groundwater levels could occur due to new precipitation patterns. The potential change in shallow subsurface water conditions could expand the potential liquefiable areas within the city, increasing the risk of future damage to additional structures in the city. In contrast, a reduction in precipitation as a result of climate change could reduce groundwater levels in the future, which could reduce liquefaction potential in the city.

Vulnerability / Risk Assessment

The HAZUS analysis results indicate that consequences of the Newport-Inglewood earthquake scenario would be considerable great significance than consequences of the San Andreas Fault M7.0. The scenario indicates that it could result in up to 122 casualties within the city, including up to five life-threatening injuries or fatalities. An estimated 3,077 buildings within the city could be damaged and 212 households displaced. Economic losses could exceed 710 million dollars.

The western part of the City is located on an alluvial flood plain and has a potential for high shaking intensity and ground failure. The greatest potential damage and loss of life is likely to result from structural failure and collapse due to liquefaction. Liquefaction is a phenomenon in which the strength and rigidity of soil is diminished by earthquake shaking or other extreme pressure. This phenomenon has been responsible for tremendous amounts of damage in earthquakes around the world.

Liquefaction is based on the potential for the following three required conditions to occur:

Loose Unconsolidated Soils – the City of Orange is underlain by loose sandy and silty soils that exhibit liquefaction potential.
Shallow Groundwater – liquefaction occurs when shallow groundwater is present and the hazard is greatest when groundwater is within 50 feet or less from the ground surface. Current groundwater elevations within the City are approximately twenty-seven feet beneath the surface.
Strong Seismic Shaking – the City of Orange is located in close proximity to active earthquake faults that can produce strong seismic shaking. Figure 3.6 presents the areas at risk to liquefaction in the City of Orange.

Seismic-induced ground shaking can result in secondary effects such as landslides, rockfalls, and dam failure which could result in flooding and/or a seiche which is an oscillation or water in a reservoir.

Seismic shaking and liquefaction from earthquakes can cause major damage to nearly all utility systems, both aboveground and underground. Utility poles may fall, cutting off electrical and telephone service. Gas lines may rupture, causing fires. Water lines may rupture and prevent access to potable water. Any one or a combination of these occurrences would prevent the response and recovery process from taking place and would place lives and property at risk. Those utilities located within or in close proximity to faults and liquefaction areas are potentially susceptible to these hazards and failure of these facilities could further exacerbate emergency response and recovery.

Critical facilities in the City of Orange that are susceptible to seismic shaking and liquefaction are listed in Table 3.9 with their replacement values, content values and potential loss in the event of a magnitude 7.0 earthquake along the Newport-Inglewood or San Andreas faults.

The HAZUS analysis, located in Appendix D, provides estimates of the chance of moderate or extensive damage to the city's critical facilities following a magnitude7.0 Newport-Inglewood earthquake as identified in Table 3.10. Except for the Grijalva Park Sports Center, the city's critical facilities are not located within areas with high potential for earthquake induced soil liquefaction or landslide.

Damage and Functionality Estimates for Critical Facilities in the event of a San Andreas Fault M7.0 Scenario can be found in Table 3.11. Table 3.11 provides HAZUS analysis estimates the chance of moderate or extensive damage and the percent functionality of the city's critical facilities following a San Andreas M7.0 earthquake scenario event.

Table 3.9: Orange Critical Facilities Susceptible to Seismic Shaking and Liquefaction

Map #	Facility	Replacement Value	Contents Value	Potential Loss							
				M7.0 Newport-Inglewood Fault with Liquefaction				M7.0 San Andreas Fault with Liquefaction			
				Structural	Non-Structural Drift	Non-Structural Acceleration	Contents	Structural	Non-Structural Drift	Non-Structural Acceleration	Contents
1	City Hall	$12,747,874	$3,305,813	$32,240	$94,860	$179,430	$54,360	$2,500	$8,720	$15,350	$4,140
2	Fire Stations 1	$4,345,220	$4,345,220	$6,010	$25,960	$55,020	$45,830	$450	$2,000	$3,350	$2,550
3	Fire Station 2	$575,381	$575,402	$920	$3,170	$6,690	$23,860	$100	$390	$680	$2,210
4	Fire Station 3	$1,509,862	1,509,862	$2,570	$8,750	$18,550	$26,110	$270	$1,020	$1,770	$2,270
5	Fire Station 4	$563,402	$563,402	$920	$3,150	$6,640	$20,690	$100	$370	$630	$1,790
6	Fire Station 5	$1,217,077	$1,217,077	$3,000	$10,210	$18,660	$39,010	$220	$830	$1,430	$2,680
7	Fire Station 6	$1,705,243	$1,577,350	$5,160	$17,450	$29,660	$39,970	$280	$1,090	$1,810	$2,150
8	Fire Station 7 Police Substation	$3,296,234	$3,296,234	$4,350	$15,090	$33,130	$18,880	$740	$2,820	$5,240	$2,770
9	Fire Station 8	$1,577,350	$1,577,350	$1,940	$6,650	$13,980	$39,430	$340	$1,250	$2,220	$5,830
10	Police HQ	$24,834,460	$4,637,691	$48,170	$130,550	$296,300	$61,950	$3,360	$10,620	$19,960	$3,800
11*	Community Srvs.	$2,014,526	$401,028	$5,140	$15,080	$28,590	$6,650	$400	$1,380	$2,430	$500
12	Corporation Yard	$7,405,872	$1,951,232	$32,690	$53,180	$113,260	$34,850	$3,360	$6,600	$9,830	$2,680
13	Water Plant	$2,788,500	$1,095,219	$12,400	$20,130	$42,840	$19,660	$1,250	$2,440	$3,600	$1,470
14	Grijalva Park Ctr.	$7,724,331	$20,000	$14,770	$44,140	$93,760	$280	$1,430	$4,970	$8,450	$20
15	Main Library	$11,234,369	$7,403,458	$51,730	$84,180	$177,250	$136,770	$4,970	$9,550	$14,110	$9,580
16	El Modena Library	$2,065,630	$2,000,186	$4,110	$12,280	$24,970	$27,880	$440	$1,550	$2,760	$2,790
17	Taft Library	$1,644,473	$1,553,478	$3,410	$10,190	$20,410	$22,290	$360	$1,260	$2,260	$2,230
	TOTALS	$87,249,804	$37,030,002	$229,530	$555,020	$1,159,140	$381,580	$20,570	$56,860	$95,880	$28,480

Replacement value information based on City insured values for each facility.

* Replacement value, contents value, and potential losses were not estimated for overpasses

† The values of these facilities were updated after the preparation of the HAZUS potential loss analysis. The potential loss values have been adjusted to reflect these updated values. The analyses for these facilities may not be consistent with the HAZUS Risk Assessment presented in Appendix D

NOTE:

- Structural losses are estimated costs to repair load-bearing components of the building that can make the building unsafe for occupancy or lead to collapse.
- Non-structural drift losses are estimated costs to repair components damaged by building displacement such as walls, partitions, etc.
- Non-structural acceleration losses are estimated costs to repair components damaged by shaking such as suspended ceilings, ductwork, etc.
- Contents losses are estimated costs to repair or replace building contents damaged or destroyed by shaking.

Table 3.10: Newport-Inglewood Fault Scenario Critical Facilities % Chance of Damage and % Functionality

Map #	Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
1	Civic Center - City Hall	0.4	0.0	95.8	96.0	99.5	99.5	99.9	99.9
2	Fire Headquarters and EOC	7.6	0.5	67.4	67.9	91.3	91.8	99.5	99.7
3	Fire Station No. 2	4.8	0.2	72.2	72.7	94.4	94.9	99.7	99.8
4	Fire Station No. 3	19.4	6.3	48.4	48.9	72.3	72.9	92.3	95.5
5	Fire Station No. 4	18.9	6.0	49.5	50.0	73.2	73.8	92.7	95.7
6	Fire Station No. 5	8.4	0.5%	65.3	65.9	90.4	91.0	99.4	99.6
7	Fire Station No. 6	10.4	0.7	60.3	61.0	88.1	88.8	99.2	99.5
8	Fire Station No. 7	10.3	0.4	58.6	59.3	88.4	89.1	99.4	99.6
	Police Substation	4.3	0.2	77.8	78.2	95.0	95.5	99.7	99.8
9	Fire Station No. 8	15.3	4.3	57.5	58.0	79.1	79.6	94.9	97.0
10	Police Headquarters	6.5	0.4	75.1	75.5	92.5	92.9	99.4	99.7
11*	Community Services Department	0.4	0.0	95.8	96.0	99.5	99.5	99.9	99.9
12	Corporation Yard	1.4	0.1	95.4	95.5	98.4	98.4	99.8	99.9
13	Water Plant	1.3	0.1	95.5	95.6	98.5	98.5	99.8	99.9
14	Grijalva Park Sports Center	4.3	0.7	85.1	85.6	94.9	94.9	99.2	99.9
15	Main Library	1.3	0.1	95.5	95.7	98.5	98.5	99.8	99.9
16	El Modena Library	0.5	0.0	95.5	95.7	99.4	99.4	99.9	99.9
17	Taft Library	0.5	0.0	95.4	95.6	99.4	99.4	99.9	99.9

HAZUS casualty estimates were determined by the time of day the earthquake may occur.

Table 3.11: San Andreas Fault Scenario Critical % Chance of Damage and % Functionality

Map #	Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
1	Civic Center - City Hall	0.4	0.0	95.8	96.0	99.5	99.5	99.9	99.9
2	Fire Headquarters and EOC	0.4%	0.0%	95.8	95.9	99.4	99.5	99.9	99.9
3	Fire Station No. 2	0.3%	0.0%	95.4	95.5	99.5	99.6	99.9	99.9
4	Fire Station No. 3	4.4%	0.7%	84.7	85.0	94.5	94.8	99.1	99.5
5	Fire Station No. 4	4.3%	0.7%	85.0	85.2	94.6	94.8	99.2	99.5
6	Fire Station No. 5	0.4%	0.0%	95.9	96.0	99.4	99.5	99.9	99.9
7	Fire Station No. 6	0.4%	0.0%	96.2	96.3	99.5	99.5	99.9	99.9
8	Fire Station No. 7	0.5%	0.0%	93.0	93.2	99.3	99.4	99.9	99.9
	Police Substation	0.6	0.0	95.0	95.1	99.3	99.4	99.9	99.9
9	Fire Station No. 8	5.0%	0.9%	83.1	83.4	93.8	94.0	99.0	99.4
10	Police Headquarters	0.3	0.0	97.3	97.3	99.5	99.6	99.9	99.9
11*	Community Services Department	0.4	0.0	95.8	96.0	99.5	99.5	99.9	99.9
12	Corporation Yard	1.4	0.1	95.4	95.5	98.4	98.4	99.8	99.9
13	Water Plant	1.3	0.1	95.5	95.6	98.5	98.5	99.8	99.9
14	Grijalva Park Sports Center	4.3	0.7	85.1	85.6	94.9	94.9	99.2	99.9
15	Main Library	1.3	0.1	95.5	95.7	98.5	98.5	99.8	99.9
16	El Modena Library	0.5	0.0	95.5	95.7	99.4	99.4	99.9	99.9
17	Taft Library	0.5	0.0	95.4	95.6	99.4	99.4	99.9	99.9

HAZUS casualty estimates were determined by the time of day the earthquake may occur.

The total economic loss of 710.28 million dollars is estimated for the Newport-Inglewood Fault Scenario and 63.78 million dollars for the San Andreas Fault earthquake scenario event. More detailed information regarding the economic loss estimate is provided in the HAZUS Analysis, Appendix D.

3.4.2 WILDLAND/URBAN FIRE

Hazard Profile

Wildland and Wildland Urban Interface Fires
Fire and its destructive potential are safety concerns within both the urban areas of the City and the undeveloped hillsides. Wildland fires are most problematic along the developed residential fringes of the hillsides, known as the wildland-urban interface. On a seasonal basis, dry vegetation, little seasonal rain, and Santa Ana wind conditions combine to increase wildfire potential.

A relatively large portion of East Orange is covered by natural (though modified) vegetation. Of these different vegetation types, coastal sage scrub, chaparral and grasslands reach some degree of flammability during the dry summer months and, under certain conditions, during the winter months. For example, as chaparral gets older, twigs and branches within the plants die and are held in place. A stand of brush 10 to 20 years of age usually has enough dead material to produce rates of spread about the same as in grass fires when the fuels have dried out. In severe drought years, additional plant material may die, contributing to the fuel load. There will normally be enough dead fuel accumulated in 20-to 30-year old brush to give rates of spread about twice as fast as in a grass fire. Under moderate weather conditions that produce a spread rate of one-half foot per second in grass, a 20- to 30-year old stand of chaparral may have a rate of fire spread of about one foot per second. Fire spread in old brush (40 years or older) has been measured at eight times as fast as in grass, about four feet per second. Under extreme weather conditions, the fastest fire spread in grass is 12 feet per second or about eight miles per hour.

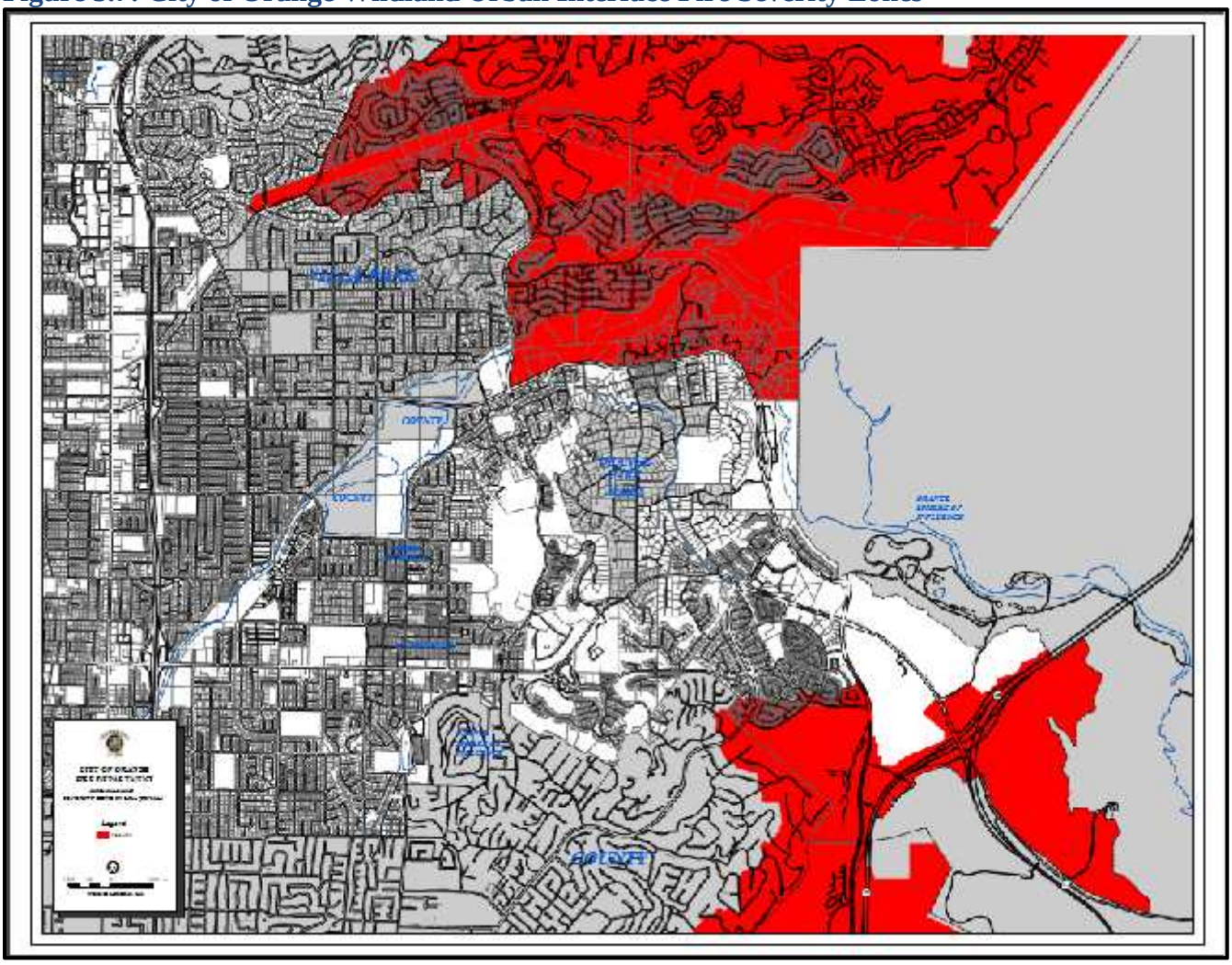
Risks associated with fire hazards are generally reduced through compliance with municipal codes. Development located within or adjacent to the wildland fire area must prepare and implement a comprehensive fuel modification program in accordance with City regulations. The City will review new developments and fire services to ensure adequate emergency services and facilities to residents and businesses. Coordinating with adjacent local cities, and participating in regional, state, and federal programs will better prepare the City for wildfire emergencies and will reduce fire-related risks.

Urban Fires
Although updated fire code requirements reduce urban fire risks in Orange, structures in older parts of the City, especially in Old Towne, were constructed prior to adoption of modern standards. Structures used for the transport, production, and handling of combustible equipment in the industrial areas also pose a credible urban fire threat. The Fire Department will participate in environmental review procedures to reduce urban fire risks in these areas, and will help educate the public regarding fire prevention.

Location and Extent of Wildland and Wildland Urban Interface Fire Threat

Figure 3.7 indicates the location and extent of wildland Urban Interface Fire Severity Zones.

Figure 3.7: City of Orange Wildland Urban Interface Fire Severity Zones



See the Orange Fire Department Plans for additional information.

Past Occurrences

In the 1982 Gypsum Canyon Fire, 17 homes were lost and 18,000 acres burned, leaving an estimated $16 million in damage. The Stagecoach Fire in 1993 destroyed 2 homes and damaged 7 others. The Santa Ana winds during the time of these fires were approximately 50-55 mph, making the fires difficult to contain. More recently were the fires that burned in Orange or threatened the City which included: The Sierra Fire in 2006; the 241Fire in 2007; the Santiago Fire in 2008; and the Freeway Fire in 2008. In addition to winds, structural development within or adjacent to wildland exposures represents an extreme fire protection problem due to flying embers and the predominance of combustible roof coverings.

Climate Change Considerations

According to the Union of Concerned Scientist, the number of large wildfires — defined as those covering more than 1,000 acres — is increasing throughout the Western United States. Over the past 12 years, every state in the Western U.S. has experienced an increase in the average number of large wildfires per year compared to the annual average from 1980 to 2000. Wildfire season is generally defined as the time period between the year's first and last large wildfires. Local wildfire seasons vary by location, but have almost universally become longer over the past 40 years. Temperatures are increasing much faster in the Western U.S. than for the planet as a whole. Since 1970, average annual temperatures in the Western U.S. have increased by 1.9° F, about twice the pace of the global average warming. Scientists are able to gauge the onset of spring snowmelt by evaluating streamflow gauges throughout the Western U.S. Depending on location, the onset of spring snowmelt is occurring 1-4 weeks earlier today than it did in the late 1940s. The projected increase in annual burn area varies depending on the type of ecosystem. Higher temperatures are expected to affect certain ecosystems, such as the Southern Rocky Mountain Steppe-Forest of central Colorado, more than others, such as the semi-desert and desert of southern Arizona and California. Every ecosystem type, however, is projected to experience an increase in average annual burn area.

Probability of Future Occurrences

Many major wildland fires in and near the City of Orange have been associated with adverse weather conditions. In addition to winds, structural development within or adjacent to wildland exposures represent an extreme fire protection problem due to flying embers and combustible roof coverings. There is a high probability of future occurrences.

Vulnerability / Risk Assessment of Fire Hazards

Due to adverse conditions such as drought, high temperatures and seasonal Santa Ana winds the city remains vulnerable to fire hazards.

3.4.3 EXTREME HEAT

While there is no universally accepted definition of extreme heat, the Centers for Disease Control and Prevention define extreme heat as "summertime temperatures that are substantially hotter and/ or more humid than average for that location at that time of year[1]". According to the State of California, Cal-Adapt website, the threshold for an extreme heat day in Orange is approximately 91 °F. Five such extreme heat days in a row is considered a heat wave. Historically, Orange experiences an average of four extreme heat days each year, and at most one heat wave.

Hazard Profile

Extreme heat poses substantial health risks to a number of people. Extreme heat events can override the body's ability to maintain a safe internal temperature (an ability known as thermoregulation), potentially causing the body's temperature to rise to dangerous levels. The symptoms of heat-related illnesses such

[1] Preparing California for Extreme Heat: Guidance and Recommendations, Heat Adaptation Workgroup, a subcommittee of the Public Health Workgroup, California Climate Action Team (CAT), October 2013.

as heat stroke may include headache, dizziness, rash, and fainting and seizures. If not treated, extreme heat can result in coma or death.

The risks of extreme heat are greatest among elderly individuals, particularly those 85 years of age or older. Heat-related mortality rises sharply with age, and elderly people can suffer potentially fatal respiratory and cardiovascular conditions during high temperatures. Elderly individuals may also be less able to take care of themselves during extreme heat events, and may be more likely to take a medication that impacts their thermoregulatory capacity.

Extreme heat risks are high as well among lower-income individuals, who are more likely to live in housing with no or inadequate cooling capacity (e.g., an air conditioner), and may not have access to effective transportation that can allow them to reach cooling centers or seek other assistance as needed. Outdoor workers, such as construction workers, are more exposed to extreme heat conditions than many other people and are therefore also at increased risk of extreme heat.

Other impacts of extreme heat can indirectly affect a person's health. Power lines become less efficient during extreme heat events; coupled with increased stress on the electric grid due to increased energy demand for cooling, this can cause blackouts. During particularly intense heat events, roads and railways may be damaged by the high temperatures, resulting in transportation delays.

Past Occurrences

The number of extreme heat events in the City of Orange varies from year to year. On average, the community experiences four extreme heat days and between zero and one heat waves per year. These events typically occur between the months of July through October and in rare occasions can occur in April, May, or June. According to the National Climatic Data Center, between 1990 and 2011[2], several notable extreme heat events have occurred in 1992, 1997, 1998, 1999, 2004, 2006, 2008, and 2009.

Probability of Future Occurrence

Extreme heat events are very likely to continue to occur in and around Orange. These events are expected to be more frequent and severe as a result of climate change, as discussed below.

Climate Change Considerations

Extreme heat is one of the primary risks posed by climate change in California. As a result of increased temperatures and other changes to climate conditions, the number of extreme heat days in Orange is expected to increase from the current average of four each year to 15–35 annually by 2050. By the end of the twenty-first century, Orange may see as many as 50 to 100 extreme heat days each year. The severity of these events may be exacerbated by a decline in precipitation and an increased risk of drought.

[2] http://www7.ncdc.noaa.gov/CDO/cdoextremesdateselect.cmd

Vulnerability/Risk Assessment

Like other communities in the region, Orange is at an elevated risk of extreme heat. Urbanized areas experience higher temperatures than rural communities (known as the urban heat island effect), which could further elevate temperatures in and around Orange.

Utility Concerns

Extreme heat events can cause an increase in the number of blackouts and other failings of the electrical power grid, driven by greater electrical demand for cooling and heat stress on the grid's mechanical system. Power outages may in turn have impacts on other utility systems and key services.

3.4.4 DROUGHT

Hazard Profile

According to the California Office of Emergency Services, there are two common types of drought. The most commonly referred to form of drought is meteorological drought: a period of below normal precipitation. The second form of drought is hydrologic drought, a period of below average runoff from water sources. There is no established universal definition to identify when a drought begins or ends.

The declaration of a drought is considered within the context of the needs for water resources. Due to the long-term drought facing California and in response to the State of Emergency declared by Governor Brown, the Orange City Council adopted Ordinance No. 05-14, May 12, 2015.

Location and Extent of Drought

According to the City of Orange 2015 Urban Water Management Plan, the City depends on a combination of imported and local supplies to meet its water demands and has taken numerous steps to ensure it has adequate supplies.

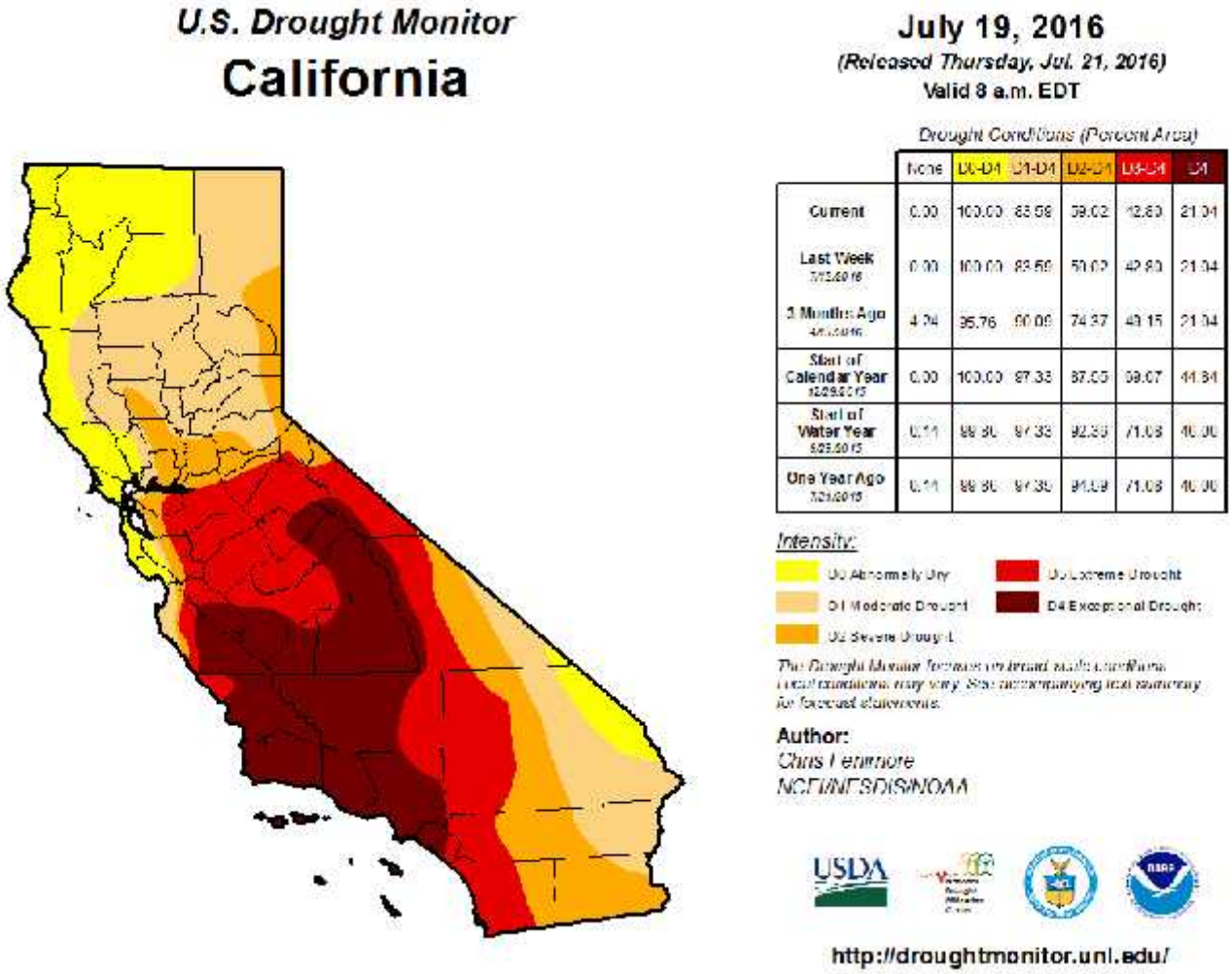
The City of Orange's existing water supply is a blend of locally pumped groundwater and imported surface water. The city's groundwater source (the Orange County Groundwater Basin) is managed by the Orange County Water District (OCWD) and comes from a natural underground aquifer that is replenished with water from the Santa Ana River, local rainfall, imported water storage, and the Groundwater Replenishment Program (GWR). The groundwater basin is 350 square miles in area and lies beneath north and central Orange County from Irvine to the Los Angeles border, and from Yorba Linda to the Pacific Ocean. Orange has 10 active groundwater wells and two eight-million gallon reservoirs located in the city.

Some of the city's imported water originates in the San Francisco-San Joaquin Bay Delta in Northern California and is delivered via the State Water Project into Southern California. Other imported water originates from the Colorado River and is delivered via the Colorado River Aqueduct. Both import sources are brought to Orange by the Municipal Water District of Orange County (MWDOC) via the Metropolitan Water District of Southern California (MET). MWDOC is one of 28 member agencies in MET's service area that in turn serves 300 retail agencies, such as the City of Orange. Orange has three active import water connections. The blend percentage of import vs. groundwater changes on an annual basis depending on the overdraft conditions of the basin.

Drought affects the potable water supply in the city in two ways. First, localized drought reduces the amount of water that percolates into the Orange County Groundwater Basin while also increasing water demand for local landscaping needs. Second, drought conditions in the southwest U.S. results in a reduced snowpack in the Colorado Rockies and the Sierra Nevada, which in turn, reduces the amount of surface water available for import into the city.

Per the General Plan, over 75 percent of the water supply to the City is drawn from municipal wells drilled into the Santa Ana River Aquifer from the Lower Santa Ana River groundwater basin. Other water sources include surface water bodies, two major drainage courses, and one minor course. The Lower Santa Ana River basin, which extends from San Bernardino County southwest to the Pacific Ocean, underlies the entire western portion of the planning area. The Santa Ana Mountains and foothills form the basin's eastern boundary.

Figure 3.8: California Drought Conditions, 2015



Past Occurrences

Although the definition of drought has varied over time and defining drought can be challenging across a large geography, California has experienced numerous severe droughts over the past century. The most severe drought on record began in 2012 and continues through the writing of this document (2015). During the current drought, much of the state, including the City of Orange, is in a state of "exceptional drought." "Exceptional drought" is the most severe of five drought distinctions identified by the United States Drought Monitor. Table 3.12 identifies the historical droughts that have occurred in California from 1855 through the present. Figure 3.87 illustrates the severity of the current drought.

Table 3.12: Historic Droughts in California

Date	Area Affected	Notes
1827-1916	Statewide	Multiyear: 1827-29, 1843-44, 1856-57, 1863-64 (particularly extreme), 1887-88, 1897-1900, 1912-13.
1917-21	Statewide except central Sierra Nevada and north coast	Simultaneous in affected areas, 1919-20. Most extreme in north.
1922-26	Statewide except central Sierra Nevada	Simultaneous in effect for entire state only during 1924, which was particularly severe.
1928-37	Statewide	Simultaneously in effect for entire state, 1929-34. Longest, most severe in state's history.
1943-51	Statewide	Simultaneously in effect for entire state, 1947-49. Most extreme in south.
1959-62	Statewide	Most extreme in Sierra Nevada and central coast.
1976-77	Statewide, with the exception of southwestern deserts	Driest 2 years in state's history. Most severe in northern two-thirds of state.
1987-1992	Statewide	Moderate, continuing through 1989. Most extreme in northern Sierra Nevada.
2000-2002	Statewide	Most severe in southern California.
2007-2009	Statewide	12th driest three-year period on record at the time. Most severe in western San Joaquin Valley.
2012-2015	Statewide	Most severe California drought on record.

Sources: USGS.1990.http://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/cawater1.html;

Cook et al. 2009 - http://www.ldeo.columbia.edu/res/div/ocp/pub/cook/2009_Cook_IPCC_paleo-drought.pdf; CA Department of Water Resources. 2010.

Probability of Future Occurrence

The historical prevalence of severe droughts in California as well as the severe drought conditions the city and the state are currently facing indicates that there is a high probability of future occurrence.

Climate Change Considerations

There is a close link between climate change and increased drought frequency and severity. Although precise localized impacts of climate change on water resources remain less certain, even in the absence of changes in precipitation patterns, higher temperatures resulting from increased greenhouse gas concentrations are expected to lead to higher evaporation rates, reductions in stream flow, and more

frequent droughts.[3] Based on the current data and modeling, it is anticipated that future drought conditions will become more intense and reduce the City's adaptive capacity.

Vulnerability/Risk Assessment

As described above, the City of Orange obtains potable water from locally pumped groundwater and imported surface water supplies. The city, and the county as a whole, is vulnerable to drought. The 2010 Urban Water Management Plan sets forth a path for the city to reduce per capita water use 20 percent by 2020, which would make the city more resilient to drought. Additionally, regional sources of water storage and water production through desalination are currently being considered. However, the entire city remains highly vulnerable to drought. Since droughts are not likely to cause physical or structural damage to critical facilities, potential losses were not quantified.

3.4.5 SEVERE WEATHER (WIND, RAIN, LIGHTENING, TORNADOES)

This section addresses the threats to life and property as a result of severe weather (direct impacts from severe wind, lightening, and rain). Flooding is addressed as a separate hazard in this chapter. In addition to flooding impacts addressed in Section 3.4.8, severe weather has the potential to cause damage through direct impacts to assets in the city. Although rain can cause direct impacts, the majority of damage during severe weather is caused by wind either directly damaging property, or by wind blowing over trees, power lines, or other items in the landscape, which in turn, pose a threat to property and life. For this reason, this section focuses primarily on wind and wind related hazards.

Hazard Profile

The entire city is affected by Santa Ana winds. According to the National Weather Service, winds must blow at speeds greater than 25 knots to be called Santa Ana winds. These winds accelerate to speeds of 35 knots as they move through canyons and passes, with gusts to 50 or even 60 knots.

Santa Ana winds are warm, dry, gusty offshore winds that blow from the east or northeast and occur below the passes and canyons of the coastal ranges of Southern California, sweeping across the Los Angeles Basin. Based on local history, most incidents of high wind in the city are the result of the Santa Ana wind conditions. While high impact wind incidents such as tornadoes are not common to the area, there is still the potential for them to occur. On average the state of California experiences 11 tornadoes a year[4]. The most prevalent and significant wind related hazards within the City involve the Santa Ana wind events that occur on a yearly basis and have been known to negatively impact the local community.

Location and Extent

Windstorms that affect Orange County, notably Santa Ana winds, are not location specific but rather impact much of the area. Several meteorological conditions contribute to the phenomenon. These regional winds typically occur annually, from October to March, and can last several days. Hazards

[3] Climate Change and Water Supply Security: Reconfiguring Groundwater Management to Reduce Drought Vulnerability. California Energy Commission's Climate Change Center White Paper. July 2012. http://www.energy.ca.gov/2012publications/CEC-500-2012-017/CEC-500-2012-017.pdf

[4] Average Annual Number of Tornadoes (1991-2010), National Climatic Data Center of the National Oceanic and Atmospheric Administration.

created by wind-fallen trees or utility poles can threaten property and have the potential for personal injury and even death. Many older neighborhoods have larger trees. Although these trees are usually well-rooted enough to withstand higher speed winds, broken and falling tree limbs can create significant hazards.

It is unlikely that Orange County will be subject to widespread damage from wind storm activity but there is potential for isolated events, such as damage to property or communications. Although Santa Ana winds are frequent, the occurrence of wind with enough velocity to cause significant damage is much lower. Therefore, wind damage in the city may not always be associated with wind, but with tree falls that occur during windy conditions. If soil is saturated due to rain, the trees are more susceptible to falling in the wind. Table 3.13 Beaufort Scale, describes the effects that can be observed when wind speeds reach these levels.

Table 3.13: Beaufort Scale

Force	Wind (Knots)	WMO Classification	Physical Description
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-2	Light Air	Smoke drift indicates wind direction, still wind vanes
2	3-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Not experienced on land
12	64+	Hurricane	Not experienced on land

Past Occurrences

Table 3.14 identifies past windstorms and Santa Ana events in Southern California from 1957 through the present. Of these events, the windstorms in 1987, 1988, 1997, 1998, and 2000 directly impacted Orange County.

Table 3.14: Major Windstorms/Santa Ana Events in Orange County

Dates	Location/Event	Damage
November 21-22, 1957	Extremely destructive Santa Ana winds.	Winds produced a 28,000-acre brush fire on a 40-mile front west of Crystal Lake. People were ordered off streets in some areas due to flying debris. 12 of 33 passengers on an airplane over Ontario were hurt by a downdraft in extreme turbulence. Paint was completely stripped off of windward sides of 4 cars stalled in a Fontana sandstorm.
November 5-6, 1961	Strong Santa Ana winds fanned fires in Bel Air and Brentwood.	Fire in Topanga Canyon. 103 injured firemen, $100 million economic losses including 484 buildings (mostly residential) and 6,090 acres destroyed.
January 18-28, 1969	Strong storm winds.	4 dead from falling trees. Power outages.
February 10-11, 1973	Strong storm winds.	Strong storm winds caused damage to trees and some flying debris.
March 25, 1975	Wind gust of 101 mph at the community of Sandberg (located in N. Los Angeles County), a California record.	None reported.
September 10, 1976	Hurricane Kathleen brought the southwest the highest sustained winds ever associated with an Eastern Pacific tropical cyclone with sustained winds of 57 mph at Yuma.	Minor Damage.
October 9, 1982	Santa Ana winds gusted to 60 mph.	A major wildfire moved across the Santa Monica Mountains.
December 4-5, 1987	Strong Pacific storm brought gale force winds along the coast exceeding 40 mph in many areas.	Trees down, power outages.
December 15, 1987	Strong storm winds of 100 mph at Wheeler Ridge in the Tehachapi Mountains. 80 mph in San Bernardino County. Up to 70 mph gusts at Point Arguello and gusts up to 60 mph gusts were clocked in Orange County and the San Gabriel Mountains.	One truck overturned.
February 16-19, 1988	Very strong Santa Ana winds: Gusts of 90 mph at Newport Beach, 70+ mph in the San Gabriel Mountain foothills.	Numerous trees, power lines downed and power outages all near the foothills of the San Gabriel and San Bernardino Mountains. Three were killed when a big rig truck overturned and burned; one was killed having stepped on a downed power line. Power outages hit 200,000 customers in LA and Orange counties. Minor structural damage occurred to signs, etc. Grass fires resulted. Roof damage was widespread in communities around Glendale and Pasadena. Planes flipped in Burbank and at John Wayne airports.
November 2-4, 1993	Santa Ana winds gusted to over 60 mph.	The Old Topanga fire burned from Calabasas to the ocean, consuming hundreds of homes and other structures.
August 20, 1997-98	The remnants of Tropical Storm Ignacio tracked northward moving inland in central California with gale force winds over portions of the Southern California coastal waters. This occurred during the strong El Niño of 1997-98.	
January 6-7, 1997	Severe windstorm.	One of the most severe windstorms in Southern California history. Caused the closure of the Foothill Freeway, damage to vehicles, sidewalks, irrigation systems, and public buildings. Over 50 trees were lost, local streets were closed to traffic shortly after the windstorm due to leaning power poles and downed electrical lines. It was estimated at the time that the windstorm caused $310,000 in damage.
October 14, 1997	Santa Ana winds: gusts 87 mph in central Orange County.	Large fire in Orange County.

Dates	Location/Event	Damage
February 3-4, 1998	Strong storm winds: gust 60 mph at Newport Harbor, 51 San Clemente.	
March 28-29, 1998	Strong storm winds in Orange County: sustained 30-40 mph. Gust 70 mph at Newport Beach, gust 60 Huntington Beach. Gusts to 60 mph in the mountains.	Trees down, power out, and damage across Orange and San Diego Counties. 1 dead in Jamul.
April 1, 2000	Santa Ana winds: gust 93 mph at Mission Viejo, 67 Anaheim Hills.	
October 21-23, 2007	Very strong Santa Ana winds. Gusts recorded at Fremont Canyon (85 mph); San Bernardino (79 mph); Descanso and Mira Loma (75 mph); and Fallbrook and Rancho Cucamonga (74 mph). Some locations experienced tropical storm force winds (or greater) for 36+ consecutive hours.	Winds caused at least $60 million in damage and destruction to buildings, fences, vehicles, etc. The devastating wildfires of 2007 were fanned by these winds. These fires caused the largest mass evacuation in California history.

Source: National Weather Service. 2010. "A History of Significant Weather Events in Southern California Organized by Weather Type."; LA Times November 30, 2011, December 1, 2011 and December 22, 2011 editions.

Probability of Future Occurrence

Due to its location, it is anticipated that the City of Orange will experience windstorms/lightening in the future. The prevalence of annual Santa Ana winds in the region creates a high probability of future occurrences of windstorms throughout Southern California. It is difficult to predict the amount of damage that could occur from a windstorm with great precision. Based on current modeling and information, it is anticipated that most windstorms will follow the general patterns that have historically affected both the city and the region.

Climate Change Considerations

Some projections suggest that climate change could alter wind patterns, although there is much uncertainty as to how the wind patterns could shift. At this point, the climate change considerations with regard to wind should be considered unknown.

Vulnerability/Risk Assessment

The entire city and all critical facilities are susceptible to storm damage. A majority of windstorm damage that occurs is associated with fallen trees/tree limbs. Facilities located in close proximity to large trees may be more susceptible to windstorm damage as a result. Historically, falling trees and power lines have been the major cause of power outages in the region. Windstorms such as strong microburst and Santa Ana wind conditions can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Falling trees can bring electric power lines down to the pavement, creating the possibility of lethal electric shock. Lightning strikes have occurred in Orange County injuring people.

3.4.6 HAZARDOUS MATERIALS

"Hazardous materials" covers a large number of substances that are a danger to the public. These include toxic metals, chemicals, and gases; flammable and/or explosive liquids and solids; corrosive materials; infectious substances; and radioactive materials. The City of Orange Municipal Code Chapter 15.33 requires that any person who uses or handles a hazardous material must semi-annually submit a completed disclosure form to the fire department, and that any person who for the first time becomes a user or handler of any hazardous material must submit a completed disclosure form to the fire department within 30 days of becoming a user or handler. The fire department may specify in writing such other times that the submittal of the disclosure form may be necessary. Any person who fails to file a disclosure form within the time limits set forth shall pay such penalty for such late filing as established pursuant to Section 8.31.090. Upon receipt of a disclosure form, the fire department shall maintain files on all disclosure forms received.

In addition to the immediate risk to life safety, public health, and air quality, the potential for water source contamination, and the potential environmental impacts of accidental hazardous materials releases and toxic substances, there is also concern over the long-term public health and environmental impacts that may result from the sustained use of or exposure to certain substances. An incident could result in the evacuation of a few people, a section of a facility, or an entire neighborhood.

Hazard Profile

Large volumes and myriad classifications of hazardous materials are routinely transported by the BNSR freight services, including intermodal and bulk volumes. BNSR was created in 1995 from the merger of Burlington Northern, Inc. and the Santa Fe Pacific Corporation and is one of North America's leading freight companies. Hazardous materials are transported through, adjacent to or over the City via three major modes of transportation (highway, city street, subsurface pipeline and rail). The transportation of hazardous materials presents a significant day-to-day risk for a hazardous materials emergency. As of September 2015, there are approximately 500 facilities located in Orange which use chemicals over the regulatory thresholds. There are also a number of oil and liquid fuel pipelines operations within Orange.

Rail

The main operational railroad line within the City of Orange is the line used by BNSF (for freight traffic), and Amtrak and Metrolink for passenger traffic. The line is relatively high volume and runs north-south bordering the industrial and residential/commercial areas in the western portion of the City, with two separate west-bound track connections through the City's industrial zones. A rail accident can have a significant impact on the City.

Pipelines

According to the US DOT National Pipeline Mapping System there are two active and one inactive underground hazardous liquid pipelines in the City of Orange designated for crude oil and refined petroleum products, and several major high-pressure natural gas pipelines. The California Public Utilities Commission ensures that natural gas pipeline systems are designed, constructed, operated and maintained according to the safety standards set by the CPUC and the federal government.

Air

The airspace surrounding Orange is among the busiest in the state. John Wayne Airport is the major commercial and private airport in Orange County. Orange County is located in one of the busiest areas in the world. Two of the busiest aviation areas in the world are within a 40-mile radius along with a multitude of transient traffic. Currently incoming traffic to regional large airports crosses airspace above Orange. The number of aircraft operating within and over Orange and adjacent to Los Angeles counties and the associate air routes heightens the chances of aircraft accidents, yet aircraft accidents occur infrequently when compared to the number of air operations.

Location and Extent

Statewide, hazardous material incidents are generally minor but some did cause significant impacts such as injuries, evacuation, and the need for cleanup. Figure 3.9 shows Hazardous Materials Locations in Orange, which are properties in the city containing hazardous materials. These facilities include medical research and development facilities; pharmacies; automotive-related businesses; and industrial businesses.

In addition to fixed locations within the City, numerous roadways as well as underground pipelines are used to transport hazardous materials within and through the City. Accidents involving vehicles conducting this transport or damage to pipelines could also cause a release of materials and impact residents and businesses.

Figure 3.9: Hazardous Materials Locations in the City of Orange (2009 data)

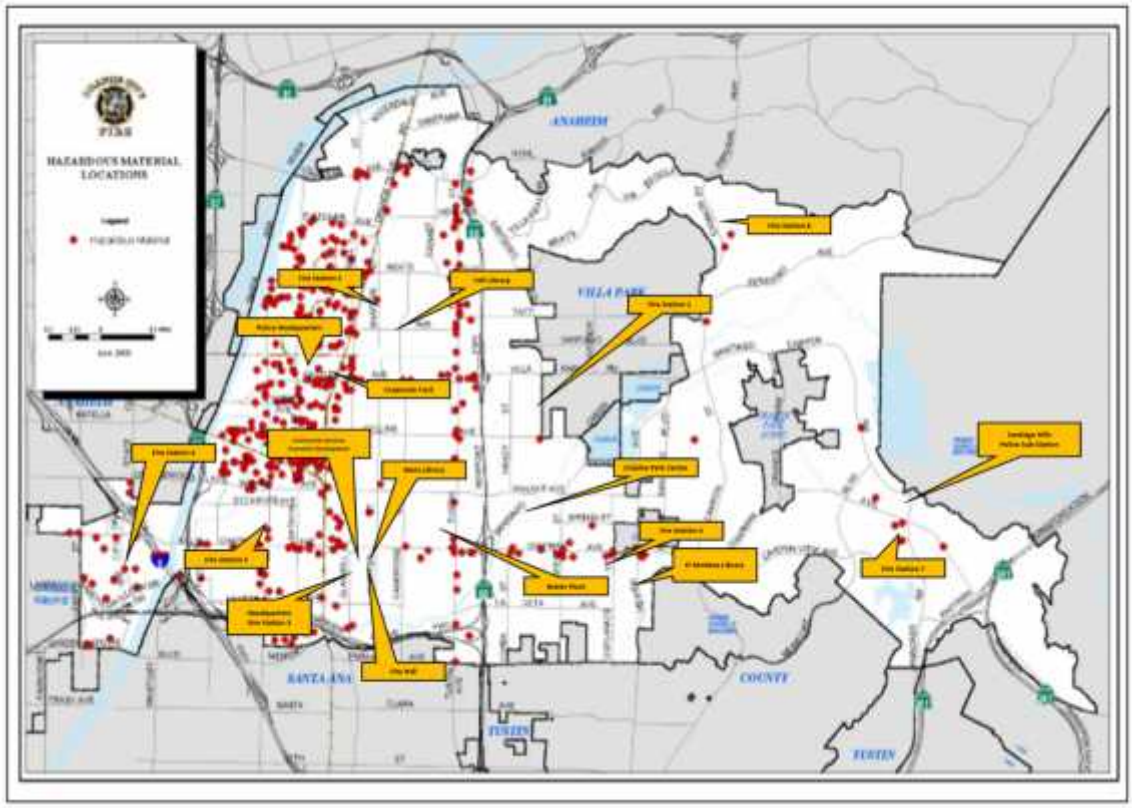
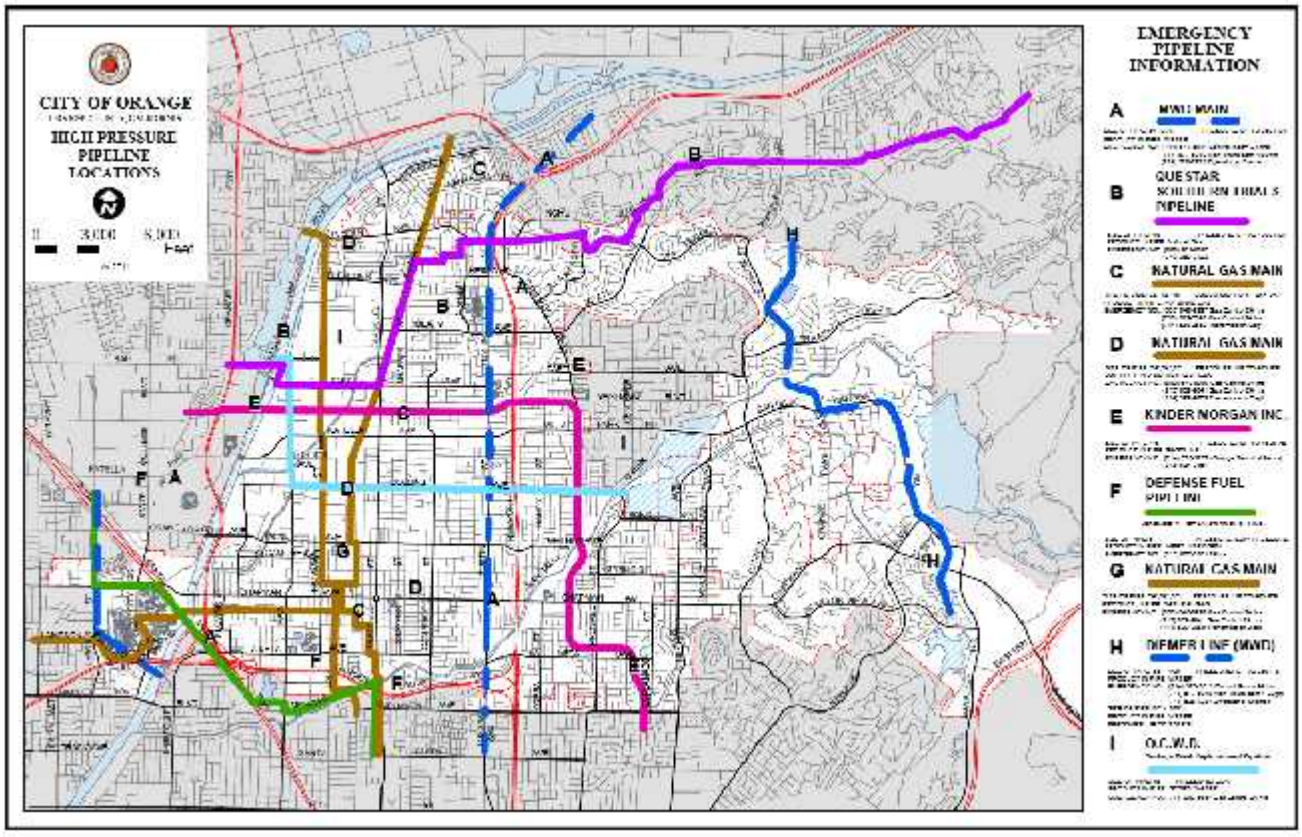


Figure 3.10: High Pressure Pipe Locations Within the City of Orange



Past Occurrences

Appendix E lists the 19 hazardous materials spills that occurred within the City of Orange from July 2010 to May 2016 as identified by the City of Orange Fire Department.

Probability of Future Occurrence

Although past occurrences can be an indicator of future impacts, in the case of hazardous materials spills, the City is constantly improving the mechanisms by which it approves and regulates businesses that use hazardous materials. In addition, technological advances and increases in industry standards are also improving safety and further preventing/ minimizing potential releases of hazardous materials. As a result, it is anticipated that future incidents will decrease over time as newer technologies, standards, and regulations are put in place.

Climate Change Considerations

Anticipating that precipitation regimes may change in the future as a result of climate change, there may be greater opportunity for the release of hazardous materials to enter local waterways and the groundwater aquifer. It is anticipated that if this concern increases, the City and other regulating agencies would revisit procedures and practices in place to ensure the greatest amount of protection occurs.

Vulnerability/Risk Assessment

Table 3.15 identifies critical facility locations that could be exposed to hazardous materials releases during a disaster event. These locations only take into consideration the proximity to existing hazardous materials facilities and do not include potential exposure associated with the movement/transport of hazardous materials. The total potential loss shown in the table is based on the assumption that all facilities within 1,000 feet of a hazardous materials facility would be impacted during a hazardous materials release/event and shows the maximum potential losses. While this is possible, actual losses will vary based on the location and magnitude of the event.

Table 3.15: Orange Critical Facilities Located Adjacent to Hazardous Materials Sites (within 1000ft.)

Map #	Facility	Replacement Value	Contents Value	Potential Loss
1	City Hall	$12,747,874	$3,305,813	$16,053,687.00
2	Fire Station 1	$4,345,220	$3,238,706	$7,583,926
3	Fire Station 2	$575,402	$1,843,341	$2,418,743
4	Fire Station 3	1,509,862	$1,902,321	$3,412,183
5	Fire Station 4	$563,402	$1,573,678	$2,137,080
6	Fire Station 5	$1,217,077	$2,221,822	$3,438,899
7	Fire Station 6	$1,577,350	$1,987,145	$3,564,495
8	Fire Station 7/ Police Substation	$3,296,234	$1,690,602	$4,986,836
9	Fire Station 8	$1,577,350	$4,080,971	$5,658,321
10	Police Headquarters	$24,834,460	$4,637,691	$29,472,151.00
11*	Community Services	$2,014,526	$401,028	$2,415,554.00
12	Corporation Yard	$7,405,872	$1,951,232	$9,357,104.00
13	Water Plant	$2,788,500	$1,095,219	$3,883,719.00
15	Main Library	$11,234,369	$7,403,458	$18,637,827.00
	Total Potential Losses	$75,687,498.00	$37,333,027.00	$113,020,525.00

Replacement value information based on City insured values for each facility.

3.4.7 LANDSLIDE / EXPANSIVE SOILS / EROSION

Hazard Profile

Landslides are the downward and outward movement of rock and soil. Landslide potential depends on the soil types, underlying strata and the slope angle or steepness. Degree of saturation of water is a major factor in predicting the potential for landslides.

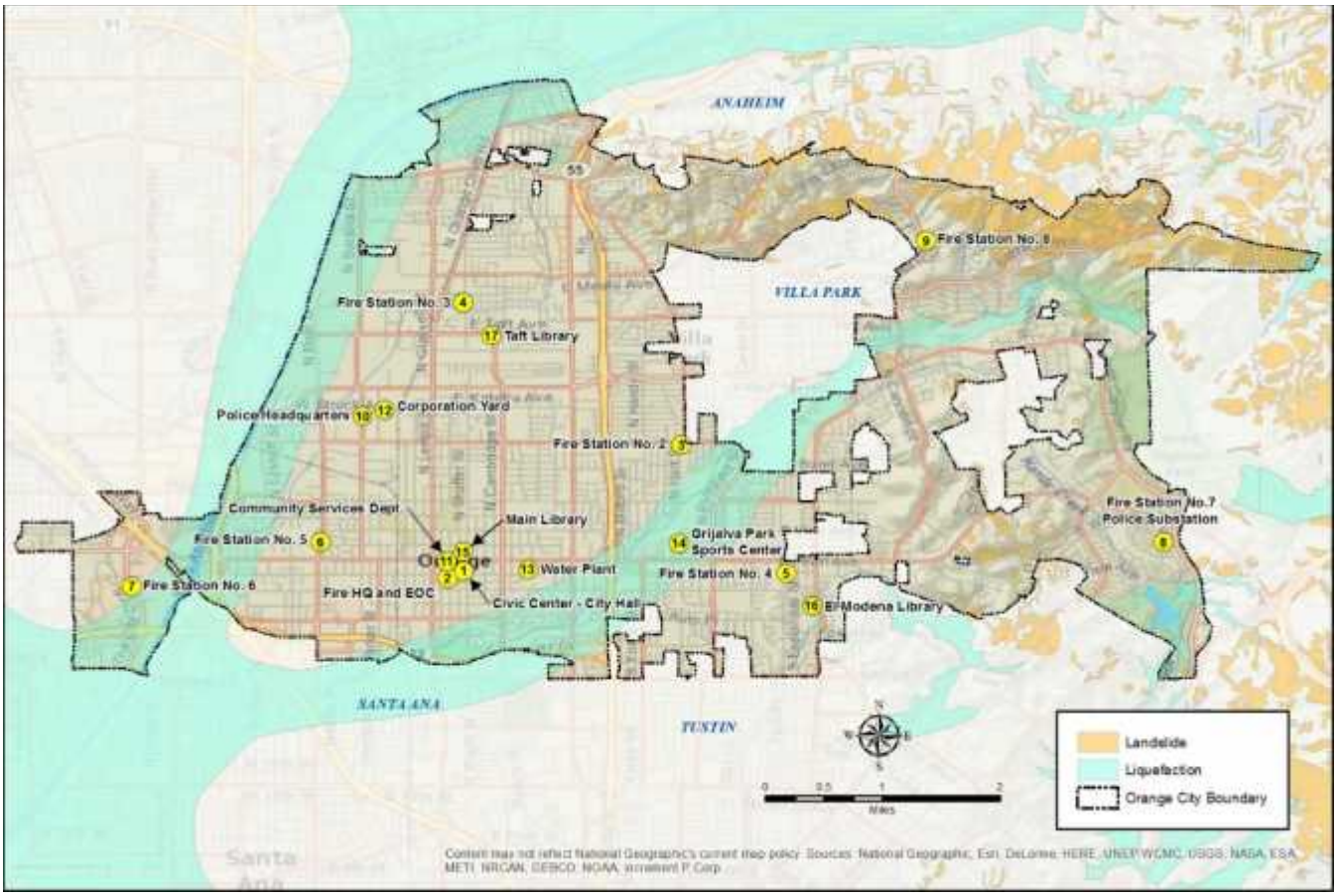
Locations and Extent

Earthquakes greatly increase the potential for landslides in areas that already are prone to landslides. Landslides can occur when strong ground movement such as an earthquake shakes loose soil and causes land and debris to lose stability and slide. Liquefaction occurs when moisture-saturated soils lose stability during seismic conditions. Structures built on such soils may collapse and result in damage and loss.

Earthquake-induced landslides are most probable in poorly consolidated or semi-consolidated sedimentary rock, characteristic of the low hills of the northern and eastern parts of the planning area. Portions of the planning area susceptible to seismically-induced liquefaction include areas near the Santa Ana River and Santiago Creek. A smaller area of high liquefaction potential is present in the areas east of Panorama Heights, in Crawford Canyon. These alluvial plains are characterized by fluvial and loose, floodplain sediments.

A local emergency was proclaimed by the city due to land movement and/or a landslide occurring in the residential area of Vista Royale Drive on April 6, 1999. Land movement continued in this area for the next couple of years. The emergency was terminated July 24, 2001.

Figure 3.11: Areas Within the City of Orange Susceptible to Landslide



Past Occurrences

The Vista Royale Drive neighborhood experienced landslides in April,1999. The Vista Royale neighborhood was developed in the late 1980s in the foothills east of the Newport-Costa Mesa Freeway. The City of Orange proclaimed a local emergency April 6, 1999, due to earth movement in the area of Vista Royale Drive, Resolution No. 9094. On May 10th, five homes within the area were evacuated in the Vista Royale area due to the necessity to discontinue water and sanitation service to these homes and the continuing land movement, Resolution No. 9113. On May, 24, 1999, an evacuation was ordered to protect the health and safety of the residents in the area. Resolution No. 9131. The local emergency was terminated July 24, 2001.

Probability of Future Occurrence

Natural processes can cause landslides or re-activate historical landslide sites. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause additional failure that can occur on gentle slopes above steep steams and riverbanks. There is a probability of future occurrence since landslides can occur during or following an earthquake and/or heavy rains.

Vulnerability/Risk Assessment

While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been conducted for the City of Orange and/or the County of Orange landslide events, there are many qualitative factors that point to potential vulnerability. Landslides can impact major transportation arteries, blocking residents from essential services and businesses. Past landslides have caused major property damage or significantly impacted residents, and continuing to map landslide and debris flow areas will help in preventing future loss.

Vulnerability assessment for landslides will assist in predicting how different types of property will be affected by a hazard. Data that includes specific landslide-prone and debris flow locations in the city can be used to assess the population and total value of property at risk from future landslide/land movement occurrences. At the time of this publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available.

3.4.8 FLOOD HAZARDS

Flood Hazard Profile

In Orange, flooding may result from either the overflow of watercourses due to excessive and unusual storm run-off, or from failure of dams and/or water storage reservoirs. Flood hazards related to storm events generally are described in terms of a "100-year flood. A one-hundred-year flood is a flood event that has a 1percent probability of occurring in any given year. Because the 1 percent flood has a 1 in 100 chance of being equaled or exceeded in any 1 year, and it has an average recurrence interval of 100 years, it often is referred to as the "100-year flood". The 100-year flood plains shown in Federal Emergency Management Agency (FEMA) maps indicate that the stream drainage areas along the Santa Ana River and Santiago Creek are subject to flooding by the largest storm event in 100 years or within 100 to 500 years. The 100 year flood areas also include the western portion of the planning area, bounded by the Santa Ana River and the city boundary, including The Block at Orange. The floodplain may be subject to modification by manmade facilities such as flood control basins, levees, and concrete-lined stream channels.

Additionally, according to FEMA maps, a flood area determined for the 100-year storm event (Zone A) is a reservoir water surface elevation of approximately 800 feet mean sea level (msl) as shown. Backwater into Santiago Creek, Limestone Creek, and immediately adjacent to Santiago Reservoir tributary drainage also reaches this elevation. As development in the hillside and basin areas progresses, runoff and absorption rates will be altered. Adequate infrastructure will be needed to ensure that the increased runoff can be handled without increasing the risk of flooding. Appropriate flood control measures will be implemented along Santiago Creek and throughout the planning area, where necessary, to reduce the risks from localized flooding.

The National Flood Insurance Program, in which Orange participates, covers at a minimum all properties affected by the 100-year flood. To receive insurance benefits in the event of a flood, participating agencies must recognize these official flood boundaries and establish appropriate land use policy for the flood zones. Additional flood prevention methods such as provision of detention basins and on-site stormwater drainage will be required of developers to reduce runoff into the City's drainage facilities and to provide adequate drainage for new developments.

Location and Extent

The City of Orange is primarily located in a coastal alluvial plan, drainage stemming from the mountains to the north and east must cross through Orange to reach the coast. The major control of runoff is the Santa Ana River. This river is the largest single river in Southern California, draining an area of about 2,500 square miles. The City of Orange is protected from all but the most severe flooding by the Santa Ana River and major storm channels maintained by the Orange County Flood Control District. This includes a series of spreading/retarding basins. Typically, local streets are designed to carry excess waters to storm drains which then drain into the Santa Ana River.

Irvine Lake, Villa Park Reservoir, and Peters Canyon Reservoir are artificial lakes constructed to provide water storage and flood control capabilities. The Santa Ana River, which forms the City's western boundary, is the major drainage course for the Santa Ana River basin. The river performs valuable flood control and groundwater recharge functions along its entire route. In recognition of the

important role the river plays in providing groundwater recharge areas and adequate flood protection for Orange County, land use policy calls for open space uses along the river.

Santiago Creek flows from the Santa Ana Mountains through Orange and empties into the Santa Ana River in the City of Santa Ana. In addition to controlling floodwaters and recharging the groundwater basin, Santiago Creek has become a defining feature of the community, characterized by trails and recreational open space throughout portions of its length within Orange. Community members identify with the creek, and the City seeks to incorporate natural characteristics of Santiago Creek in the design of adjacent future projects. The upper portions of Santiago Creek are characterized by large, abandoned mining pits. In particular, the pits near Bond Street serve valuable groundwater recharge purposes. Land use policy recognizes these uses by designating the creek and several surrounding properties as Open Space or Open Space-Park.

The urban flooding areas described above are considered to be a hazard only to their specific location and are not expected to threaten or endanger the lives of persons in the surrounding areas; therefore, the hazard is considered to be moderate. Figure 3.12 identifies flood zones in the City, as identified by FEMA. According to the FEMA maps for Orange County, a moderate sized area in the south-central portion of the City of Orange, is within the 500-year flood zone. A small area of the eastern portion of the city, as well as areas along waterways, are within the 100-year flood zone. No critical facilities are located within the 100-year flood zone.

Figure 3.12: Flood Hazard Zones

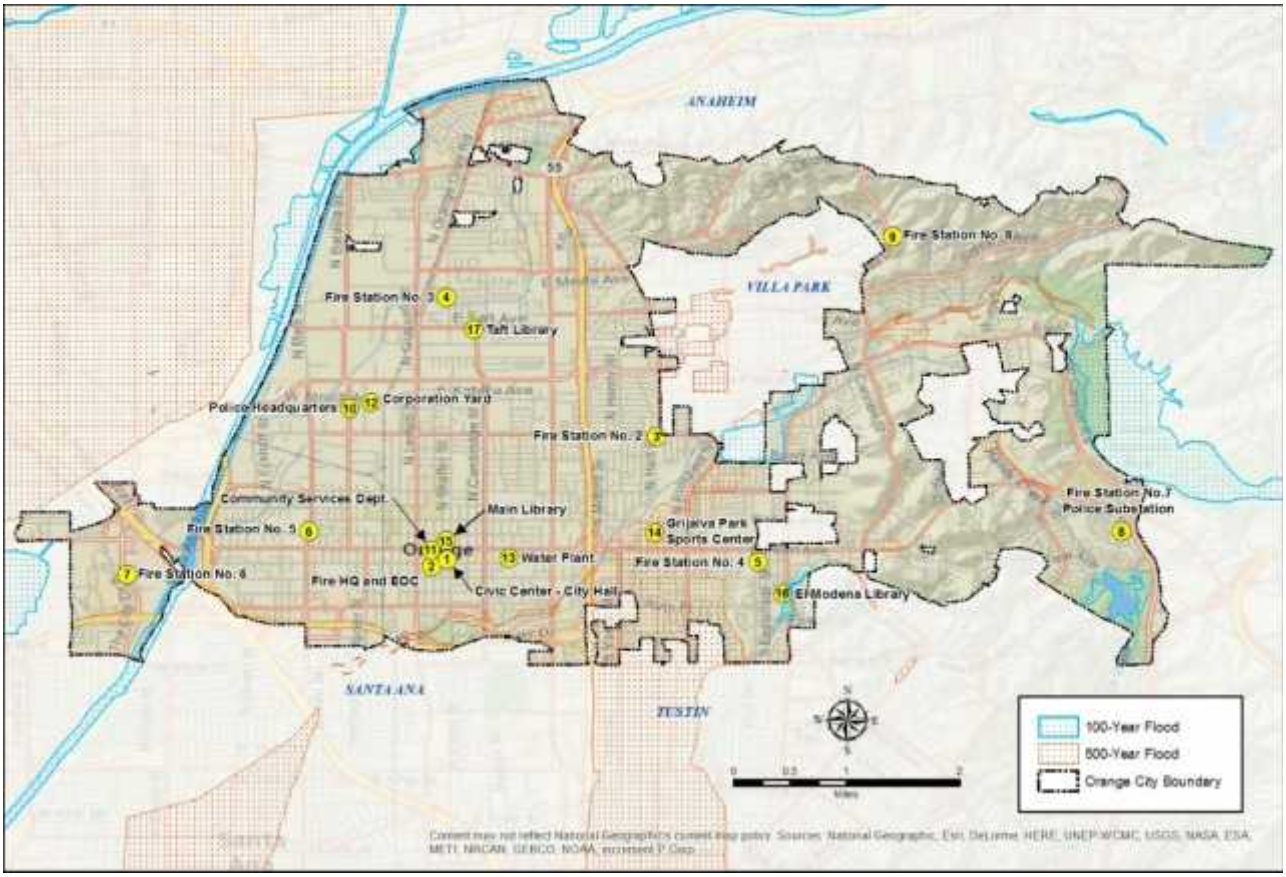


Table 3.16: Orange Critical Facilities Located in or Near a 500-Year Flood Zone

Map #	Facility	Replacement Value	Contents Value	Potential Loss
5	Fire Station No. 4	$563,402	$1,573,678	$2,137,080
14	Grijalva Park Sports Center	$7,724,331	$20,000	$7,744,331.00
	Total Potential Losses	$8,287,733.00	$1,593,678.00	$9,881,411.00

Replacement value information based on City insured values for each facility.

Past Occurrences

California has a chronic and destructive flood history. Out of 72 federally declared disasters in the state between 1950 and 2000, half were flood-related. Orange and other cities in Orange County have suffered from significant flooding events over the years. Many of these events have been catalysts to changing the way communities address flood conditions and mitigation of impacts. A significant flood in 1938 within the County is considered to be the catalyst for the construction of the Prado Dam, which is now part of the Army Corps of Engineers flood protection program along the main stem of the Santa Ana River.

A Proclamation of the Existence of a Local Emergency in the City of Orange, Resolution No. 5858, was proclaimed on Tuesday, March 1, 1983 as a result of heavy rains caused flood conditions in portions of the city of Orange.

Table 3.17 identifies past flood events affecting Orange County from 1950 through 2012.

Table 3.17: Orange County Flood Events

Year	Disaster Declaration #	Event	Deaths and/or Injuries [1]
1950	OCD 50-01	Flooding	9 deaths
1955	DR-47	Flooding	74 deaths
1958	-	Severe storms	13 deaths, multiple injuries
1969	DR-253	Severe storms	47 deaths, 161 injuries
1978	DR-547	Coastal storms, mudslides, and flooding	14 deaths, 21 injuries
1980	DR-615	Severe storms, mudslides, and flooding	N/A
1982-83	DR-677	Coastal storms, floods, slides, and tornadoes	N/A
1988	DR-812	Severe storms, high tides, and flooding	N/A
1992	DR-935	Snow storm, heavy rain, high winds, flooding, and mudslide	5 deaths
1992	DR-979	Severe storm, winter storm, mud & landslides, and flooding	20 deaths, 10 injuries
1993	DR-1005	Fires, mud & landslides, soil erosion, and flooding	4 deaths, 162 injuries 2
1995	DR-1044	Severe winter storms, flooding, landslides, and mud flows	11 deaths
1995	DR-1046	Severe winter storms, flooding, landslides, and mud flows	17 deaths
1997	97-04	Flooding	N/A

Year	Disaster Declaration #	Event	Deaths and/or Injuries [1]
1998	DR-1203	Severe storms	17 deaths
2008	DR-1577, GP2005-01	Severe storms	N/A
2005	DR-1585	Severe storms, flooding, landslides, and mud and debris flows	N/A
2010	DR-1952	Severe storms	N/A

1. Number of deaths and/or injuries reported statewide

2. Deaths and injuries total include those caused by other elements of this disaster

Source: California 2013 State Hazard Mitigation Plan. http://hazardmitigation.calema.ca.gov/plan/state_multi-hazard_mitigation_plan_shmp.

Probability of Future Occurrence

FEMA defines flood zones based on the probability of occurrence, expressed in a percentage of the chance of a flood of a specific extent occurring in any given year. For areas located within the 100-year flood zone, there is a 1 percent annual chance in a given year that this area will be inundated by flood waters. For areas located within the 500-year flood zone, this probability decreases to 0.2 percent. Due to the history of flooding events in Orange County, there is a probability of future occurrences.

Climate Change Considerations

Although Southern California is likely to experience a decrease in overall precipitation levels due to climate change, the region is also expected to see an increase in the number of extreme precipitation events. A meteorological phenomenon known as the "atmospheric river," a narrow stream of extremely moist air, is frequently responsible for the more intense storms that strike California. Atmospheric rivers generally deliver high levels of precipitation, up to 50 percent of the state's total precipitation in any given year.

Some recent studies indicate that atmospheric rivers may strengthen as a result of climate change. This is expected to lead to an increase in the number of storms caused by atmospheric rivers. Additionally, there is some indication that the most powerful atmospheric river storms will increase in intensity. Although there are no specific flooding projections for the City of Orange, flood events are expected to become more frequent, and it is possible that the areas subject to flooding could expand.

Vulnerability/Risk Assessment

No critical facilities are within the 100-year flood zone; however, the 500-year flood zone will exceed the capacity of the Santiago Canyon Reservoir in Villa Park and may impact areas of Orange south of the reservoir.

Significant damage can occur to utilities during flooding events. When water rushes through a City in this way, it takes everything in its path, which could include any aboveground infrastructure such as electricity line poles and traffic signal control boxes. The water sometimes mixes with sediment, oil, and/or sewage, which can impact roads, block storm drains and further exacerbate flood damage. Infrastructure located underground may be damaged due to inundation or could be exposed, requiring repair or reconstruction. Ultimately utilities located within flood prone areas should be designed and constructed to accommodate these concerns when feasible. For communities where above ground

infrastructure is located, flood proofing techniques should be identified to ensure continued operations during flood events.

Appendix D provides a detailed description of the flood loss estimations.

3.4.9 TERRORISM

Through collaboration with county and federal agencies, as well as through the implementation of the Terrorism Liaison Officer (TLO) program, specially trained individuals gather and share intelligence deemed to be a threat to the public. Personnel are kept apprised of the current, relevant international and national information to maintain the highest possible degree of readiness and tactical awareness. First responders are trained to handle all types of terrorist events whether they involve chemicals, biological weapons, radiation, nuclear devices and/or explosives. First responders take initial actions and call for specialized resources depending upon the type of incident they face, and notify appropriate local, State and Federal agencies to coordinate the response.

The City of Orange's plans for responding to acts of terrorism are considered classified information that is coordinated by the Orange Police Department in coordination with county, state and federal law enforcement agencies.

3.4.10 DAM FAILURE

Dam failures can result from a number of natural causes such as earthquakes, erosion of the face or foundation of the dam, improper siting of the dam, and rapidly rising floodwaters, or from man-made causes including structural/design flaws. Dam failure can result in severe flood events to lower-lying areas. A dam failure can cause loss of life, damage to property, and other ensuing hazards, as well as the displacement of persons residing in the inundation path. Damage to electric-generating facilities and transmission lines could also impact life support systems in communities outside the immediate hazard areas. A catastrophic dam failure, depending on the size of the dam and the population downstream, could exceed the response capability of local communities, especially overtaxing the public safety personnel and resources. Damage control and disaster relief support would be required from other local government agencies, private organizations, the state of California, and possibly, the federal government.

Hazard Profile

The Santa Ana River is controlled by a network of dams and flood control measures. This network of carefully planned dams has protected the City of Orange from any serious flooding events. The natural water cycle and flow are significantly altered to protect the adjacent communities from flood damage and to better use local water resources for urban and agricultural water supplies. The network of dams and flood control measures have been very effective in controlling flood waters in Orange County and the surrounding region; however, a major earthquake could cause sudden failure of one of these facilities, resulting in major damage. As a result, the city can be exposed to property damage and public safety hazards from overbank flooding of the Santa Ana River or failure of the Prado Dam.

Currently there are 44 dams and reservoirs within or immediately adjacent to Orange County. There are three dams that could impact the City of Orange: Santiago Dam, Villa Park Dam and Prado Dam. While

all three dams could impact the city if they were to fail at near capacity, the Prado Dam is considered the greatest threat. Santiago and Villa Parks are earth filled structures.

Santiago Dam built in 1933, is owned by Serrano and Irvine Ranch Water Districts and is located in the Santa Ana Mountains in eastern Orange County and is situated west of Black Star Canyon and north of Santiago Canyon Road in the City of Silverado. It is a roller compacted earth and rockfill structure with a 25,000 acre-feet capacity reservoir (Irvine Lake). Irvine Lake is the reservoir formed behind the dam and is the largest man-made lake in Orange County. The dam is designed to contain up to a 50-year flood and withstand a 500-year flood.

Historically the Santiago Creek provided water for the Tongva people, whose territory extended over much of northern present-day Orange County and into the Los Angeles Basin. Native Americans have inhabited the Santiago Creek and Santa Ana River watershed for up to 12,000 years. In 1929 the Santiago Dam was built to form Irvine Lake to supply ply irrigation water.

Dam failure would result in a flood flow that will spread beyond the banks of Santiago Creek and form a wide flood plan which will form two tributaries before emptying into upper Newport Bay, and the Pacific Ocean.

Table 3.18: Santiago Dam & Reservoir Water Movement Timeline

Location	Estimated Arrival Time
Santiago Canyon & Orange Park Blvd	4 hour 45 minutes
Villa Park Rd & Hewes	4 hours 45 minutes
North of Collins & Prospect	5 hours 15n minutes
South of Collins & Prospect	5 hours 45 minutes
55 Freeway & 17th Street	6 hours
Santa Ana River Channel Fork	
22 Freeway & Cambridge	6 hours 30 minutes
22 Freeway & Main Street	7 hours
17th & Bristol	7 hours 30 minutes
1st Street	8 hours
Between Edinger & Warner	9 hours
MacArthur	10 hours
Sunflower	10 hours 30 minutes
Gisler	12 hours
Just North of Adams	12 hours 30 minutes
Victoria	13 hours
San Diego Creek Channel Fork	
Newport Ave & Bryan Ave	6 hours 15 minutes
261 Toll Road & Edinger	6 hours 45 minutes
Old Tustin USMC base	7 hours
Red Hill & Alton Parkway	7 hours 15 minute
405 Freeway	7 hours 45 minutes
South of Campus Drive	8 hours
73 Toll Road	8 hours 15 minutes
East side of Irvine Ave & Santa Isabel	8 hours 45 minutes

Villa Park Dam built in 1963 is owned by the County of Orange. The Villa Park Dam is an embankment dam on Santiago Creek in Orange, California. Along with the upstream Santiago Dam, the Villa Park dam serves primarily for flood control for the cities of Villa Park, Orange, Tustin and Santa Ana and also regulates the inflow of Santiago Creek into the Santa Ana River.

Villa Park Dam is a flood control dam located downstream from Santiago Dam. It is an earth fill structure with a capacity of 15,600 acre-feet and is owned by the Orange County Flood Control District. The failure of the Santiago Dam could also result in a failure of the Villa Park Dam. Floodwaters from Villa Park Reservoir would affect approximately the same area west of the Costa Mesa Freeway as floodwaters originating from Santiago Reservoir. However, flood waves would reach urbanized areas faster as only those ports of Old Towne south of La Veta Avenue may be inundated.

Table 3.19: Villa Park Dam & Reservoir Water Movement Timeline

Location	Estimated Arrival Time
Santiago Canyon & Orange Park Blvd	1 hour 45 minutes
Villa Park Rd & Hewes	2 hours 45 minutes
North of Collins & Prospect	3 hours 15n minutes
South of Collins & Prospect	3 hours 45 minutes
Santa Ana River Channel Fork	
55 Freeway & Chapman	4 hours 30 minutes
22 Freeway & Cambridge	5 hours
22 Freeway & Main Street	5 hours 30 minutes
17th & Bristol	6 hours 15 minutes
1st Street	6 hours 30 minutes
Between Edinger & Warner	7 hours
MacArthur	7 hours 15 minutes
Sunflower	7 hours 45 minutes
Gisler	8 hours 15 minutes
Just North of Adams	8 hours 45 minutes
Victoria	9 hours 15 minutes
San Diego Creek Channel Fork	
Newport Ave & Bryan Ave	4 hours
261 Toll Road & Edinger	4 hours 15 minutes
Old Tustin USMC base	4 hours 30 minutes
Red Hill & Alton Parkway	5 hours
405 Freeway	5 hours 15 minutes
South of Campus Drive	5 hours 30 minutes
73 Toll Road	5 hours 45 minutes
East side of Irvine Ave & Santa Isabel	6 hours 15 minutes

Prado Dam built in 1941 is owned by the Army Corps of Engineers and is located in the City of Corona. It is within the Prado Reservoir inundation zone, meaning that if Prado Dam fails, large portions of the city would be at risk to inundation. However, the amount and duration of inundation would be based on the amount of water held in the reservoir at the time of the incident. In the event of Prado Dam failure, floodwaters would flow through the Santa Ana Canyon on its way to the Pacific Ocean. Recent modifications made to Prado Dam have upgraded the facility to ensure that it will withstand a 7.5 magnitude earthquake.

In addition, although the mapping in Figure 3.13 identifies the areas of the city that would become inundated, it does not take into consideration the downstream improvements that have been made along the Santa Ana River main stem and several tributaries since this mapping was initially completed. So, this mapping is meant to identify the worst-case inundation scenario for planning purposes.

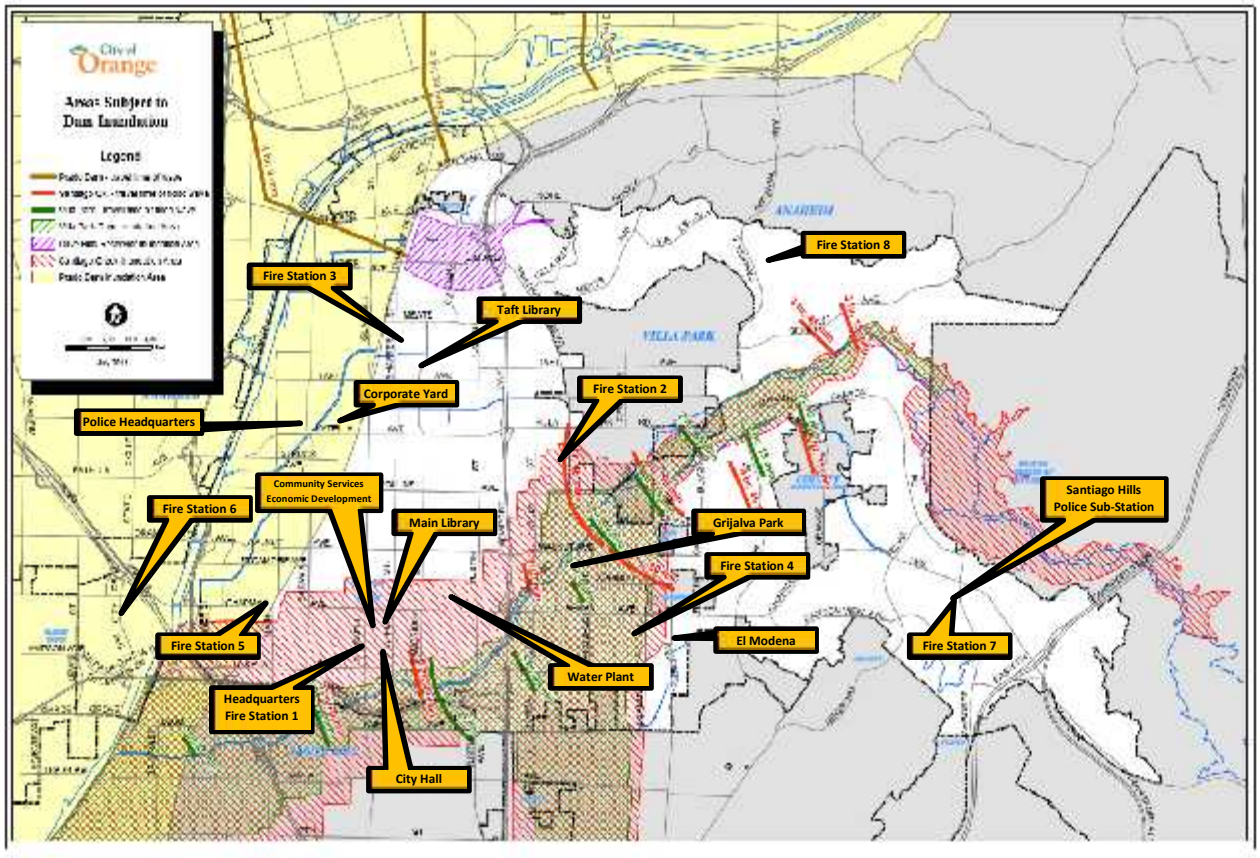
Table 3.20: Prado Dam Water Movement Timeline

Location	Estimated Arrival Time (Hours)	Distance from Dam (Miles)	Peak Elevation (NAVD)	Time of Peak Elevation (Hours)	Avg. Over Bank Depth (Feet)
Hwy 71 (Riverside Co.)	.25	.4 0	480	1.75	15
Green River	.50	1.7 0	449	2.25	15
91 Fwy between Green River & Weir Canyon (east)	.75	2.9 0	440	2.50	16
91 Fwy between Green River & Weir Canyon (west)	1.00	3.90	426	2.50	16
91 Fwy @ Weir Canyon	1.25	5.30	393	2.75	15
91 Fwy between Weir Canyon & Yorba Linda Blvd	1.50	6.70	371	3.00	15
91 Fwy @ Yorba Linda Blvd	2.00	9.30	325	3.25	13
91 Fwy between Yorba Linda Blvd & Imperial Hwy	2.50	11.10	299	3.75	13
91 Fwy @ Imperial Hwy	3.25	13.00	267	4.00	11
Santa Ana Canyon & Tustin to Tustin & Orangethorpe (Anaheim)	3.50	14.50	239	4.25	9
Lincoln & Orange Olive (Orange) to 57 Fwy & Chapman (Fullerton)	4.00	16.00	207	4.75	7
Katella & Batavia (Orange) to Raymond Ave & Commonwealth (Fullerton)	4.50	17.50	181	5.25	6
Bristol & Civic Center (Santa Ana) to Malvern & Dale (Buena Park)	6.25	22.00	96	7.50	6
Past LA County Line to Harbor and Baker (Costa Mesa) * timeline border runs parallel to south side of 405 Fwy.	8.50	27.00	32	10.25	7
Past LA County Line to Warner east of PCH (Huntington Beach) to Seapoint (Huntington Beach)	9.50	31.00	9	15.50	4
Atlanta & Beach (Huntington Beach) to Victoria east of SAR (Costa Mesa)	9.50	31.50	9	15.50	4
Jamboree & Main St (Irvine) to Jamboree and Michaelson (Irvine)	21.50	28.00	32	26.50	2
Campus Drive (Irvine) between Jamboree and University	21.75	30.00	19	32.25	9
Jamboree between Bison and University (Newport Beach)	22.00	31.00	7	32.75	2

Major Roads subject to flooding include Interstate Highway 5 (Santa Ana Freeway), #405 (San Diego Freeway), and #605 (San Gabriel Freeway) and State Highways #1 (Pacific Coast Highway), #22 Garden Grove Freeway), #55 (Newport Freeway), #57 (Orange Freeway), #71 (Corona Highway), #90 (Imperial Highway), and #91 (Riverside Freeway).

Location and Extent

Figure 3.13: Dam Failure Inundation Zones



Past Occurrences

Table 3.21 identifies dam failure events affecting Orange County from 1928 through 1998 (the most recent occurrence).

Table 3.21: Historical Dam Failure Events, Southern California

Date	Disaster Declaration #	Dam	Impacts
March 12, 1928	N/A	St. Francis Dam (located 40 miles NW of City of L.A.)	Up to 600 deaths
December 14, 1963	DR-161	Baldwin Hills Reservoir (located in City of Los Angeles)	5 deaths; 277 homes destroyed

Source: http://cee.engr.ucdavis.edu/faculty/lund/dams/Dam_History_Page/Failures.htm Accessed12-8-14.

While dam failures are infrequent in Southern California, one of the most notable dam failures occurred on December 14, 1963. The 155-foot-high Baldwin Hills Dam gave way and sent 360 million gallons of water in a 50-foot-high wall cascading onto the community below, killing five persons, destroying 277 homes, and damaging 50 million dollars (1963 dollars) in property. Luckily, early warning and prompt

action by dam personnel and the police prevented more lives from being lost. During construction of the Baldwin Hills Dam in 1950, geologists found that two faults ran through the reservoir and the earthen dam. One of the faults was thought to be active, so special drains were constructed underneath the reservoir to allow water, which might percolate through the fault to exit safely. The dam was built near a large oil field, and the extraction of oil caused the ground to subside, causing slippage between the two faults. The slippage was minimal (only a couple of centimeters), but it was enough to rupture the lining of the reservoir. The special drains quickly clogged up with sand and water, and the 65 million gallons of water quickly cut an opening under and through the dam itself.

The failure of the Baldwin Hills Dam caused the California legislature to amend the State Water Code. The statutes governing dam safety in California place the supervision of the safety of non-federal dams and reservoirs under the jurisdiction of the Department of Water Resources' Division of Safety of Dams. The Division of Safety of Dams reviews plans and specifications for the construction of new dams or for the enlargement, alteration, repair, or removal of existing dams. Professional engineers and geologists from the division supervise the maintenance and operations of all dams as well as evaluate each project to enlarge, alter, repair, or remove any existing dams.

Prado Dam Seepage: Following heavy rains, on January 13, 2005, the U.S. Army Corps of Engineers discovered minor seepage on the downstream face of Prado Dam, the seepage was located in an area that was under construction to build new outlet works as part of the overall flood control improvement to Prado Dam. As a precautionary measure Corona city officials evacuated over 800 homes below the dam and Orange County officials relocated campers in the Canyon RV Park because of their proximity to the adjacent floodplain. To decrease the amount of water behind Prado dam the release of water was increased from 5,000 cubic feet per second (cfs) to 10,000 cfs to reduce the level of water being held to 505 feet. As the water level was lowered the hydraulic pressure on the dam abutment subject to seepage was reduced. When the water was reduced to 505 feet (25,750 acre feet of water) on Monday, January 17, 2005 the USACE was able to start the reconditioning of the cofferdam in order to be ready for subsequent flood inflows to the dam.

Probability of Future Occurrence

Based on the dam failure inundation maps we can conclude that a large portion of the city is vulnerable to dam failure. The largest impact on the community from a dam failure is the loss of life and property.

Climate Change Considerations

Climate change is expected to produce longer and more severe droughts due to higher average temperatures, as well as greater and more frequent floods. Orange County's current water systems are designed to balance flood protection during the winter and spring months with water storage during the dry months. Increased rainfall and an earlier melting of the snowpack could result in overburdened facilities that cannot adequately protect communities from floods.

Vulnerability/Risk Assessment

Loss of life and damage to structures, roads, and utilities may result from a dam failure. Economic losses can also result from damage sustained due to a dam failure. These effects would certainly accompany the failure of one of the dams in Orange County and or the City of Orange. Because dam failure can have severe consequences, FEMA and the California Office of Emergency Services require all dam

owners to develop Emergency Action Plans for warning, evacuation, and post-flood actions. Although there may be coordination with city and or county officials in the development of the EAP, the responsibility for developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner.

Table 3.22 identifies all critical facilities in the city that could be inundated as a result of the failure of Prado Dam, Villa Park Dam, and Santiago Dam. The total potential loss shown in the table is based on the assumption that structures are completely destroyed, which is highly unlikely given the proximity to the dam.

Table 3.22: Orange Critical Facilities at Risk of Inundation from Dam Failure

Map #	Facility	Replacement Value	Contents Value	Potential Loss
1	City Hall	$12,747,874	$3,305,813	$16,053,687.00
2	Fire Stations 1	$4,345,220	$3,238,706	$7,583,926
3	Fire Station 2	$575,402	$1,843,341	$2,418,743
5	Fire Station 4	$563,402	$1,573,678	$2,137,080
11*	Community Services	$2,014,526	$401,028	$2,415,554.00
13	Water Plant	$2,788,500	$1,095,219	$3,883,719.00
14	Grijalva Park Center	$7,724,331	$20,000	$7,744,331.00
15	Main Library	$11,234,369	$7,403,458	$18,637,827.00
	Total Potential Losses	$41,993,624.00	$18,881,243.00	$60,874,867.00

Replacement value information based on City insured values for each facility.

3.4.11 EPIDEMIC AND VECTOR BORNE DISEASE

Hazard Profile

Disease and pest management hazards occur when an undesirable type of organism (including insects and pathogens such as bacteria) inhabits an area in a manner that causes serious harm to plants, animals, or humans. In some communities, diseases can do significant harm to agricultural operations, or cause widespread devastation to forests which may have safety and economic impacts.

Locations and Extent

The most widespread potentially serious disease known to occur in Orange is influenza, which commonly occurs during winter. The virus that causes influenza is spread through the air, usually by coughing or sneezing, and may also be spread by touching surfaces which may have been contaminated with the pathogen. The symptoms of influenza may include fever, headache, runny or stuffy noses, fatigue, and gastrointestinal distress. In some instances, influenza can be severe; each year an estimated 3 to 5 million people are affected by a significant case of the disease and approximately 250,000 to 500,000 people are killed. Fatalities are most common among the young, the elderly, and those with weakened immune systems.

Although vaccines for influenza are often widely available, a primary health concern is that of a pandemic, which would affect a large number of people and for which there may not be an effective vaccine or treatment options. An influenza pandemic most recently occurred in 2009, when the H1N1 version of the disease (commonly known as the "swine flu") killed an estimated 284,500 people worldwide, on top of fatalities caused by all other versions of influenza. Most recently, the Centers for Disease Control and Prevention and World Health Organization have been monitoring the H5N1 strain of Avian Influenza across the globe. This strain infects birds, poultry, and humans; however, no reported infections have occurred within the United States. Areas of the globe where confirmed infections/outbreaks have occurred include parts of Asia and the Middle East[5].

The second primary disease risk, as identified by the Orange County Health Care Agency, is West Nile virus. The virus is spread by mosquitoes, which can infect a victim with the virus through a bite. Birds commonly act as a host for the virus, which is passed on when a mosquito bites an infected bird. Approximately 80 percent of people infected by West Nile virus show no outward symptoms, while 20 percent experience symptoms associated with a cold or mild flu, such as fever, nausea, and a headache. In a small number of people (less than 1 percent of those infected), West Nile virus attacks the central nervous system, causing severe illness and potentially a coma or death. As of August 20, 2015, there have been 3 reported cases in Orange County[6].

In the past, the Orange County Health Care Agency has also identified severe acute respiratory syndrome (SARS) as a primary health risk. The disease first appeared in China in November 2002 and spread to a number of other countries, including the United States, before the outbreak was declared contained in July 2003. The worldwide number of probable SARS infections reached 8,273 people; including 27 in the United States (only eight cases were confirmed). No known deaths occurred in the United States, although globally the disease killed 775 people. There have been no new reported cases of SARS since 2004.

Most recently, in December 2014, an outbreak of measles occurred within California originating in Orange County. During this outbreak, 131 measles cases were reported to the California Department of Public Health (CDPH) that are likely linked to this outbreak. Forty-two cases were directly linked to an initial exposure in December at the Disneyland Theme Parks in Anaheim, California. As of April 17, 2015, the CDPH announced that the measles outbreak that began in December 2014 is over. According to the Orange County Health Care Agency, 35 cases were confirmed within the County; however specific information on place of residence was not available at the time of this writing.

Past Occurrences

As influenza strains and their virulence change each year, the number of people severely affected by influenza can vary widely. In the 2009–2010 H1N1 pandemic, Orange County saw 47 flu-related fatalities and 166 victims who lived but required intensive care. Since then, influenza-related deaths in Orange County have ranged from 2 to 20 each year, with an additional 18 to 44 people requiring intensive care.

[5] http://www.flu.gov/about_the_flu/h5n1/index.html

[6] http://ochealthinfo.com/phs/about/dcepi/epi/disease/wn

West Nile Virus infections also range significantly from year to year. The virus first appeared in California in 2003, and had spread to all counties in the state by 2004. Since the disease arrived, the number of reported West Nile virus infections in humans in Orange County has ranged annually from 0 to 71. In 2013, Orange County saw 10 reported human infections of West Nile Virus. Currently three cases of West Nile Virus have been reported this year in Orange County.

Probability of Future Occurrence

It is likely that influenza and West Nile virus infections will continue to occur in Orange. Influenza viruses change rapidly and have proven virtually impossible to eradicate, although vaccination and basic hygiene rules can substantially reduce the odds of being infected. West Nile virus has proven similarly challenging to wipe out, although the disease remains relatively rare and can be constrained by reducing the risk of mosquito bite through insect repellents, the use of screens and protective clothing, and draining pools of stagnant water where mosquitoes breed.

New viruses are continuously manifesting themselves and presenting new challenges for health care agencies across the country and across the globe. Zika Virus is the latest such challenge. Zika virus was first discovered in 1947 and is named after the Zika Forest in Uganda. In 1952, the first human cases of Zika were detected and since then, outbreaks of Zika have been reported in tropical Africa, Southeast Asia, and the Pacific Islands. Zika outbreaks have probably occurred in many locations. Before 2007, at least 14 cases of Zika had been documented, although other cases were likely to have occurred and were not reported. Because the symptoms of Zika are similar to those of many other diseases, many cases may not have been recognized. There is no vaccine or medicine for Zika. It is spread mostly by the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). These mosquitoes are aggressive daytime biters but also bite at night.

Zika can be passed through sex from a person who has Zika to his or her sex partners**.** Zika can be passed from a pregnant woman to her fetus. Zika infection during pregnancy can cause a birth defect of the brain called microcephaly and other severe fetal brain defects. Other problems have been detected among fetuses and infants infected with Zika virus before birth, such as defects of the eye, hearing deficits, and impaired growth. There have also been increased reports of Guillain-Barré syndrome, an uncommon sickness of the nervous system, in areas affected by Zika. Many people infected with Zika virus won't have symptoms or will only have mild symptoms. The most common symptoms of Zika are, fever, rash, joint pain, and conjunctivitis (red eyes). Other symptoms include muscle pain and headache. Symptoms can last for several days to a week. People usually don't get sick enough to go to the hospital, and they very rarely die of Zika. Once a person has been infected with Zika, they are likely to be protected from future infections. Many areas in the United States have the type of mosquitoes that can spread Zika virus.

As of July 27, 2016, Zika virus disease and Zika virus congenital infection are nationally notifiable conditions. This update from the CDC Arboviral Disease Branch includes provisional data reported to ArboNET for January 01, 2015 – July 27, 2016.

- Locally acquired mosquito-borne cases reported: 0
- Travel-associated cases reported: 1,657
- Laboratory acquired cases reported: 1
- Total: 1,658

- Sexually transmitted: 15
- Guillain-Barré syndrome: 5

Table 3.23 provides the number of travel-associated infections with Zika virus in California residents in 2015 and 2016. CDPH is following CDC testing guidelines. This table is updated every Friday. As of July 29, 2016, there have been 114 travel-associated Zika virus infections in California.

- Total infections: 114
- Cumulative number of infections in pregnant women: 21*
- Cumulative number of infections due to sexual transmission: 1

Table 3.23: Zika Virus Infections in California, 2015-2016§ (as of July 29, 2016)

County	Travel-Associated ¥	Locally Acquired †
Alameda	9	0
Contra Costa	6	0
Fresno	1	0
Los Angeles	24	0
Marin	1	0
Merced	2	0
Monterey	1	0
Napa	2	0
Orange	9	0
Riverside	1	0
San Bernardino	6	0
San Diego	23**	0
San Francisco	8	0
San Joaquin	3	0
San Mateo	2	0
Santa Clara	7	0
Solano	1	0
Sonoma	2	0
Stanislaus	2	0
Tulare	1	0
Yolo	2	0
Yuba	1	0
Total	114	0

*Local Health Departments and CDPH are monitoring all pregnant women and their infants
§Total number includes laboratory-confirmed and probable infections as defined by the CSTE Position Statement
¥Persons exposed through travel to an affected area or contact with a traveler
†Presumed local mosquito-borne transmission
**Includes one non-resident

Climate Change Considerations

There is no clearly identified link between climate change and influenza, although changes in animal migration patterns may create new opportunities for influenza mutation. The West Nile virus, however, is expected to be impacted by changing climate conditions. As climate change causes temperatures to rise, the time of year when mosquitoes are most active is expected to increase, resulting in greater opportunities for the spread of the disease.

Vulnerability/Risk Assessment

As described above, Orange County as a whole, and thus the City of Orange, is vulnerable to influenza, West Nile virus, and to some extent the Zika virus. Orange does not have any unique conditions that make the community more or less vulnerable to the impacts of these diseases.

3.5 SUMMARY OF VULNERABILITY

Table 3.24 shows a summary of critical facilities that intersect with hazard areas in the City of Orange. Those facilities that intersect with a hazard area are indicated with a "Y" and a blue-shaded cell. Facilities that do not fall within the hazard area are designated by an "N" and a yellow-shaded cell. The risks of drought, extreme heat, severe weather, and disease and pest management hazards are equal throughout the community.

As stated in Section 3.3, hazard and critical facility overlays were not conducted for drought, extreme heat, disease/pest management, and severe weather. Overlays were conducted for seismic hazards (including liquefaction), flood, hazardous materials, and dam failure. More detailed findings from this analysis can be found in the sections below.

3.5.1 SIGNIFICANT HAZARDS

The vulnerability assessments in each hazard profile are used to understand the varying levels of risk to the City of Orange. Based on these assessments, the planning team concluded that the hazards that pose the greatest risk to the city are seismic hazards, wildland fire, extreme heat and drought.

Table 3.24: Risk Assessment Summary Table

	Facility	Wildland Fire	Drought	Seismic Hazards		Flood (500 ft. of 100 year flood zone)	Landslide / Expansive Soil / Erosion	Hazardous Materials (1,000 ft.)	Extreme Heat	Severe Weather (Wind)	Disease and Pest Mgmt.	Dam Failure
				Ground Shaking	Liquefaction							
1	City Hall	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
2	Fire Stations 1	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
3	Fire Station 2	N	Y	Y	N	N	N	N	Y	Y	Y	Y
4	Fire Station 3	N	Y	Y	N	N	N	Y	Y	Y	Y	N
5	Fire Station 4	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
6	Fire Station 5	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
7	Fire Station 6	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
8	Fire Station 7 / Police Substation	Y	Y	Y	N	N	N	Y	Y	Y	Y	N
9	Fire Station 8	Y	Y	Y	N	N	N	Y	Y	Y	Y	N
1	Police HQ	N	Y	Y	N	N	N	Y	Y	Y	Y	N
1	Community	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
1	Corporation Yard	N	Y	Y	N	N	N	Y	Y	Y	Y	N
1	Water Plant	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
1	Grijalva Park	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y
1	Main Library	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
1	El Modena Library	N	Y	Y	N	N	N	N	Y	Y	Y	N
1	Taft Library	N	Y	Y	N	N	N	N	Y	Y	Y	N

Y denotes that the critical facility intersects the hazard layer

N denotes that the critical facility does not intersect the hazard layer

3.5.2 FACILITIES MOST AT RISK

The critical facilities listed in Table 3.25 are the most at risk to hazard events in the City of Orange. They fall within multiple hazard zones, making them susceptible to future damage from a variety of potential events.

Table 3.25: Orange Critical Facilities Most at Risk

Facility	Wildland Fire	Drought	Seismic Hazards		Flood (500 ft. of 100 year flood zone)	Landslide / Expansive Soil / Erosion	Hazardous Materials (1,000 ft.)	Extreme Heat	Severe Weather (Wind)	Disease and Pest Mgmt.	Dam Failure
			Ground Shaking	Liquefaction							
Grijalva Park Center	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y
City Hall	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Fire Stations 1	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Fire Station 4	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Fire Station 5	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Fire Station 6	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Fire Station 8	Y	Y	Y	N	N	N	Y	Y	Y	Y	N
Fire Station 7 Police Substation	Y	Y	Y	N	N	N	Y	Y	Y	Y	N
Community Services	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Water Plant	N	Y	Y	N	N	N	Y	Y	Y	Y	Y
Main Library	N	Y	Y	N	N	N	Y	Y	Y	Y	Y

3.5.3 POTENTIAL LOSSES

Table 3.26 identifies the critical facilities with the greatest total value (combination of building replacement and contents value) in the city. Should these facilities be completely destroyed by a hazard event, their replacement will be the costliest compared to other identified critical facilities.

Table 3.26: Most Costly Orange Critical Facilities

Map#	Facility	Replacement Value	Content Value	Total (Replacement and Contents) Value*
10	Police Headquarters	$24,834,460	$4,637,691	$29,472,151.00
15	Main Library	$11,234,369	$7,403,458	$18,637,827.00
1	City Hall	$12,747,874	$3,305,813	$16,053,687.00
12	Corporation Yard	$7,405,872	$1,951,232	$9,357,104.00
14	Grijalva Park Center	$7,724,331	$20,000	$7,744,331.00

*Replacement value information based on City insured values for each facility.

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CHAPTER 4 – MITIGATION ACTIONS

Hazard mitigation strategies can reduce the impacts concentrated at large employment and industrial centers, public infrastructure, critical facilities, and on residents of the community. This section of the LHMP is derived from an in-depth review of the vulnerabilities and capabilities described in this Plan. Mitigation actions from the County of Orange and the Orange County Fire Authority Hazard Mitigation Plan (2015) were also reviewed so that the City's actions do not conflict with those of the County or surrounding municipalities. Overall, the actions represent Orange's risk-based approach for reducing and/or eliminating the potential losses as identified in the Vulnerability/Risk Assessment section of each Hazard Profile.

4.1 HAZARD MITIGATION OVERVIEW

4.1.1 FEMA NATIONAL FLOOD INSURANCE PROGRAM

In 1968, the US Congress created the National Flood Insurance Program (NFIP). Participation in the NFIP by a community is voluntary; however, in order to receive funding from FEMA, a community is required to participate in the program. The City of Orange participates in the NFIP. FEMA has established regulations and restrictions regarding any construction or development within areas designated as Special Flood Hazard Area (SFHA). These areas are often referred to as the 100-year floodplain, which means there is a one percent annual chance that this area will be flooded during a storm. Special Flood Hazard Areas are shown on the National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM). In the City of Orange, the Special Flood Hazard Areas are in the vicinity of Santa Ana River, Santiago Creek, and Handy Creek. City of Orange Municipal Code Chapter 15.60 establishes the code and regulations regarding floodplain management within the City.

Construction of any kind is not permitted in the Special Flood Hazard Area without first obtaining approval by the City Public Works Department. A Grading Permit is required to ensure that development is in compliance with the City Ordinance and the National Flood Insurance Program (NFIP). Making improvements within the Special Flood Hazard Area without proper consideration of flood flow and flood mitigation could potentially result in loss of life and property. Proper review and permitting ensure that cuts and fills, landscaping, new improvements, and any other man-made changes do not obstruct flood flows and consequently resulting in flooding of properties outside of the floodplain.

The Community Rating System (CRS) is an NFIP program that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating incentives for a community to go beyond minimum discounts. CRS ratings are on a 10-point scale (from 10 to 1, with 1 being the best rating); with residents of the community who live within FEMA's Special Flood Hazard Areas receiving a 5 percent reduction in flood insurance rates for every Class improvement in the community's CRS rating. The City of Orange does not currently participate in the CRS.

Repetitive Loss Properties

At this time, the City of Orange is not aware of any Repetitive Loss Properties under the NFIP. The City's Floodplain Administrator has contacted FEMA to verify this information.

4.1.2 HAZARD MITIGATION GOALS

The Plan goals, presented in Section 1.5 (Mitigation Priorities and Goals), serve as basis for direction to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from hazards. The Plan goals guide the direction of future activities aimed at reducing risk and preventing loss from natural hazards. The goals also serve as checkpoints as agencies and organizations begin implementing mitigation action items.

The hazard mitigation actions identified below list those activities that the City of Orange will utilize to reduce its risk of potential hazards. These mitigation actions were identified through data collection and research, and collaboration with the LHMP team. Some of these actions may be eligible for funding through federal and state grant programs, and other funding sources as made available to the City. The mitigation actions are intended to address the comprehensive range of identified hazards. Some actions may address risk reduction from multiple hazards.

4.1.3 HAZARD MITIGATION PRIORITIZATION

The LHMP Team selected a benefit-cost review method known as STAPLEE as described in Table 4.1, This methodology, as endorsed by FEMA, requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions to undertake. Team members were provided a worksheet and instructions for conducting this process and determined each mitigation action according to its benefit (positive score) or cost (negative score).

4.1.4 HAZARD MITIGATION BENEFIT – COST REVIEW

FEMA requires local governments to analyze the benefits and costs of a range of mitigation actions that can reduce the effects of each hazard within their communities. Benefit-cost analysis is used in hazard mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit-cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. The analysis is based on calculating the frequency and severity of a hazard, avoided future damages, and risk.

A hazard mitigation plan must demonstrate that a process was employed that emphasized a review of benefits and costs when prioritizing the mitigation actions. The benefit-cost review must be comprehensive to the extent that it can evaluate the monetary as well as the nonmonetary benefits and costs associated with each action. The benefit-cost review should at least consider the following questions:

- How many people will benefit from the action?
- How large an area is impacted?
- How critical are the facilities that benefit from the action (e.g., which is more beneficial to protect, the fire station or the administrative building)?
- Environmentally, does it make sense to do this project for the overall community?

For the Orange Plan, the team used these questions to determine the appropriateness of mitigation actions. Those actions that did not have adequate benefits were excluded from the list of mitigation actions.

Table 4.1: STAPLE/E Review and Selection Criteria

Social
⎫ Is the proposed action socially acceptable to the jurisdiction and surrounding community?
⎫ Are there equity issues involved that would mean that one segment of the jurisdiction and/or community is treated unfairly?
⎫ Will the action cause social disruption?
Technical
⎫ Will the proposed action work?
⎫ Will it create more problems than it solves?
⎫ Does it solve a problem or only a symptom?
⎫ Is it the most useful action in light of other jurisdiction goals?
Administrative
⎫ Can the jurisdiction implement the action?
⎫ Is there someone to coordinate and lead the effort?
⎫ Is there sufficient funding, staff, and technical support available?
⎫ Are there ongoing administrative requirements that need to be met?
Political
⎫ Is the action politically acceptable?
⎫ Is there public support both to implement and to maintain the project?
Legal
⎫ Is the jurisdiction authorized to implement the proposed action?
⎫ Are there legal side effects? Could the activity be construed as a taking?
⎫ Will the jurisdiction be liable for action or lack of action?
⎫ Will the activity be challenged?
Economic
⎫ What are the costs and benefits of this action?
⎫ Do the benefits exceed the costs?
⎫ Are initial, maintenance, and administrative costs taken into account?
⎫ Has funding been secured for the proposed action? If not, what are the potential funding sources (public, nonprofit, and private)?
⎫ How will this action affect the fiscal capability of the jurisdiction?
⎫ What burden will this action place on the tax base or local economy?
⎫ What are the budget and revenue effects of this activity?
⎫ Does the action contribute to other jurisdiction goals?
⎫ What benefits will the action provide?
Environmental
⎫ How will the action affect the environment?
⎫ Will the action need environmental regulatory approvals?
⎫ Will it meet local and state regulatory requirements?
⎫ Are endangered or threatened species likely to be affected?

4.2 HAZARD MITIGATION ACTIONS

The process used by the Orange LHMP team to identify hazard mitigation actions for this Plan included the following:

- Review of the Risk Assessment presented in Chapter 3 of this Plan;
- Review of the Capabilities Assessment presented in Chapter 4 of this Plan;
- Review of the 2015 County of Orange and Orange County Fire Authority Hazard Mitigation Plan mitigation actions; and
- Team discussion of new concerns/issues that need to be addressed to reduce hazards to critical facilities.

Table 4.2 identifies the hazard, proposed mitigation action, City department responsible for implementation, the anticipated funding source(s), opportunities for integration with other City policy or planning frameworks, the target completion date, and priority.

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
1. Multiple Hazards-Related Actions						
1.1	Develop a strategy to effectively alert, warn, and make notifications to all community members in the event of an imminent threat or a need to evacuate. This strategy should include distribution of notices and "canned messages" through multiple methods (television, phone, radio, mobile device, door-to-door notifications, etc.) and in all languages widely spoken in the community and for people with disabilities and access and functional needs.	Emergency Management, Police, Fire	General fund	Emergency Operations Plan; department work plans	2017	High
1.2	Distribute information about ways to reduce the threat of hazards to all community members through mailings, printed notifications, television and digital devices, and in-person events and workshops. All information should be in multiple languages, culturally appropriate, and for people with disabilities and access and functional needs	Emergency Management	General fund; grant opportunities for disaster preparedness, public health, community engagement and outreach, etc.	Emergency Operations Plan	2017	High
1.3	Incorporate all hazards identified in the Local Hazard Mitigation Plan into all City emergency response planning efforts and programs.	Community Development, Fire, Police, Public Works	General fund; grant opportunities for disaster preparedness, public health, etc.	General Plan; Emergency Operations Plan; department work plans	2017	Low

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
1.4	Identify and implement needed infrastructure and program-level actions to maintain City services to community members during emergency situations.	City Manager, Public Works, Police, Fire, Community Services	General fund; grant opportunities for disaster preparedness, resiliency, etc.	Department work plans; Urban Water Management Plan; Community Services Capital Improvements Plan	2018	Low
1.5	Work with regional utility companies and service agencies, including electricity and natural gas providers, telecommunication providers, and transit agencies, to determine approximate time frames for service interruptions, develop appropriate stopgap measures, and establish emergency activities to provide public safety through the restoration process	Public Works, Emergency Management	General fund	Emergency Operations Plan; department work plans	2019	Low
1.7	In coordination with state and regional agencies and other key stakeholders, conduct disaster training and exercises of increasing complexity.	Emergency Management, Fire, Police, Public Works	General Fund; Grant Opportunities	Department Work Plans	2019	High
1.8	Ensure General Plan updates and incorporates hazards information provided in this Local Hazard Mitigation Plan and a policy framework consistent with the actions in this Local Hazard Mitigation Plan. Consider adopting the LHMP into the Safety Element of the General Plan.	Community Development Emergency Management, City Manager, City Council	General fund; Staff Budget; Grant Opportunities	General Plan	2019	Medium
1.10	Coordinate and participate with local, regional, and state agencies to monitor potential changes in the severity, duration, and affected areas of all hazards, and evaluate the possibility for additional hazards to become a threat. In particular, monitor the effects that climate change may have on future hazards.	Community Development, Fire, Police, Public Works	Grant opportunities for disaster preparedness, climate change, public health, etc.	General Plan; Emergency Operations Plan; department work plans	2021	Low
1.12	Invest in energy efficiency upgrades, energy conservation programs, renewable energy facilities, and innovative energy technologies such as microgrids to ensure government facilities are operational during extreme events. Critical facilities and facilities identified as cooling centers should be prioritized.	Public Works, Finance	Grant opportunities for energy efficiency retrofits and renewable energy facilities	Capital Improvements Plan	2019	Medium

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
3. Seismic Hazards-Related Actions						
2.1	Identify seismically vulnerable municipally owned facilities, and identify potential funding sources to conduct seismic retrofits in public buildings.	Public Works, Community Development, City Map.	General fund; grant opportunities for disaster preparedness, resiliency, seismic hazard mitigation, etc.	Department work plans; Capital Improvements Plan	2019	Medium
2.2	Inventory the unreinforced masonry, soft story, and other seismically vulnerable private buildings in the city. Advise the owners of potential means of pursuing solutions to assist with seismic retrofits.	Public Works, Community Development, City Manager's Office	General fund; grant opportunities for disaster preparedness, resiliency, seismic hazard mitigation, etc.	Department work plans; Capital Improvements Plan	2019	Medium
2.3	New development will be required to abide by the most recently adopted City and state seismic and geotechnical requirements. All older buildings, particularly unreinforced masonry buildings, and buildings located near the Peralta Hills and El Modena Faults should be reinforced and strengthened to prevent damage to structures and loss of life in the event of an earthquake.	Public Works, Community Development, City Manager's Office	General fund; grant opportunities for disaster preparedness, resiliency, seismic hazard mitigation, etc.	Department work plans; Capital Improvements Plan	2019	Medium
2.4	Contact utility companies and districts to obtain information regarding seismic evaluations of utility infrastructure, including power lines, water pipelines, sewer lines, freeways and key surface streets, and natural gas pipelines, in coordination with utility companies and appropriate agencies. Advise utility companies and districts of potential means of pursuing solutions to assist with seismic retrofits.	Public Works	General fund; grant opportunities for disaster preparedness, resiliency, seismic hazard mitigation, etc.	Department work plans; Urban Water Management Plan; Capital Improvements Plan	2021	Low
2.5	Continue to provide public education programs regarding geologic and seismic hazards and continue to cooperate with surrounding cities, regional, state, and federal government in programs designed to implement the most strategic and efficient actions to mitigate such hazards.	Public Works, Community Development, City Manager	General fund; grant opportunities for disaster preparedness, resiliency, seismic hazard mitigation, etc.	Department work plans, Emergency Operations Plan	2019	Medium

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
3. Liquefaction-Related Actions						
3.1	Require liquefaction assessment studies and implementation of mitigation measures for qualifying projects. Potential mitigation measures include soil densification or compaction, displacement or compaction grouting, post-tensioned slab foundations, piles, or caissons.	Community Development, Public Works	General Fund	General Plan; Municipal Code	2019	Medium
3.2	Identify critical facilities and key pieces of infrastructure that are at an elevated risk of liquefaction, and conduct retrofits to reduce vulnerability.	Community Development, Public Works	General fund; grant opportunities for disaster preparedness, resiliency, seismic hazard mitigation, etc.	Department work plans; Urban Water Management Plan; Capital Improvements Plan	2019	Medium
4. Wildland / Urban Fires						
4.1	Continue to educate the public, and provide up-to-date maps delineating areas that could face fire hazards.	Fire Department, Community Development, City Manager	General fund, grant opportunities	General Plan Emergency Operations Plan, Department work plans	2017	Medium
4.2	Regulate structural development within or adjacent to wildland to insure best building practices to create fire resistive communities	Fire Department, Community Development	General fund	General Plan	2017	Medium
5. Extreme Heat-Related Actions						
5.1	Designate selected City and community facilities as cooling centers, ensuring that all residents have easy access to a cooling center, including those with limited mobility. Set a temperature trigger to open the cooling centers and distribute information about cooling center availability through multiple media forms.	Emergency Management, Police, Community Services	General fund; grant opportunities for disaster preparedness, resiliency, climate change, etc.	Emergency Operations Plan; department work plans	2017	High

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
5.2	Provide training to outdoor City workers, including landscaping, recreation, and construction staff, about the risks posed by extreme heat and ways to reduce vulnerability. Work with local businesses and community groups to encourage similar training in the private sector.	Human Resources, Public Works, Emergency Management	General fund; grant opportunities for disaster preparedness, resiliency, climate change, etc.	Department work plans	2021	Low
6. Drought-Related Actions						
6.1	Identify and pursue alternative water sources to supplement imported Colorado River and State Water Project deliveries.	Public Works	Grant opportunities for drought mitigation, resiliency, climate change, sustainability, etc.	General Plan; department work plans; Urban Water Management Plan	2021	Low
6.2	Explore constructing additional water storage facilities and additional emergency connections to supplement water supplies during drought conditions or short-term shortages.	Public Works	General fund; grants for disaster preparedness, drought mitigation, resiliency, etc.	Urban Water Management Plan; Capital Improvements Plan	2021	Low
6.3	Develop and implement long-term strategies to reduce community water use, including mandatory use of drought-tolerant plants in new or replacement landscapes, and requirements to install water fixtures in new buildings that exceed minimum code requirements.	Community Development, Public Works	General fund; grants for drought mitigation, resiliency, climate change, sustainability, etc.	General Plan; department work plans; Urban Water Management Plan	2021	Low
6.4	Educate community residents and businesses about available rebates for water-efficient and water-conserving equipment.	Public Works	General fund; grants for drought mitigation, resiliency, climate change, sustainability, etc.	Department work plans; Urban Water Management Plan	2021	Low

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
6.5	Consider implementing additional mandatory restrictions on water use during drought conditions.	Community Development, Public Works	General fund	Department work plans; Urban Water Management Plan; Municipal Code	2021	Low
6.6	Install drought-tolerant or artificial turf at City parks as feasible.	Community Services	General fund; grants for drought mitigation, resiliency, climate change, etc.	Department work plans; Urban Water Management Plan; Capital Improvements Plan	2021	Low
6.7	When conducting water supply analyses for future Urban Water Management Plans, use more severe/long-lasting drought scenarios.	Public Works	General fund	Urban Water Management Plan	2021	Low
7. Severe Weather-Related Hazards						
7.1	Design future critical infrastructure to withstand wind events beyond minimum code standards.	Community Development, Public Works	General fund; grant opportunities for disaster preparedness, resiliency, etc.	General Plan; Capital Improvements Plan	2017	High
7.2	Monitor trees and other vegetation near power lines, and promptly inform Utilities and/or Public Works of the need for any tree trimming.	Public Works	General fund	Department work plans	2021	Low
8. Hazardous Materials-Related Actions						
8.1	Develop and maintain protocols to ensure that City staff and emergency responders are notified as soon as possible following a hazardous materials release, or if an emergency situation (e.g., a flood) may result in a hazardous materials release.	City Manager, Fire, Police	General fund	Emergency Operations Plan; department work plans	2017	High

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
9. Landslide / Expansive Soils / Erosion						
9.1	Require all new development to abide by the most recently adopted City and state seismic and geotechnical requirements.	Community Development	General fund	Department Work Plans	2019	High
9.2	Provide public education programs regarding geologic and hazards.	City Manager, Fire, Police, Public Works	General fund	Department Work Plans	2017	Medium
9.3	Continue to cooperate with surrounding cities, regional, state, and federal government in programs designed to implement the most strategic and efficient actions to mitigate landslide, expansive soil, and erosion hazards.	City Manager, Fire, Police, Public Works	General fund	Department Work Plans	2017	Medium
10. Flood-Related Actions						
10.1	Evaluate the effectiveness of City-owned stormwater drainage and pipeline systems, and conduct improvements as needed.	Public Works	General fund; grants for disaster preparedness, resiliency, etc.	Department work plans; Capital Improvements Plan	2021	Low
10.2	In coordination with utility companies and state and regional agencies, conduct a flood resiliency analysis of critical facilities and key utility and transportation infrastructure. Identify actions to reduce vulnerability and pursue funding to carry out improvements.	Public Works	General fund; grants for disaster preparedness, resiliency, etc.	Department work plans; Urban Water Management Plan; Capital Improvements Plan	2021	Low
10.3	Supplement existing drainage systems with low-impact development features as feasible such as promoting developments that incorporate permeable surfaces within site design	Public Works	General fund; grants for disaster preparedness, resiliency, etc.	General Plan; department work plans; Capital Improvements Plan	2021	Low
10.4	Support the use of low-impact development in new projects, including as a condition of approval for major developments.	Community Development, Public Works	General fund	General Plan; Municipal Code	2021	Low

Table 4.2: Orange Hazard Mitigation Actions

#	Mitigation Action	Responsible Department	Potential Funding Source(s)	Policy Integration Opportunities	Target Completion Date	Priority
10.5	Investigate the City's ability to continue to participate in the National Flood Insurance Program's Community Rating System to reduce local insurance premiums and further mitigate flood impacts.	Public Works	General fund	General Plan; Municipal Code	2021	Low
10.6	Develop critical public and private facilities such as medical, educational, and civic facilities to be located outside of flood zones.	Community Development, Public Works	General fund	General Plan; Municipal Code	2021	Low
10.7	Develop and offer educational programs for the public and City staff regarding flood hazards.	Public Works	General fund	General Plan; Municipal Code	2021	Low
11. Dam Failure-Related Hazards						
11.1	Develop an outreach campaign for residents regarding the upgrades to Prado Dam, and potential flooding impacts in the city associated with Santiago and/or Villa Park dam failures.	Public Works	General Fund, Grant Opportunities	Emergency Operations Plan; Department Work Plans	2021	Low
12. Disease/Pest Management-Related Hazards						
12.1	Coordinate with the Orange County Public Health Services, Orange County Vector Control District, and local medical care providers to distribute information about ways to reduce the risks associated with diseases of concern, including influenza and West Nile virus.	Emergency Management, Fire	General Fund	Emergency Operations Plan; Department Work Plans	2021	Low
12.2	Identify areas of poor drainage or other areas with consistently stagnant water, and address through new or retrofitted drainage infrastructure.	Community Development, Public Works	General Fund; grants for disaster preparedness, resiliency, etc.	Department Work Plans; Capital Improvements Plan	2021	Low

4.3 CAPABILITIES ASSESSMENT

This capabilities assessment is designed to identify existing local agencies, personnel, planning tools, public policy and programs, technology, and funds that have the capability to support hazard mitigation activities and strategies outlined in this Plan. To create this capability assessment, the LHMP team collaborated to identify current local capabilities and mechanisms available to the City for reducing damage from future natural hazard events. These plans and resources were reviewed while developing the Plan and are summarized below.

4.3.1 KEY RESOURCES

The City of Orange has several key departments with resources to support the implementation of mitigation actions. These departments offer a variety of planning, technical, policy, and staffing resources as summarized in Table 4.3.

Table 4.3: Orange Capabilities Assessment

Type of Resource	Resource Name	Ability to Support Mitigation	Web Address
Community Development Department			
Policy Resource	Zoning Code	The Zoning Code is the main tool to implement the City's General Plan. It sets land use regulations and the zoning map for the city. Mitigation actions outlined in this Plan can be adopted in the form of land use/development regulations.	http://www.cityoforange.org/depts/default.asp
Policy Resource	Building Code/Fire Code	International Building Code, International Fire Code.	http://www.cityoforange.org/depts/commdev/building/ http://www.cityoforange.org/depts/default.asp
Plan Resource	General Plan	Principal policy document that guides conservation, development, and change in the city. Identifies City programs and policies as they pertain to land use, public services, housing, natural resources, and safety. Hazard data and mitigation actions described in this Plan can be incorporated into the General Plan.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Policy Resource	Housing Program	The City offers numerous referrals to programs to help residents maintain safe housing.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Plan Resource	Floodplain Management	In City of Orange, the Special Flood Hazard Areas are in the vicinity of Santa Ana River, Santiago Creek, and Handy Creek. City of Orange Municipal Code Chapter 15.60 establishes the code and regulations regarding floodplain management within the City.	http://ocflood.com/nfc/floodplain http://www.cityoforange.org/depts/publicworks/flood_insurance.asp

Table 4.3: Orange Capabilities Assessment

Type of Resource	Resource Name	Ability to Support Mitigation	Web Address
Personnel Resource	Planning Commission	The Planning Commission meets twice per month to review and decide on planning and development matters in Orange.	http://www.cityoforange.org/depts/commdev/planning/planning_commission.asp
Building and Safety Department			
Personnel Resource	Building Official	Enforces building codes and development ordinances.	www.cityoforange.org/depts/commdev/building
Policy Resource	Inspections & Permit	Building permits ensure that development standards as well as fire and structural safety standards are met.	www.cityoforange.org/depts/commdev/e_permit.asp
City Council			
Policy Resource	Policy Approval	Policy legislation and implementation.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
City Administration			
Personnel Resource	City Manager	Supports the development and implementation of this Local Hazard Mitigation Plan by allocating the appropriate personnel and resources.	Not available online.
Financial Resource	Finance	Budgeting for City-owned facilities.	Not available online.
Public Works Department			
Technical and Personnel Resources	GIS Program	GIS creates an updated zoning map and General Plan map and also maintains an interactive parcel map that residents can use to determine information about their property location.	http://www.cityoforange.org/depts/publicworks/gis_mapping/
Policy Resource	2010 Urban Water Management Plan	The Plan utilizes reflects the latest information about future water supply and demand.	http://www.cityoforange.org/depts/publicworks/water_services/

Table 4.3: Orange Capabilities Assessment

Type of Resource	Resource Name	Ability to Support Mitigation	Web Address
Plan Resource	2015 UWMP, Water Master Plan	A planning document to aid in updating city plans and for preparation of environmental documents under the California Environmental Quality Act. Serves as a detailed source of information to coordinate local water supply availability and certain land use decisions made by the city. Identifies adequate water supplies and proper planning and funding of future water infrastructure improvements.	http://www.cityoforange.org/depts/publicworks/water_services/
Technical Resource	Solid Waste and Wastewater services	Operates solid waste collection/disposal and wastewater collection and treatment services for the City of Orange	http://www.cityoforange.org/depts/publicworks/solid_waste_and_recycling.asp
Personnel Resource	Public Works Manager	Participates in the development and implementation of this Local Hazard Mitigation Plan.	www.cityoforange.org/depts/publicworks/default.asp
Police Department			
Personnel Resource	Emergency Management	Coordinates preparedness training, public outreach on safety and emergency preparedness, and emergency response.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Personnel Resource	Police Department	Leads the development and implementation of this Local Hazard Mitigation Plan.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Policy and Plan Resource	Traffic Division, Emergency Management	Includes emergency preparedness guides for the elderly, physically challenged, and children.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Policy Resource	Code Enforcement	Each zoning district has specific zoning codes and guidelines that were developed to enhance and protect each district. The Police Department enforces and carries out these guidelines.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Personnel Resource	Traffic Division Emergency Management	Coordinates with City staff on emergency preparedness, response, and mitigation activities.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Policy Resource	Traffic Division Emergency Management	Educates City employees and residents on hazards awareness, prevention, and preparedness.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp

Table 4.3: Orange Capabilities Assessment

Type of Resource	Resource Name	Ability to Support Mitigation	Web Address
Technical Resource	Police Communications	Provides a means of notification to residents and listed phone numbers during an emergency situation, allowing resident and businesses to relocate out of a potentially vulnerable area.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
Technical and Staffing Resource	Emergency Management SEMS/NIMS/EOC Training	On an ongoing basis, Orange Emergency Management conducts training for City personnel on their roles in an emergency based on the Standardized Emergency Management System, the National Incident Management Systems (NIMS), and National Response Framework.	http://www.cityoforange.org/depts/commdev/planning/general_plan.asp
FIRE			
Personnel Resource	Fire Personnel, Fire Department Plans, EOP	Provides emergency response, fire prevention education, and training.	http://www.cityoforange.org/depts/fire/default.asp
Policy Resource	Fire; Building Inspections and Permits	The Orange Fire Department provides recurring fire prevention inspections of buildings in the city and provides plan check and permit functions for all development.	http://www.cityoforange.org/depts/fire/fire_prevention_and_hazardous_materials_safety/default.asp
Orange County Resources			
Technical Resource	Flood Control (Department of Public Works)	Provides flood protection and regulation and stormwater services. Assists the City in protecting the public's health, safety, and welfare through superior engineering, maintenance, operations, and administrative services that incorporate customer service and integrity with competence and productivity for a sustained commitment to excellence.	http://media.ocgov.com/gov/pw/om/sections/flood/default.asp
Plan Resource	Operational Area Hazard Mitigation Plan	Identifies hazards and mitigation actions for Orange County critical facilities.	http://hazardmitigation.calema.ca.gov/docs/lhmp/Orange_County_LHMP.pdf
Plan Resource	Operational Area Emergency Operations Plan	Overall emergency management plan for the Orange County Operational Area.	http://cams.ocgov.com/Web_Publisher/Agenda06_24_2014_files/images/O00214-000956E.PDF
Plan Resource	Orange County General Plan 2005	Provides policies intended to reduce hazards and disasters within Orange County.	http://ocplanning.net/planning/generalplan2005

Table 4.3: Orange Capabilities Assessment

Type of Resource	Resource Name	Ability to Support Mitigation	Web Address
Report	Orange County Essential Facilities Risk Assessment Project Report April, 2009	Provides risk assessment on six natural hazards and Hazus estimated impacts on Orange County for two Earthquake Scenarios.	http://www.fema.gov/media-library-data/20130726-1719-25045-0604/ocefra_report_final___tagged.pdf
State and Federal Agencies			
Technical Resource	National Weather Service (NWS)	Decision Support Program (improved forecast interpretations for making informed decisions).	http://www.weather.gov/
Technical Resource	California Office of Emergency Services (Cal OES)	Hazard Mitigation Web Portal provides guidance and examples of hazard mitigation planning as well as notifications regarding available funding.	http://hazardmitigation.calema.ca.gov/
Technical Resource	Federal Emergency Management Agency (FEMA)	Guidance for hazard mitigation planning processes and resources.	http://www.fema.gov/multi-hazard-mitigation-planning

4.3.2 CITY OF ORANGE FISCAL CAPABILITY

The Finance Department manages and maintains the City's financial records in conformity with generally accepted accounting principles and in compliance with state and federal laws. The city is committed to developing and maintaining effective and efficient financial planning, reporting and central support systems in order to provide the City Council, City Manager and other City officials with financial information on a timely and meaningful basis. The city is responsible for providing quality service to the City's customers which includes the preparation of the City's utility bills, business licenses, and paramedic subscription services. The Finance Department also manages the City's finances, including accounts payable, accounts receivable, investments, purchasing, and cash receipts.

Sales Tax is the largest source of General Fund revenue. The city expects to see strong performances by local automotive dealerships and the business-to-business sector, and a strengthening job market, and strong building and construction activity. The performance of The Outlets at Orange is expected to remain strong as they continue to enhance the quality of stores and add new merchants. Sales tax projections are based on data received from sources including the Orange County Transportation Authority, Chapman University, California State University, Fullerton, and the State Board of Equalization, as well as our thorough analysis of local economic conditions. Property Tax is the second largest source of General Fund revenue.

The City has allocated the majority of these financial resources to the following departments: City Council, City Manager, City Attorney, City Clerk, City Treasurer, Finance, Human Resources, Information Technology, Library Services, Fire, Police, Public Works, Community Development, and Community Services which are all relevant for implementing hazard mitigation actions. These departments all have a general fund that could be used toward mitigation activities. These departments also have budgets used to employ City staff members who are an integral part of the mitigation planning process.

4.3.3 CAPITAL IMPROVEMENT PROJECTS

For the upcoming fiscal year, there are 28 new budgeted projects and continued investment in 95 previously approved projects. This is a major investment in the City’s infrastructure and represents a significant commitment to our community’s future. Seventeen new and on-going road projects continue to be a major focus of our CIP. The 45 identified facility improvements address aging City facilities and major equipment. Funding for the CIP comes from 31 different funding sources including Gas Taxes, Measure “M”, Traffic Congestion Relief Funds, Developer Impact Fees, State and Federal Grants, former Redevelopment Bond Proceeds, and Community Development Block Grants (CDBG).

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CHAPTER 5 – PLAN MAINTENANCE

5.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

5.1.1 COORDINATING BODY

The Orange LHMP team will be responsible for the maintenance of this LHMP. The City of Orange Fire Department will take the lead in LHMP maintenance issues, by coordinating maintenance of this Plan and undertaking the formal review process and the future updates of the LHMP. Key City departments heads and staff positions are identified below:

City Attorney
City Clerk
City Council Member
City Manager
Community Development Director
Community Services Director
Finance Director
Fire Chief
Emergency Management Coordinator
Human Resources Director
Library Services Representative
Police Chief
Public Works Director

The City of Orange Emergency Management Coordinator will facilitate the LHMP team meetings, and will assign tasks such as updating and presenting the Plan to other departments, stakeholder groups, and/or elected officials. Plan implementation and evaluation will be a shared responsibility among all LHMP team members.

5.1.2 EVALUATION

The minimum task of the ongoing annual LHMP team meeting will be the evaluation of the progress of the Plan and incorporating the actions into other planning documents. These annual meetings will commence in 2017. These annual meetings will be conducted during the month of April in conjunction with departmental budget planning for the next fiscal year. This review will include the following:

- Summary of any hazard events that occurred during the prior year and their impacts on the community.
- Review of successful mitigation initiatives identified in the Plan.
- Brief discussion about why targeted mitigation strategies were not completed.
- Reevaluation of the mitigation actions to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term project due to funding availability).

- Recommendations for new mitigation actions.
- Changes in, or potential for, new funding options/grant opportunities.
- Integration of new GIS data and maps that can be used to inform the Plan.
- Evaluation of any other planning programs or initiatives within the city that involve hazard mitigation.

The City will create a template to guide the LHMP team in preparing a progress report. The City will also prepare a formal annual report on the progress of the LHMP. This report will be used as follows:

- Distributed to City department heads for review.
- Posted on the City website on the page dedicated to the Plan, with the ability for the public to provide comments.
- Provided to the local media through a press release.
- Presented in the form of a council report to the City Council.

5.2 METHOD AND SCHEDULE FOR UPDATING THE PLAN WITHIN FIVE YEARS

Section 201.6. (d)(3) of Title 44 of the Code of Federal Regulations requires that local hazard mitigation plans be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under the DMA. The City intends to update the Plan on a five-year cycle from the date of initial plan adoption. It is anticipated that this update process will occur one year prior to expiration of the existing plan. This cycle may be accelerated to less than five years based on the following triggers:

- A presidential disaster declaration that impacts the City of Orange.
- A hazard event that causes loss of life.

The intent of the update process will be to add new planning process methods, community profile data, hazard data and events, vulnerability analyses, mitigation actions, and goals to the adopted Plan so that the Plan will always be current and up to date. Based on the needs identified by the planning team, the update will, at a minimum, include the elements below:

1) The update process will be convened through a committee appointed by the Director of each City department and will consist of at least one staff member from each department to ensure consistency between Plans. The City should reach out to local agencies at the onset of the update process and involve any relevant external agencies that are interested in participating in the LHMP update. This update process will begin in 2020, one year prior to the expiration of this Plan.
2) The hazard risk assessment will be reviewed and updated using best available information and technologies on an annual basis.
3) The evaluation of critical structures and mapping will be updated and improved as funding becomes available.

4) The mitigation actions will be reviewed and revised to account for any actions completed, deferred, or changed to account for changes in the risk assessment or new City policies identified under other planning mechanisms, as appropriate (such as the General Plan).
5) The draft update will be sent to appropriate agencies for comment.
6) The public will be given an opportunity to comment prior to adoption.
7) The draft update will be transmitted to Cal OES and FEMA for review and approval.
8) The Orange City Council will adopt the updated Plan within one year of the commencement of the update process.

5.3 ADOPTION

The Orange City Council is responsible for final adoption of the Plan. This adoption should take place every five years upon receipt of notification from FEMA that the plan is Approved Pending Adoption (APA). Once the Plan has been adopted, the City of Orange Fire Department will be responsible for transmitting the adopted version to FEMA for their records.

5.4 IMPLEMENTATION THROUGH EXISTING PROGRAMS

The effectiveness of the City's non-regulatory LHMP depends on the implementation of the Plan and incorporation of the outlined mitigation action items into existing City plans, policies, and programs. The Plan includes a range of action items that, if implemented, would reduce loss from hazard events in the city. Together, the mitigation action items in the Plan provide the framework for activities that the City can choose to implement over the next five years. The City has prioritized the Plan's goals and identified actions that will be implemented (resources permitting) through existing plans, policies, and programs.

The Fire Department has the responsibility for overseeing the Plan's implementation and maintenance through the City's existing programs. The Emergency Management Coordinator, or designated appointee, will assume lead responsibility for facilitating LHMP implementation and maintenance meetings. Although the Fire Department will have primary responsibility for review, coordination, and promotion, plan implementation and evaluation will be a shared responsibility among all departments identified as lead departments in the mitigation action plan, and incorporating the plan into Existing Planning Mechanisms.

The information on hazards, risk, vulnerability, and mitigation contained in this Plan is based on the best information and technology available at the time the LHMP was prepared. As previously stated, the City's General Plan is considered to be an integral part of this plan. The City, through adoption of its General Plan Safety Element goals, has planned for the impact of natural hazards. The LHMP process has allowed the City to review and expand upon the policies contained within the General Plan Safety Element. The City views the General Plan and the LHMP as complementary planning documents that work together to achieve the ultimate goal of the reduction of risk exposure to the citizens of Orange. Many of the ongoing recommendations identified in the mitigation strategy are programs recommended by the General Plan and other adopted plans. The City will coordinate the recommendations of the LHMP with other planning processes and programs including the following:

- Orange Capital Improvement Program
- Orange Building Codes
- Orange Emergency Operations Plan
- General Plan
- Orange Hazardous Materials Plan

5.5 CONTINUED PUBLIC INVOLVEMENT

The public will continue to be apprised of the LHMP actions through the City website and through the provision of copies of the annual progress report. Copies of the Plan will be available upon request. Upon initiation of the LHMP update process, a new public involvement strategy will be developed based on guidance from the planning team. This strategy will be based on the needs and capabilities of the City at the time of the update. At a minimum, this strategy will include the use of the City's website as well as local media outlets within the planning area.

5.6 POINT OF CONTACT

Preparation and future update of the City's Local Hazard Mitigation Plan will be the responsibility of the City's Emergency Management Coordinator: City of Orange Fire Department (714) 288-2500.

Appendix A: List of Stakeholders in the LHMP Planning Team

City of Orange Planning Team

Name	Organization	Phone Number	E-Mail
Jennifer Amat	Police Department	714.325.1423	jamat@orangepd.org
Katrin Bandhauer	Finance	714.744.2251	kbandhauer@cityoforange.org
Bill Crouch	Community Development	714.744.7021	wcrouch@cityoforange.org
Casey Fieldhouse	Fire Department	714.288.2550	cfieldhouse@cityoforange.org
Lisa Kim	Economic Development / City Manager's Office	714.744.2207	lkim@cityoforange.org
Neil Millward	Public Works		nmillward@cityoforange.org
Eric Rosauer	Orange PD-Lt	714-936-0957	erosauer@orangepd.org
Paul Sitkoff	Community Services	714.288.2590	psitoff@cityoforange.org
Robert Stefano	Fire Department	949.533.2049	rstefano@cityoforange.org
Frank Sun	Public Works	714.744.5529	fsun@cityoforange.org
Jack Thomas	Fire Department	714.288.2501	jthomas@cityoforange.org
Alan Velasco	Fire Department	714.915.7873	avelasco@cityoforange.org
Pete Goodrich	Community Development	714.744.7201	pgoodrich@cityoforange.org
Lan Nguyen	WHS	714.299.6272	Lan.nguyen@willdan.com
Ellen Lopez	WHS		elopez562@icloud.com

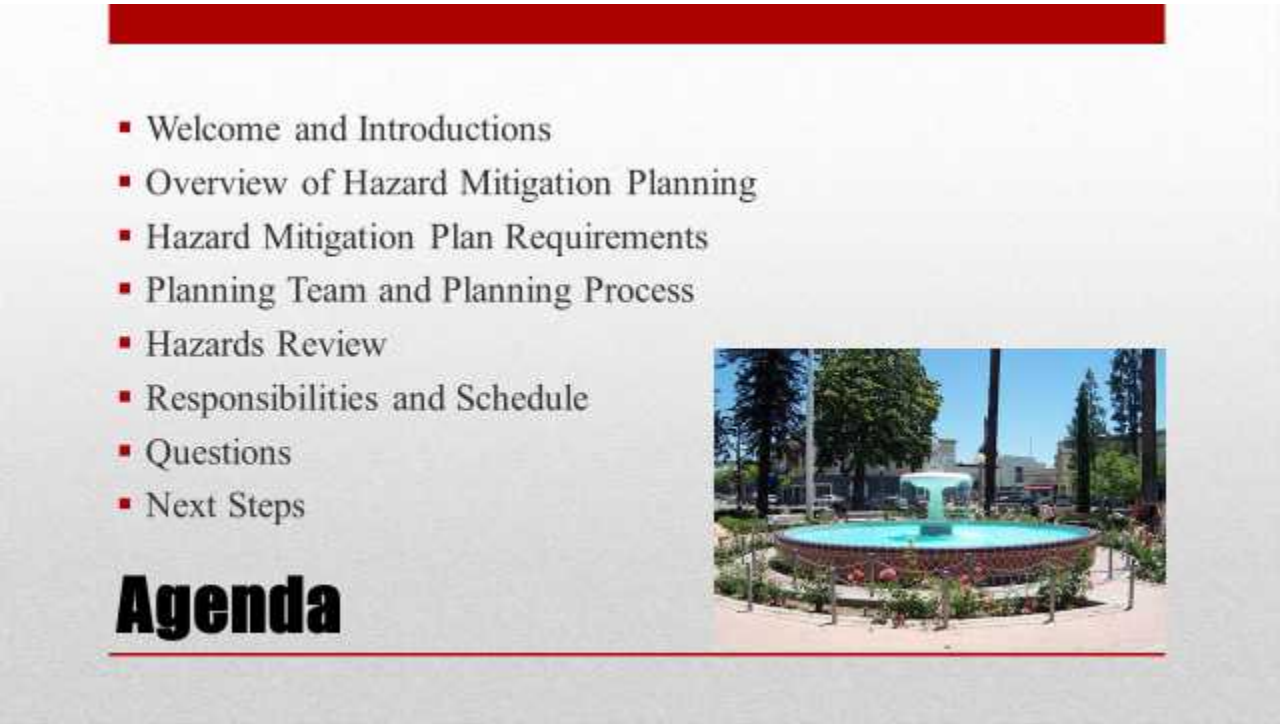
Public Stakeholders Identified

Company	Name	Address	Email	RSVP	
Stadium Promenade	Bill Vierra	1701 W. Katella Ave. Orange, CA 92867	bill_vierra@sywest.com		
National Oilwell Varco	Dave Ramos	743 N. Eckhoff St., Orange, CA 92868	david.ramos@nov.com	YES	
SC Fuels	De Holbrook	1800 W. Katella Ave., # 400, Orange, CA 92867	holbrookd@scfuels.com	YES	
Santiago Canyon College	Don Maus	8045 E. Chapman Ave, Orange, CA 92869	maus_donald@rsccd.edu	YES	Manny Pacheco
St. Norbert Catholic Church	Fr. Patrick Rudolph	185 S. Center St., Orange, CA 92866	frprudolph@stnorbertchurch.org		
Metrolink	Fred Jackson	One Gateway Plaza, 12th Floor, Los Angeles, CA 90012	jacksonf@scrra.net		
Orange County Sheriff's Department	Grace Zambrana-Sutton	550 N. Flower St., Santa Ana, CA 92703	oaadmin@ocsd.org		
The Village at Orange	Jeff Axtell	1500 E. Village Way, Orange, CA 92865	jaxtell@vestar.com		
UCI Medical	Joe Reiss	101 The City Dr. South, Orange, CA 92868	jreiss@uci.edu		
Orange Unified School District	Joe Sorrera	1401 N. Handy Street, Orange, CA 92867	joes@orangeusd.org	YES	Ed Howard, Sheldon Glass, Scott Harvey
St. Paul's Lutheran Church	Katherine Masterson	1250 E. Heim Ave., Orange, CA 92865	kmasterson@stpaulsorange.org		

Company	Name	Address	Email	RSVP	
Holy Family Cathedral School	Kathleen McDonald	530 S. Glassell St., Orange, CA 92866	kmcdonald@holyfamilyk8.org		
The Outlets at Orange	Kristin Elfring	20 City Blvd. West, Orange, CA 92868	kelfring@simon.com		
Chapman University	Linda Padilla-Smyth	1 University Drive, Orange, CA 92866	padillas@chapman.edu	YES	Mark Davis mcdavis@chapman.edu
Orange County Health Care Agency	Mike Steinkraus	405 W. 5th St., Santa Ana, CA 92701	msteinkraus@ochca.com		
St. John's Lutheran Church	Robin Gomes	185 S. Center St., Orange, CA 92866	rgomes@stjohnsorange.org		
Greenlaw Partner	Scott Murray	1 City Boulevard West, Suite 340, Orange, CA 92868	scott@greenlawpartners.com		
Southern California Edison	Tony Caruso	1325 S. Grand Ave., Santa Ana, CA 92705	Anthony.caruso@sce.com	YES	Thomas Jacobus
Cal OES	Jim Acosta				
OC OA	Donna Boston				

Appendix B: Planning Team Meetings

October 28, 2015 Kick-Off Meeting: Agenda



October 28, 2015 Kick-Off Meeting: Sign-In Sheet

City of Orange
Hazard Mitigation Planning Team
October 28, 2015

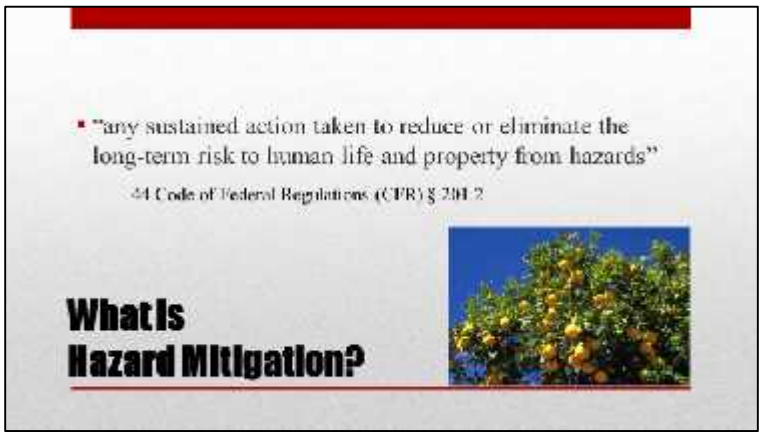
Name: Last, First	Department & Title	Phone	Email
Sitkoff, Paul	Comm Serv, PIO	714 288-2590	PSitkoff@cityoforange.org
Fieldhouse, Carey	Fire - DEM/PIO	714 288-2550	cfieldhouse@cityoforange.org
Frank Sun	DPW - City Engineer	714 744 5529	fsun@cityoforange.org
Katrin Bandhauer	Asst Finance Director	714 744 2251	kbandhauer@cityoforange.org
Lisa Kim	EM Manager	714 744 2307	lkim@cityoforange.org
Jennifer Amat	PD-Homeland Sec/EM	714-325-1423	jamat@orangepd.org
Jack Thomas	Fire - Chief	714 744 5561	JThomas@cityoforange.org
Bill Crouch	CDD Director	714 744 7021	wcrouch@cityoforange.org
Robert Stefano	OFD - Deputy Chief	949 533 2049	RSTEFANO@CITYOFORANGE.ORG
Eric Krauer	OFD - LT	714 936-0757	ERIC.KRAUER@ORANGEFD.COM
Ryan Velasco	OFD - CAPT.	714/935-7873	rvelasco@cityoforange.org
Denise Davis	Willdan	714-349-6434	Ddavis@willdan.com
	EMS		
	FIRE ADVISORY PLAN GROUP		


CITY OF ORANGE INTEROFFICE TELEPHONE DIRECTORY

UPDATED 5/1/2015

October 28, 2015 Kick-Off Meeting: Presentation

City of Orange
Hazard Mitigation Plan
Planning Team Kick Off Meeting
October 28, 2015



City of Orange
Hazard Mitigation Plan
Planning Team Kick Off Meeting
October 28, 2015

- Retrofitting a public building to protect it from earthquake damage.
- Elevating a structure to reduce the likelihood of flood damage.
- Providing emergency preparedness materials to the community.

Hazard Mitigation Examples

- The Code of Federal Regulations (44 CFR § 201.3(d)(1)) requires local governments to prepare and adopt local hazard mitigation plans (LHMPs) in order to receive federal mitigation grant funding.

Requirement for a Hazard Mitigation Plan

- **Pre-Disaster Mitigation Grant Program:** funding for hazard mitigation planning and implementing mitigation projects prior to a disaster.
- **Hazard Mitigation Grant Program:** funding to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration.
- **Flood Mitigation Assistance Program:** funding for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP).
- **Severe Repetitive Loss Program:** funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss structures insured under the National Flood Insurance Program.

Federal Mitigation Grants

- Assembly Bill 2140 prohibits the state share for any eligible project from exceeding 75% of total state eligible costs unless the local agency is located within a city, county, or city and county that *has adopted a local hazard mitigation plan* in accordance with the federal Disaster Mitigation Act of 2000 *as part of the safety element of its general plan*, in which case the Legislature may provide for a state share of local costs that exceeds 75% of total state eligible costs.

AB 2140
(CA Government Code Sections 65302.6 / 8685.9)

- Local governments have a responsibility to protect the health, safety, and welfare of their citizenry.
- Proactive mitigation efforts help reduce risk and create safer, more disaster-resilient communities.
- Mitigation is an investment in Orange's future safety and sustainability.
- Compliance with the Code of Federal Regulations plan requirements for future hazard mitigation grant funding.
- Incorporate the hazard section of the HMP into the General Plan Safety Element.

Objectives of Hazard Mitigation Planning

- FEMA created a Plan Review Guide in October 2011, including a plan review tool which lists the requirements.
- FEMA also developed a Local Mitigation Planning Handbook which was revised in March 2013.

Local Mitigation Plan Review Tool

City of Orange
Hazard Mitigation Plan
Planning Team Kick Off Meeting
October 28, 2015

- You have been selected to be on the Planning Team to help revise the plan because of your knowledge and expertise.
- You have the knowledge and/or authority to implement the mitigation strategies developed in the planning process.

The Planning Team

- Work together to develop, review and revise drafts of the 2016 HMP.
- Assist with the risk assessments and vulnerability analysis.
- Review and determine mitigation strategies.
- Assist with opportunities in outreach for stakeholder agencies and the public.
- Review plan prior to submitting for state and FEMA approval and local adoption.
- Implement the plan, monitor its impact, and prepare for future revisions of the HMP.

Planning Team Role

- Document how the plan was prepared, and who was involved in the process.
- Provide opportunities for neighboring communities, local and regional agencies involved in hazard mitigation, agencies authorized to regulate development, and other to be involved in the planning process.
- Include how the public was involved during the drafting stage, and will continue to be involved in plan maintenance (whole community concept).
- Incorporate existing plans, studies, reports, and technical information.
- Develop a method and schedule for keeping the plan current.

Planning Process

- Describe the type, location, and extent of all natural hazards that can affect Orange.
- Include information on previous hazard events and the probability of future hazard events.
- Describe the potential impact of each hazard identified, and an overall summary of Orange's vulnerability.
- Address NFIP-insured structures repetitively damaged by floods.

Hazard Identification and Risk Assessment

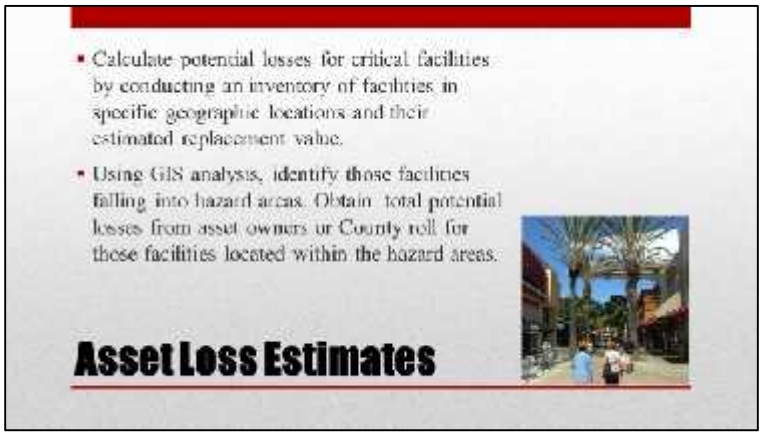
Hazard Profiles:
- Earthquake and Seismic Hazards
- Fires – Wildland and Urban
- Flooding – Localized Storms and Dam Failure
- Hazardous Materials Incident
- Severe Weather – Wind, Heat and Tornados
- Transportation Incident – Air, Rail, Highways
- Public Health Emergencies – Epidemic and Pandemic
- Terrorism
- Drought
- Climate Change

Hazard Identification

Vulnerability Analysis


CPRI Rating


Include City facilities for continuity of operations
Include key infrastructure
Include potential shelter or evacuee locations
Include vital communications facilities
Include information on high population business and industry
Include schools and churches and other high occupancy facilities
Include high hazard facilities
Critical Facilities


Calculate potential losses for critical facilities by conducting an inventory of facilities in specific geographic locations and their estimated replacement value.
Using GIS analysis, identify those facilities falling into hazard areas. Obtain total potential losses from asset owners or County roll for those facilities located within the hazard areas.
Asset Loss Estimates

City of Orange
Hazard Mitigation Plan
Planning Team Kick Off Meeting
October 28, 2015

Mitigation Strategy

The mitigation strategy is composed of three components: mitigation goals, mitigation actions, and an action plan for implementation.

- List existing authorities, policies, programs, and resources and the ability to expand and improve these existing policies and programs.
- List participation in and continued compliance with NFIP requirements.
- List goals to reduce and avoid long-term vulnerabilities to the identified hazards.

Mitigation Strategy

Mitigation strategy, continued:

- Add comprehensive, specific mitigation actions to reduce the effect of hazards, emphasizing buildings and infrastructure.
- Include an action plan describing how actions identified will be prioritized, implemented, and administered.
- Describe a process for integrating the mitigation plan into other planning mechanisms as appropriate.

Develop Mitigation Actions

Examples:

- Land-use planning and regulation of development in hazard zones such as floodplains and wildland-urban interface areas.
- Development and enforcement of building codes - the Seismic Safety Commission has identified stringent building codes and standards as the primary reason why California has suffered relatively low damages during hazard events.
- Retrofitting structures - this can include activities such as seismic retrofits to reduce damage from earthquakes, elevating buildings in flood-prone areas, and reroofing with fire-resistant shingles.
- Removing structures from hazardous areas.

City of Orange
Hazard Mitigation Plan
Planning Team Kick Off Meeting
October 28, 2015

- Meetings held with businesses, industry, related non-governmental organizations, interested public.
- Meetings with Faith Based groups
- Meetings with established organizations in the community, e.g. Rotary, Kiwanis, City Commissions, etc.
- Distribute information on the city website, community cable, local newspaper, and other means as determined.
- Survey distributed to citizens of Orange.

Develop a Public and Stakeholder Outreach Plan

- Additional 2-3 meetings to be held.
- Provide necessary documentation required for the HMP:
  - Existing authorities, policies, programs and resources to mitigate hazards.
  - Specific actions and projects considered to reduce the effects of hazards, emphasizing new and existing buildings and infrastructure.
  - Integration of strategies into other planning mechanisms, i.e., comprehensive or capital improvement plans.
  - Data for maps, assessments and other vulnerability products.

Expectations for Planning Team

- Previous damage from hazards
- Ongoing or completed hazard mitigation projects
- Location maps
- Land use
- Population density
- Building stock
- Areas for future development
- Estimated dollar losses to vulnerable structures
- Exposure analysis
- Financial resources
- Legal and regulatory resources

Example Data Needed

City of Orange
Hazard Mitigation Plan
Planning Team Kick Off Meeting
October 28, 2015

- Information will be requested from the Planning Team throughout the planning process.
- Request individuals to retrieve information or data for the plan.
- Send requested information or review documents to Team members prior to meetings.
- Use other methods that are effective to the planning process while minimizing disruption of your schedules.
- Meeting and plan writing schedule

Planning Process

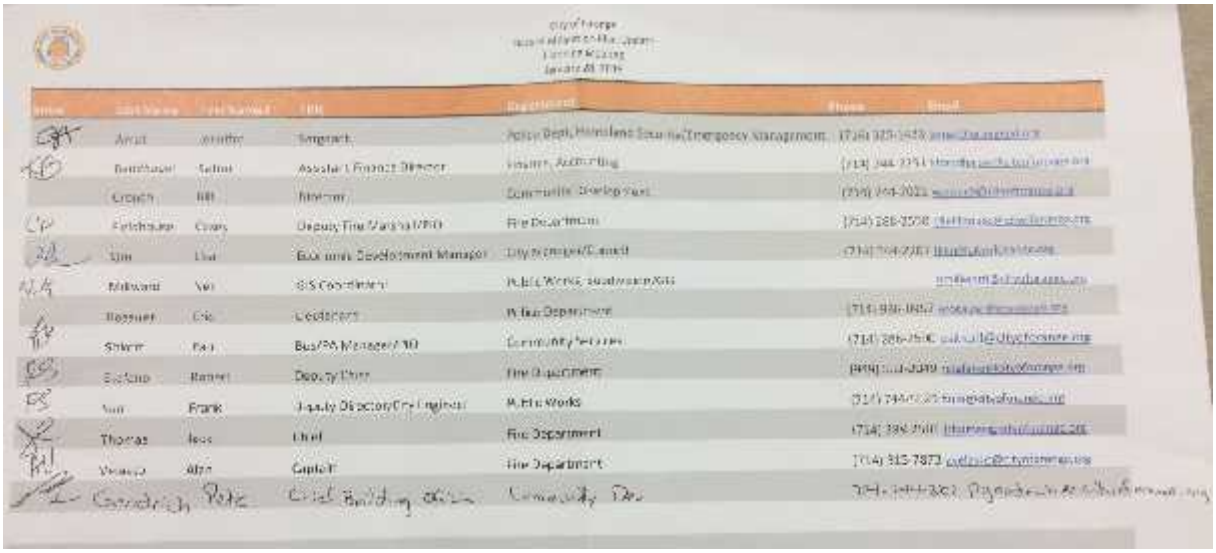
Any Questions?

Thank you for attending!

October 28, 2015 Kick-Off Meeting: Minutes

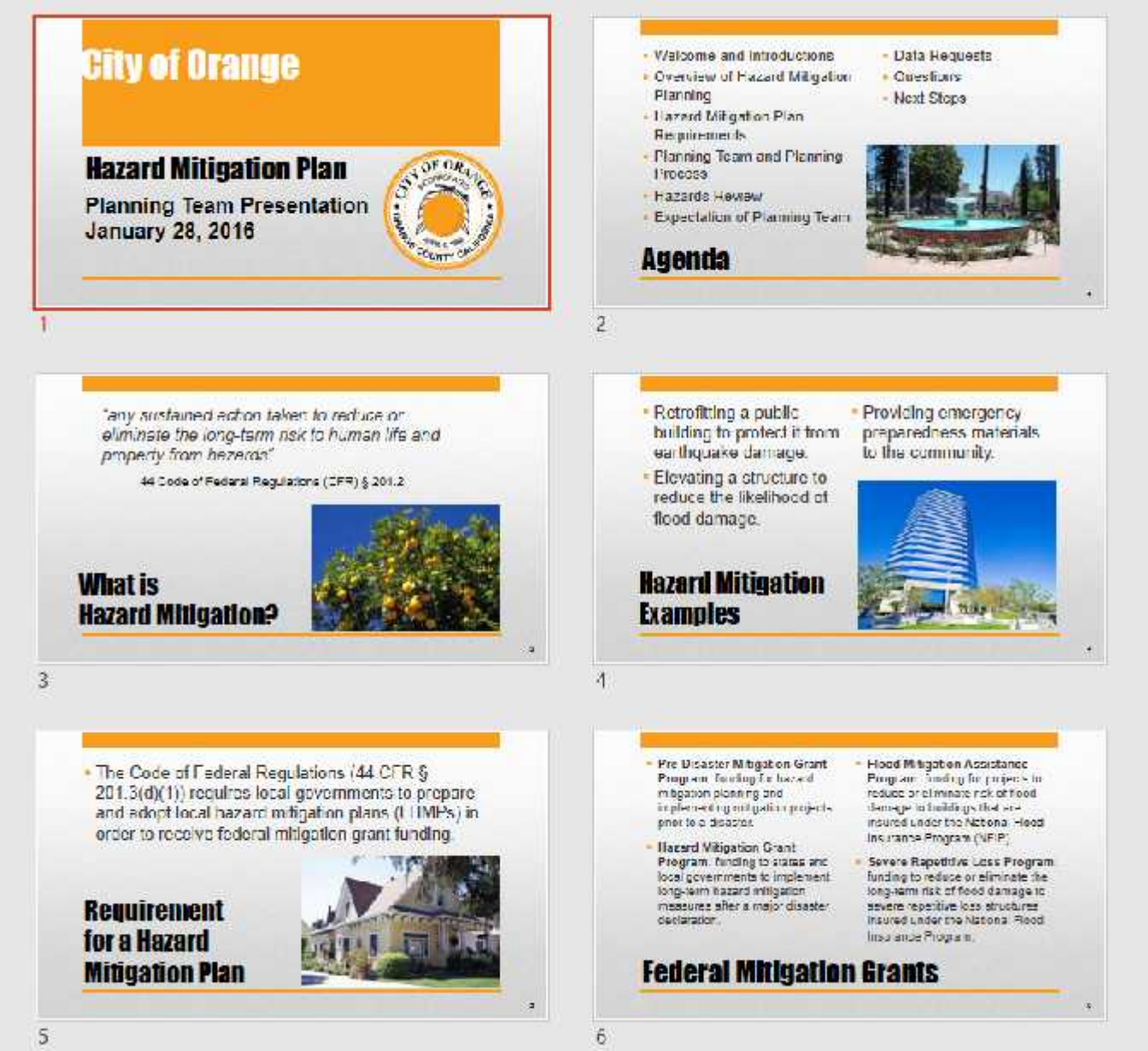
January 28, 2016 Planning Team Meeting: Agenda

January 28, 2016 Planning Team Meeting: Sign-In Sheet



January 28, 2016 Planning Team Meeting: Presentation

City of Orange
Hazard Mitigation Plan
Planning Team Meeting
January 28, 2016



- Assembly Bill 2140 prohibits the state share for any eligible project from exceeding 75% of total state eligible costs unless the local agency is located within a city, county, or city and county that *has adopted a local hazard mitigation plan* in accordance with the federal Disaster Mitigation Act of 2000 *as part of the safety element of its general plan*, in which case the Legislature may provide for a state share of local costs that exceeds 75% of total state eligible costs.

AB 2140
(CA Government Code Sections 85302.6 / 8685.9)

7

- Local governments have a responsibility to protect the health, safety, and welfare of their citizenry
- Proactive mitigation efforts help reduce risk and create safer, more disaster resilient communities.
- Mitigation is an investment in Orange's future safety and sustainability.
- Compliance with the Code of Federal Regulations plan requirements for future hazard mitigation grant funding
- Incorporate the hazard section of the HMP into the General Plan Safety Element

Objectives of Hazard Mitigation Planning

8

- FEMA created a Plan Review Guide in October 2011, including a plan review tool which lists the requirements
- FEMA also developed a Local Mitigation Planning Handbook which was revised in March 2013.

Local Mitigation Plan Review Tool

9

- You have been selected to be on the Planning Team to help revise the plan because of your knowledge and expertise.
- You have the knowledge and/or authority to implement the mitigation strategies developed in the planning process.

The Planning Team

10

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- Review and determine mitigation strategies.
- Assist with opportunities in outreach for stakeholder agencies and the public
- Review plan prior to submittal for state and FEMA approval and local adoption.
- Implement the plan, monitor its impact, and prepare for future revisions of the HMP

Planning Team Role

11

- Document how the plan was prepared, and who was involved in the process.
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- Incorporate existing plans, studies, reports, and technical information.
- Develop a method and schedule for keeping the plan current.

Planning Process

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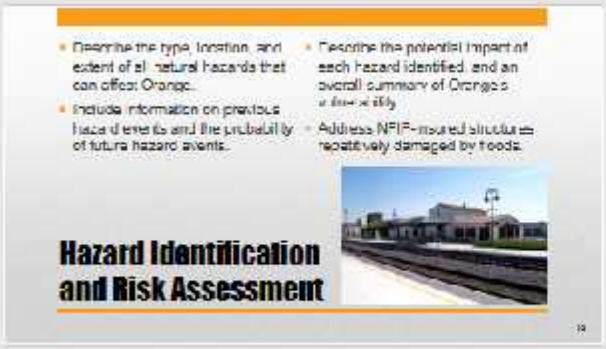

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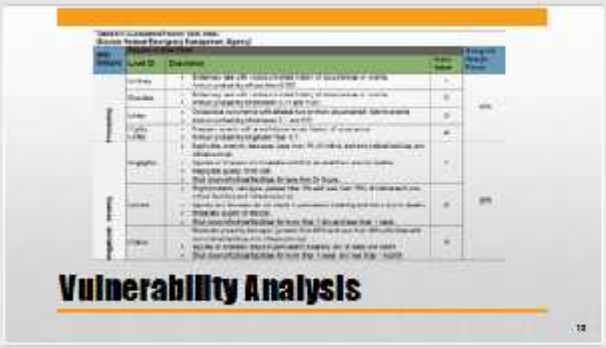

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City of Orange
Hazard Mitigation Plan
Planning Off Meeting
January 28, 2016

January 28, 2016 Planning Team Meeting: Minutes

City of Orange Hazard Mitigation Planning Meeting Minutes

January 28, 2016 9:00 AM – 11:00 AM

Date, Time and Location. The City of Orange Hazard Mitigation Planning Meeting was held on Thursday, January 28, 2015 from 9:00 AM – 11:00 AM at the City of Orange, Fire Department Headquarters. Attendees (see Appendix A for a full list) included representatives from the following:

- City Manager's Office
- Community Development Department
- Community Services Department
- Economic Development
- Finance Department
- Fire Department
- Police Department
- Public Works Department

Meeting Purpose. The purpose of the Planning Meeting was to provide an opportunity to review the hazard mitigation planning process, identify stakeholders, identify plans with hazards information, and prioritize hazards. The Planning Meeting agenda is in Appendix B.

Overview of Meeting Activities

Discussion Overview. The Planning Team worked on worksheets from the FEMA Local Mitigation Planning Handbook. The worksheets include:

- Worksheet 2.1: Mitigation Planning Team Worksheet – The Planning Team are confident that the appropriate city staff and agencies are represented on the Planning Team however, stakeholders were identified for future collaboration. Stakeholders include special districts and authorities, non-governmental organizations, state agencies, federal agencies, and other local organizations.
- Worksheet 3.1: Sample Mitigation Public Opinion Survey – It is important to include public opinion on hazard mitigation and the group decided to develop a survey for Orange community members. The survey will be posted on the city website, sent out via iWatch, distributed at CERT meetings/trainings, and to City of Orange Amateur Radio volunteers.
- Worksheet 4.1 Capability Assessment Worksheet – Local mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. The Planning Team completed tables and answered questions in the worksheet.

- Worksheet 4.2: Safe Growth Audit – This worksheet was used to identify gaps in the City of Orange's growth guidance instruments and improvements that could be made to reduce vulnerability to future development.
- Worksheet 4.3: National Flood Insurance Program – This worksheet was used to collect information the City of Orange's community participation in and continued compliance with the NFIP, as well as identify areas for improvement that could be potential migration actions.
- Worksheet 5.1 Hazard Summary Worksheet – The Planning Team reviewed natural disasters and identified which hazards are most significant to the City of Orange. They are as follows (in order):
    1. Earthquake
    2. Wildfire
    3. Severe Wind
    4. Flood
    5. Landslide
    6. Extreme Heat
    7. Erosion
    8. Drought
    9. Dam Failure
    10. Lightening
    11. Expansive Soils

Action Items

The following is a list of action items, responsible party and due date.

Action Items	Responsible Party	Due
Send out action items to planning team	WHS	1/29/16
Send out a Doodle Poll to schedule the next planning meeting in one month	WHS	2/1/16
Compile maps of critical infrastructure (buildings, railroads, roads, pipelines), liquefaction, 100 and 500 year flood, and fire history on a flash drive or CDROM for consultant	Neil Millward	2/3/16
Provide Floodplain Management Plan to consultant	Frank Sun	2/3/16
Provide a copy of the City's 2012 Emergency Operations Plan to consultant	Alan Velasco	2/3/16
Provide Windshield Survey Plan and General Plan Safety Section to consultant	Casey Fieldhouse	2/3/16
Provide contact information for stakeholders identified in Worksheet 2.1.	All	2/3/16
Obtain a copy of the County of Orange Multi-Jurisdiction Multi-Hazard Mitigation Plan and Emergency Operations Plan for internal reference	Alan Velasco	2/5/16
Develop draft community hazard mitigation survey based off of Worksheet 3.1 of FEMA guidance and send to consultant	Paul Sitkoff	2/11/16
Review and revise draft community hazard mitigation survey	WHS	2/25/16
Planning team will review and approve survey at the next meeting	All	Next Meeting

Attendee List

Name	Organization	Phone Number	E-Mail
Jennifer Amat	Police Department	714.325.1423	jamat@orangepd.org
Katrin Bandhauer	Finance	714.744.2251	kbandhauer@cityoforange.org
Bill Crouch	Community Development	714.744.7021	wcrouch@cityoforange.org
Casey Fieldhouse	Fire Department	714.288.2550	cfieldhouse@cityoforange.org
Lisa Kim	Economic Development / City Manager's Office	714.744.2207	lkim@cityoforange.org
Neil Millward	Public Works		nmillward@cityoforange.org
Paul Sitkoff	Community Services	714.288.2590	psitoff@cityoforange.org
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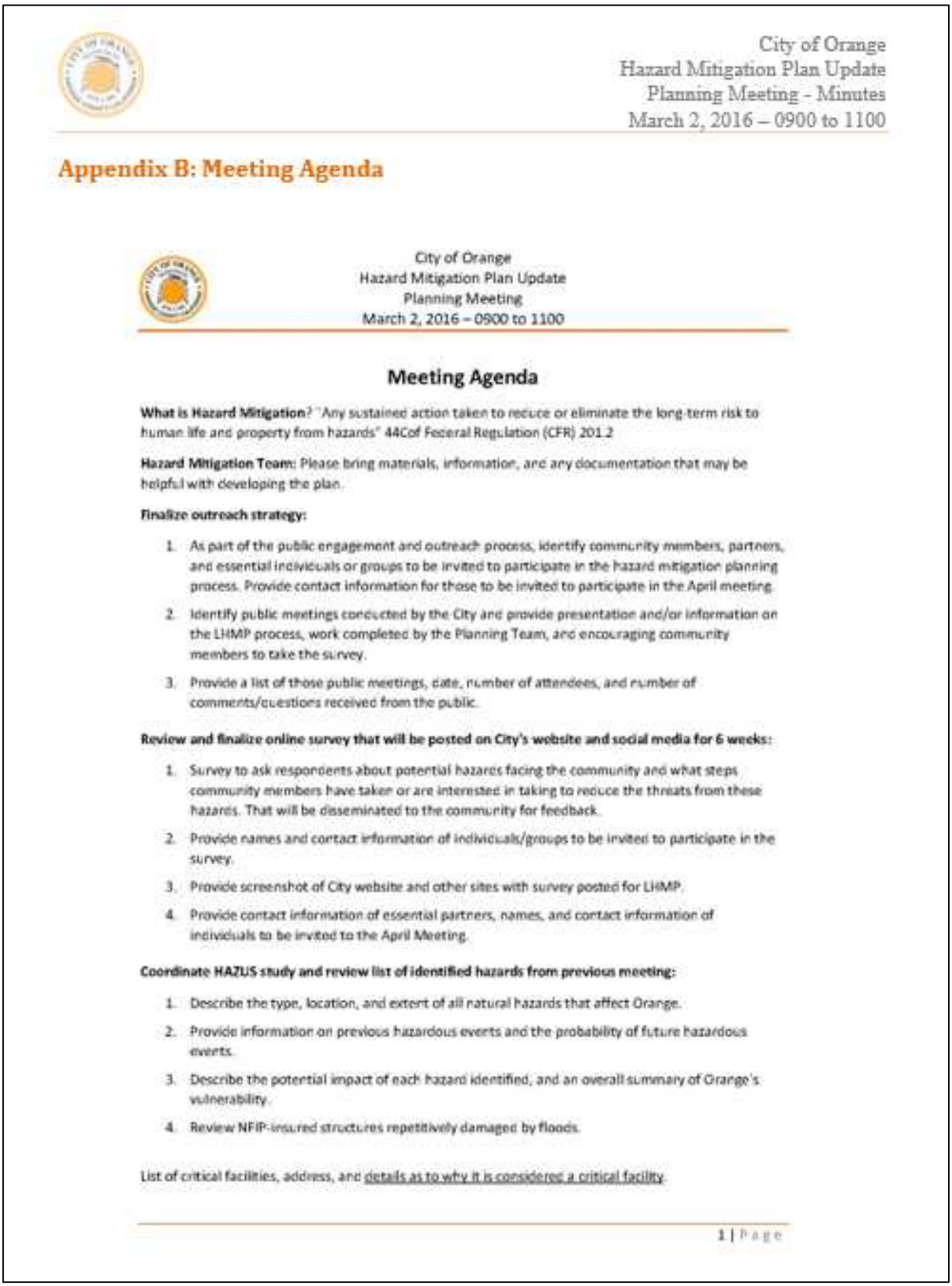
Jack Thomas	Fire Department	714.288.2501	jthomas@cityoforange.org
Alan Velasco	Fire Department	714.915.7873	avelasco@cityoforange.org
Pete Goodrich	Community Development	714.744.7201	pgoodrich@cityoforange.org
Lan Nguyen	WHS	714.299.6272	Lan.nguyen@willdan.com
Ellen Lopez	WHS		elopez562@icloud.com

March 2, 2016 Planning Team Meeting: Agenda



City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
March 2, 2016 – 0900 to 1100

Appendix B: Meeting Agenda

City of Orange
Hazard Mitigation Plan Update
Planning Meeting
March 2, 2016 – 0900 to 1100

Meeting Agenda

What is Hazard Mitigation? "Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards" 44Cof Federal Regulation (CFR) 201.2

Hazard Mitigation Team: Please bring materials, information, and any documentation that may be helpful with developing the plan.

Finalize outreach strategy:

1. As part of the public engagement and outreach process, identify community members, partners, and essential individuals or groups to be invited to participate in the hazard mitigation planning process. Provide contact information for those to be invited to participate in the April meeting.
2. Identify public meetings conducted by the City and provide presentation and/or information on the LHMP process, work completed by the Planning Team, and encouraging community members to take the survey.
3. Provide a list of those public meetings, date, number of attendees, and number of comments/questions received from the public.

Review and finalize online survey that will be posted on City's website and social media for 6 weeks:

1. Survey to ask respondents about potential hazards facing the community and what steps community members have taken or are interested in taking to reduce the threats from these hazards. That will be disseminated to the community for feedback.
2. Provide names and contact information of individuals/groups to be invited to participate in the survey.
3. Provide screenshot of City website and other sites with survey posted for LHMP.
4. Provide contact information of essential partners, names, and contact information of individuals to be invited to the April Meeting.

Coordinate HAZUS study and review list of identified hazards from previous meeting:

1. Describe the type, location, and extent of all natural hazards that affect Orange.
2. Provide information on previous hazardous events and the probability of future hazardous events.
3. Describe the potential impact of each hazard identified, and an overall summary of Orange's vulnerability.
4. Review NFIP-insured structures repetitively damaged by floods.

List of critical facilities, address, and details as to why it is considered a critical facility.

1 | Page

March 2, 2016 Planning Team Meeting: Sign-In Sheet

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
March 2, 2016 – 0900 to 1100

Appendix A: Sign in Sheet

City of Orange
Hazard Mitigation Plan Update
Planning Meeting
March 2, 2016

Initial	Last Name	First Name	Title	Department	Phone	Email
	Arnu	Jennifer	Sergeant	Police Dept, Homeland Security/Emergency Management	(714) 525-1422	jarnu@orangepd.org
	Banchauer	Katrin	Assistant Finance Director	Finance Accounting	(714) 744-7251	kbanchauer@cityoforange.org
	Crouch	Bill	Director	Community Development	(714) 744-7021	wcrouch@cityoforange.org
CF	Fieldhouse	Casey	Deputy fire Marshall/PIO	Fire Department	(714) 288-2550	cfieldhouse@cityoforange.org
	Goodrich	Peter	Chief Building Official	Building	(714) 744-7206	pgoodrich@cityoforange.org
	Hill	Lisa	Economic Development Manager	City Manager/Council	(714) 744-7207	lhill@cityoforange.org
NM	Millward	Neil	GIS Coordinator	Public Works, Subdivision/GIS		nmillward@cityoforange.org
	Rosauer	Eric	Lieutenant	Police Department	(714) 936-8957	erosauer@orangepd.org
	Sitkoff	Pau	Bus/PA Manager/PIO	Community Services	(714) 288-2590	psitkoff@cityoforangy.org
	Stefano	Robert	Deputy Chief	Fire Department	(949) 533-2049	rstefano@cityoforange.org
	Sun	Frank	Deputy Director/City Engineer	Public Works	(714) 744-5529	fsun@cityoforange.org
	Thomas	Jack	Chief	Fire Department	(714) 288-2501	jthomas@cityoforange.org
	Velasco	Alan	Captain	Fire Department	(714) 915-7873	avelasco@cityoforange.org

8 | Page

March 2, 2016 Planning Team Meeting: Presentation

March 2, 2016 Planning Team Meeting: Minutes

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
March 2, 2016 – 0900 to 1100

Attendees

Name	Department	Email	Phone #
Jennifer Amat	Police	jamat@orangepd.org	714.325.1423
Casey Fieldhouse	Fire	cfieldhouse@cityoforange.org	714.288.2550
Peter Goodrich	Building	pgoodrich@cityoforange.org	714.744.7200
Shadi Kia	Willdan	skia@willdan.com	714.940.6356
Lisa Kim	City Manager/Council	lkim@cityoforange.org	714.744.2207
Ellen Lopez	Willdan	Elopez562@icloud.com	562.252.5358
Neil Millward	Public Works/GIS	nmillward@cityoforange.org	714.744.5544
Paul Sitkoff	Community Services	psitkoff@cityoforange.org	714.288.2590
Frank Sun	Public Works	fsun@cityoforange.org	714.744.5529
Alan Velasco	Fire	avelasco@cityoforange.org	714.915.7873

Next Meeting(s)

- Planning Meeting (TBD)
  - A Doodle Poll will be sent to participants to determine the best date and time for the next planning meeting.

Acronyms

Acronym	Definition	Acronym	Definition
CERT	Community Emergency Response Team	LHMP	Local Hazard Mitigation Process
FEMA	Federal Emergency Management Agency	NFIP	National Flood Insurance Program
GIS	Geographical Information System	OCEMO	Orange County Emergency Management Organization
HAZMIT	Hazard Mitigation	PIO	Public Information Officer
HAZUS	Hazards Unites States	RACES	Radio Amateur Civil Emergency Service

1 | Page

Meeting Notes

Topic/Task	Discussion	Responsible Party
Finalize Outreach Strategy	Planning Team members identified a list of community members, partners, and essential individuals and groups to be invited to participate in the April meeting. • Please see pages 6 & 7 for current list • Review and update any missing/incorrect information • Provide any additional partners not previously identified	Planning Team • All
	As part of the Outreach Strategy, the Planning Team has been tasked with identifying and providing presentations or other information/materials from any public meetings conducted by the City where any aspect of the LHMP process is discussed. The following have been noted: • OCEMO Monthly meeting o March 3, 2016 o 50 participants present o Planning process shared during roundtable discussion • City Council weekly meeting The following information must be captured for each meeting: • Name of meeting • Date • Number of attendees • Number of comments/questions received from the public	Planning Team • All
Review and Finalize Online Survey	The Planning Team has indicated that the content of the online survey must still be modified/updated and approved before it can be posted to any website. The Planning Team has been made aware that the survey must be posted for a duration of six weeks. • Alan has been tasked with sending out a memo regarding the survey with a deadline of a week from today	Planning Team • Alan • Lisa

Topic/Task	Discussion	Responsible Party
	• Lisa will include the memo in the weekly City Council briefing • The Planning Team has agreed to finalize the survey and have it posted within two weeks • Please see pages 6 & 7 for current list of partners who will be invited to participate in the survey • Provide screenshot of City website and any other sites with the survey posted	
Social Media	The survey can also be posted on social media sites. The City of Orange utilizes the following social media outlets: • Facebook o Posted to 6 x a week o Local and community information • Nextdoor o Critical information for public to know • Twitter o Local and community information • Instagram o Fun feel good pictures • Youtube o City videos • Provide screenshot of any social media sites with the survey posted	Planning Team • All
HAZUS/GIS Study	A HAZUS study will be conducted for the City of Orange. The following disasters have been identified as the focus of the study: • Earthquake – 7.0 magnitude o Newport/Inglewood Fault o San Andreas Fault • Fire o Statistical Wildfire	WHS
Identified Hazards	The Planning Team has been tasked with providing information/data on any disasters/hazards that have impacted the City of Orange. The information requested is as follows:	Planning Team • Alan • Neil • Jennifer

Topic/Task	Discussion	Responsible Party

	• Budgetary reports/annual reports such as the City's Comprehensive Financial Annual Report and Adopted Annual Report
	• Any reports that specify what mitigation activities and planning are currently in place as well as any preventative measures taken by the City
	  o The Planning Team has indicated that many of the requested reports can be located on the City's website
	• Disaster proclamation for the City
	  o Resolution number and year
	• Any deaths resulting from any hazard in the City
	• Probability of future hazardous events and possible impact
	• List of critical facilities that include
	  o Address
	  o Details as to why it is considered a critical facility
	
	In response to Ellen's questions, the Planning Team also provided the following City related information:
	
	• Railroads
	  o Orange Subdivision
	  o BNSF Railway (Freight)
	• Flooding - None
	• Drought
	  o Water division financial impact
	  o Sanitation – 22% less revenue
	  o Provide revenue impact report
	• No water treatment plan
	• Pump stations (provide list)
	• Drinking water comes from reservoirs
	• Water distribution – City's own pipeline, distribution facility
	  o Provide details on how water distribution works
	  o Maintenance and repairs
	  o How much water, provide breakdown
	• Sewage handled through Orange County Sanitation district
		• Paul

Topic/Task	Discussion	Responsible Party
	○ Fee is added to resident's bill • Train Derailment ○ Catastrophic freight ○ 3 historic photos are available (took place sometime between the 1930 – 1970) • Airplane crashes – None • Civil unrest – None • Terrorism ○ Domestic Terrorist Groups ▪ KKK ▪ Sovereign Citizens ○ Caltrans Active Shooter Incident ○ San Bernardino Active Shooter Incident ○ FBI Facility (Possible target) • Nuclear ○ Isotopes – 3 locations • Oil Spill/Damage ○ Kinder Morgan Petroleum tank farm explosion ○ Facility damage ○ Provide probability of future hazardous event	

Deadlines/Additional Information

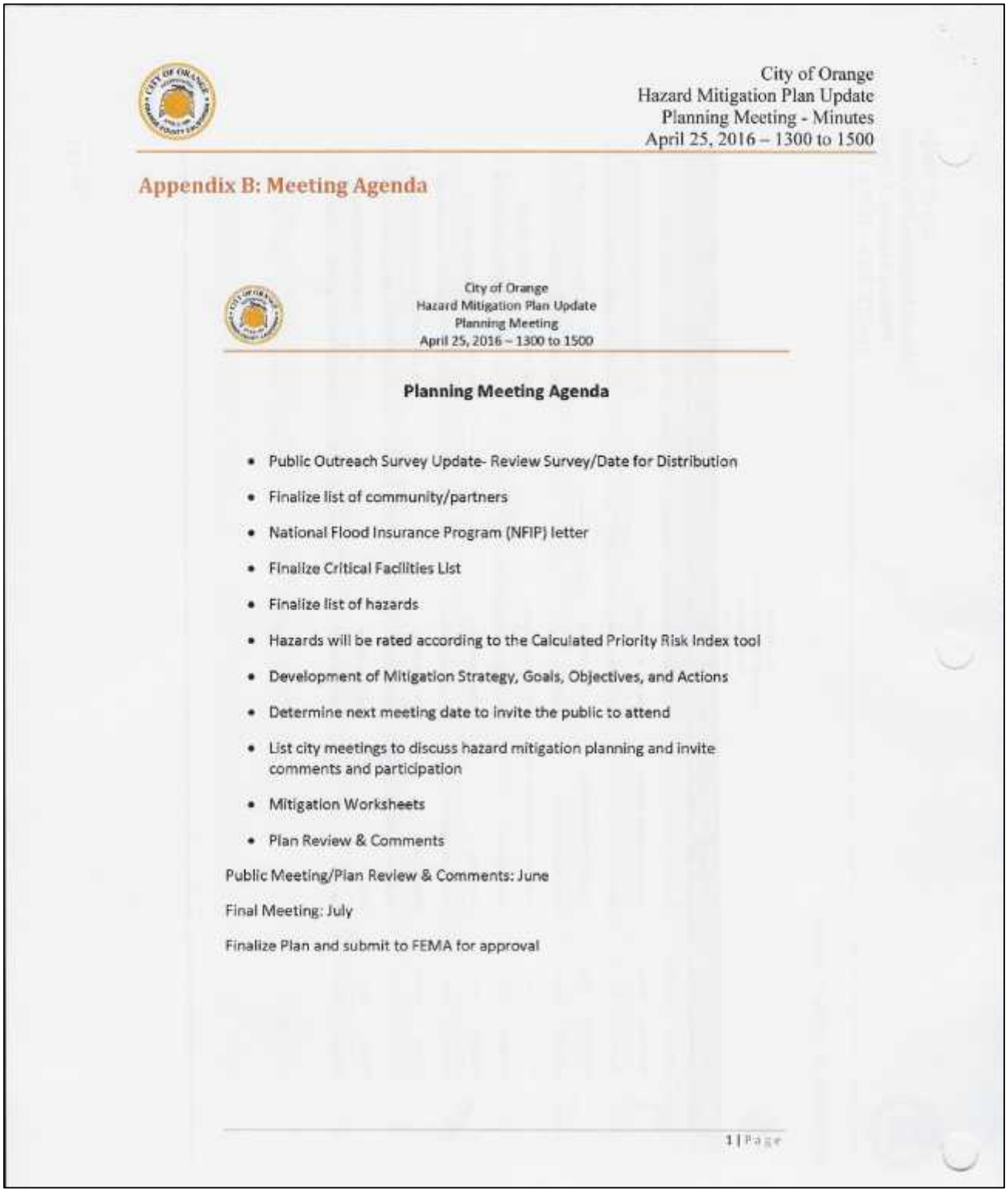
- All requested information due to Ellen by 3/11/16
- Survey finalized and out to the public by 3/18/16
- Survey must run for a six consecutive weeks
- Ellen available to meeting one on one
- A Doodle poll will be sent out to determine the date and time of the April planning meeting
- Mitigation strategies – Ellen will provide additional guidance in regards to the specific information she is requesting from the Planning Team

List of Partners

Organization	Point of Contact	Email	Phone
Access/Functional Needs Groups			
CalTrans			
CERT/Volunteer Groups	Jennifer Amat	jamat@orangepd.org	714.325.1423
Chapman University	Linda Padilla-Smyth	padillas@chapman.edu	714.744.7862
CHOC Childrens Hospital	Calvin Fakkema		714.509.8335
Doubletree Hotels	Denise Pflum		714.634.7140
Elks Lodge			
Green Law Partner	Scott Murray	scott@greenlawpartners.com	949.331.1338
Holy Family Cathedral School	Kathleen McDonald	kmcdonald@holyfamilyk8.org	714.538.6012 ext. 301
Kiwanis Club			
Kinder Morgan			
Libraries (3)			
Local Historical Committees			
Metrolink			
National Guard			
National Oilwell Varco	Dave Ramos	david.ramos@nov.com	714.456.1322
OCHCA	Mike Steinkraus	msteinkraus@ochca.com	714.834.3125
OCTA	Katrina Faulkner		

Organization	Point of Contact	Email	Phone
Orange Lutheran High School			
OUSD	Joe Sorrera	joes@orangeusd.org	714.628.4479
Rancho Santiago Community College District			
Santiago Canyon College			
SC Fuels	De Holbrook	holbrookd@scfuels.com	714.516.7273
Shelters (Other than High Schools)			
SoCal Gas Company			
Southern California Edison	Tony Caruso		562.518.2509
St. John's Lutheran Church	Robin Gomes	rgomes@stjohnsorange.org	714.288.4406
St. Joseph Hospital	Nicola Harwood		714.771.8000 ext. 13678
St. Norbert Catholic Church	Fr. Patrick Rudolph	frprudolph@stnorbertchurch.org	714.637.6822
St. Paul's Lutheran Church	Katherine Masterson	kmasterson@stpaulsorange.org	714.921.3188 ext. 201
Stadium Promenade	Bill Vierra	bill_vierra@sywest.com	415.448.8321
The Outlets at Orange	Kristin Elfring	kelfring@simon.com	714.923.9922
The Village at Orange	Jeff Axtell	jaxtell@vestar.com	562.938.1722
Toll Roads	Sarah King		949.754.3417
UCI Medical	Joe Reiss	jreiss@uci.edu	

April 25, 2016 Planning Team Meeting: Agenda



City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
April 25, 2016 – 1300 to 1500

Appendix B: Meeting Agenda

City of Orange
Hazard Mitigation Plan Update
Planning Meeting
April 25, 2016 – 1300 to 1500

Planning Meeting Agenda

- Public Outreach Survey Update- Review Survey/Date for Distribution
- Finalize list of community/partners
- National Flood Insurance Program (NFIP) letter
- Finalize Critical Facilities List
- Finalize list of hazards
- Hazards will be rated according to the Calculated Priority Risk Index tool
- Development of Mitigation Strategy, Goals, Objectives, and Actions
- Determine next meeting date to invite the public to attend
- List city meetings to discuss hazard mitigation planning and invite comments and participation
- Mitigation Worksheets
- Plan Review & Comments

Public Meeting/Plan Review & Comments: June

Final Meeting: July

Finalize Plan and submit to FEMA for approval

1 | Page

April 25, 2016 Planning Team Meeting: Sign-In Sheet

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
April 25, 2016 – 1300 to 1500

Appendix A: Sign in Sheet

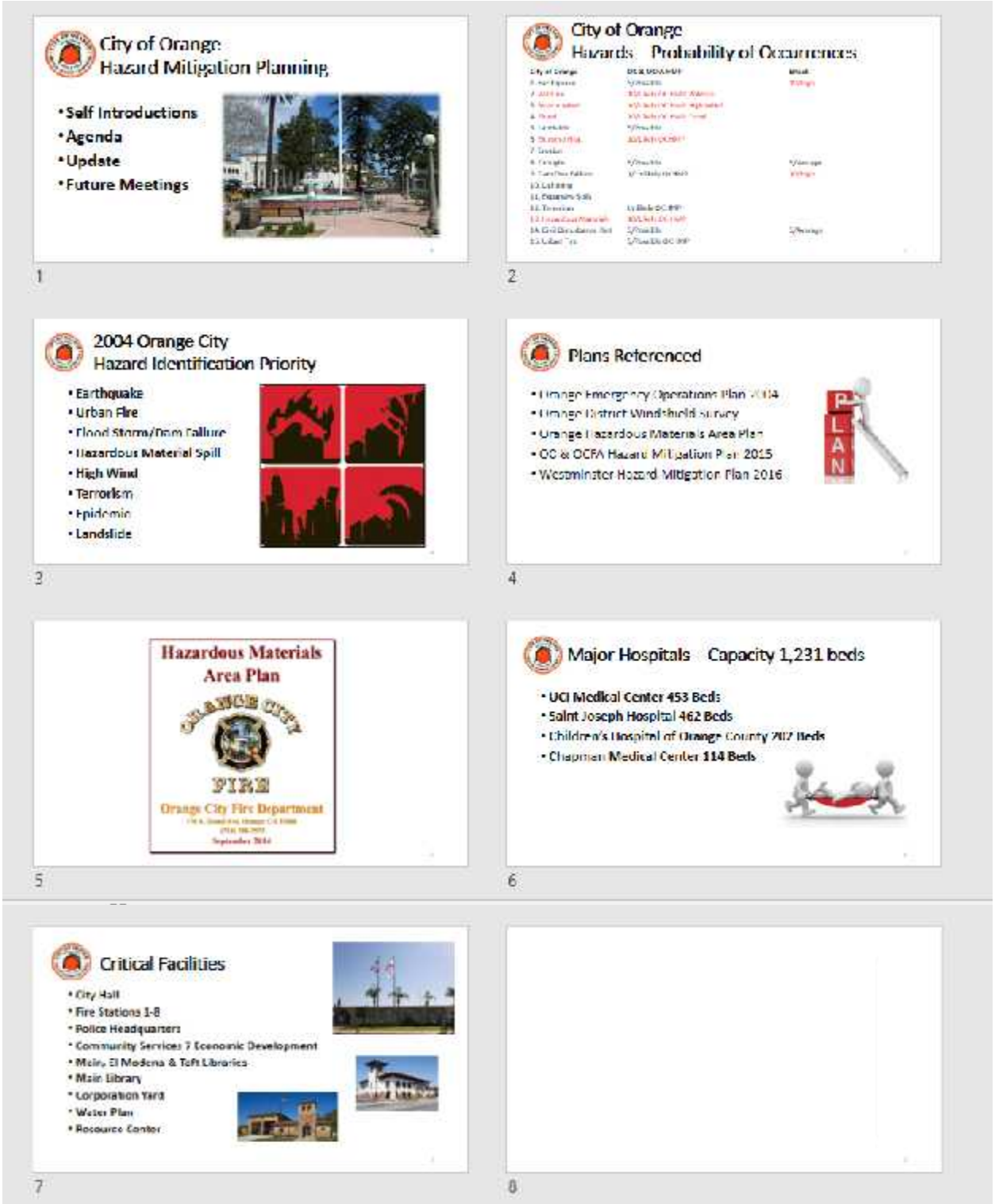
City of Orange
Hazard Mitigation Plan Update
Planning Meeting
April 25, 2016

Initial	Last Name	First Name	Title	Department	Phone	Email
	Amat	Jennifer	Sergeant	Police Dept. Homeland Security/Emergency Management	(714) 325-1423	
	Bardhouer	Katrin	Assistant Finance Director	Finance, Accounting	(714) 744-2251	
	Crouch	Bill	Director	Community Development	(714) 744-7021	
	Fieldhouse	Casey	Deputy Fire Marshal/PIO	Fire Department	(714) 288-2550	
	Goodrich	Peter	Chief Building Official	Building	(714) 744-7200	
	Kim	Lisa	Economic Development Manager	City Manager/Council	(714) 744-2207	
	Millward	Neil	GIS Coordinator	Public Works, Subdivision/GIS		
	Rosauer	Eric	Lieutenant	Police Department	(714) 936-0957	
	Silkoff	Paul	Bus/PA Manager/PIO	Community Services	(714) 288-2590	
	Stefano	Robert	Deputy Chief	Fire Department	(949) 533-2049	
	Sun	Frank	Deputy Director/City Engineer	Public Works	(714) 744-5529	
	Thomas	Jack	Chief	Fire Department	(714) 288-2501	
	Velasco	Alan	Captain	Fire Department	(714) 915-7873	

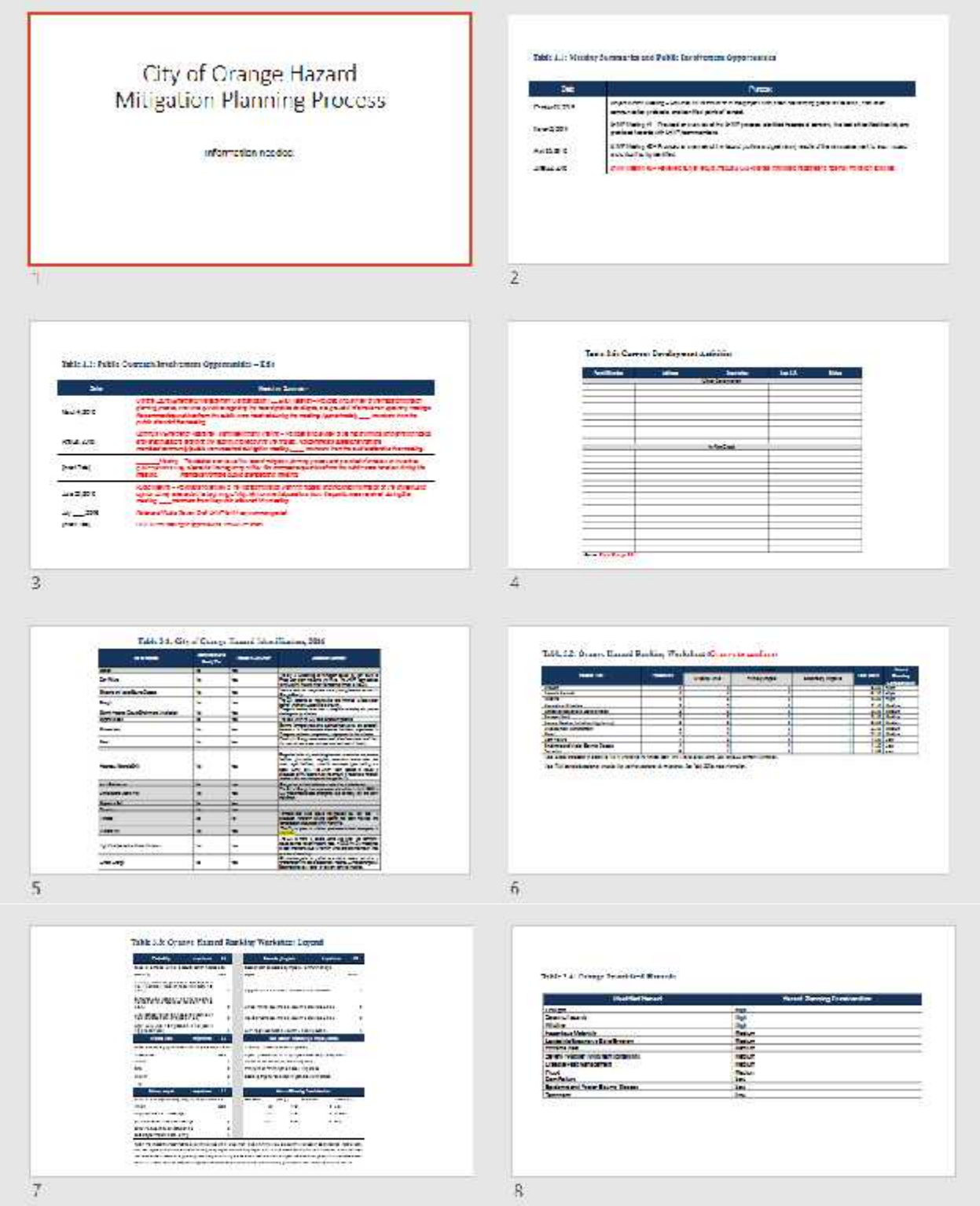
7 | Page

April 25, 2016 Planning Team Meeting: Presentation

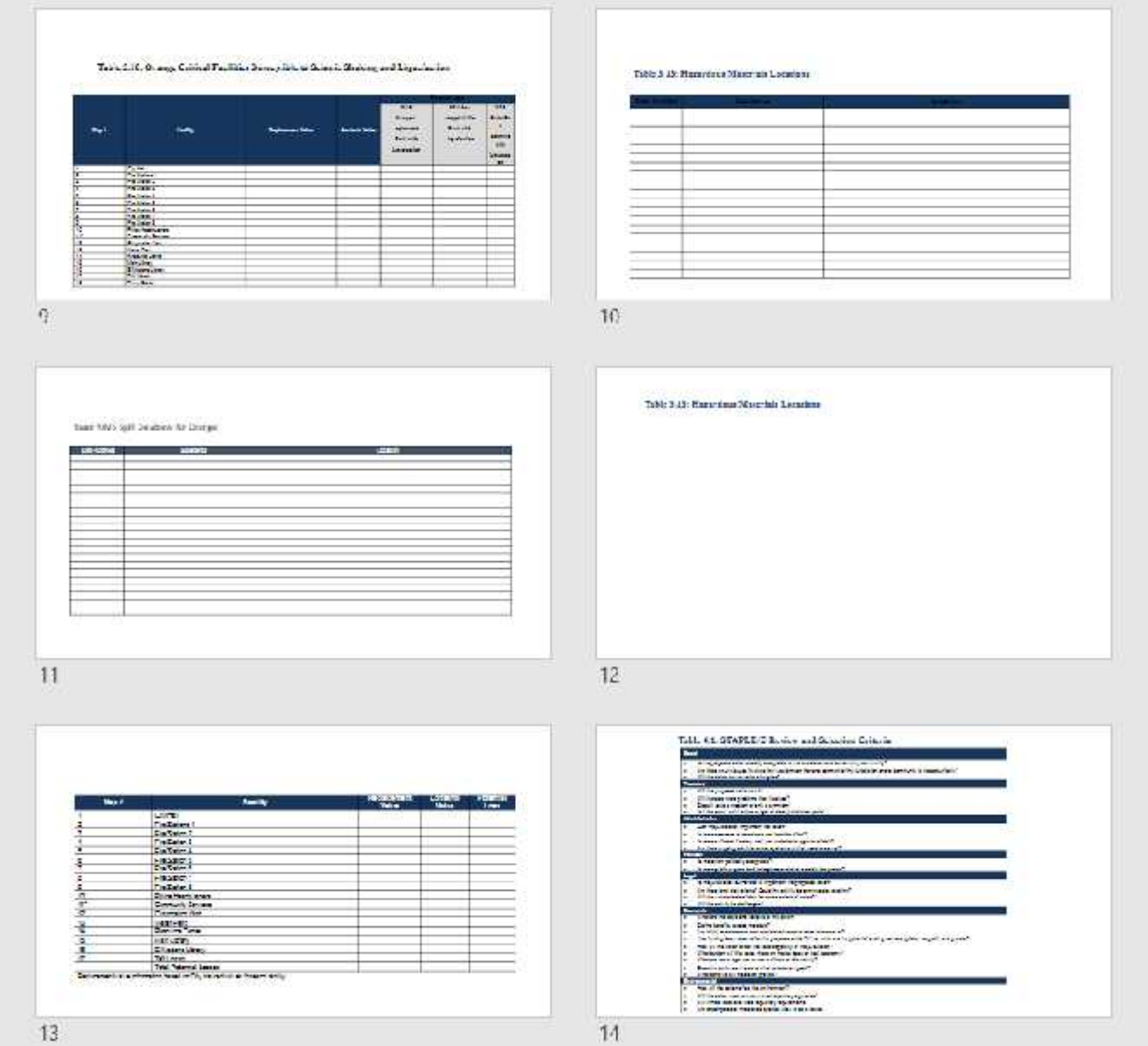
City of Orange
LHMP Planning Team Meeting
April 25, 2016



City of Orange
LHMP Planning Team Meeting
April 25, 2016



City of Orange
LHMP Planning Team Meeting
April 25, 2016



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12

13

14

April 25, 2016 Planning Team Meeting: Minutes

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
April 25, 2016 – 1300 to 1500

Attendees

Name	Department	Email	Phone #
Jennifer Amat	Police	jamat@orangepd.org	714.325.1423
Bill Crouch	Community Development	wcrouch@cityoforange.org	714.744.7021
Casey Fieldhouse	Fire	cfieldhouse@cityoforange.org	714.288.2550
Peter Goodrich	Building	pgoodrich@cityoforange.org	714.744.7200
Shadi Kia	Willdan	skia@willdan.com	714.940.6356
Ellen Lopez	Willdan	Elopez562@icloud.com	562.252.5358
Neil Millward	Public Works/GIS	nmillward@cityoforange.org	714.744.5544
Eric Rosauer	Police Department	erosauer@orangepd.org	714.936.0957
Paul Sitkoff	Community Services	psitkoff@cityoforange.org	714.288.2590
Frank Sun	Public Works	fsun@cityoforange.org	714.744.5529
Alan Velasco	Fire	avelasco@cityoforange.org	714.915.7873

Next Meeting(s)

- Planning Meeting (TBD)
  - A Doodle Poll will be sent to participants to determine the best date and time for the next planning meeting.
- Public Outreach Meeting (TBD)
  - A Doodle Poll will be sent to participants to determine the best date and time for the next planning meeting.

1 | Page

Acronyms

Acronym	Definition	Acronym	Definition
CERT	Community Emergency Response Team	LHMP	Local Hazard Mitigation Process
FEMA	Federal Emergency Management Agency	NFIP	National Flood Insurance Program
GIS	Geographical Information System	OCEMO	Orange County Emergency Management Organization
HAZMIT	Hazard Mitigation	PIO	Public Information Officer
HAZUS	Hazards Unites States	RACES	Radio Amateur Civil Emergency Service

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
April 25, 2016 – 1300 to 1500

Meeting Notes

Topic/Task	Discussion	Responsible Party
Public Outreach Survey Update/Date of Distribution	City manager has reviewed the survey, made revisions, and it has been sent to City Council for notification and should be posted online by the following week. • Survey posted on Wednesday, May 4, 2016 • Posted on City Website, Facebook, Twitter, and Nextdoor (screenshots provided) • Six-week review period for comment submissions (approx. June 15, 2016) • Meeting will be scheduled to review comments and implement into the plan, Shadi to send out Doodle Poll for the week of the 20th and 27th	Planning Team: • Paul WHS
Finalize list of Community Partners	• Review and update missing information in spreadsheet (see pages 5 and 6 for current list) • Public meeting invitation letter regarding the City of Orange LHMP will be sent out to the Community Partners listed o Provide potential dates for Public Outreach meeting – May 27th or June 3rd o Ellen to facilitate, Planning Team member's/3 or 4 City officials present to answer any questions that may arise o Need to receive NFIP letter prior to meeting date o Alan to send letter requesting NFIP o Shadi to send out Doodle Poll o Alan to send out the invitation via email • Add LHMP as an agenda item to internal department meetings or any other public meetings conducted by the City • Will be added to Planning Commission as an agenda item • The following must be captured for each meeting: o Name of meeting o Date o Sign in sheet/roster or approved minutes o Number of comments/questions received	Planning Team • All • Alan • Bill WHS

3 | Page

Topic/Task	Discussion	Responsible Party
Critical Facilities List	Ellen pulled critical facilities information from maps provided by Neil • Addresses needed for locations identified • Pump stations to be included in Hazus Study • Neil to provide required information	Planning Team • Neil
Finalize List of Hazards	Once the Hazus study is complete, the next step will be to rate the hazards according to the calculated priority risk tool. • Casey to provide HazMat Area Plan in word format	Planning Team • All • Casey
Development of Mitigation Strategy	Ellen to provide a mitigation strategy template to the planning team to revise to begin the mitigation process to develop goals, objectives, and actions. • Will be discussed at next planning meeting • Ellen will send out mitigation worksheets to planning team	Planning Team • Ellen

Deadlines/Additional Information

- A Doodle poll will be sent out to determine the date and time of the June planning meeting
- A Doodle poll will be sent out to determine the date and time of the Public Outreach meeting
- Send out NFIP request letter
- Send out Public Meeting invitation letter via email
- Ellen to send mitigation worksheets to planning team
- Allen and Jennifer to provide update on hospital bed counts

List of Partners

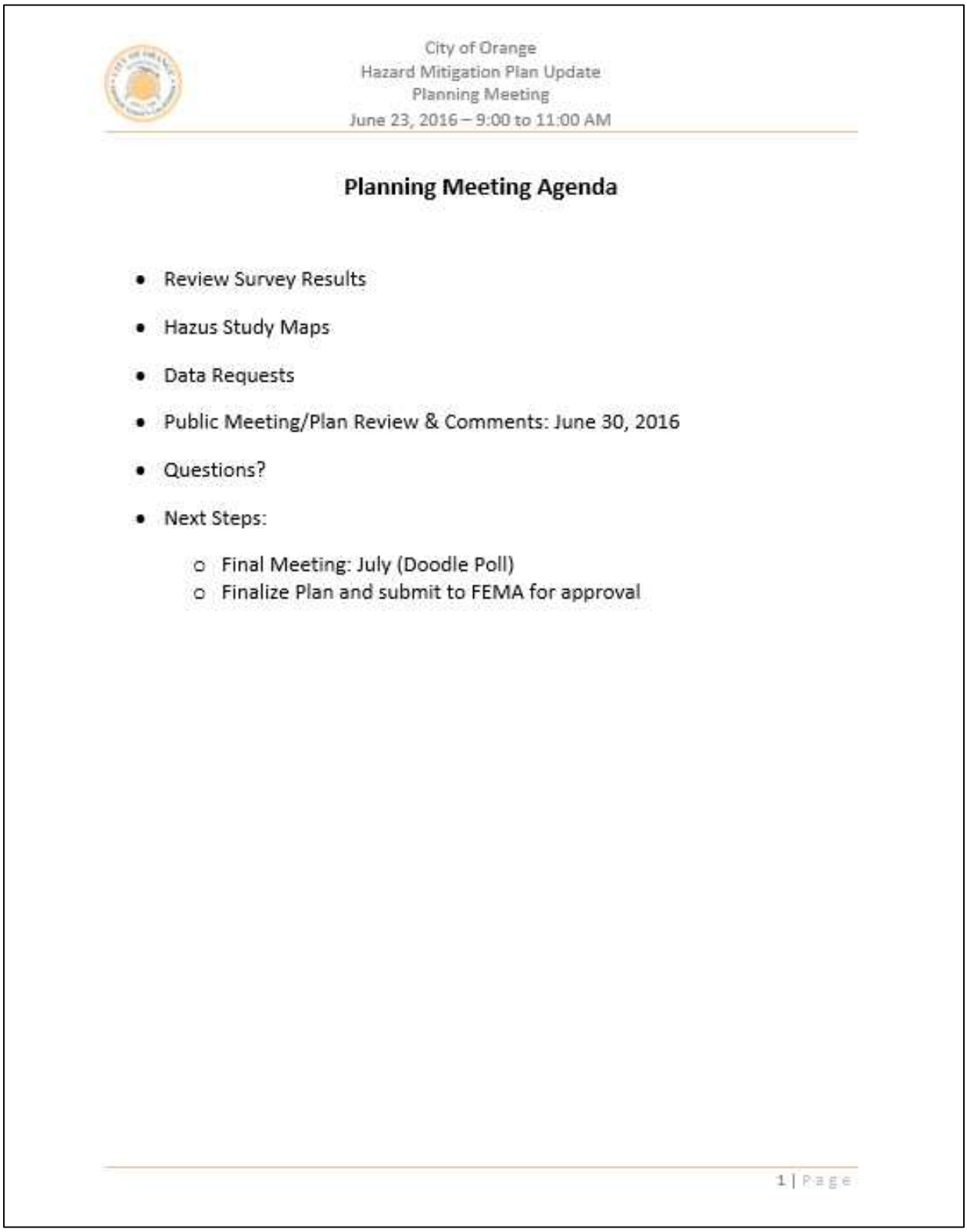
Organization	Point of Contact	Email	Phone
Access/Functional Needs Groups	Grace Zambrana-Sutton	oaadmin@ocsd.org	714.628.7054
CalTrans			
CERT/Volunteer Groups	Jennifer Amat	jamat@orangepd.org	714.325.1423
Chapman University	Linda Padilla-Smyth	padillas@chapman.edu	714.744.7862
CHOC Childrens Hospital	Calvin Fakkema		714.509.8335
Doubletree Hotels	Denise Pflum		714.634.7140
Elks Lodge			
Green Law Partner	Scott Murray	scott@greenlawpartners.com	949.331.1338
Holy Family Cathedral School	Kathleen McDonald	kmcdonald@holyfamilyk8.org	714.538.6012 ext. 301
Irvine Company			
Kiwanis Club			
Kinder Morgan			
Libraries (3)			
Metrolink	Fred Jackson	jacksonf@scrra.net	213.452.0200
National Guard			
National Oilwell Varco	Dave Ramos	david.ramos@nov.com	714.456.1322
OCHCA	Mike Steinkraus	msteinkraus@ochca.com	714.834.3125
OCTA	Katrina Faulkner		
OTPA			
Orange Lutheran High School			

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
April 25, 2016 – 1300 to 1500

Organization	Point of Contact	Email	Phone
Orange Parkade			
OUSD	Joe Sorrera	joes@orangeusd.org	714.628.4479
Rancho Santiago Community College District			
Santiago Canyon College	Don Maus	maus_donald@rsccd.edu	714.480.7330
SC Fuels	De Holbrook	holbrookd@scfuels.com	714.516.7273
SoCal Gas Company			
Southern California Edison	Tony Caruso	Anthony.caruso@sce.com	562.618.2509
St. John's Lutheran Church	Robin Gomes	rgomes@stjohnsorange.org	714.288.4406
St. Joseph Hospital	Nicola Harwood		714.771.8000 ext. 13678
St. Norbert Catholic Church	Fr. Patrick Rudolph	frprudolph@stnorbertchurch.org	714.637.6822
St. Paul's Lutheran Church	Katherine Masterson	kmasterson@stpaulsorange.org	714.921.3188 ext. 201
Stadium Promenade	Bill Vierra	bill_vierra@sywest.com	415.448.8321
The Outlets at Orange	Kristin Elfring	kelfring@simon.com	714.923.9922
The Village at Orange	Jeff Axtell	jaxtell@vestar.com	562.938.1722
Toll Roads	Sarah King		949.754.3417
UCI Medical	Joe Reiss	jreiss@uci.edu	

6 | Page

June 23, 2016 Planning Team Meeting: Agenda



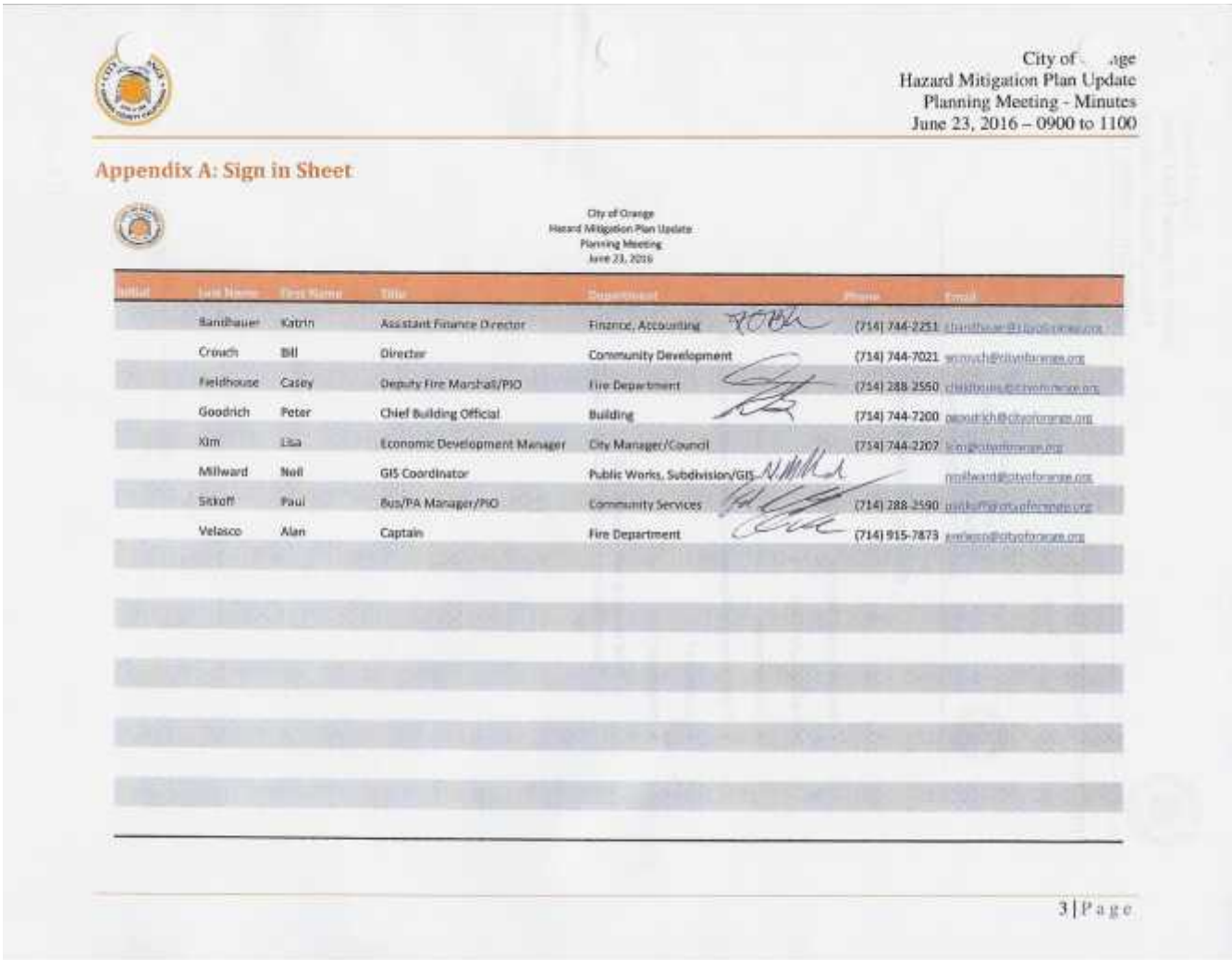
City of Orange
Hazard Mitigation Plan Update
Planning Meeting
June 23, 2016 – 9:00 to 11:00 AM

Planning Meeting Agenda

- Review Survey Results
- Hazus Study Maps
- Data Requests
- Public Meeting/Plan Review & Comments: June 30, 2016
- Questions?
- Next Steps:
  - Final Meeting: July (Doodle Poll)
  - Finalize Plan and submit to FEMA for approval

1 | Page

June 23, 2016 Planning Team Meeting: Sign-In Sheet



City of ...ge
Hazard Mitigation Plan Update
Planning Meeting - Minutes
June 23, 2016 – 0900 to 1100

Appendix A: Sign in Sheet

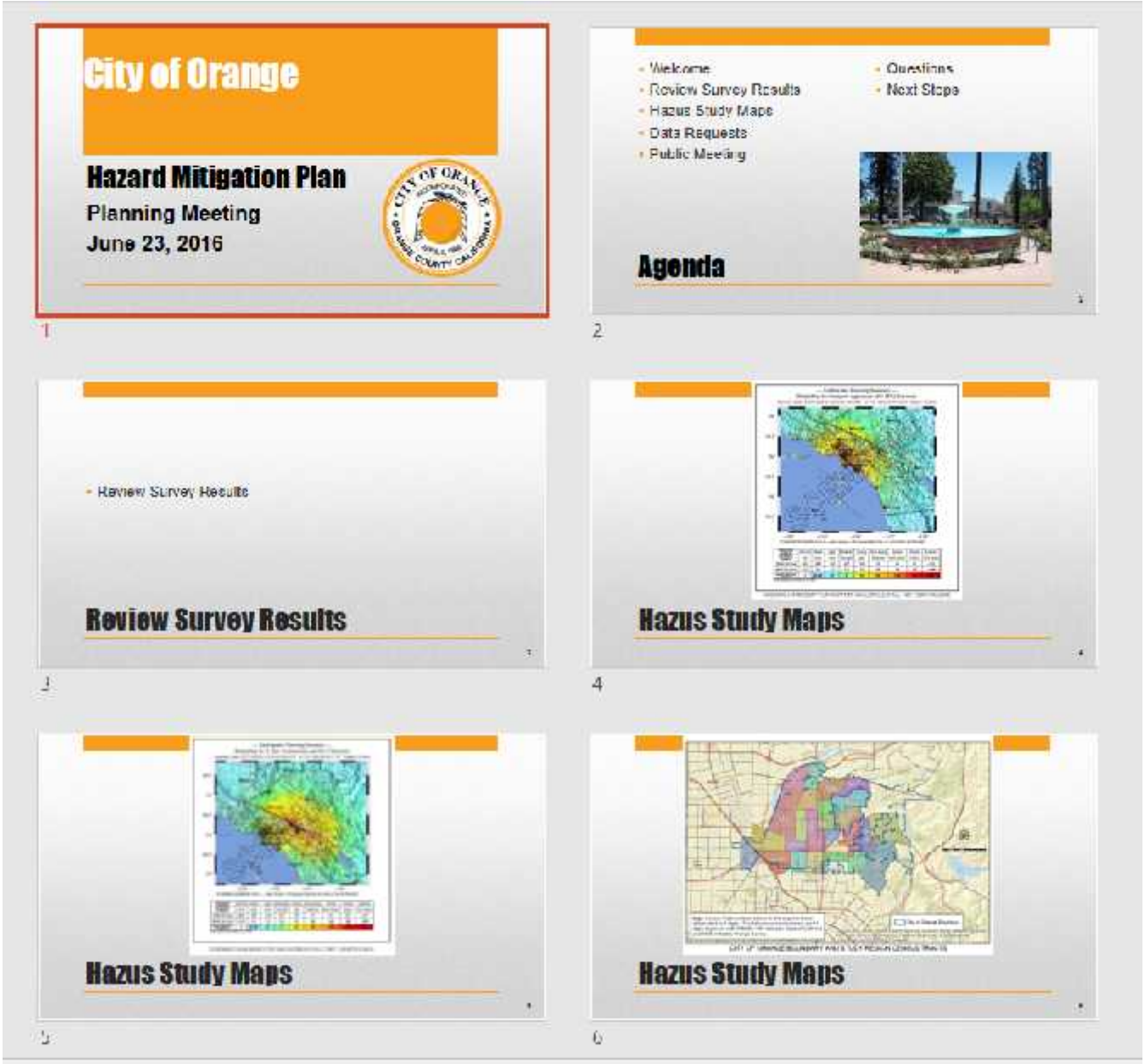
City of Orange
Hazard Mitigation Plan Update
Planning Meeting
June 23, 2016

Initial	Last Name	First Name	Title	Department	Phone	Email
	Bandbauer	Katrin	Assistant Finance Director	Finance, Accounting	(714) 744-2251	
	Crouch	Bill	Director	Community Development	(714) 744-7021	
	Fieldhouse	Casey	Deputy Fire Marshall/PIO	Fire Department	(714) 288-2550	
	Goodrich	Peter	Chief Building Official	Building	(714) 744-7200	
	Kim	Lisa	Economic Development Manager	City Manager/Council	(714) 744-2207	
	Millward	Neil	GIS Coordinator	Public Works, Subdivision/GIS		
	Sitkoff	Paul	Bus/PA Manager/PIO	Community Services	(714) 288-2590	
	Velasco	Alan	Captain	Fire Department	(714) 915-7873	

3 | Page

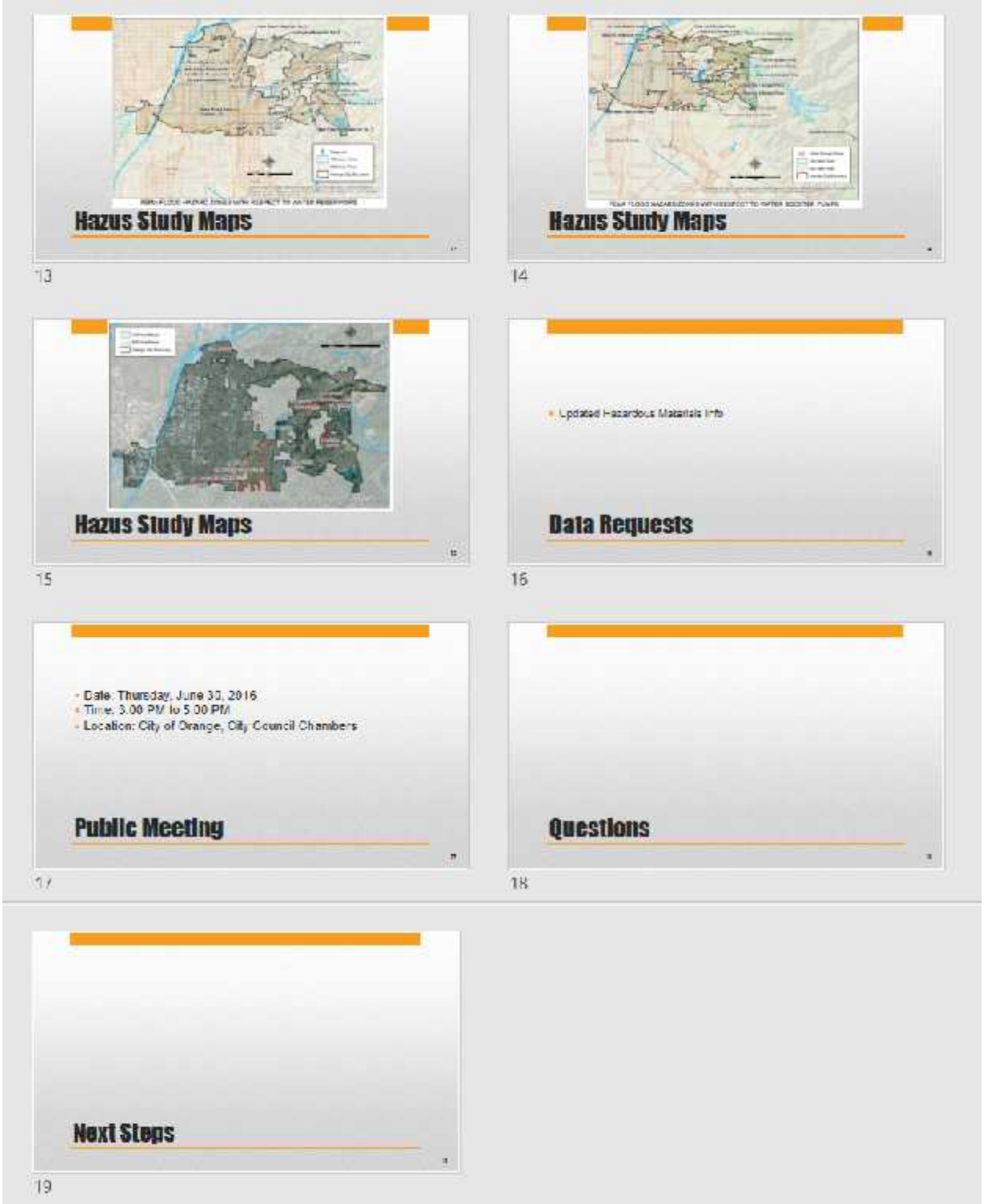
June 23, 2016 Planning Team Meeting: Presentation

City of Orange
LHMP Planning Team Meeting
June 23, 2016



City of Orange
LHMP Planning Team Meeting
June 23, 2016

City of Orange
LHMP Planning Team Meeting
June 23, 2016



June 23, 2016 Planning Team Meeting: Minutes

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
June 23, 2016 – 0900 to 1100

Attendees

Name	Department	Email	Phone #
Katrin Bandhauer	Finance	kbandhauer@cityoforange.org	714.744.2251
Casey Fieldhouse	Fire	cfieldhouse@cityoforange.org	714.288.2550
Peter Goodrich	Building	pgoodrich@cityoforange.org	714.744.7200
Shadi Kia	Willdan	skia@willdan.com	714.940.6356
Ellen Lopez	Willdan	Elopez562@icloud.com	562.252.5358
Neil Millward	Public Works/GIS	nmillward@cityoforange.org	714.744.5544
Paul Sitkoff	Community Services	psitkoff@cityoforange.org	714.288.2590
Alan Velasco	Fire	avelasco@cityoforange.org	714.915.7873

Next Meeting(s)

- Public Outreach Meeting (TBD)
  - Date: June 30, 2016
  - Time: 3:00 PM to 5:00 PM
  - Location: City Council Chambers
    300 E. Chapman Avenue
    Orange, CA 92866

Acronyms

Acronym	Definition	Acronym	Definition
FEMA	Federal Emergency Management Agency	HAZUS	Hazards Unites States
GIS	Geographical Information System	LHMP	Local Hazard Mitigation Process
HAZMIT	Hazard Mitigation	NFIP	National Flood Insurance Program

1 | Page

City of Orange
Hazard Mitigation Plan Update
Planning Meeting - Minutes
June 23, 2016 – 0900 to 1100

Meeting Notes

Topic/Task	Discussion	Responsible Party
Review Survey Results/Hazus Study Maps/Mitigation Forms	• Discuss public survey, request results of survey • Review maps in Hazus Study, Orange GIS Coordinator to provide higher resolution maps to replace various Hazus maps • The planning team reviewed and discussed the mitigation forms • The planning team ranked disasters pertaining to the city	Planning Team • Paul • Neil
Data Requests	See below for action items pertaining to data requests	All
Public Meeting/Plan Review	• The public meeting date and time have been confirmed	

Deadlines/Additional Information

Planning Team:

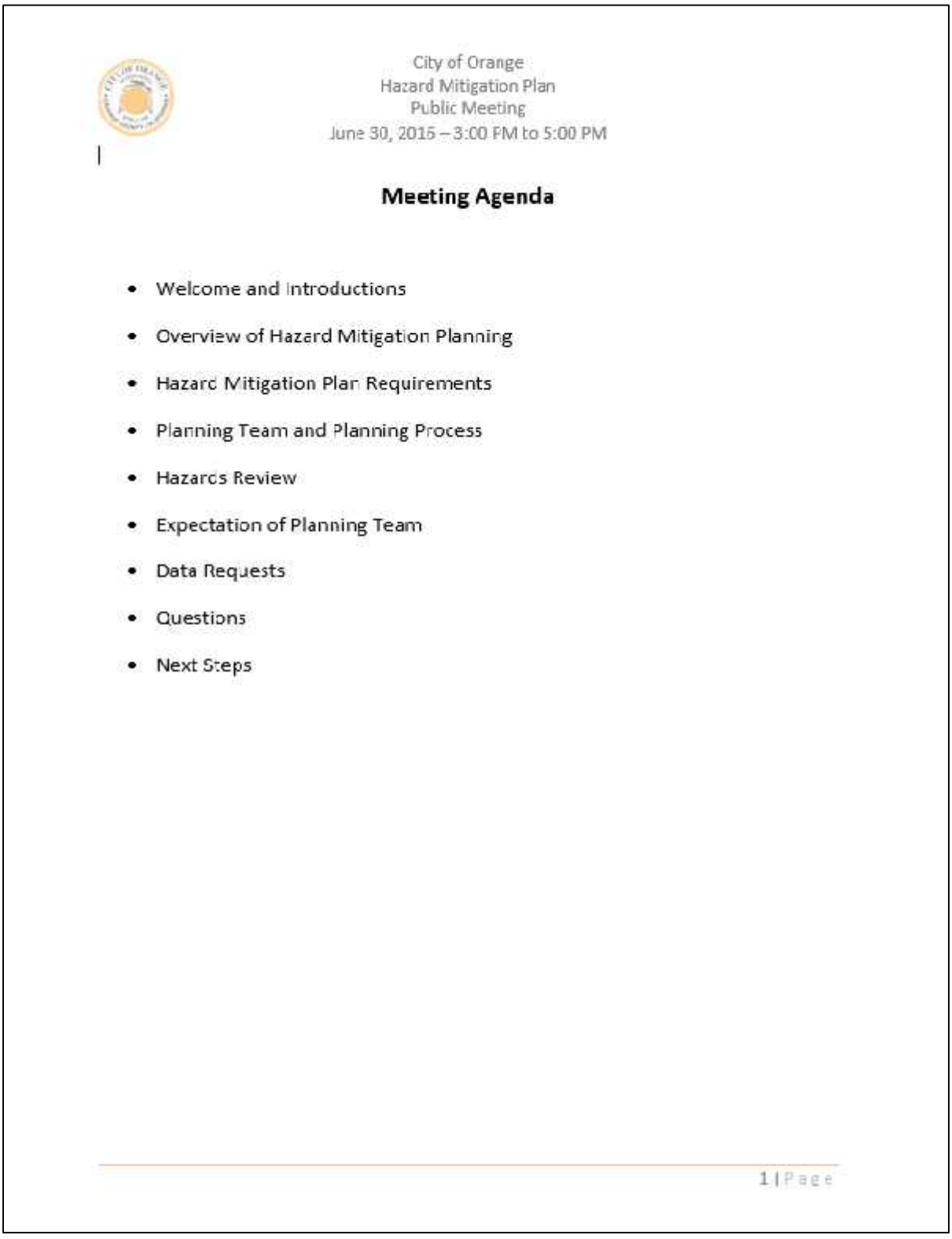
- Forward WUI pre-plan
- Develop flyer for July 3rd event
- Confirm Ellen has list of Hazmat locations within the city
- Obtain RIMS Spill Database
- Provide a list of Current Development Activities
- Provide list of values for the critical facilities identified in the plan
- Review maps provided by Hazus and identify ones that should be replaced
- Finalize information needing to be removed from the plan

Willdan:

- Send Pete Good rich the form for Current Development Activities
- Provide Alan completed worksheets for Hazard Mitigation Actions
- Send Paul Stikoff verbiage for development of the July 3rd flyer

2 | Page

June 30, 2016 Public Meeting: Agenda



City of Orange
Hazard Mitigation Plan
Public Meeting
June 30, 2016 – 3:00 PM to 5:00 PM

Meeting Agenda

- Welcome and Introductions
- Overview of Hazard Mitigation Planning
- Hazard Mitigation Plan Requirements
- Planning Team and Planning Process
- Hazards Review
- Expectation of Planning Team
- Data Requests
- Questions
- Next Steps

1 | Page

June 30, 2016 Public Meeting: Contact List

City Of Orange
Hazard Mitigation Plan
Public Meeting Contacts
June, 2016

Company	Name	Address	Email	RSVP		
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	YES		
[illegible]	[illegible]	[illegible]	[illegible]	YES		
[illegible]	[illegible]	[illegible]	[illegible]	YES	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible] Los Angeles, [illegible]	[illegible]			
Orange County Sheriff's Department	[illegible]	550 N. Flower St., Santa Ana, CA 92703	[illegible]			
The Village at Orange	[illegible]	1500 E. Village Way, Orange, CA 92865	[illegible]			
UCI Medical	[illegible]	101 The City Dr. South, Orange, CA 92868	[illegible]			
Orange Unified School District	[illegible]	1401 N. Handy Street, Orange, CA 92867	[illegible]	YES	[illegible]	
St. Paul's Lutheran Church	[illegible]	1250 E. Heim Ave, Orange, CA 92865	[illegible]			
Holy Family Cathedral School	[illegible]	530 S. Glassell St., Orange, CA 92866	[illegible]			
The Outlets at Orange	[illegible]	20 City Blvd West, Orange, CA 92868	[illegible]			
Chapman University	[illegible]	1 University Drive, Orange, CA 92866	[illegible]	YES	[illegible]	[illegible]
Orange County Health Care Agency	[illegible]	[illegible] Santa Ana, [illegible]	[illegible]			
[illegible]	[illegible]	[illegible] Orange, CA [illegible]	[illegible]			
[illegible]	[illegible]	1 City Boulevard West, Suite [illegible], Orange, CA 92868	[illegible]			
Southern California Edison	[illegible]	1325 S. Grand Ave., Santa Ana, CA 92705	[illegible]	YES	[illegible]	
[illegible]	[illegible]					
[illegible]	[illegible]					

June 30, 2016 Public Meeting: Attendees

Public Meeting Attendees

Last Name	First Name	Agency	Phone	Email
Amat	Jennifer	Orange Police Dept., Homeland Security/Emergency Mgmt.	(714) 325-1423	jamat@orangepd.org
Anthony	Benjamin	The Village at Orange	(714) 745-3821	vaodirector@gscsecurity.com
Beach	Jason	Health Care Agency	(714) 559-9148	jbeach@ochca.com
Caruso	Tony	SCE	(562) 618-2509	Anthony.caruso@sce.com
Davis	Mark	Chapman University		mrdavis@chapman.edu
Glass	Sheldon	Orange Unified School District		shglass@orangeusd.org
Goodrich	Peter	City of Orange	(714) 744-7200	pgoodrich@cityoforange.org
Holbrook	De	SC Fuels		holbrookd@scfuels.com
Howard	Ed	Orange Unified School District		ehoward@orangeusd.org
Jacobus	Thomas	Southern California Edison		Thomas.Jacobus@sce.com
Lopez	David		(714) 713-5679	ocairops@me.com
Pacheco	Manny	Santiago Canyon College	(714) 628-4989	Pacheco_manny@rsccd.edu
Ramos	Dave	National Oilwell Varco	(714) 456-1322	david.ramos@nov.com
Thomas	Jack	Orange Fire Department	(714) 288-2501	jthomas@cityoforange.org
Velasco	Alan	Orange Fire Department	(714) 515-7873	avelasco@cityoforange.org

June 30, 2016 Public Meeting: Sign-In Sheets

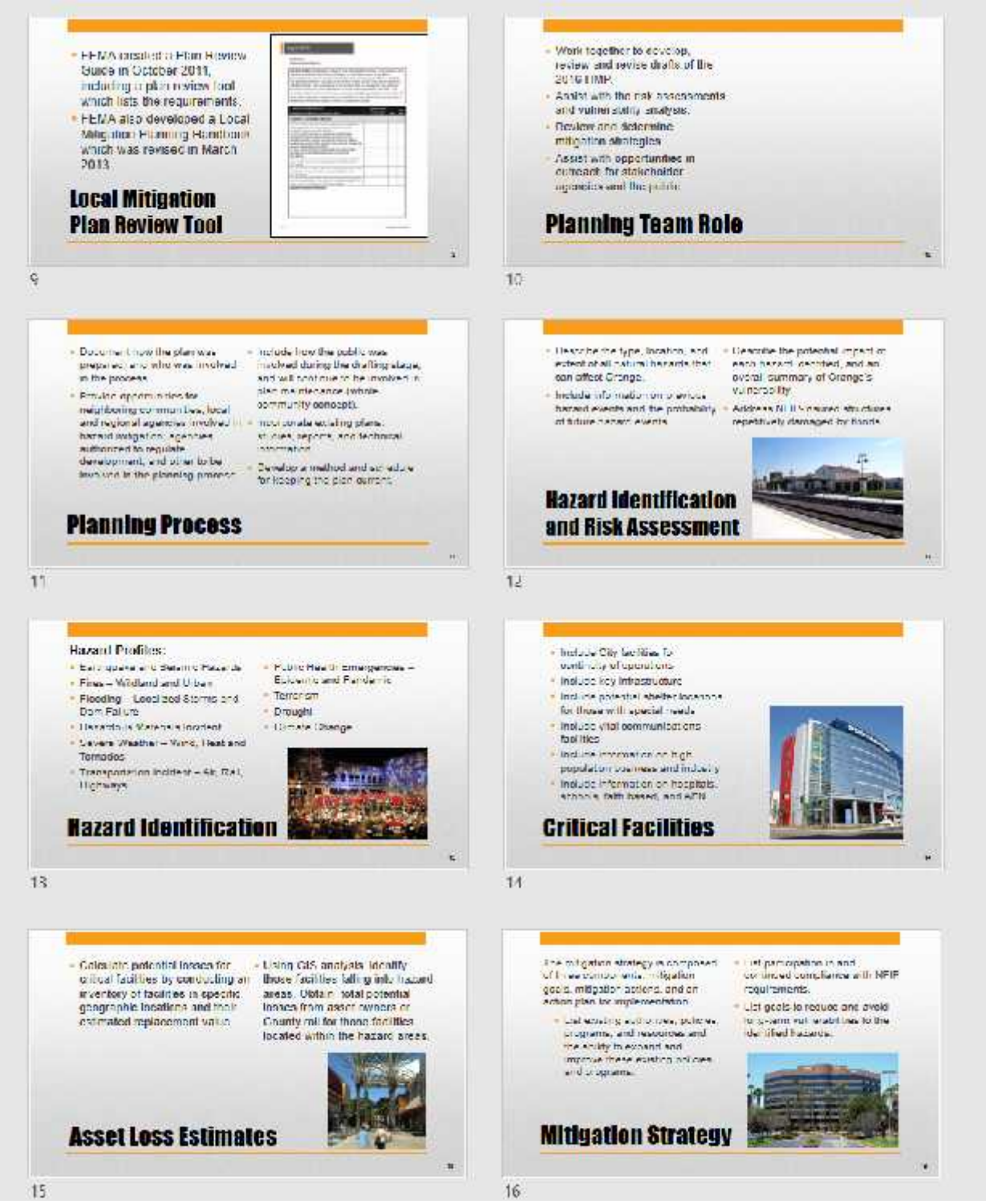
City of Orange
Hazard Mitigation Plan
Public Meeting
June 30, 2016

Initials	Last Name	First Name	Agency	Phone	Email
	Amat	Jennifer	Orange Police Dept., Homeland Security/Emergency Mgmt.	(714) 325-1423	jamat@orangepd.org
	Cheung	Raymond	Orange County Sheriff's Department		
	Davis	Mark	Chapman University		mcdavis@chapman.edu
	Fieldhouse	Casey	Orange Fire Department	(714) 288-2550	cfieldhouse@cityoforange.org
	Glass	Sheldon	Orange Unified School District		shglass@orangeusd.org
	Goodrich	Peter	City of Orange	(714) 744-7200	pgoodrich@cityoforange.org
	Harvey	Scott	Orange Unified School District		
	Holbrook	De	SC Fuels		holbrookd@scfuels.com
	Howard	Ed	Orange Unified School District		ehoward@orangeusd.org
	Jacobus	Thomas	Southern California Edison		Thomas.Jacobus@sce.com
	Pacheco	Manny	Santiago Canyon College	714 628 4989	PACHECO_MANNY@RSCCD.EDU
	Ramos	Dave	National Oilwell Varco	(714)456-1322	david.ramos@nov.com
	Rosauer	Eric	Orange Police Department	(714) 936-0957	erosauer@orangepd.org
	Stefano	Robert	Orange Fire Department	(949) 533-2049	rstefano@cityoforange.org
	Thomas	Jack	Orange Fire Department	(714) 288-2501	jthomas@cityoforange.org
	Velasco	Alan	Orange Fire Department	(714) 915-7873	avelasco@cityoforange.org
	CARUSO	TONY	SCE	5626182504	ANTHONY.CARUSO@SCE.COM
	JASON	BEACH	HEALTH CARE AGENCY	714-554-9147	JBeach@ochca.com
	BENJAMIN	ANTHONY	THE VILLAGE AT ORANGE	714 745 3821	VADDIRECTOR@GSC SECURITY.CO
	DAVID	LOPEZ		714-713-5679	OCAIROPS@ME.COM

1 of 2

June 30, 2016 Public Meeting: Presentation

City of Orange
LHMP Public Meeting
June 30, 2016


Local Mitigation Plan Review Tool
9
Planning Team Role
10
Planning Process
11
Hazard Identification and Risk Assessment
12
Hazard Identification
13
Critical Facilities
14
Asset Loss Estimates
15
Mitigation Strategy
16


Mitigation strategy, continued:
Become a process for integrating the mitigation plan into other planning mechanisms as appropriate
Mitigation Strategy
17
Examples:
Develop Mitigation Actions
18
Meetings held with businesses, industry, related non-governmental organizations, interested public.
Distribute information on the city website, community cable, local newspaper, and other means as determined.
Survey distributed to citizens of Orange.
Develop a Public and Stakeholder Outreach Plan
19
Information will be requested throughout the planning process.
Request individuals to retrieve information or data for the plan
Review of City General Plan
Planning Process
20
Scope and Content of the Public Safety Element
21
Regional Location Map
22
Orange Planning Area
23
Public Safety Considerations
24

City of Orange
LHMP Public Meeting
June 30, 2016


Emergency Services and Safety
23
Disaster/Emergency Preparedness
24
Identified Hazards
35
Identified Hazards – Cont.
36
37
38
Fire Hazards
As part of its efforts to prevent injury and loss due to fire hazards in undeveloped hillside and urban areas, the City will continue to educate the public, and provide up to date maps delineating areas that could face fire hazards. The City will ensure minimum road widths, clearance areas and access to adequate fire protection services by enforcing Municipal Code provisions and City specifications, and conducting development review.
Identified Hazards – Cont.
39
Identified Hazards – Cont.
40


Liquefaction Zone
41
Critical Facility Functionality
42
Hospital Functionality
43
Utility System Economic Losses (Millions of $)
44
Critical Facility Functionality
45
Hospital Functionality
46
Utility System Economic Losses (Millions of $)
47
Survey Results
48

June 30, 2016 Public Meeting: Minutes

City of Orange
Hazard Mitigation Plan Update
Public Meeting - Minutes
June 30, 2016 – 1500 to 1700

Acronyms

Acronym	Definition		Acronym	Definition
FEMA	Federal Emergency Management Agency		**HAZUS**	Hazards Unites States
GIS	Geographical Information System		**LHMP**	Local Hazard Mitigation Process
HAZMIT	Hazard Mitigation		**NFIP**	National Flood Insurance Program

Meeting Notes

Topic/Task	Discussion
Welcome and Introductions	• Captain Alan Velasco of the City of Orange Fire Department provided the opening remarks and conducted the introductions as well as a brief overview of what a Hazard Mitigation Plan is
Overview of Hazard Mitigation	• Ellen Lopez provided an overview of Hazard Mitigation and the planning process
Hazard Mitigation Plan Requirements	• The City of Orange and Willdan have followed the FEMA Hazard Mitigation guidelines and utilized the plan review tools in order to meet all the plan requirements set forth by FEMA
Hazards Review	• A list of hazards has been identified that are most relevant to the City of Orange ○ Earthquake ○ Fires ○ Flooding ○ Hazardous Materials Incident ○ Severe Weather ○ Transportation Incidents ○ Public Health Emergencies ○ Terrorism ○ Drought ○ Climate Change • A review of critical facilities within the city • Determine the potential impact of each hazard identified and provide and overall summary of the city's vulnerability
Expectations of Planning Team	• The planning team works together to develop and review the Hazard Mitigation plan • Assist with the risk assessment and vulnerability analysis

2 | Page

Topic/Task	Discussion
	• Review and determine mitigation strategies • Assist with opportunities in outreach for stakeholder agencies and the public
Data Requests	• Stakeholders were encouraged to participate in the survey posted on the City of Orange website
HAZUS Analysis Review	• The draft HAZUS report provided by Willdan was based on a scenario of a 7.0 earthquake from both the Newport/Inglewood and San Andreas faults • Various locations within the city were reviewed and discussed regarding their functionality on day 1 through day 3 based on the two 7.0 earthquake scenarios • The draft HAZUS report was handed out the participants to review the flood loss estimate
Survey results	• The survey and survey results were handed out to participants • The survey the City put together is handed out to meeting participants • 479 people participated in the survey • Earthquake is the #1 concern based on the survey results

Public Questions

Question	Answer
When did the process begin?	• The entire Hazard Mitigation process has been three years in the making starting with obtaining the Pre-disaster mitigation grant which allowed the city to hire a consultant to create the Hazard Mitigation plan.
In regards to the HAZUS study, how deep did you go in regards to the attributes of the building? (Age of construction, type of construction)	• The HAZUS Analysis will be handed out at the end of the meeting for your review.
Is the criteria for hospitals in that report also? Because those numbers seem impossible.	• The numbers are high in functionality, because the structures are newer, modern, meet the building requirements and so HAZUS factors these based on a formula. So the numbers are high based on the facility and locations of that facility.

Question	Answer
	We will indicate that we are we are talking building structure and not actually continuity of operations. We will rename the map more definitively.
Will water plant/water well information be included in the plan?	• The plan that is made available to the general public will not include water plant/water well data as that is sensitive information. The full and complete plan can be reviewed by the public at the City of Orange City Hall only and will not be allowed off the premises.
Are the numbers shown in the analysis straight out of HAZUS and if so, has anyone from the City reviewed the numbers to confirm this information?	• The analysis is a draft and the city still needs to provide some data in order to finalize the analysis. • Based on the data we have right now; these are the results. Once we have more inclusive data, the numbers may change.
Will we receive the analysis via email?	• The plan will be made available to the public by coming down to the City of Orange City Hall.
Does this analysis include infrastructure?	• It does include some infrastructure but not down to the pipes itself. It is shown in the table regarding economic loss.
Regarding the survey, were demographics captured for those taking the survey?	• No, demographics of the survey participants were not captured.

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Appendix C: On-Line Survey Detailed Summary

Hazard Mitigation Plan Survey

1. How concerned are you about hazardous situations that may have the potential to impact the City of Orange? (Check one response for each hazard)

	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned
Earthquake – Seismic Hazards	☐	☐	☐	☐	☐
Hazardous Materials	☐	☐	☐	☐	☐
Terrorism	☐	☐	☐	☐	☐
Transportation Incidents – Air, Rail, Water	☐	☐	☐	☐	☐
Pipeline – Oil Spills	☐	☐	☐	☐	☐
Nuclear related incident	☐	☐	☐	☐	☐
Flooding – Localized Storms	☐	☐	☐	☐	☐
Drought	☐	☐	☐	☐	☐
Urban and Wildland Fires	☐	☐	☐	☐	☐
Severe Weather – Wind, Tornados, Heat	☐	☐	☐	☐	☐
Public Health – Epidemic, Pandemic	☐	☐	☐	☐	☐
Climate Change – Air Pollution	☐	☐	☐	☐	☐
Civil Unrest	☐	☐	☐	☐	☐

2. How prepared is your household to cope with a hazard event?

	Not at all Prepared	Somewhat Prepared	Adequately Prepared	Well Prepared	Very well Prepared	Not Sure
Check one:	☐	☐	☐	☐	☐	☐

3. Which of the following activities have been taken to prepare your household for a hazard event? (Check all that apply)

☐ Prepared a disaster supply kit
☐ Stored water (one gallon per person per day)
☐ Stored non-perishable food
☐ Received First Aid / CPR training
☐ Taken a Community Emergency Response Team (CERT) course
☐ Stored medical supplies (first aid kit, prescription medicines, over-the-counter medications)
☐ Created a home evacuation plan
☐ Designated a family meeting place
☐ Identified utility shut offs / have shut-off tools available
☐ Stored a battery-powered radio, flashlights, and extra batteries
☐ Installed smoke detectors on each level of the house
☐ Installed carbon monoxide detector on each level of the house

1

☐ Have fire extinguishers in appropriate areas of the house
☐ Purchased flood insurance
☐ Purchased earthquake insurance
☐ None

4. Do you or anyone in your household have disabilities and / or access and functional needs that would require a specialized response to evacuate during disasters?
☐ **Yes**
☐ **No**

5. Which of the following sources of information have helped you to prepare for a hazard event? (Check all that apply)
☐ Emergency preparedness information from a government source (federal, state, or local)
☐ Attended meetings that have provided disaster preparedness information
☐ Community Emergency Response Team (CERT) training
☐ Disaster exhibit at a local fair or community event
☐ Church disaster preparedness
☐ Civic organization disaster preparedness (American Red Cross, etc.)
☐ Personal experience with previous hazard or disaster
☐ School or other academic institution distribution of materials
☐ Locally provided news or regional media source

6. Which of the following sources or methods of receiving hazard and disaster preparedness information do you think are most effective? (Check all that apply)

☐ Newspaper Articles	☐ Fire Department
☐ Telephone Book	☐ City Website
☐ Information Brochures	☐ Law Enforcement
☐ Radio Advertisement	☐ Public Library
☐ Internet	☐ American Red Cross
☐ Schools and Academic Institutions	☐ Community Safety Events
☐ City Newsletters	☐ Public Meetings
☐ Workshops	☐ Public Awareness Campaigns
☐ Chamber of Commerce	☐ Word of Mouth
☐ Social Media (Facebook, Linkedin, Twitter)	☐ Reverse 9-1-1 Notifications (AlertOC)

2

7. Please indicate how you feel about the following statement:

It is my personal responsibility to be educated and take actions that will reduce my exposure to the risks associated with natural hazards.

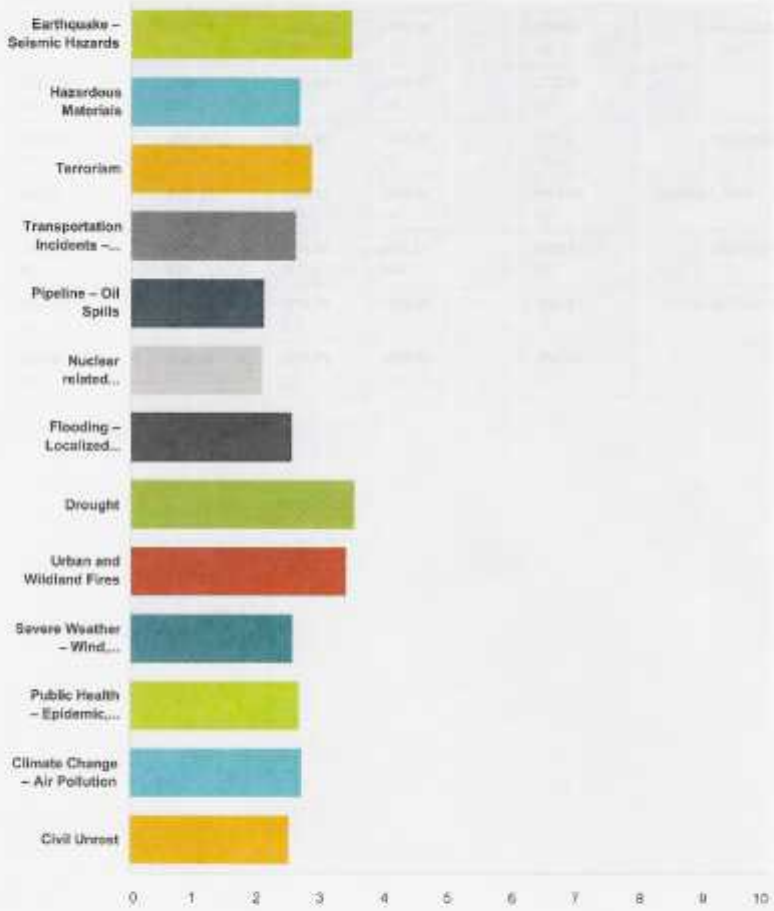
	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree
Choose one:	☐	☐	☐	☐	☐

3

City of Orange Hazard Mitigation Survey SurveyMonkey

Q1 How concerned are you about hazardous situations that may have the potential to impact the City of Orange? (Check one response for each hazard)

Answered: 479 Skipped: 1



	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned	Total	Weighted Average
Earthquake – Seismic Hazards	2.94% 14	17.65% 84	27.73% 132	32.77% 156	18.91% 90	476	3.47
Hazardous Materials	18.01% 85	28.81% 136	30.30% 143	15.89% 75	6.99% 33	472	2.65

1 / 11

City of Orange Hazard Mitigation Survey — SurveyMonkey

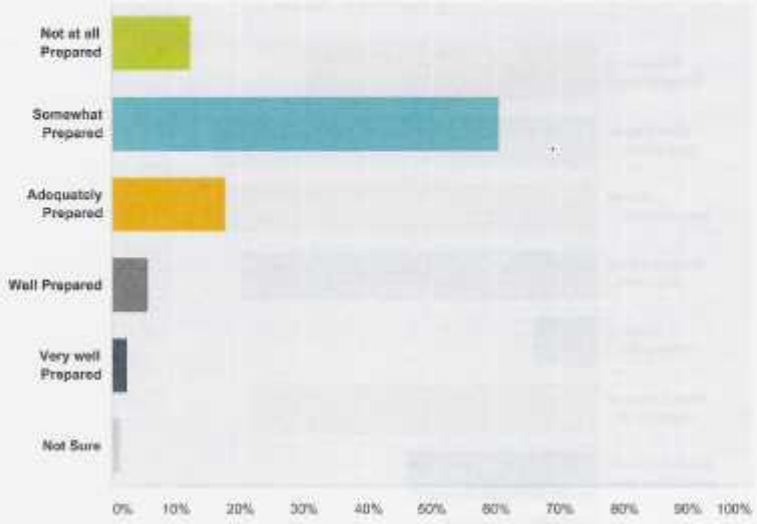
Terrorism	16.88% 80	26.37% 125	27.43% 130	15.82% 75	13.50% 64	474	2.83
Transportation Incidents – Air, Rail, Water	16.07% 76	34.04% 161	30.02% 142	14.80% 70	5.07% 24	473	2.59
Pipeline – Oil Spills	38.48% 182	30.87% 146	19.24% 91	6.55% 31	4.86% 23	473	2.08
Nuclear related incident	42.62% 202	29.75% 141	13.50% 64	6.54% 31	7.59% 36	474	2.07
Flooding – Localized Storms	18.91% 90	34.24% 163	27.52% 131	14.92% 71	4.41% 21	476	2.52
Drought	6.07% 29	14.44% 69	25.10% 120	31.80% 152	22.59% 108	478	3.50
Urban and Wildland Fires	5.71% 27	16.49% 78	30.23% 143	28.12% 133	19.45% 92	473	3.39
Severe Weather – Wind, Tornados, Heat	21.94% 104	30.59% 145	27.64% 131	11.60% 55	8.23% 39	474	2.54
Public Health – Epidemic, Pandemic	17.09% 81	31.22% 148	28.48% 135	15.19% 72	8.02% 38	474	2.66
Climate Change – Air Pollution	19.16% 91	30.95% 147	21.89% 104	17.68% 84	10.32% 49	475	2.69
Civil Unrest	24.79% 117	29.03% 137	25.21% 119	12.92% 61	8.05% 38	472	2.50

2 / 11

City of Orange Hazard Mitigation Survey SurveyMonkey

Q2 How prepared is your household to cope with a hazard event?

Answered: 471 Skipped: 9



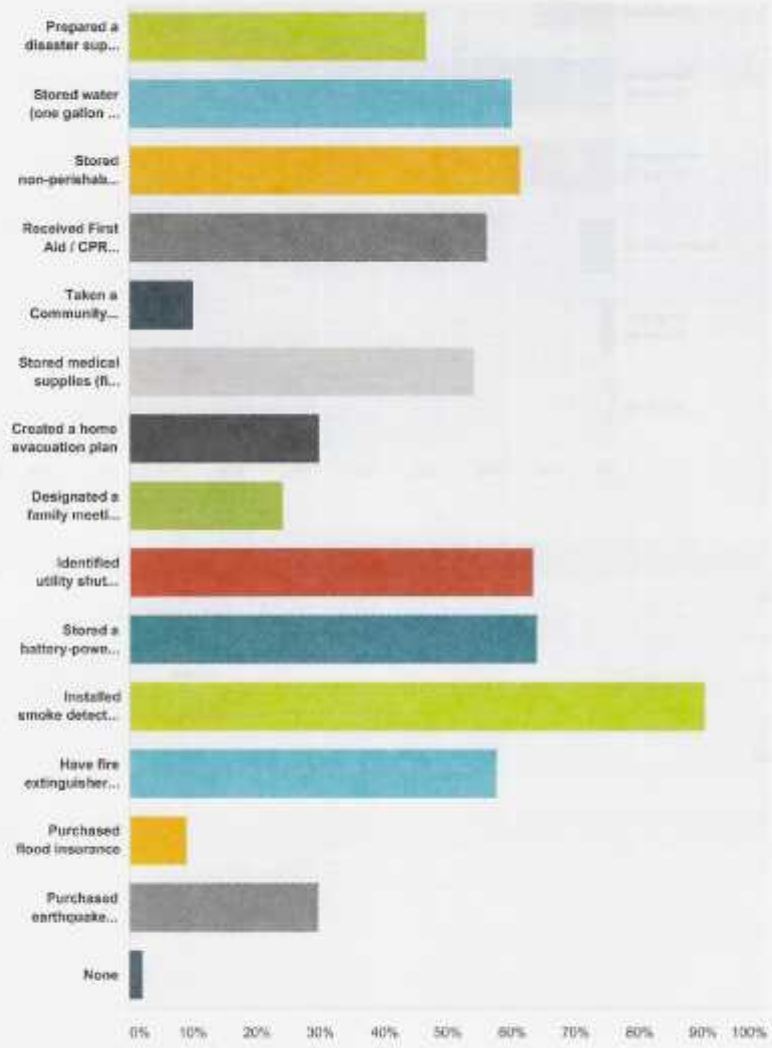
Answer Choices	Responses	
Not at all Prepared	12.31%	58
Somewhat Prepared	60.51%	285
Adequately Prepared	17.83%	84
Well Prepared	5.73%	27
Very well Prepared	2.34%	11
Not Sure	1.27%	6
Total		471

3 / 11

City of Orange Hazard Mitigation Survey SurveyMonkey

Q3 Which of the following activities have been taken to prepare your household for a hazard event? (Check all that apply)

Answered: 478 Skipped: 2



Answer Choices	Responses	
Prepared a disaster supply kit	46.65%	223

4 / 11

City of Orange Hazard Mitigation Survey — SurveyMonkey

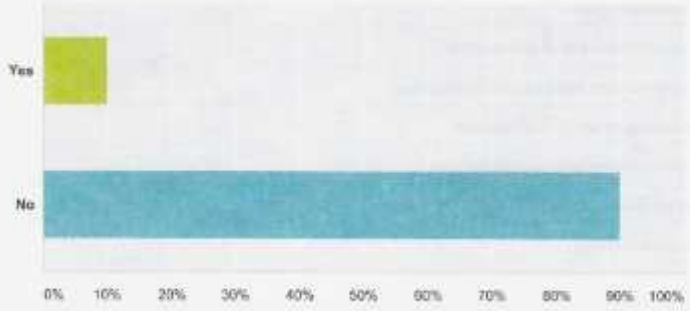
Stored water (one gallon per person per day)	59.83%	286
Stored non-perishable food	61.09%	292
Received First Aid / CPR training	55.86%	267
Taken a Community Emergency Response Team (CERT) course	10.04%	48
Stored medical supplies (first aid kit, prescription medicines, over-the-counter medications)	53.77%	257
Created a home evacuation plan	29.71%	142
Designated a family meeting place	24.06%	115
Identified utility shut offs / have shut-off tools available	62.97%	301
Stored a battery-powered radio, flashlights, and extra batteries	63.60%	304
Installed smoke detectors on each level of the house	89.96%	430
Have fire extinguishers in appropriate areas of the house	57.32%	274
Purchased flood insurance	9.00%	43
Purchased earthquake insurance	29.71%	142
None	2.09%	10

Total Respondents: 478

5 / 11

Q4 Do you or anyone in your household have disabilities and / or access and functional needs that would require a specialized response to evacuate during disasters?

Answered: 467 Skipped: 13

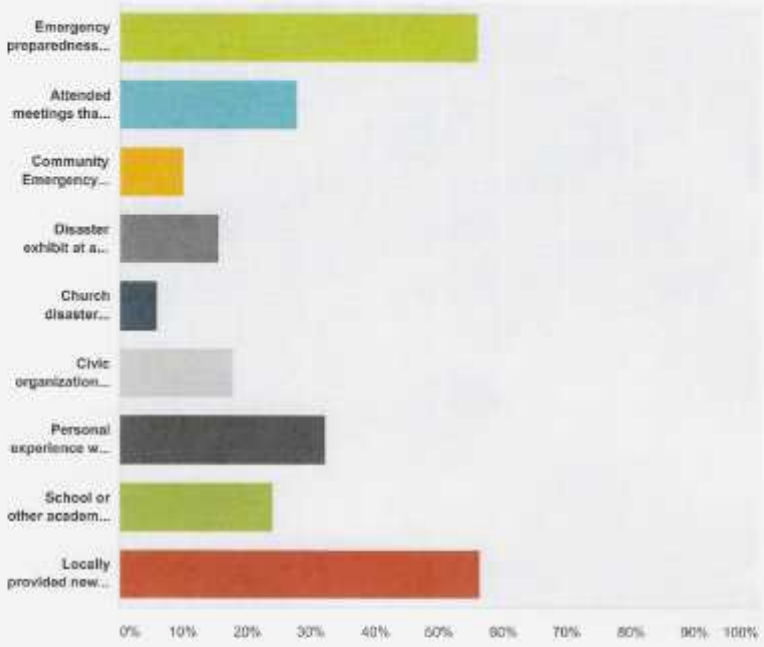


Answer Choices	Responses	
Yes	10.06%	47
No	89.94%	420
Total		467

City of Orange Hazard Mitigation Survey SurveyMonkey

Q5 Which of the following sources of information have helped you to prepare for a hazard event? (Check all that apply)

Answered: 426 Skipped: 54

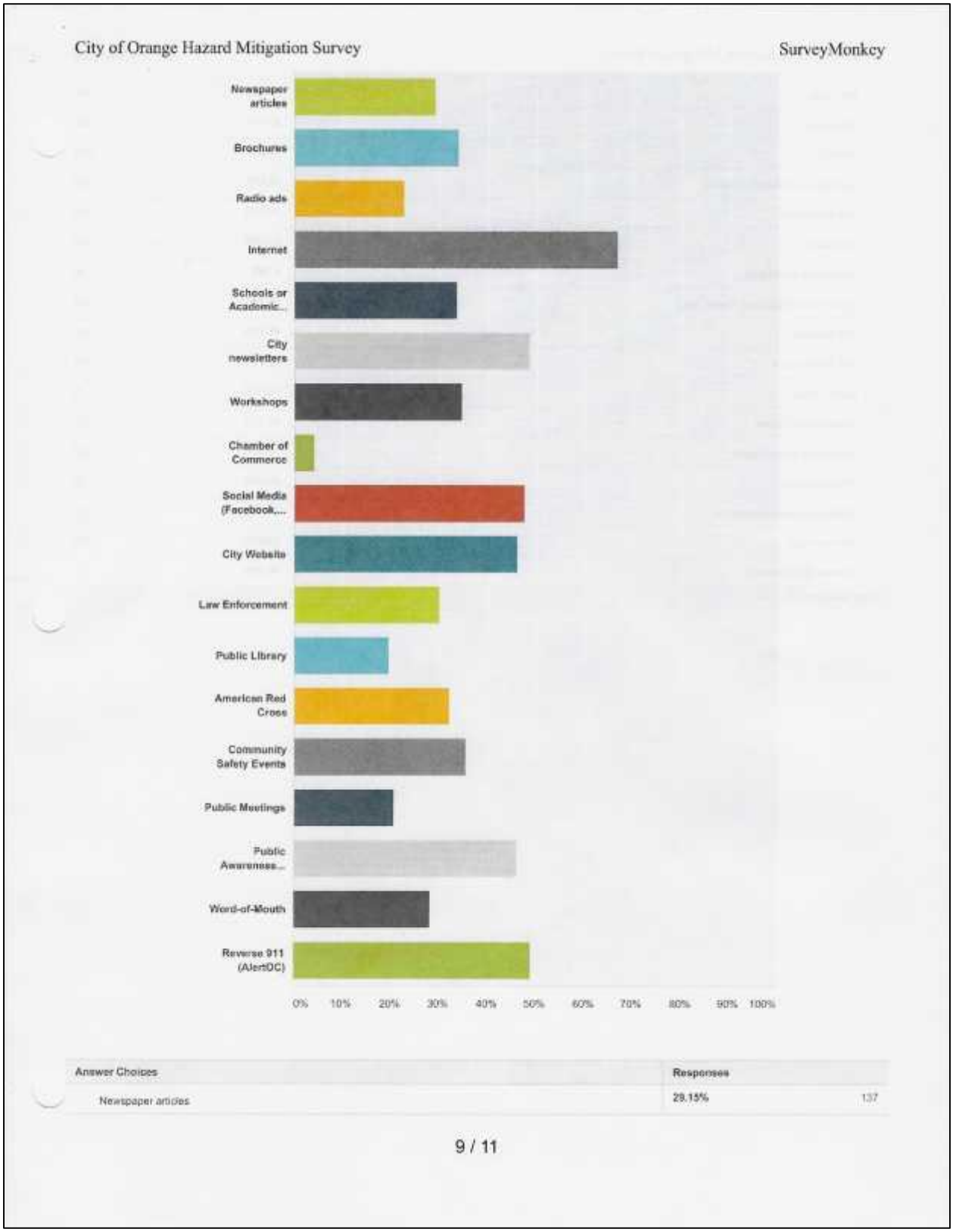


Answer Choices	Responses	
Emergency preparedness information from a government source (federal, state, or local)	55.87%	238
Attended meetings that have provided disaster preparedness information	27.70%	118
Community Emergency Response Team (CERT) training	10.09%	43
Disaster exhibit at a local fair or community event	15.49%	66
Church disaster preparedness	5.87%	25
Civic organization disaster preparedness (American Red Cross, etc.)	17.84%	76
Personal experience with previous hazard or disaster	32.16%	137
School or other academic institution distribution of materials	23.94%	102
Locally provided news or regional media source	56.34%	240
Total Respondents: 426		

7 / 11

Q6 Which of the following sources or methods of receiving hazard and disaster preparedness information do you think are most effective? (Check all that apply)

Answered: 479 Skipped: 10


City of Orange Hazard Mitigation Survey
SurveyMonkey
Newspaper articles
Brochures
Radio ads
Internet
Schools or Academic...
City newsletters
Workshops
Chamber of Commerce
Social Media (Facebook,...
City Website
Law Enforcement
Public Library
American Red Cross
Community Safety Events
Public Meetings
Public Awareness...
Word-of-Mouth
Reverse 911 (AlertOC)
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Answer Choices
Responses
Newspaper articles
28.15%
137
9 / 11

City of Orange Hazard Mitigation Survey — SurveyMonkey

Brochures	34.04%	160
Radio ads	22.77%	107
Internet	66.81%	314
Schools or Academic institutions	33.62%	158
City newsletters	48.72%	229
Workshops	34.68%	163
Chamber of Commerce	4.26%	20
Social Media (Facebook, Twitter, etc.)	47.66%	224
City Website	46.17%	217
Law Enforcement	30.00%	141
Public Library	19.57%	92
American Red Cross	32.13%	151
Community Safety Events	35.53%	167
Public Meetings	20.64%	97
Public Awareness campaigns	46.17%	217
Word-of-Mouth	28.09%	132
Reverse 911 (AlertOC)	49.15%	231

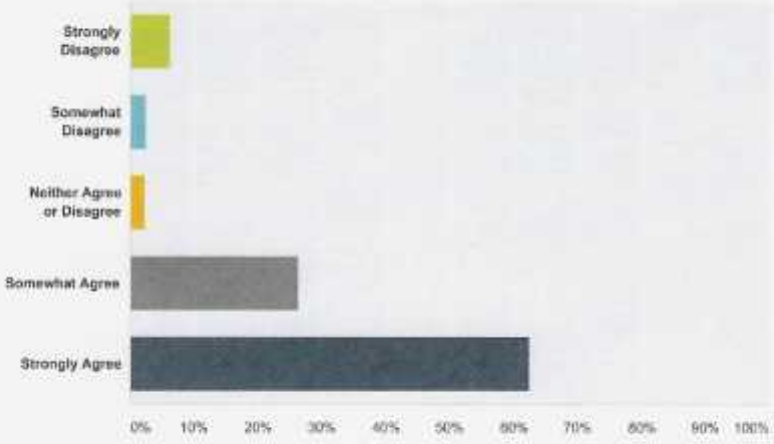
Total Respondents: 470

10 / 11

City of Orange Hazard Mitigation Survey SurveyMonkey

Q7 Please indicate how you feel about the following statement:"It is my personal responsibility to be educated and take actions that will reduce my exposure to the risks associated with natural hazards."

Answered: 472 Skipped: 0



Answer Choices	Responses	
Strongly Disagree	6.36%	30
Somewhat Disagree	2.54%	12
Neither Agree or Disagree	2.33%	11
Somewhat Agree	26.27%	124
Strongly Agree	62.50%	295
Total		472

11 / 11

Appendix D: HAZUS Risk Assessment & Detailed Description of Flood Loss Estimates

HAZUS LOSS ESTIMATION ANALYSIS FOR CITY OF ORANGE, CA

Introduction

Willdan Engineering used FEMA HAZUS-MH Version 3.1 software to estimate losses in the City of Orange, CA due to selected earthquake and flood scenarios.

Earthquake Hazard Scenarios

Two earthquake scenarios were chosen by City of Orange staff for analysis using HAZUS software:

- Newport-Inglewood Fault Magnitude 7.0 earthquake event
- San Andreas Fault Magnitude 7.0 earthquake event

The earth's crust consists of tectonic plates floating on the earth's inner core of molten magma. Earthquake faults are places where two tectonic plates meet. Faults may be divided into sections for the purposes of visualizing and predicting their behavior. Faults are not just a single crack in the ground, but consist of many cracks and fissures. Depending on the geology of a region, a fault may "creep" as the two plates slide past each other, or they may be locked. Where faults are locked, energy slowly builds up until it overcomes the friction that has kept the fault locked, resulting in an earthquake. The parts of a fault that lock between areas where it can creep can be thought of as *sections*.
To perform a Hazus earthquake analysis, the software requires that the user specify the fault name and section, the epicenter, which can be thought of as the location on the surface above the origin of the earthquake, and the earthquake magnitude. The City of Orange has provided the fault and magnitude. It was necessary to also determine the fault section and epicenter location for the two scenario earthquake events.

United States Geological Survey (USGS) has a tool called ShakeMap used to portray the extent of potentially damaging shaking following an earthquake. Their system uses a network of hundreds of ground motion sensors linked to computers to create a map showing peak ground motion generated by the earthquake event. The system can generate a map depicting the intensity of ground shaking within about 10 minutes following an earthquake. Emergency managers can use this information to make informed decisions on where to deploy emergency response resources.

In addition to historical earthquake event ShakeMaps, the USGS also has prepared Earthquake Planning Scenario ShakeMaps. These maps are based on studies of active earthquake faults and analysis of the probability that they will produce an earthquake event. The USGS has developed a library of scenario ShakeMaps that allow planning for earthquakes and conducting of training exercises based on realistic earthquake situations. The scenario ShakeMaps are calibrated by comparing them to historical event ShakeMaps, and also by the USGS *Did You Feel It?* system that collects information from people who felt an earthquake. The USGS continues to refine their methodology for creating scenario ShakeMaps, and they continue to add new scenario ShakeMaps to their library.

Willdan studied a number of USGS Earthquake Planning Scenario ShakeMaps. Eight maps were identified for more in-depth study. Then two maps were selected that had fault section locations and

epicenters closest to the City of Orange, and that had the highest likelihood of actually occurring. These maps were used to identify the specific sections and earthquake epicenter locations on the Newport-Inglewood and San Andreas faults that the HAZUS loss estimation analysis would be based on. City of Orange staff specified the earthquake magnitude to be used for the HAZUS analysis: M 7.0. The two scenarios thus developed are:

Newport-Inglewood Fault – Alt1 Section – Magnitude 7.0
Epicenter: N33.65 W117.97
South San Andreas Fault – NSB+SSB Section – Magnitude 7.0
Epicenter: N34.28 W117.47

The USGS ShakeMaps that were reviewed to determine a most probable fault section and epicenter location are provided in the Appendix to this Report.

Flood Hazard Scenarios
Two flood scenarios were chosen by City of Orange staff for analysis using HAZUS software:

- 1 percent annual exceedance probability (a.k.a. "100-year") flood event
- 0.2 percent annual exceedance probability (a.k.a. "500-year") flood event

City of Orange Critical Facilities
Willdan performed HAZUS Level 1 analyses which use default data provided with the HAZUS software. HAZUS default data required augmentation because the default data included one police station whereas there are actually two, one fire station whereas there are actually eight, etc. The default data was augmented with information on critical facilities identified by the City of Orange including city administrative buildings, corporate yard, libraries, police and fire stations, and potable water distribution facilities such as wells, reservoirs and booster pumps. Building structure type, foundation type, year of construction and replacement value information were not available. Building structure type, number of stories, and an approximate construction era were inferred from the building occupancy type and from viewing the critical facilities using Google Earth Street View. Visual inspection of building exteriors could not provide definitive information on building structural characteristics, so for the purposes of producing a conservative damage estimate, the least resilient of likely structural characteristics based on the external observations was chosen.

The following table lists the critical facilities information that was input into HAZUS to augment the HAZUS default data.

BUILDING NAME	ADDRESS	SQ. FT.	NUM. OF STORIES	LATITUDE (DD)	LONGITUDE (DD)	HAZUS OCCUPANCY CLASS	MODEL BUILDING TYPE	EQ DESIGN LEVEL	FLOOD DESIGN LEVEL
CIVIC CENTER - CITY HALL	300 E CHAPMAN AVE	56,400	1	33.7873	117.8505	GOV1	W2	MC	Pre-FIRM
COMM. SERVICES DEPT	230 E CHAPMAN AVE	9,560	1	33.7877	117.8513	GOV1	W2	MC	Pre-FIRM
MAIN LIBRARY	101 N CENTER ST	63,278	2	33.7882	117.8500	GOV1	RM1L	MC	Post-FIRM
TAFT LIBRARY	740 E TAFT AVE	7,875	1	33.8155	117.8458	GOV1	W2	MC	Pre-FIRM
EL MODENA LIBRARY	380 S HEWES ST	9,894	1	33.7822	117.8062	GOV1	W2	MC	Pre-FIRM
CORP. YARD	637 W STRUCK AVE	27,268	2	33.8063	117.8590	GOV1	RM1L	MC	Pre-FIRM
GRIJALVA PARK SPORTS CENTER	210 N MCPHERSON RD	800	1	33.7899	117.8226	GOV1	W1	MC	Post-FIRM
POLICE HQ	1107 N BATAVIA ST	105,700	2	33.8056	-117.8617	EFPS	RM1L	MC	Post-FIRM
POLICE SUB-STATION	8525 E FORT RD	13,934	2	33.7900	117.7620	EFPS	W2	MC	Post-FIRM
FIRE HQ - EOC	176 S GRAND ST	20,175	1	33.7865	117.8509	EFFS	W2	HC	Post-FIRM
FIRE STATION # 2	2900 E COLLINS AVE	3,460	1	33.8020	117.8224	EFFS	W1	MC	Pre-FIRM
FIRE STATION # 3	1910 N SHAFFER ST	3,425	1	33.8196	117.8493	EFFS	W1	MC	Pre-FIRM
FIRE STATION # 4	201 S ESPLANADE ST	3,386	1	33.7862	117.8094	EFFS	W1	MC	Pre-FIRM
FIRE STATION # 5	1345 W MAPLE AVE	5,836	1	33.7900	117.8669	EFFS	W2	MC	Pre-FIRM
FIRE STATION # 6	345 THE CITY DRIVE S	8,000	2	33.7846	117.8902	EFFS	W2	MC	Pre-FIRM
FIRE STATION # 7	8505 E FORT RD	6,215	2	33.7900	117.7628	EFFS	W2	MC	Post-FIRM

BUILDING NAME	ADDRESS	SQ. FT.	NUM. OF STORIES	LATITUDE (DD)	LONGITUDE (DD)	HAZUS OCCUPANCY CLASS	MODEL BUILDING TYPE	EQ DESIGN LEVEL	FLOOD DESIGN LEVEL
FIRE STATION # 8	5739 E CARVER LN	2,120	1	33.8272	117.7921	EFFS	W1	MC	Pre-FIRM
WATER PLANT	189 S WATER ST	17,768	2	33.7867	117.8413	GOV1	RM1L	MC	Pre-FIRM

The City's Fire Headquarters and Emergency Operations Center are in the same building but are defined separately in HAZUS according to the floor area devoted to them in the building. Similarly, Fire Station No. 7 and the Police Substation on E. Fort Rd. are in the same building but are defined separately according to the floor area devoted to each function in the building they share. These facilities are defined in HAZUS this way because HAZUS lists police stations, fire stations and EOC's separately in its results tables and reports.

HAZUS Study Region

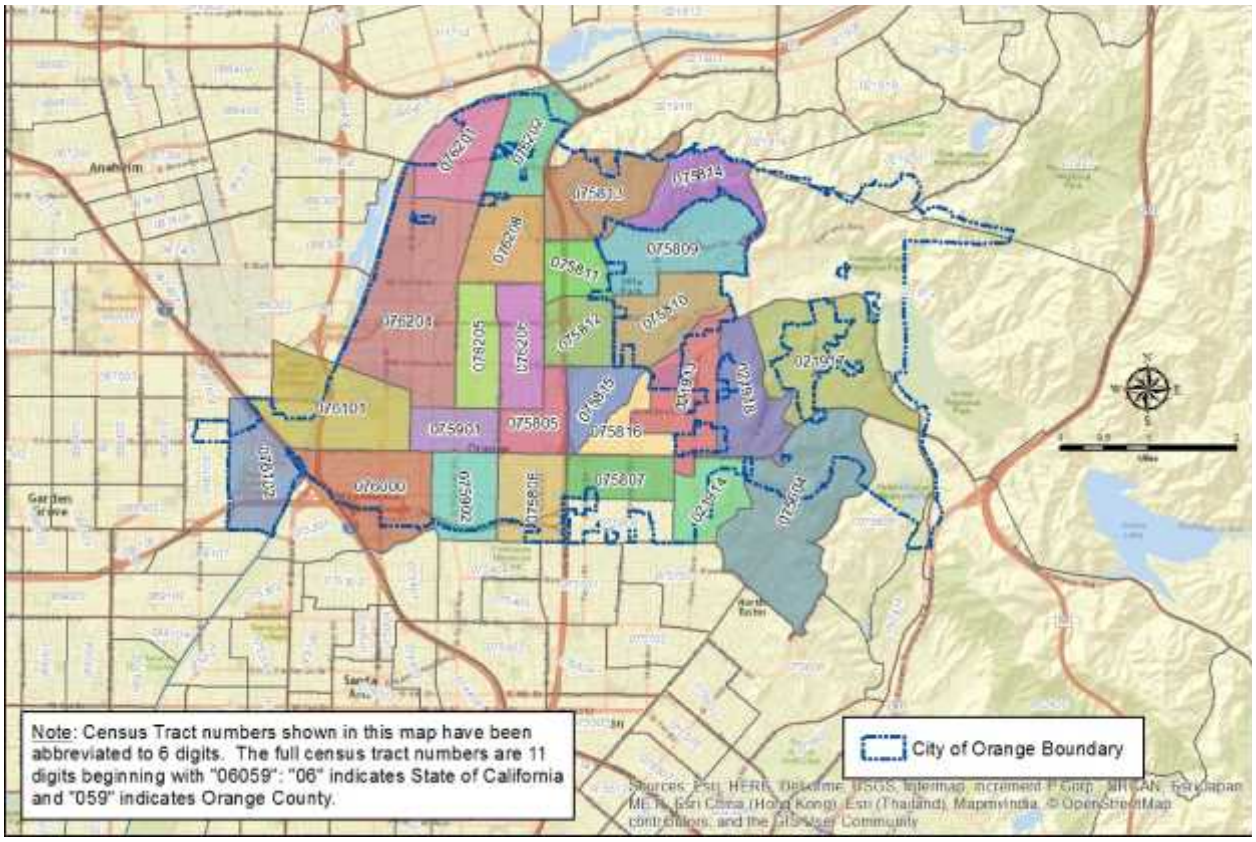
To perform a HAZUS analysis, data is compiled or *aggregated* for the region of interest from a large database for the entire state to create a HAZUS *Study Region*. Data for smaller regions such as a city are aggregated by census tract. Census tract is the smallest aggregation level that is allowed for use with the HAZUS earthquake model (data can be aggregated by census block for the flood model).

Orange County census tracts do not conform exactly to City of Orange boundaries. Twenty-seven census tracts for the City of Orange study region were selected to represent the characteristics of the City of Orange as closely as possible.
According to the *City of Orange Community Development Dept*., the City of Orange population is 140,094 (2015). The population of the HAZUS Study Region prepared for this analysis is 145,164 (2010 Census).

City incorporated area boundary GIS data was provided by the *Orange County Local Agency Formation Commission* (OCLAFCO). The city's incorporated area is 25.7 square miles. The area of the HAZUS Study Region prepared for this analysis is 26.4 square miles, which is 0.7 square miles larger than the City of Orange.

The result of using a Study Region about three percent larger than the City results in a conservative analysis, but within the uncertainties inherent in the HAZUS loss estimation methodology, or, for that matter, any loss estimate methodology.

A map depicting the City of Orange boundary and the census tracts used to create the *HAZUS Study Region* is provided below.



CITY OF ORANGE BOUNDARY AND STUDY REGION CENSUS TRACTS

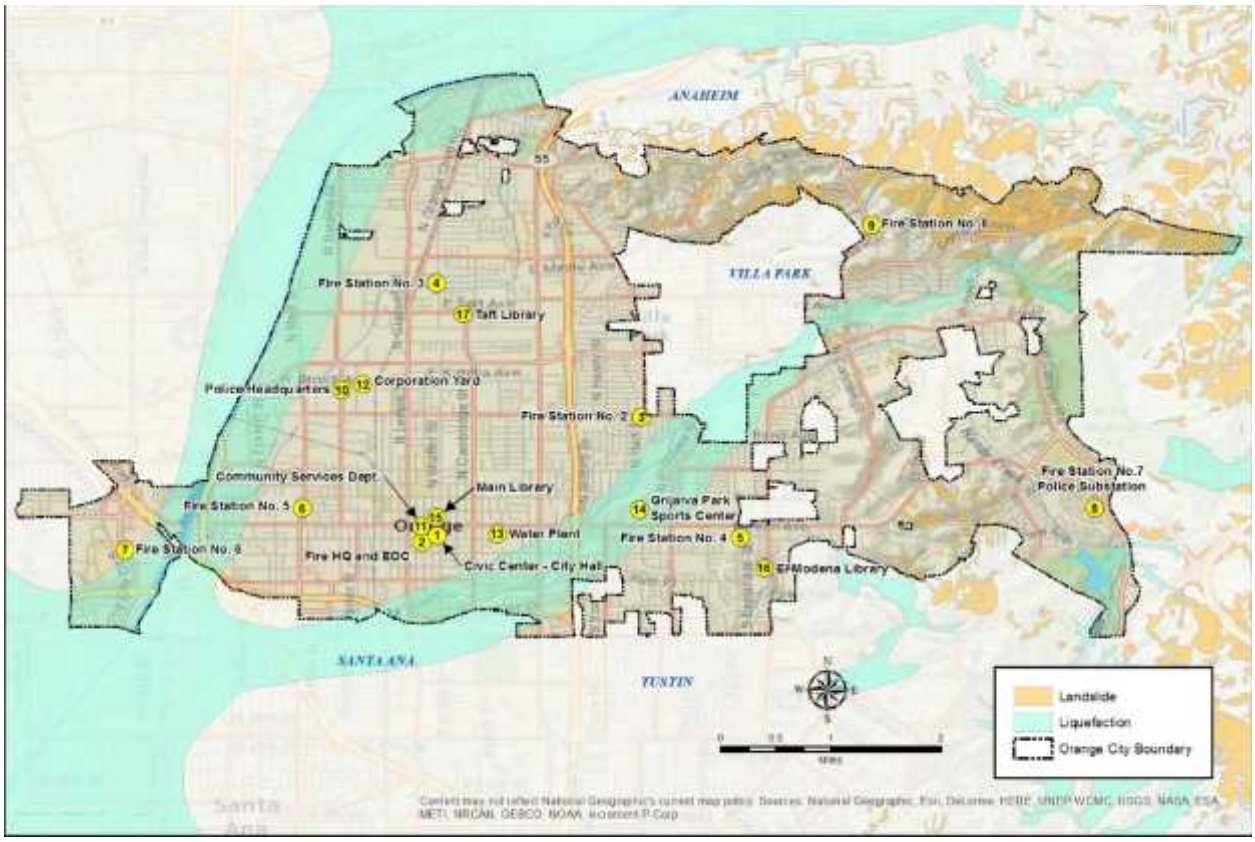
Earthquake Hazard Analysis

Earthquake Scenario Results – Soil Liquefaction and Landslide Potential

Liquefaction of soils is a process that causes soil to lose stiffness and strength, and behave like a liquid. Potential for and degree of liquefaction is a function of earthquake intensity, duration and distance from the earthquake epicenter, soil type and ground water elevation. Accuracy of liquefaction potential estimates for a given earthquake scenario can vary at a particular site depending on local soil types and ground water elevation.

Landslides are the downward and outward movement of rock and soil. Landslide potential depends on the soil types, underlying strata and the slope angle or steepness. Degree of saturation of water is a major factor in predicting the potential for landslides. Earthquakes greatly increase the potential for landslides in areas that already are prone to landslides.

The following map was prepared using data for soil liquefaction and landslide potential obtained from the California Department of Conservation.



LIQUEFACTION AND LANDSLIDE POTENTIAL WITH RESPECT TO CRITICAL FACILITIES

Except for the *Grijalva Park Sports Center*, the city's critical facilities are not located within areas with high potential for earthquake induced soil liquefaction or landslide.

Damage and Functionality Estimates for Critical Facilities– Newport Inglewood Fault M7.0 Scenario

The following tables provide HAZUS analysis estimates of the chance of moderate or extensive damage and the percent functionality of the city's critical facilities, police stations and fire stations following the Newport-Inglewood fault magnitude 7.0 earthquake scenario event.

Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day30	Percent Functionality Day 90
Civic Center - City Hall	7.6	0.4	67.5	68.7	91.8	91.9	99.5	99.9
Community Services Department	7.6	0.5	67.4	68.5	91.7	91.8	99.5	99.9
Main Library	11.3	2.3	71.5	72.2	86.3	86.3	97.6	99.9
Taft Library	6.2	0.3	71.6	72.6	93.3	93.4	99.6	99.9
El Modena Library	5.9	0.3	72.5	73.5	93.6	93.7	99.6	99.9
Corporation Yard	10.9	2.2	72.4	73.1	86.8	86.9	97.7	99.9
Grijalva Park Sports Center	19.6	6.4	48.1	49.3	72.6	72.7	92.2	98.6
Water Plant	10.9	2.2	72.2	72.9	86.7	86.8	97.7	99.9

NEWPORT-INGLEWOOD FAULT SCENARIO
CRITICAL FACILITIES PERCENT CHANCE OF DAMAGE AND PERCENT FUNCTIONALITY

Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
Police Headquarters	6.5	0.4	75.1	75.5	92.5	92.9	99.4	99.7
Police Substation	4.3	0.2	77.8	78.2	95.0	95.5	99.7	99.8

NEWPORT-INGLEWOOD FAULT SCENARIO
POLICE STATIONS PERCENT CHANCE OF DAMAGE AND PERCENT FUNCTIONALITY

Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
Fire Headquarters and EOC	7.6	0.5	67.4	67.9	91.3	91.8	99.5	99.7
Fire Station No. 2	4.8	0.2	72.2	72.7	94.4	94.9	99.7	99.8
Fire Station No. 3	19.4	6.3	48.4	48.9	72.3	72.9	92.3	95.5
Fire Station No. 4	18.9	6.0	49.5	50.0	73.2	73.8	92.7	95.7
Fire Station No. 5	8.4	0.5%	65.3	65.9	90.4	91.0	99.4	99.6
Fire Station No. 6	10.4	0.7	60.3	61.0	88.1	88.8	99.2	99.5
Fire Station No. 7	10.3	0.4	58.6	59.3	88.4	89.1	99.4	99.6
Fire Station No. 8	15.3	4.3	57.5	58.0	79.1	79.6	94.9	97.0

NEWPORT-INGLEWOOD FAULT SCENARIO
FIRE STATIONS PERCENT CHANCE OF DAMAGE AND PERCENT FUNCTIONALITY

Damage and Functionality Estimates for Critical Facilities – San Andreas Fault M7.0 Scenario
The following tables provide HAZUS analysis estimates of the chance of moderate or extensive damage and the percent functionality of the city's critical facilities, police stations and fire stations following the San Andreas fault magnitude 7.0 earthquake scenario event.

Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
Civic Center - City Hall	0.4	0.0	95.8	96.0	99.5	99.5	99.9	99.9
Community Services Department	0.4	0.0	95.8	96.0	99.5	99.5	99.9	99.9
Main Library	1.3	0.1	95.5	95.7	98.5	98.5	99.8	99.9
Taft Library	0.5	0.0	95.4	95.6	99.4	99.4	99.9	99.9
El Modena Library	0.5	0.0	95.5	95.7	99.4	99.4	99.9	99.9
Corporation Yard	1.4	0.1	95.4	95.5	98.4	98.4	99.8	99.9
Grijalva Park Sports Center	4.3	0.7	85.1	85.6	94.9	94.9	99.2	99.9
Water Plant	1.3	0.1	95.5	95.6	98.5	98.5	99.8	99.9

SAN ANDREAS FAULT SCENARIO
CRITICAL FACILITIES PERCENT CHANCE OF DAMAGE AND PERCENT FUNCTIONALITY

Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
Police Headquarters	0.3	0.0	97.3	97.3	99.5	99.6	99.9	99.9
Police Substation	0.6	0.0	95.0	95.1	99.3	99.4	99.9	99.9

SAN ANDREAS FAULT SCENARIO
POLICE STATIONS PERCENT CHANCE OF DAMAGE AND PERCENT FUNCTIONALITY

Facility Name	Percent Chance of Moderate Damage	Percent Chance of Extensive Damage	Percent Functionality Day 1	Percent Functionality Day 3	Percent Functionality Day 7	Percent Functionality Day 14	Percent Functionality Day 30	Percent Functionality Day 90
Fire Headquarters and EOC	0.4%	0.0%	95.8	95.9	99.4	99.5	99.9	99.9
Fire Station No. 2	0.3%	0.0%	95.4	95.5	99.5	99.6	99.9	99.9
Fire Station No. 3	4.4%	0.7%	84.7	85.0	94.5	94.8	99.1	99.5
Fire Station No. 4	4.3%	0.7%	85.0	85.2	94.6	94.8	99.2	99.5
Fire Station No. 5	0.4%	0.0%	95.9	96.0	99.4	99.5	99.9	99.9
Fire Station No. 6	0.4%	0.0%	96.2	96.3	99.5	99.5	99.9	99.9
Fire Station No. 7	0.5%	0.0%	93.0	93.2	99.3	99.4	99.9	99.9
Fire Station No. 8	5.0%	0.9%	83.1	83.4	93.8	94.0	99.0	99.4

SAN ANDREAS FAULT SCENARIO
FIRE STATIONS PERCENT CHANCE OF DAMAGE AND PERCENT FUNCTIONALITY

HAZUS Damage Estimates for the City of Orange Study Region

The following table summarizes HAZUS analysis damage estimates for the Newport-Inglewood Fault earthquake scenario event and for the San Andreas Fault earthquake scenario event.

Category	Newport-Inglewood Fault Earthquake Scenario	San Andreas Fault Earthquake Scenario
Number of buildings damaged	3,077	267
Percent of buildings in the region damaged	8%	1%
Number of buildings damaged beyond repair	54	0
Tons of debris generated	120,000	10,000
Truckloads of debris generated	4,920	360
Number of households displaced	212	5

HAZUS Casualty Estimates for the City of Orange Study Region

HAZUS provides casualty estimates for 2 AM, 2 PM and 5 PM. These times of day represent maximum residential occupancy time of day, maximum commercial and industrial occupancy time of day, and peak commuting time respectively.

The following table summarizes HAZUS casualty estimates for the Newport-Inglewood Fault and San Andreas Fault earthquake scenario events.

Time of Day	Newport-Inglewood Fault Earthquake Scenario					San Andreas Fault Earthquake Scenario			
	Patients Requiring Medical Treatment	Patients Requiring Hospitalization	Patients with Life Threatening Injuries	Fatalities		Patients Requiring Medical Treatment	Patients Requiring Hospitalization	Patients with Life Threatening Injuries	Fatalities
2:00 AM	60	7	0	1		5	0	0	0
2:00 PM	101	16	2	3		8	1	0	0
5:00 PM	72	11	2	2		6	1	0	0

HAZUS Economic Loss Estimates for the City of Orange Study Region

HAZUS analysis of the City of Orange Study Region provided an estimate of the total building value of 17,804 million dollars. HAZUS estimates a total economic loss of 710.28 million dollars for the Newport-Inglewood Fault earthquake scenario event and 63.78 million dollars for the San Andreas Fault earthquake scenario event. More detailed information regarding the economic loss estimate is provided below.

The following table summarizes HAZUS analysis building-related economic loss estimates expressed in millions of dollars due to the Newport-Inglewood Fault and San Andreas Fault earthquake scenario events.

Category	Newport-Inglewood Fault Earthquake Scenario Losses (Millions of dollars)	San Andreas Fault Earthquake Scenario Losses (Millions of dollars)
Wage Income Losses	31.02	1.95
Capital Related Income Losses	23.04	1.52
Rental Income Losses	21.79	1.71
Relocation Losses	42.05	2.78
Subtotal	117.90	7.97
Structural Damage Losses	76.62	6.75
Non-Structural Damage Losses	344.98	33.23
Building Contents Losses	146.29	12.42
Inventory Losses	4.47	0.42
Subtotal	572.36	52.82
Total	690.26	60.78

The following table summarizes HAZUS analysis transportation system economic loss estimates expressed in millions of dollars due to the Newport-Inglewood Fault and San Andreas Fault earthquake scenario events.

Category	Newport-Inglewood Fault Earthquake Scenario (Millions of dollars)	San Andreas Fault Earthquake Scenario (Millions of dollars)
Highways	0.00	0.00
Bridges	1.98	0.01
Railway facilities	0.51	0.11
Bus facilities	0.76	0.20
Total	4.20	0.50

The following table summarizes HAZUS analysis utility system economic loss estimates expressed in millions of dollars due to the Newport-Inglewood Fault and San Andreas Fault earthquake scenario events.

Category	Newport-Inglewood Fault Earthquake Scenario (Millions of dollars)	San Andreas Fault Earthquake Scenario (Millions of dollars)
Potable water distribution lines	1.64	0.23
Wastewater collection system lines	1.18	0.16
Natural gas distribution lines	0.34	0.05
Oil system pipelines	0.00	0.00
Oil system facilities	0.01	0.00
Electrical power facilities	12.59	1.33
Communication facilities	0.03	0.00
Total	15.79	1.77

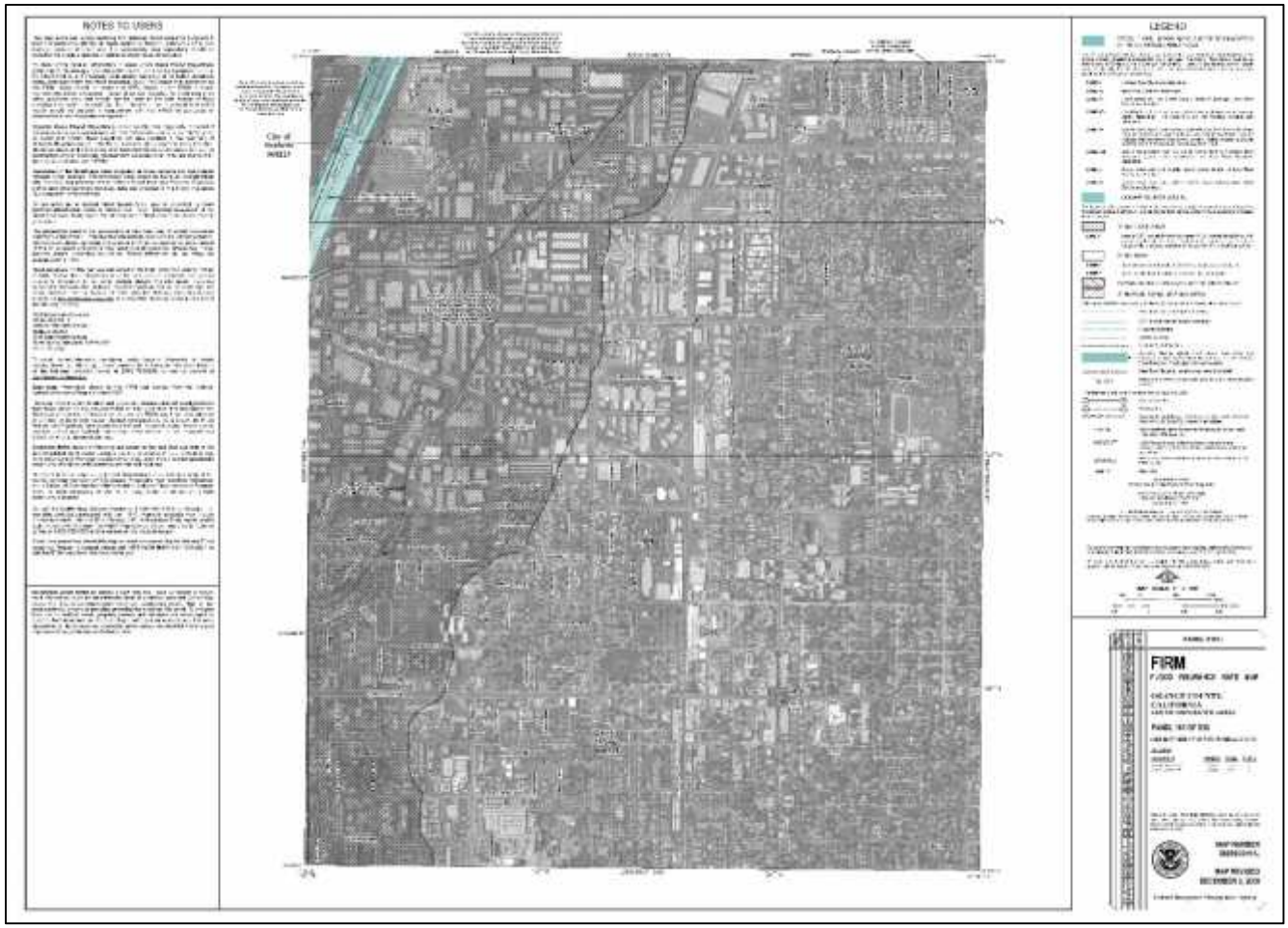
Discussion of Earthquake Hazards

HAZUS analysis results indicate that consequences of the Newport-Inglewood Fault M7.0 earthquake scenario would be of considerably greater significance than consequences of the San Andreas Fault M7.0 scenario. Additional discussion is provided in the *Conclusions and Recommendations* sections below.

Flood Hazard Analysis

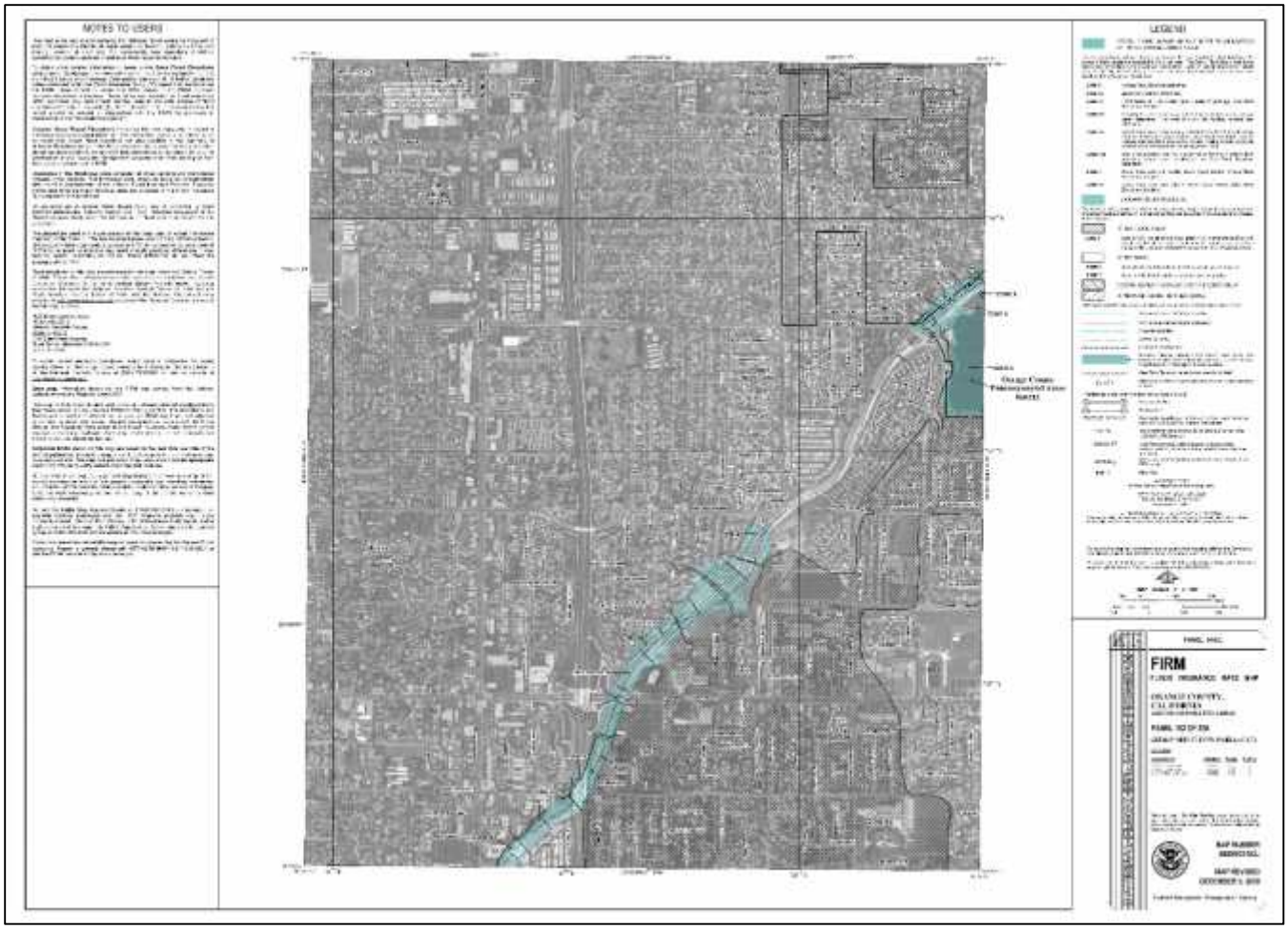
FEMA Flood Insurance Rate Maps (FIRM)

FEMA FIRM map number 06059C0161J indicates that the City of Orange is protected from the 1-percent annual chance flood by a levee system adjoining the San Gabriel River. Map number 06059C0161J is provided in the following figure.



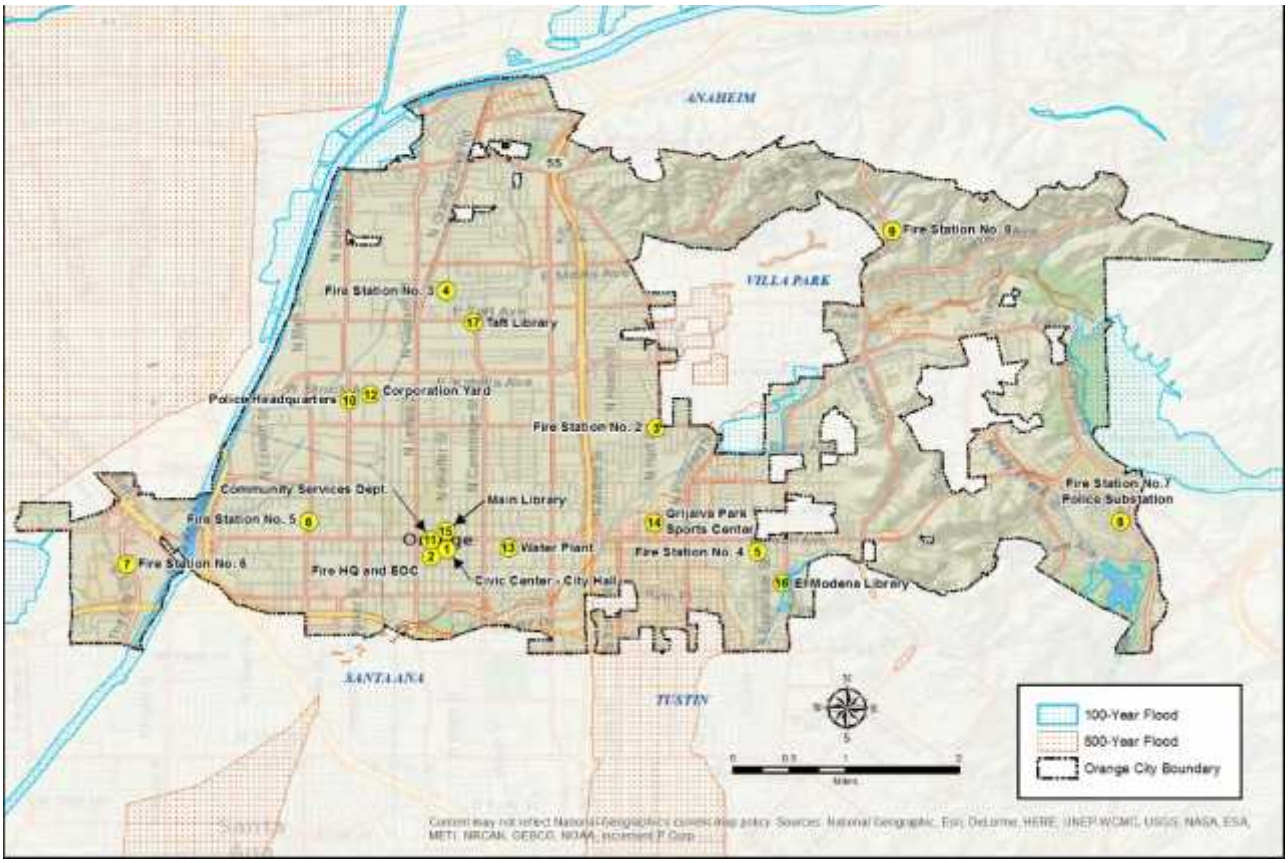
FEMA FIRM MAP NUMBER 06059C0161J

FEMA Flood Insurance Rate Maps (FIRM) show a total of 1.3 square miles (792.9) acres within the city that could be subject to flooding during the 500-year flood event. These areas adjoin Santiago Creek or Handy Creek except for a 24.2-acre area in the far north of the city near the Santa Ana River. Fully 1 square mile of the 1.3 square miles within the city that could be subject to flooding during the 500-year flood event is in a single contiguous region near the southern city boundary southeast of Santiago Creek. FEMA FIRM number 06059C0162J depicting this region is provided in the following figure.



FEMA FIRMs depicting other portions of the City are provided in the Appendix.

The following map depicts the city's critical facilities with respect to FEMA flood hazard zone data depicting 1 percent annual exceedance probability (a.k.a. "100-year") flood event and 0.2 percent annual exceedance probability (a.k.a. "500-year") flood event.



FEMA FLOOD HAZARD ZONES WITH RESPECT TO CRITICAL FACILITIES

Discussion of Flood Hazards

According to FEMA FIRM maps, the City of Orange is protected from the 1-percent annual chance flood by a levee system adjoining the San Gabriel River. Most of the city's critical facilities are not within the boundaries of the FEMA 0.2 percent annual exceedance probability (a.k.a. "500-year") flood event. The exception is the city's Grijalva Park Sports Center.

Conclusions

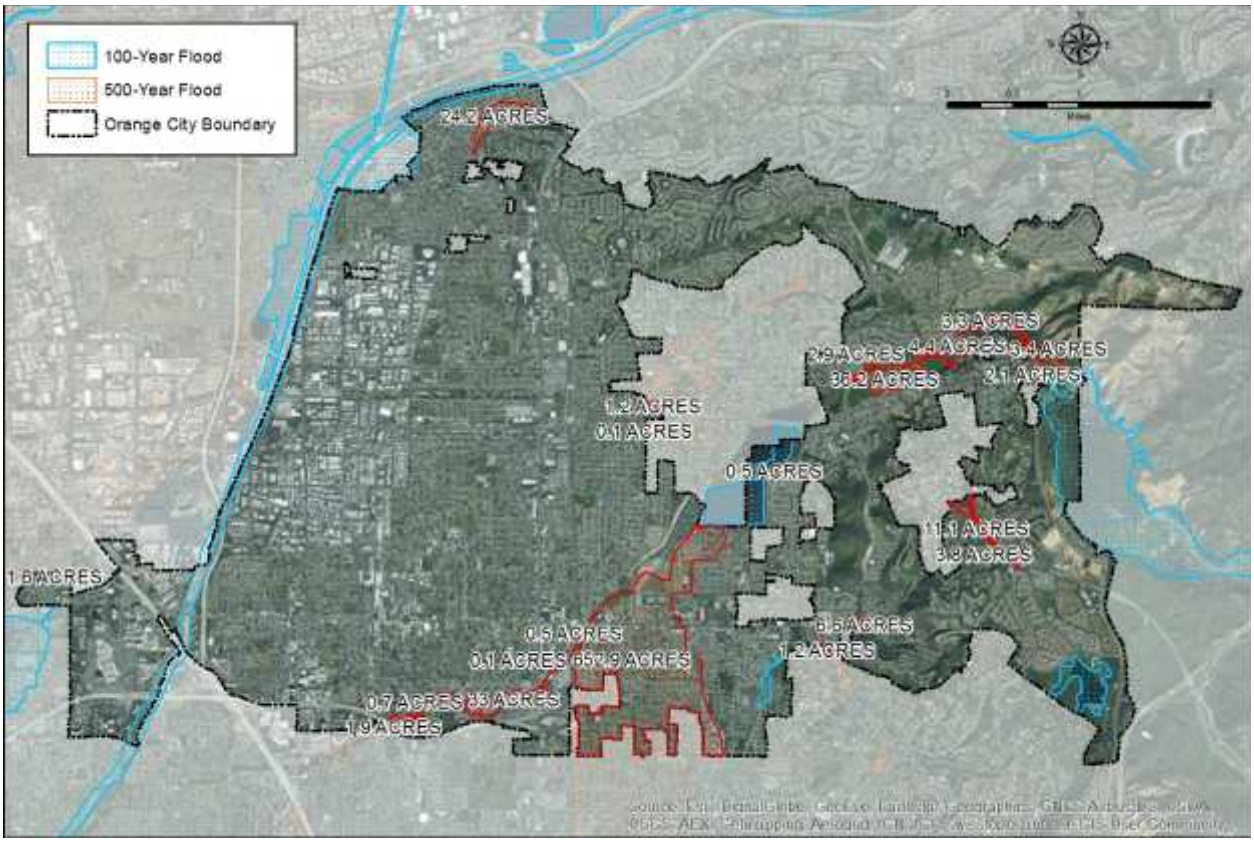
This study examined two earthquake event scenarios and two flooding event scenarios:

- Newport-Inglewood Fault Magnitude 7.0 earthquake event
- San Andreas Fault Magnitude 7.0 earthquake event
- 1 percent annual exceedance probability (a.k.a. "100-year") flood event
- 0.2 percent annual exceedance probability (a.k.a. "500-year") flood event

Loss estimates prepared using FEMA HAZUS-MH software reveal that, among the four scenarios analyzed, the most serious threat to the City of Orange is posed by the Newport-Inglewood Fault Magnitude 7.0 earthquake event scenario. The impact of this scenario event far exceeds the impact of the other three scenario events analyzed for this study. Analysis of the Newport-Inglewood Fault earthquake event scenario indicates that it could result in up to 122 casualties within the city, including

up to five life-threatening injuries or fatalities. An estimated 3,077 buildings within the city could be damaged and 212 households displaced. Economic losses could exceed 710 million dollars. Earthquake impacts are exacerbated by the presence of soils with potential for liquefaction. Such soils are present in the City of Orange in areas adjoining the Santa Ana River and Santiago Creek. A map depicting the location of soils subject to liquefaction and their proximity to the city's critical facilities was presented in the discussion of liquefaction and landslide potential above. Most of the city's critical facilities are not situated within areas containing soils with high liquefaction potential. The one exception is the Grijalva Park Sports Center.

None of the city's critical facilities are not located in areas subject to earthquake induced landslide. Most of the city is not subject to flooding. Levees along the Santa Ana River protect the city from the 1 percent annual exceedance probability (a.k.a. "100-year") flood event. The only other areas subject to flooding during a 100-year flooding event are not in developed areas. There are a few developed areas that would be subject to flooding during a 0.2 percent annual exceedance probability (a.k.a. "500-year") flood event. FEMA Flood Insurance Rate Maps (FIRM) show a total of 1.3 square miles (792.9) acres within the city that could be subject to flooding during the 500-year flood event. These areas adjoin Santiago Creek or Handy Creek except for a 24.2 acre area in the far north of the city near the Santa Ana River. Most of the area within the 500-year flood zone is in a single 1 square mile (652.9 acres) zone southeast of Santiago Creek and east of the SR-55 freeway. The following figure depicts the 100-year and 500-year flood zone boundaries, with the 500-year flood zone areas labeled with their areas in units of acres.

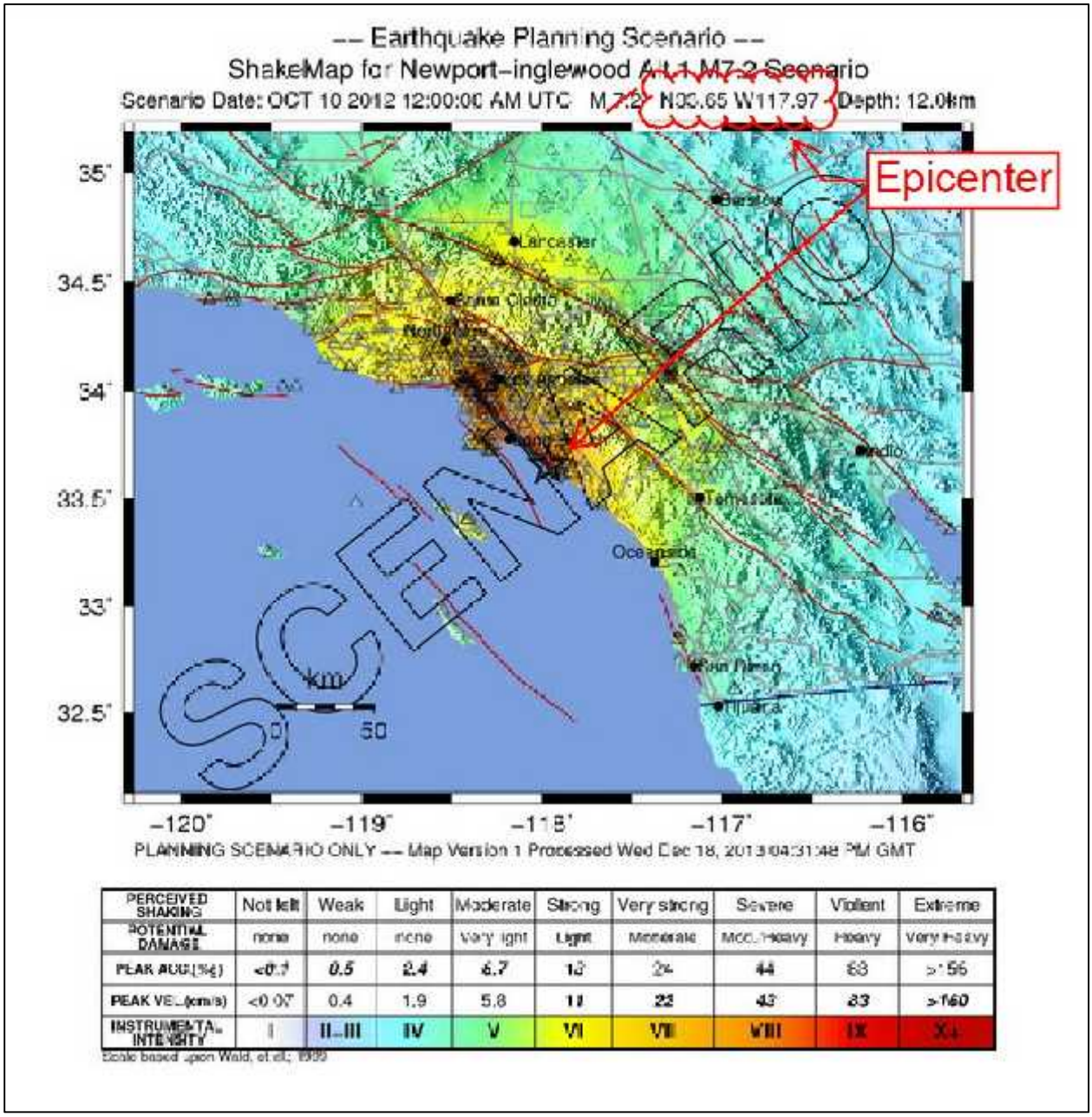


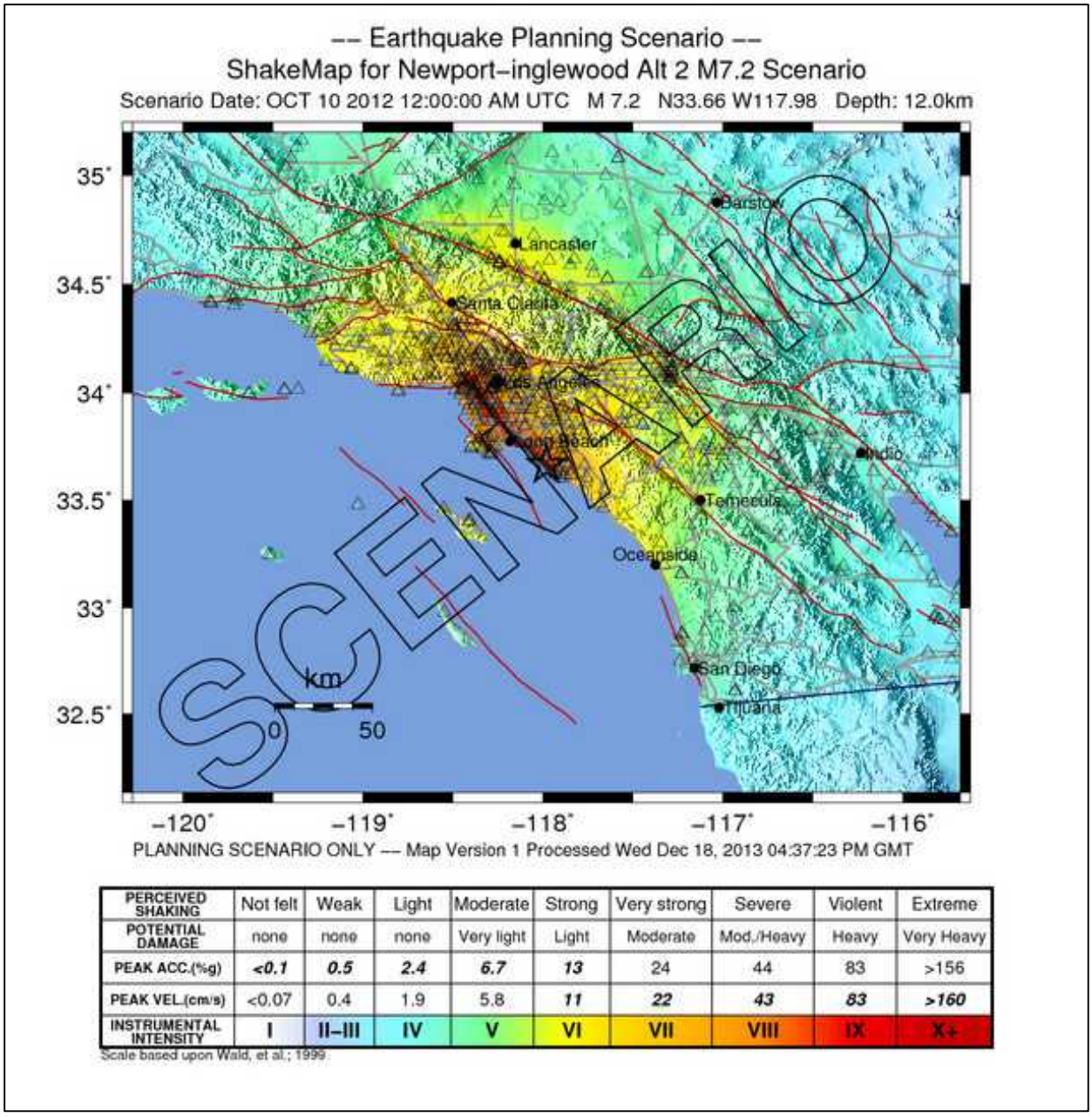
Recommendations

The city's *Grijalva Park Sports Center* is located in an area containing soils with high potential for liquefaction during a major earthquake. The city could consider studying the conditions at that site, including the ground water level and geotechnical analysis of the soil to further assess the liquefaction potential at that site.

There is a 1 square mile area adjoining Santiago Creek to the southeast that has potential for flooding during a 500-year storm event. It may be prudent to clear the Santiago Creek channel and clean debris from storm drains and catch basins each year prior to the rainy season. The other locations within the FEMA FIRM 500-year flood boundaries might also be considered for receiving similar attention. The city might also wish to consider whether other flood mitigation alternatives might be warranted in these regions of the city.

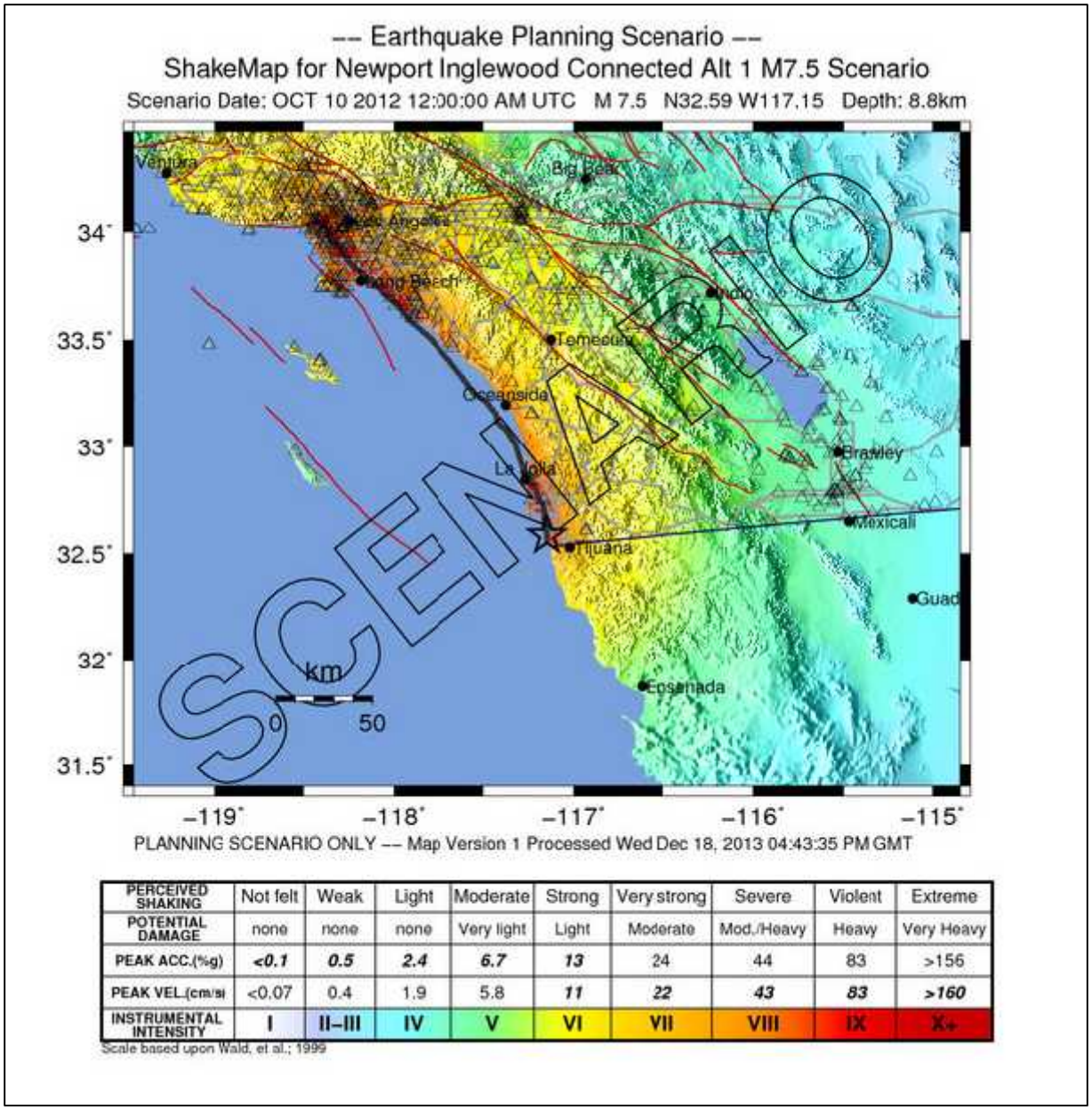
USGS Earthquake Scenario ShakeMaps





PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<0.1*	*0.5*	*2.4*	*6.7*	*13*	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	*11*	*22*	*43*	*83*	*>160*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999



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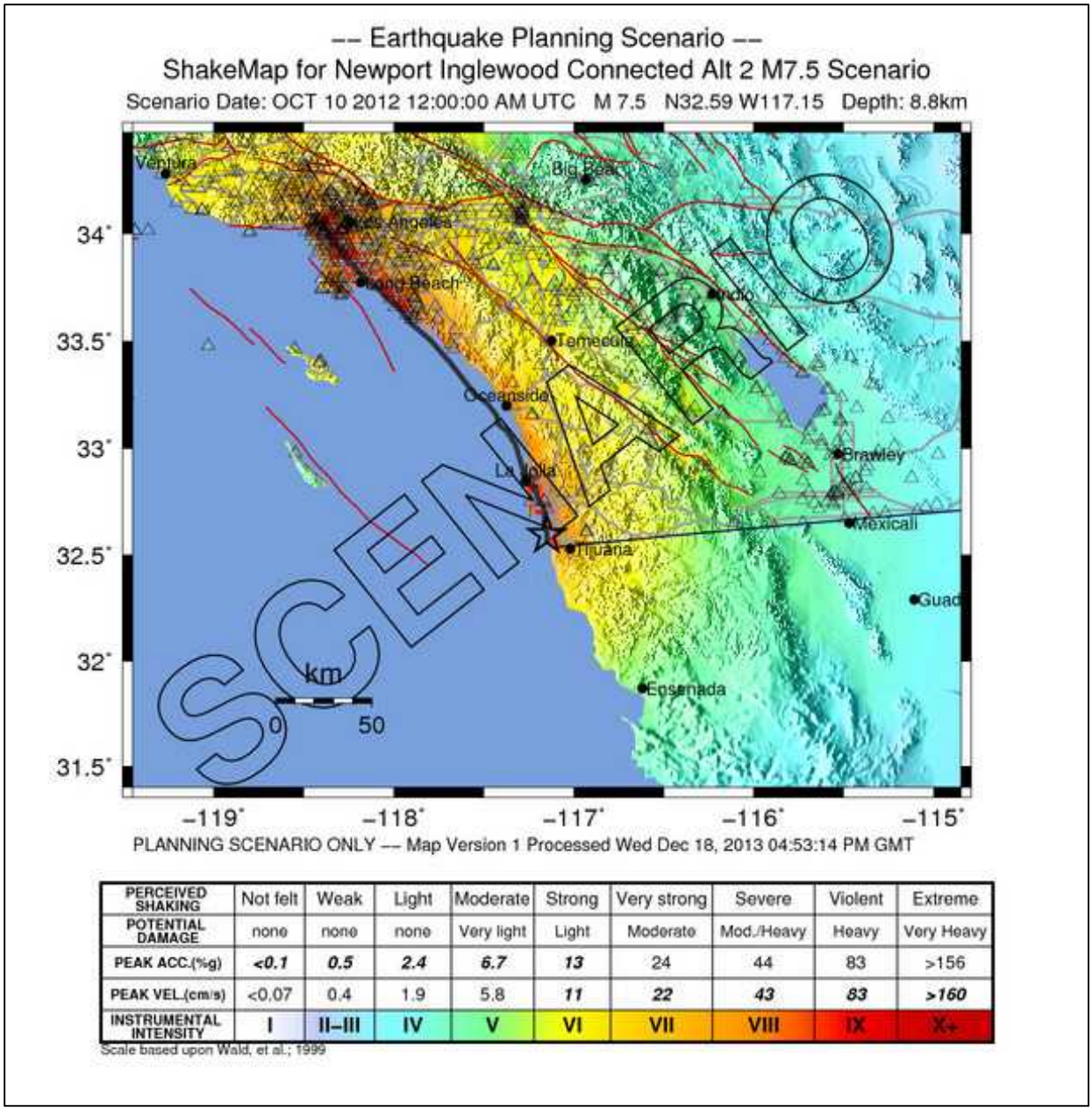

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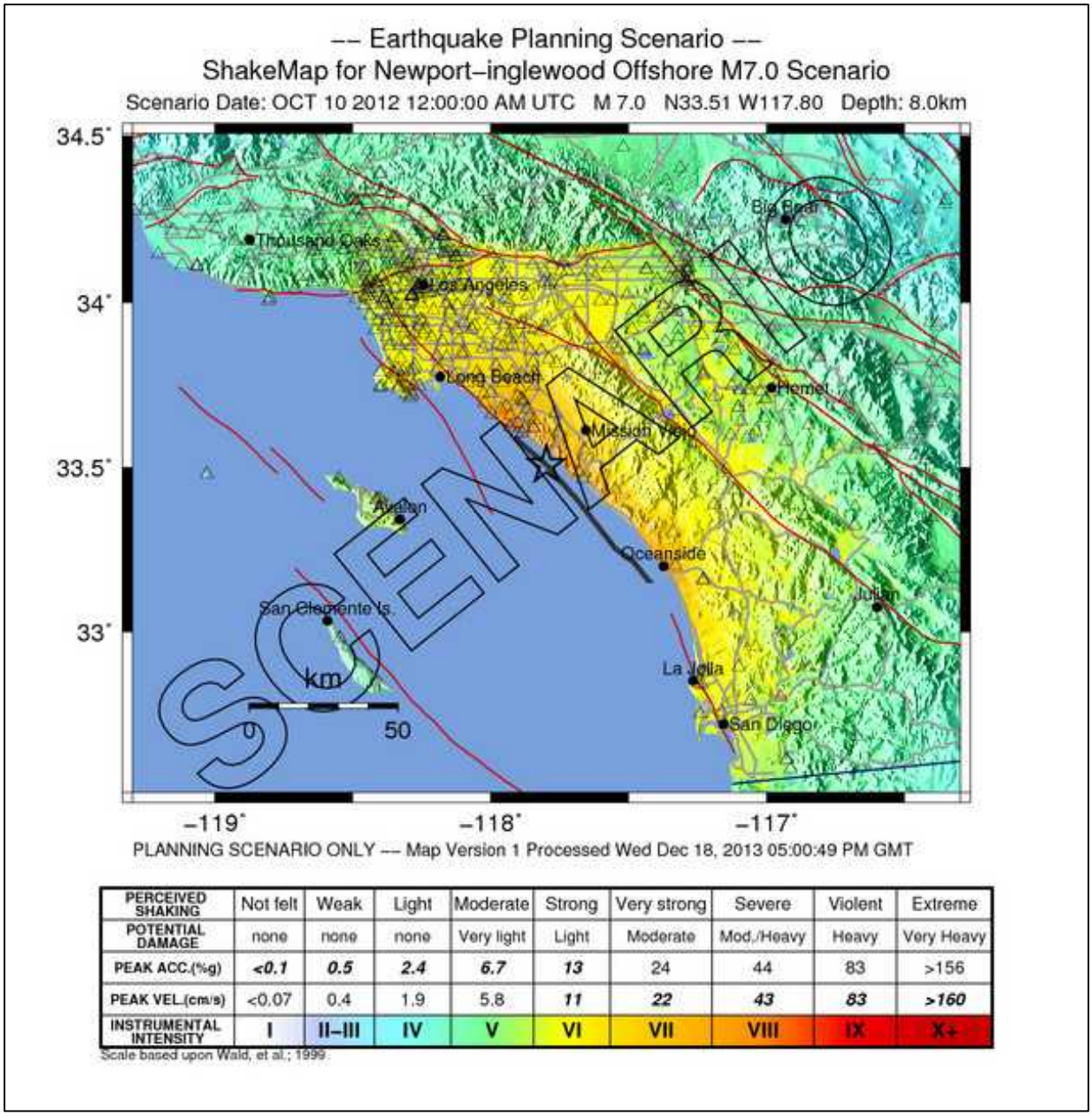

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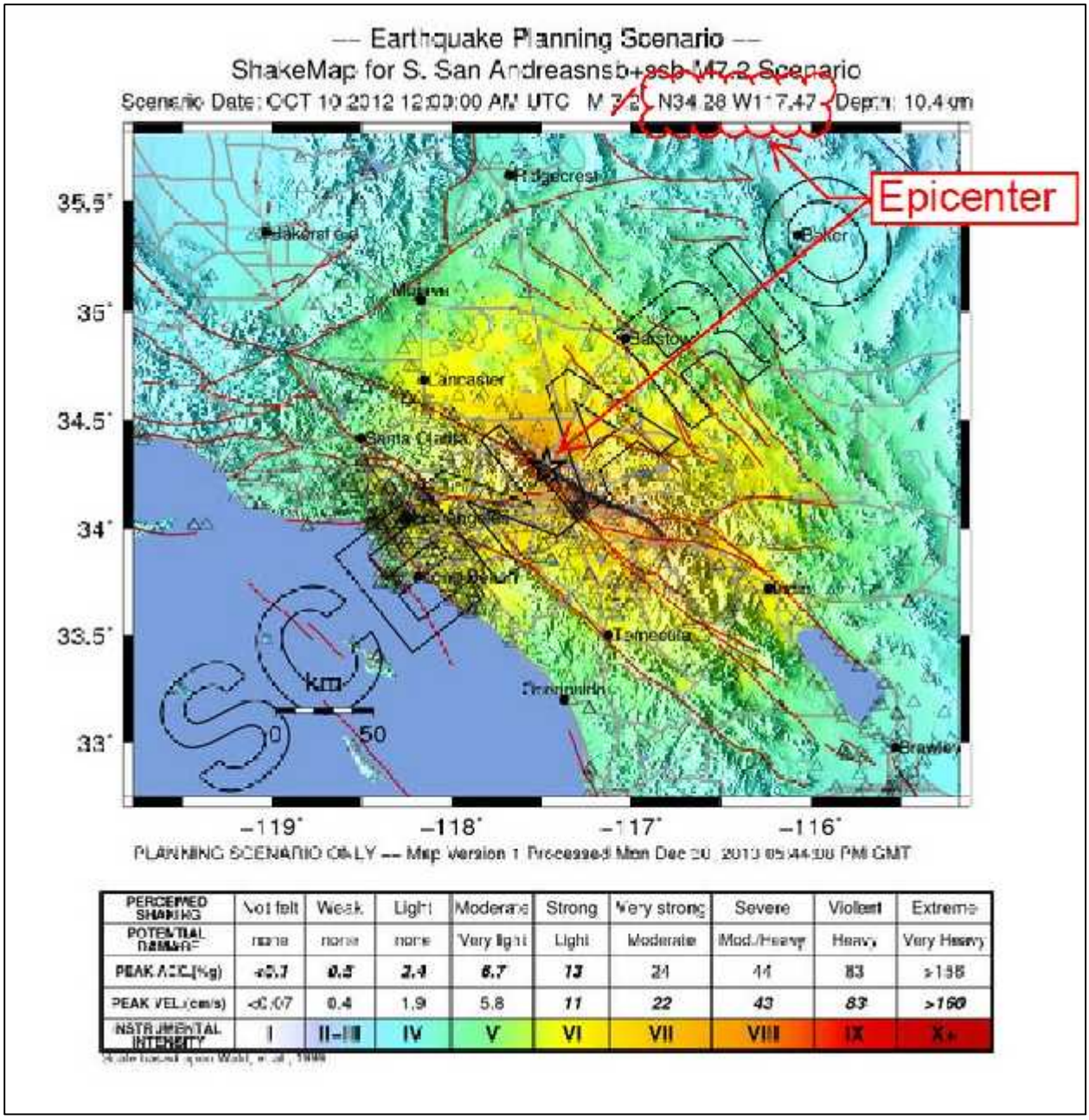

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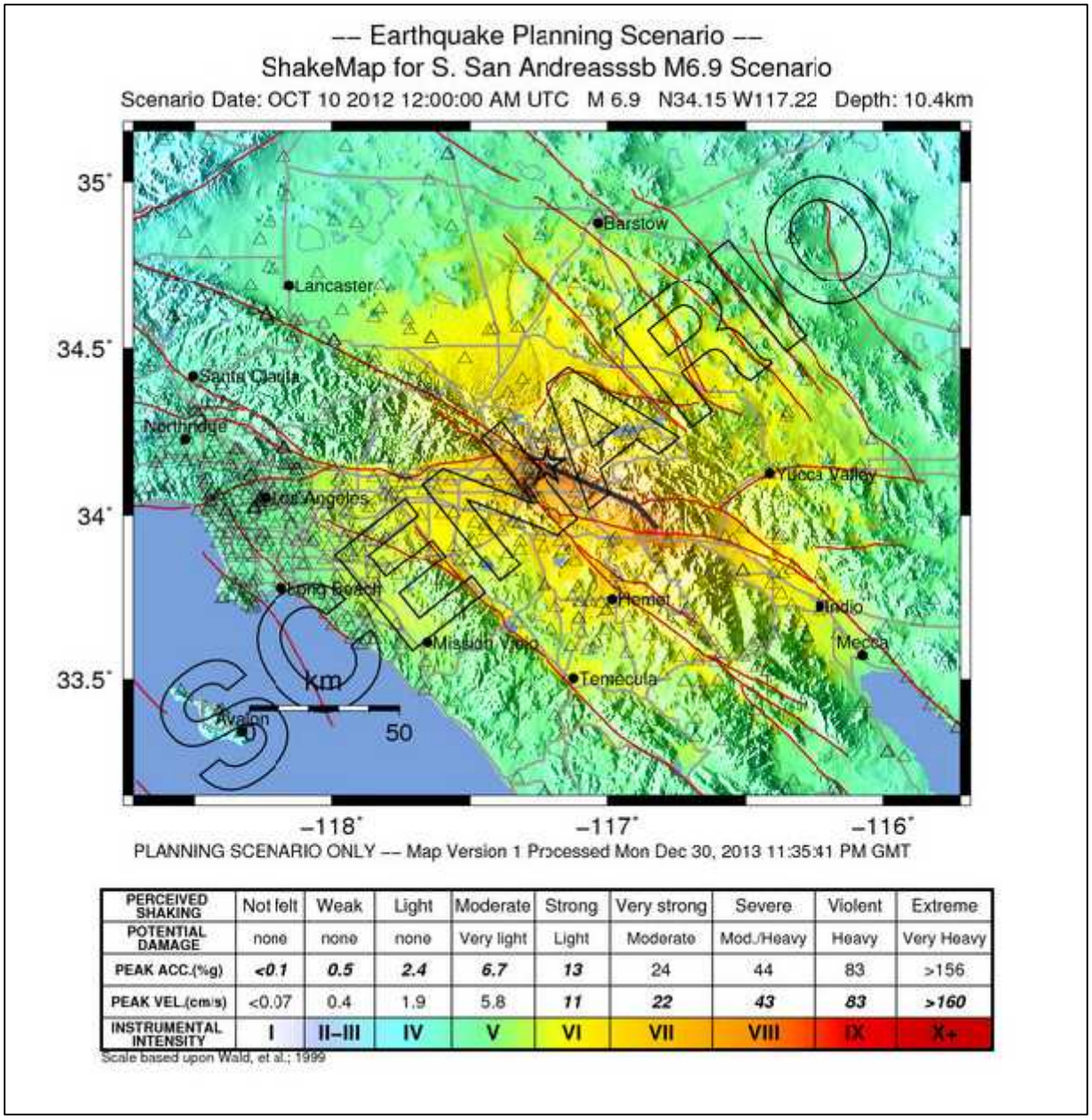

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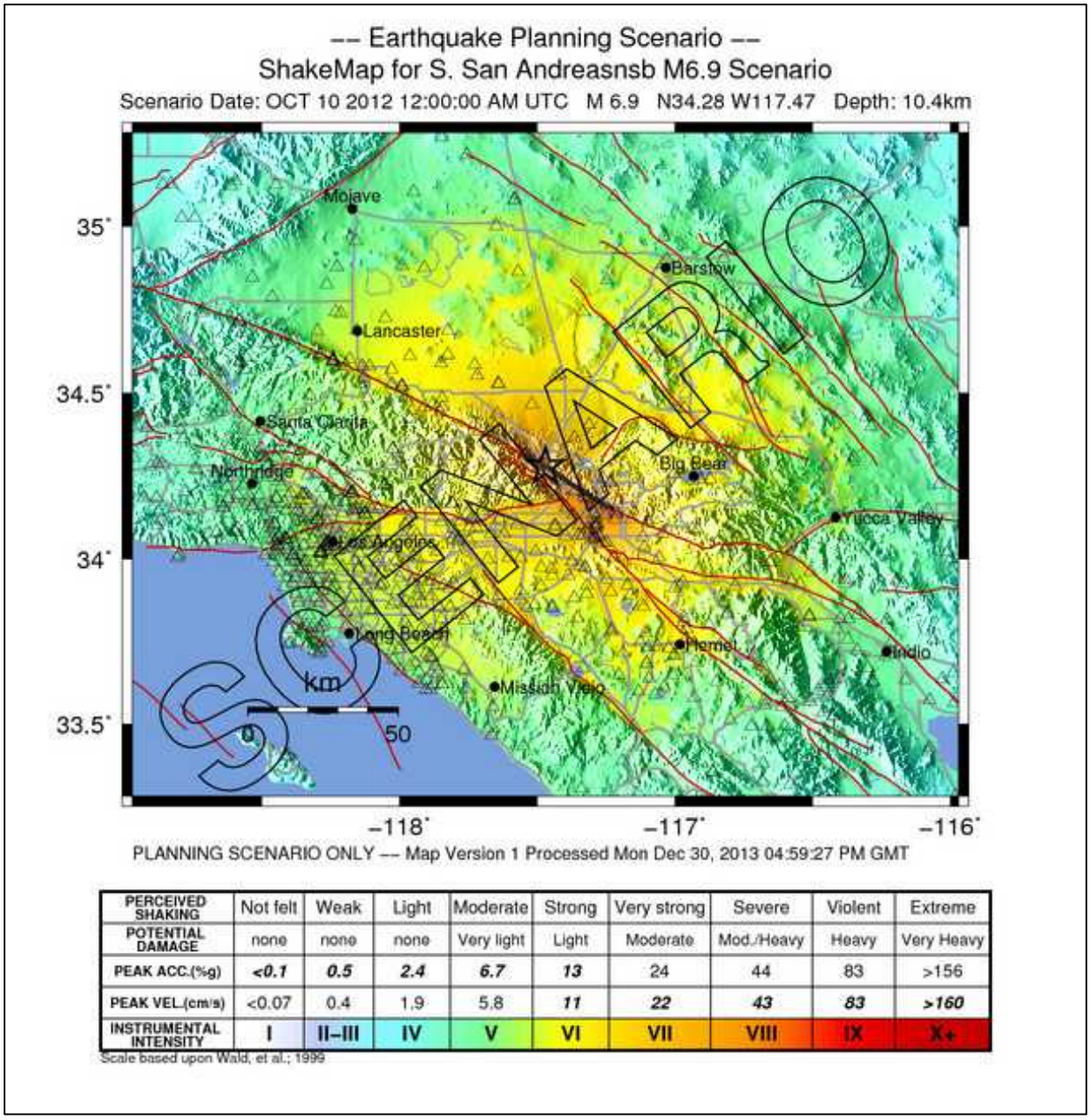

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References

FEMA Flood Map Service Center
https://msc.fema.gov/portal
USGS ShakeMaps
http://earthquake.usgs.gov/earthquakes/shakemap/
California Department of Conservation Seismic Hazard Zonation Program
http://www.conservation.ca.gov/cgs/shzp/Pages/affected.aspx

Appendix E: Hazardous Materials Spills in the City of Orange from July 2010 to May 2016

Haz-Mat Spill List
19 records listed

Date	Time	Shift	Primary	District	Incident No.	Incident Type NFIRS/Local Incident Type/Category
07/20/2010	21:33	A	E3	01532	01006047	422 Chemical spill or leak 409 Haz Mat Incident Non-Threat
	3133 N ORANGE OLIVE RD APT B					Haz Condition
10/01/2010	06:51	A	B1	C1735	01008318	422 Chemical spill or leak Service
	Villa Park					Haz Condition
08/30/2012	18:04	A	E2	01433	01208147	422 Chemical spill or leak 515 Investigation
	1546 E RIVERVIEW AVE					Service
04/15/2013	10:51	B	E4	02433	01303580	422 Chemical spill or leak 409 Haz Mat Incident Non-Threat
	S TUSTIN ST / E FAIRHAVEN AV					Haz Condition
05/06/2013	08:15	C	E5	02129	01304345	422 Chemical spill or leak 417 Spill-Misc
	N ECKHOFF ST / W COLLINS AV					Haz Condition
06/06/2013	10:22	C	I6	01930	01305377	422 Chemical spill or leak 409 Haz Mat Incident Non-Threat
	N BATAVIA ST / W KATELLA AV					Haz Condition
8/11/2013	11:59	A	T8	02038	01307622	422 Chemical spill or leak 409 Haz Mat Incident Non-Threat
	5242 E CERRITOS					Haz Condition
09/11/2013	15:13	C	E2	01735	01308738	422 Chemical spill or leak 515 Investigation
	N FEATHER HILL DR / E MEATS AV					Haz Condition
09/21/0213	07:18	A	E1	02031	01309098	422 Chemical spill or leak 515 Investigation
	KATELLA / GLASSELL ST					Haz Condition
12/01/2013	21;16	C	E6	02226	01311534	422 Chemical spill or leak 515 Investigation
	291 N SPINNAKER					Haz Condition
02/28/2014	11:18	B	E1	02331	01401973	422 Chemical spill or leak 515 Investigation
	W CHAPMAN AV / S PARKER ST					Haz Condition
04/03/2014	15:56	B	T1	A2028	01403115	422 Chemical spill or leak 417 Spill-Misc
	S SINCLAIR ST / HOWELL AV					Haz Condition
05/06/2014	11:19	A	E5	01830	01404227	422 Chemical spill or leak 515 Investigation
	1967 N MAIN					Haz Condition
07/01/2014	10:10	A	E3	01731	01406148	422 Chemical spill or leak 409 Haz Mat Incident Non-Threat
	W FLETCHER AV / N GLASSELL ST					Haz Condition
05/19/2015	12:36	A	E2	02133	015-5755	422 Chemical spill or leak 515 Investigation
	E COLLINS AV / N TUSTIN ST					Haz Condition

HazMat Spill List
19 records listed

Date	Time	Shift	Primary	District	Incident No.	Incident Type NFIRS/Local Incident Type/Category
10/03/2015	14:23	A	E1	02134	01511432	422 Chemical spill or leak 409 Haz Mat Incident Non-Threat
	701 N CLINTON					Haz Condition
11/15/2015	22:14	A	E1	02232	01513318	422 Chemical spill or leak 410 HazMat Incident Threat to Life/Property
	346 N CENTER					Haz Condition
05/02/2016	08:52	A	E3	01931	01604966	422 Chemical spill or leak 410 HazMat Incident Threat to Life/Property
	N BATAVIA ST / W KATELLA AV					Haz Condition
05/29/2016	15:34	A	E5	02330	01606103	422 Chemical spill or leak 999 Unknown
	1031 W CHAPMAN AV					Haz Condition

Appendix F: Facilities of Concern

Educational Institutions (Public Facility, Non-City Ownership)

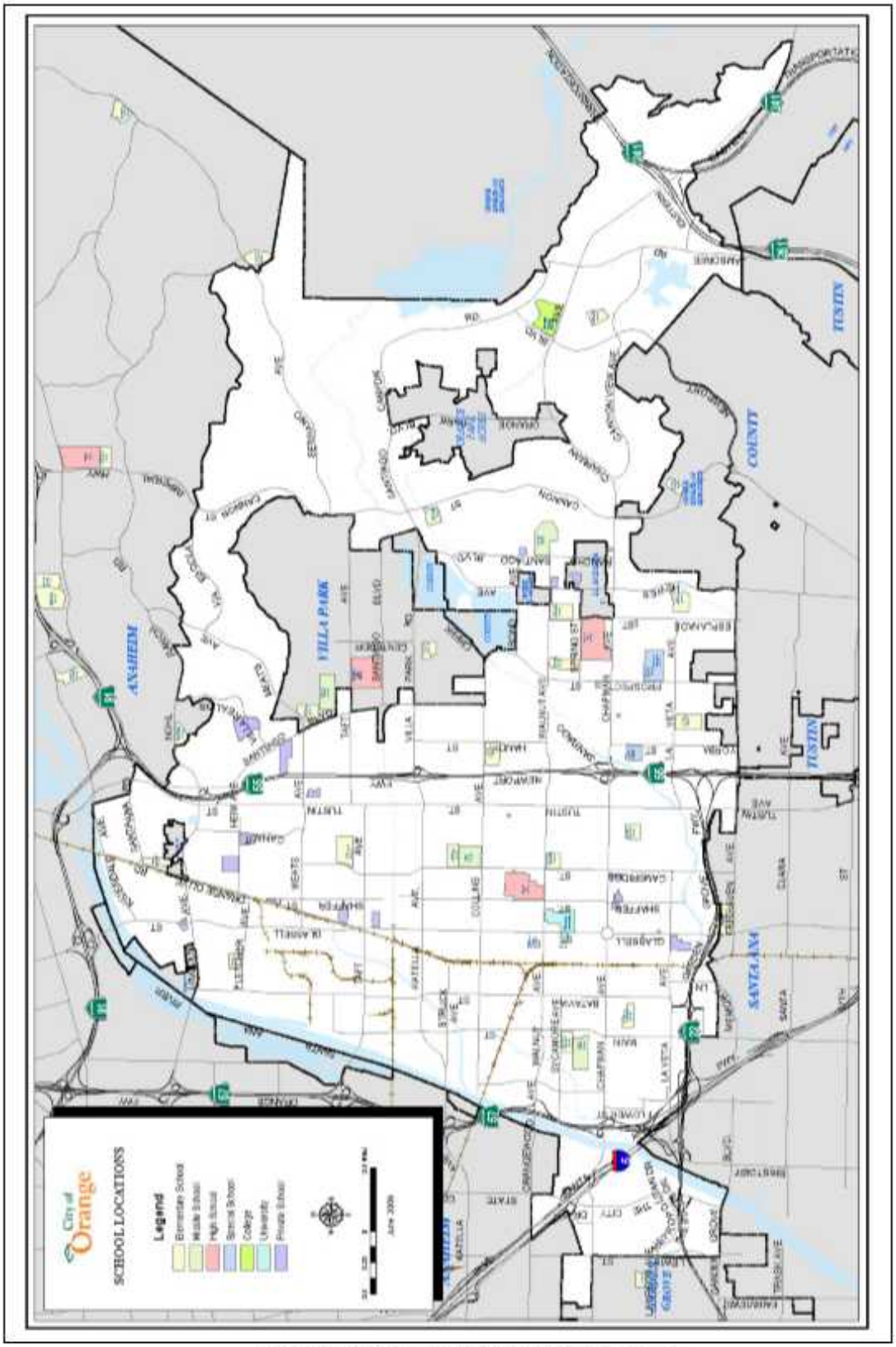
- Chapman University, 333 N. Glassell, Orange, CA 92866
- Santiago Canyon College, 8045 E. Chapman Avenue, Orange, CA 92866
- Orange Unified School District, 8045 E. Chapman Avenue, Orange, CA 92869 serves grades K-12 which includes a number of elementary, middle schools, and high schools. Numerous private and preschools are located within the city.

Hospitals (Private Properties)

- St. Joseph's Hospital
- Children's' Hospital of Orange County
- UC Irvine Medical Center
- Chapman Medical Center

Assisted Living and Skilled Nursing Homes (Private Properties)

- Fountain Care Center, 1835 W La Veta Ave, Orange, CA 92868
- Fountain Senior Assisted Living, 1800 W Culver Ave, Orange, CA 92868
- New Orange Hills, 5017 E Chapman Ave, Orange, CA 92869
- Park Plaza, 620 S Glassell St, Orange, CA 92866
- Emeritus at Orange, 142 S Prospect St, Orange, CA 92869
- Leisure Tower Guest Home, 1305 E Chapman Ave, Orange, CA 92866



Map 2-17: Schools (K-12) within Orange

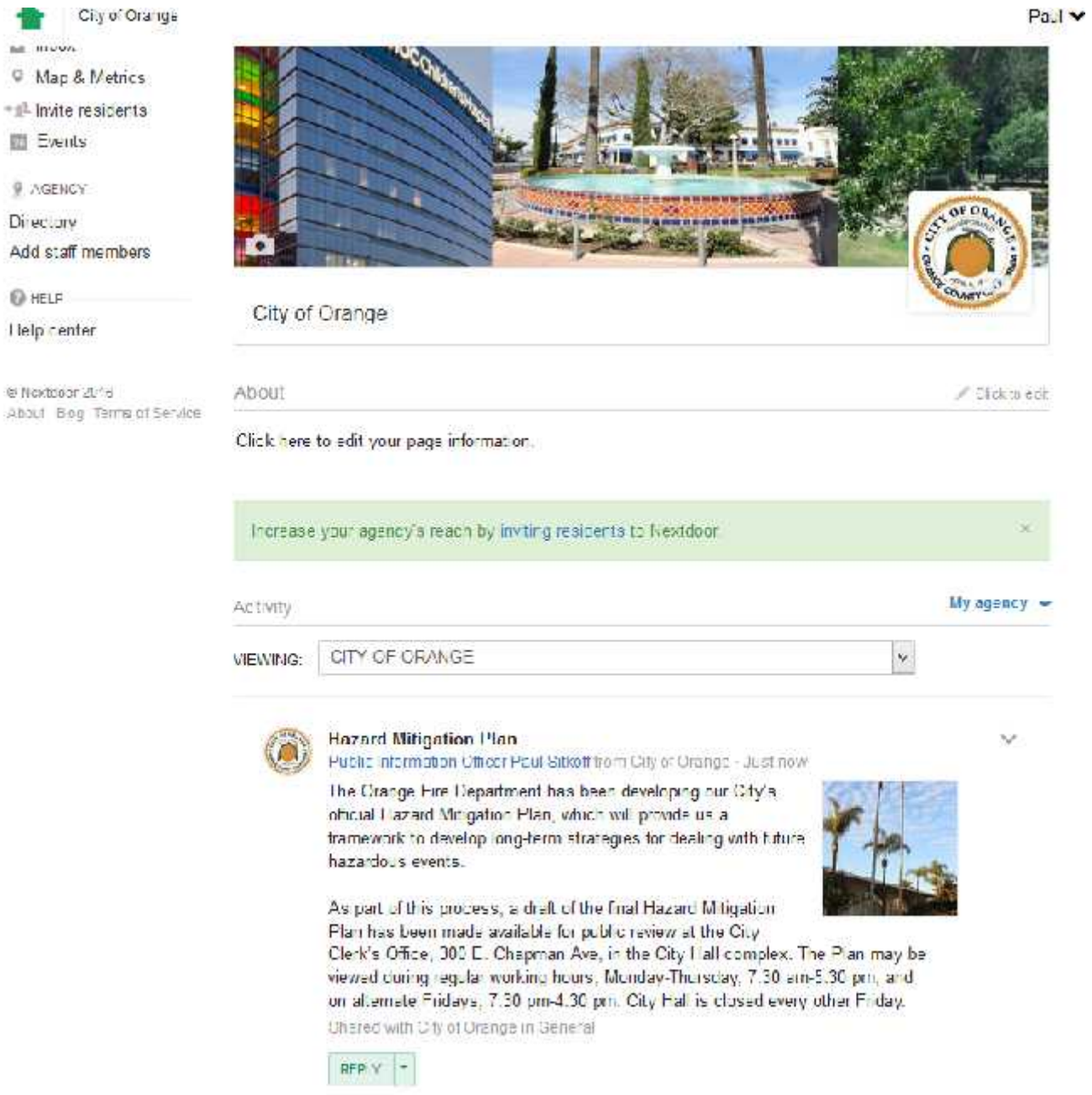
Appendix G: Acronym List

Term	Definition
APA	Approved Pending Adoption
BNSF/BNSR	Burlington Northern and Santa Fe Railways merger (freight services and freight traffic)
Cal OES	California Governor's Office of Emergency Services
CDBG	Community Development Block Grants
CDC	Center for Disease Control
CDPH	California Department of Public Health
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CIP	Capital Improvement Projects
CPR	Cardiopulmonary Resuscitation
CPUC	California Public Utilities Commission
CRS	Community Rating System
CSTE	Council of State and Territorial Epidemiologists
DMA	Disaster Mitigation Act
EAP	Emergency Action Plan
EOC	Emergency Operations Center
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate map
GIS	Geographic Information System
GWR	Groundwater Replenishment Program
HAZMIT	Hazard Mitigation
HAZUS	Hazards United States
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
LHMP	Local Hazard Mitigation Plan
M	Magnitude
MET	Metropolitan Water District of Southern California
MPH	Mile Per Hour
MWDOC	Municipal Water District of Orange County
MSL	Mean Sea Level
H1N1/N	Influenza Virus, "Swine Flu"
H5N1	Influenza Virus, "Bird Flu"

Term	Definition
NFIP	National Flood Insurance Program
OCEMO	Orange County Emergency Management Organization
OCHCA	Orange County Health Care Agency
OCP	Orange County Profiles
OCTA	Orange County Transportation Authority
OCWD	Orange County Water District
SARS	Severe Acute Respiratory Syndrome
SFHA	Special Flood Hazard Area
TLO	Terrorism Liaison Officer
U.S.	United States
USDOT	United States Department of Transportation
USGS	United States Geological Survey
WHO	World Health Organization

Appendix H: 30-Day Public Review Process

Nextdoor



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Emergency Preparedness

The Orange Fire Department has been developing our City's official Hazard Mitigation Plan, which will provide us a framework to develop long-term strategies for dealing with future hazardous events.

As part of this process, a draft of the final Hazard Mitigation Plan has been made available for public review at the City Clerk's Office, 300 E. Chapman Ave, in the City Hall complex. The Plan may be viewed during regular working hours, Monday-Thursday, 7:30 am-5:30 pm, and on alternate Fridays, 7:30 pm-4:30 pm. City Hall is closed every other Friday.

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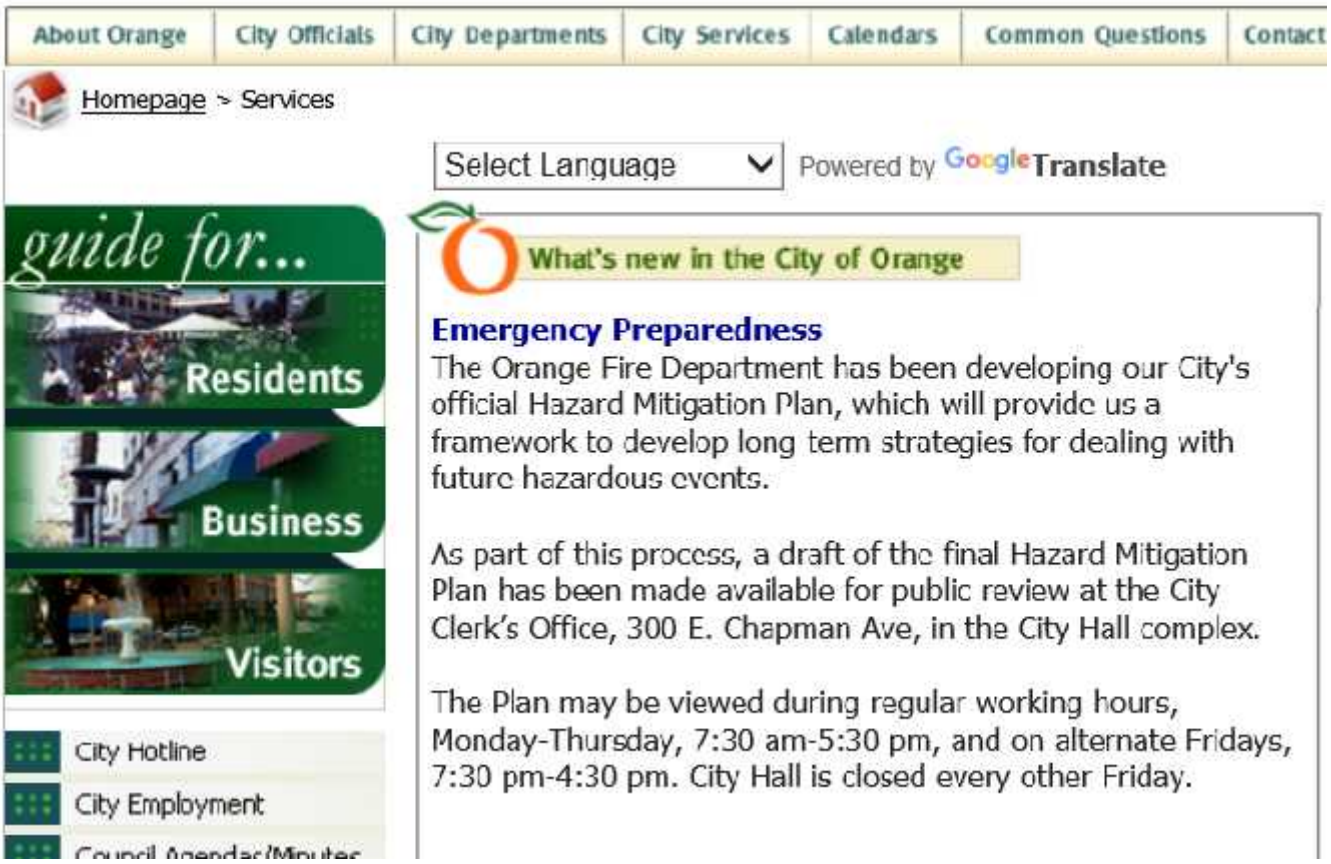
City of Orange Website



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