2015

CITY OF REDLANDS
HAZARD MITIGATION PLAN

PREPARED BY:

FAY GLASS
EMERGENCY OPERATIONS MANAGER

APRIL 2015

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Executive Summary

The City of Redlands has completed this Hazard Mitigation Plan in accordance to 44 Code of Federal Regulations (44 CFR Parts 201 and 206). The intent of "hazard mitigation" is to reduce and/or eliminate loss of life and property. Hazard mitigation is defined by the Department of Homeland Security-Federal Emergency Management Agency (FEMA) as "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." A "hazard" is defined by FEMA as "any event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other loss."

The purpose of the Hazard Mitigation Plan (HMP) is to demonstrate the plan for reducing and/or eliminating risk in the city. The HMP process encourages communities to engage community stakeholders to develop goals and projects that will reduce risk and build a more disaster resilient community by analyzing potential hazards. After disasters, repairs and reconstruction are often completed in such a way as to simply restore to pre-disaster conditions. Such efforts expedite a return to normalcy; however, the restoring of things to pre-disaster conditions sometimes result in feeding the disaster cycle; damage, reconstruction, and repeated damage. Mitigation is one of the primary phases of emergency management specifically dedicated to breaking the cycle of damage.

Hazard mitigation is distinguished from other disaster management functions in that it identifies measures (projects) which make development and the natural environment safer and more disaster resilient. Mitigation generally involves alteration of physical environments, significantly reducing risks and vulnerability to hazards by altering the built environment so that life and property losses can be avoided or reduced. Mitigation also makes it easier and less expensive to respond to and recover from disasters.

Also with an approved (*and adopted*) HMP, the city is eligible for federal Hazard Mitigation Assistance (HMA) funds/grants that are aimed to reduce and/or eliminate risk; Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Management Assistance (FMA), and Severe Repetitive Loss (SRL).

The City was awarded Hazard Mitigation funding in 2010 and due to staffing challenges the Hazard Mitigation Plan is now being submitted with final revisions.

Acknowledgements

Council Members:

Mayor	Paul Foster
Mayor Pro Tempore	Jon Harrison
Council Member	Pat Gilbreath
Council Member	Paul Barich
Council Member	John James

City Manager's Office

City Manager	N. Enriquez Martinez
City Attorney	Dan McHugh

Planning Team Members

City Manager's Office	Carl Baker, Public Information Officer
City Manager's Office	Fay Glass, Emergency Operations Manager
City Manager's Office	Angela Johnson, Volunteer
Development Services Department	Chris Boatman, Assistant Planner
Development Services Department	Richard Pepper, Building Official
Fire Department	Jeff Frazier, Chief
Fire Department	Scott MacDonald, Battalion Chief
Fire Department	David Graves , Battalion Chief
Innovation and Technology Department	Philip Mielke, GIS Supervisor
Municipal Utilities and Engineering	Chris Diggs, Assistant Utilities Director
Municipal Utilities and Engineering	Fred Mousavipour, Assistant Engineering Director
Municipal Utilities and Engineering	Rosemary Hoerning, Director
Police Department	Rogelio Garcia, Lieutenant
Police Department	Shawn Ryan, Lieutenant
Quality of Life	Danielle Garcia, Field Services Manager
Quality of Life	Fred Cardenas, Quality of Life Director
Quality of Life	Rick Cross, Operations Superintendent

Local Hazard Mitigation Plan Stakeholders - Operational Area Coordinating Council (OACC)

The City of Redlands would like to thank all of the stakeholders for their contributions in the development of the hazard mitigation plan. This coordinated effort has allowed us to develop a comprehensive plan and access the hazards within the city. This comprehensive plan will reduce the loss of life, critical infrastructure and property to the city.

San Bernardino Co. Fire Dept. - OES	Non-Profit Organization
Non-Governments Organizations	Educational Institutions
Educational Institutions	Hospitals
Local Government Agencies	Governor's Office of Emergency Service
Utility Companies	Federal Emergency Management

Resolution No. XXXX

A RESOLUTION ADOPTING THE CITY OF REDLANDS HAZARD MITIGATION PLAN AS REQUIRED BY THE FEDERAL DISASTER MITIGATION AND COST REDUCTION ACT OF 2000.

WHEREAS, President William J. Clinton signed H.R. 707, the Disaster Mitigation and Cost Reduction Act of 2000, into law on October 30, 2000.

WHEREAS, the Disaster Mitigation Act of 2000 requires all jurisdictions to be covered by a Local Hazard Mitigation Plan to be eligible for Federal Emergency Management Agency post-disaster funds; and

WHEREAS, The City of Redlands – City Manager's Office has acted as the lead agency in the development of the City of Redlands Hazard Mitigation Plan; and

WHEREAS, the City of Redlands – City Manager's Office has coordinated the development of the Hazard Mitigation Plan; and

WHEREAS, the City Manager's Office has the authority within the City of Redlands, and

WHEREAS, the City of Redlands is concerned about mitigating potential losses from natural disasters before they occur, and

WHEREAS, the plan identifies potential hazards, potential losses and potential mitigation measures to limit losses, and

WHEREAS, the California State Governor's Office of Emergency Services has reviewed the plan on behalf of the Federal Emergency Management Agency; and

WHEREAS, formal adoption of the plan by the City of Redland's City Council is required before final approval of the plan can be obtained from the Federal Emergency Management Agency; and

WHEREAS, The City of Redlands has determined that it would be in the best interest of the City as a whole to adopt the Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED THAT THE REDLANDS CITY COUNCIL HEREBY ADOPTS the City of Redlands Hazard Mitigation Plan to meet the requirements of the Disaster Mitigation and Cost Reduction Act of 2000 and directs the City Manager's Office of Emergency Management to forward the Hazard Mitigation Plan to the Governor's Office of Emergency Services and Federal Emergency Management Agency on behalf of the City of Redlands for final approval.

ADOPTED, signed and approved at a regular meeting of the City Council of the City of Redlands on this _____day of_____, 2014.

Primary Contact Information

City of Redlands

Fay Glass, Emergency Operations Manager

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Redlands, CA 92373

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Section 1. Local Hazard Mitigation Plan

The Hazard Mitigation Plan (HMP) is a "living document" that should be reviewed, monitored, and updated to reflect changing conditions and new information. As required, the HMP must be updated every five (5) years to remain in compliance with regulations and Federal mitigation grant conditions. In that spirit, this HMP is an update of the City of Redland's HMP approved by FEMA on April 29, 2005. This HMP presents updated information regarding hazards being faced by the city, mitigation measures (projects) taken or planned by the city to help reduce consequences from hazards, and hazard education (outreach) efforts by the city.

1.1. Purpose of the Plan

The intent of "*hazard mitigation"* is to reduce and/or eliminate loss of life and property. Hazard mitigation is defined by the Department of Homeland Security-Federal Emergency Management Agency (FEMA) as "*any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards*." A "*hazard*" is defined by FEMA as "*any event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other loss*."

The purpose of the Hazard Mitigation Plan (HMP) is to demonstrate the plan for reducing and/or eliminating risk in the city. The HMP process encourages communities to engage community stakeholders to develop goals and projects that will reduce risk and build a more disaster resilient community by analyzing potential hazards.

After disasters, repairs and reconstruction are often completed in such a way as to simply restore to pre-disaster conditions. Such efforts expedite a return to normalcy; however, the restoring of things to pre-disaster conditions sometimes result in feeding the disaster cycle; damage, reconstruction, and repeated damage. Mitigation is one of the primary phases of emergency management specifically dedicated to breaking the cycle of damage (Figure 1).

Figure 1. Phases of Emergency Management

Hazard mitigation is distinguished from other disaster management functions in that it identifies measures (projects) which make development and the natural environment safer and more disaster resilient. Mitigation generally involves alteration of physical environments, significantly reducing risks and vulnerability to hazards by altering the built environment so that life and property losses can be avoided or reduced. Mitigation also makes it easier and less expensive to respond to and recover from disasters.

Also with an approved (*and adopted*) HMP, the City is eligible for Federal Hazard Mitigation Assistance (HMA) funds/grants that are aimed to reduce and/or eliminate risk; Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Management Assistance (FMA), and Severe Repetitive Loss (SRL).

1.2. Authority

In 2000, FEMA adopted revisions to Title 44 of the Code of Federal Regulations (44 CFR). This revision is known as “Disaster Mitigation Act (DMA).” DMA 2000, Section 322 (a-d) requires that local governments, as a condition of receiving federal disaster mitigation funds, have a Hazard Mitigation Plan (HMP) that describes the process for assessing hazards, risks and vulnerabilities, identifying and prioritizing mitigation actions, and engaging/soliciting input from the community (public), key stakeholders, and adjacent jurisdictions/agencies.

The City of Redlands has adopted Ordinances 2639 and 2485 that require the emergency services chief to be responsible for the development and update of the City of Redlands emergency multi-hazard functional plan and hazard mitigation plan. The multi-hazard functional plan shall provide for the effective mobilization of all of the resources of the City, both public and private, to meet any condition constituting a local emergency, state of emergency, or state of war emergency. The hazard mitigation plan shall provide a well-organized public education and awareness effort involving preparedness and mitigation. These actions include hazard, risk and vulnerability identification, the identification of mitigation action, and the support of mitigation efforts. Such plans shall take effect upon adoption by resolution of the city council. (Ord. 2639 § 3, 2006: Ord. 2485 § 4 [5], 2002). The City of Redlands Title 2 – Administration and Personnel Chapter 2.52.150 – Emergency Organization Ordinance 2639).

1.3. Promulgation Authority

The promulgation authority is vested in the members of the City Council. This Hazard Mitigation Plan was reviewed and approved by the following Promulgation Authorities. (Table 1)

Table 1. Promulgation Authorities

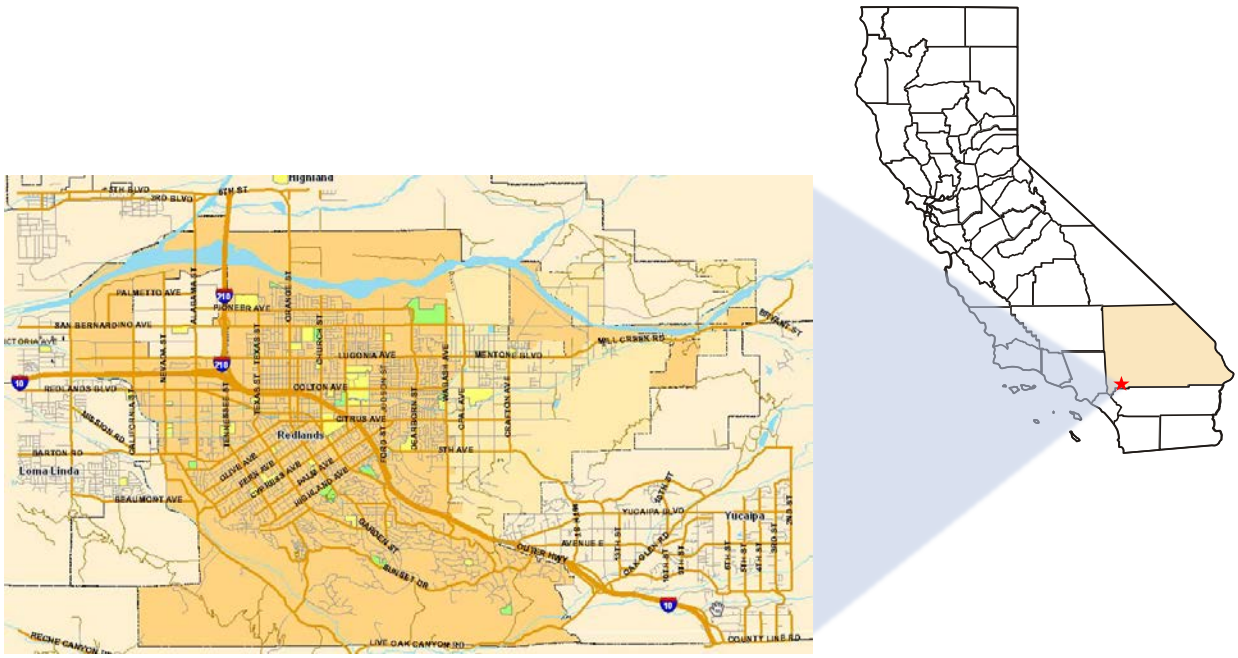
Staff	Contact Information
Paul Foster **Mayor**	City of Redlands 35 Cajon Street, Suite 200 P. O. Box 3005 Redlands, CA 92373
Jon Harrison **Mayor Pro Tempore**	City of Redlands 35 Cajon Street, Suite 200 P. O. Box 3005 Redlands, CA 92373
Pat Gilbreath **Councilmember**	City of Redlands 35 Cajon Street, Suite 200 P. O. Box 3005 Redlands, CA 92373
Paul Barich **Councilmember**	City of Redlands 35 Cajon Street, Suite 200 P. O. Box 3005 Redlands, CA 92373
John James **Councilmember**	City of Redlands 35 Cajon Street, Suite 200 P. O. Box 3005 Redlands, CA 92373

1.4. Community Profile

1.4.1. Physical Setting

The City of Redlands is located in southwestern San Bernardino County, 8 miles east of the City of San Bernardino, and 63 miles east of the Los Angeles metropolitan area. Primarily a residential community, Redlands incorporates approximately 37.5 square miles. The City is located in what is known as the East Valley Corridor of the Inland Empire. (Figure 2)

Figure 2. City of Redlands within San Bernardino County



Features include the Santa Ana River to the north, the Crafton Hills to the east, the San Timoteo Canyon to the south, and the City of Loma Linda to the west. Recognized geographical hazards include the San Andreas Fault Zone, generally located one mile north of the City of Redlands, the San Jacinto Fault Zone, generally located in San Timoteo Canyon, and 100-year flood zones which include the Santa Ana River System to the north, the San Timoteo Creek System generally located in San Timoteo Canyon, and the mission Zanja Creek System, traversing east-west through the city limits. The Interstate 10 (I-10) freeway bisects the City east to west, and State Route 210 junctions from the I-10 Freeway close to the west city limit.

Two (2) principal streams drain into Redlands, each of which presents identifiable flood hazards at peak flows:

- **The Santa Ana River/Mill Creek**
  The Santa Ana River/Mill Creek emerges from its mountain canyon 5 miles northeast of Redlands, spreads out in shallow, braided channels more than a 1.5 mile-wide wash, mantled with fluvial debris. In 1965, 1966, 1969, 1976, 1980, 1992, 1993, and 1995 the flood waters from the upper regions of the Santa Ana River/Mill Creek were responsible for extensive damage to Orange Street and Alabama Street, ranging from washouts from five to six-foot high flood waters, to extensive, permanent damages from uncontrollable runoff from the upper regions of the San Bernardino mountains.

- **Mission Zanja, also known as Mill Creek Zanja and Mission Storm Drain**
  The Mission Zanja was constructed for water supply in 1819. Diverting water from Mill Creek, the Zanja carried water for 12 miles to support the San Bernardino Assistance and surrounding farms and ranches. Today, as it traverses an east/west direction, the Zanja drains major portions of the City through various storm drain systems. During significant storm periods, the Zanja poses a serious threat to the community, and is presently being studied by the U. S. Army Corps of Engineers to determine if Corps funding might be available for design and construction of facilities to remove the flood hazard. The Mission Zanja, from the 2800 block of Mentone Boulevard to the west edge of Sylvan Park, is a designated landmark, and part of the National Register of Historic Places.

  (See Table 27 on page for flood events and their impacts on the City of Redlands).

1.4.2. History

Once part of the Spanish Mission lands, Redlands was incorporated in 1888 following an influx of wealthy easterners and mid westerners. Early settlers brought their cultures, traditions and treasures, adding to the City's reputation as a cultural and educational community. Agriculture prospered with the navel orange and many citrus groves still surround Redlands today. More than a hundred years ago the seed which became the city of Redlands was planted by two young Easterners who shared a dream of idyllic agricultural and residential community.

Redlands was the shared dream of Frank E. Brown, a civil engineer and Yale graduate, and E. G. Judson, a New York stock broker, who met in Southern California in late 1870's.

Naming their Redlands colony for the color of the adobe soil, the two busily laid out a city, brought water from the mountains to the community, introduced the newly discovered Washington navel orange, and recruited settlers. It wasn't long before Redlands proudly proclaimed itself the Navel Orange Capital of the World.

One group of early settlers called itself the Chicago Colony and created what is now the downtown business district. They named the principal shopping street for State Street in Chicago.

In 1889, twins Alfred H. and Albert K. Smiley came to Redlands, and the town has changed forever. The Smiley brothers, well known educators and resort owners from New York, established a tradition of philanthropy with their donation of the A. K. Smiley public library and park in 1889. Two decades later, the Clarence G. Whites gave the prosellis at the Redlands Bowl, and the Robert Watchorns built the Lincoln Shrine next to the library. These and many others built a city that was known as the "Jewel of the Inland Empire." Many of the jewels are still with us.

The interval from 1920-1930 was another period of growth and prosperity, largely due to the citrus industry. The town's other "industry," the University of Redlands, expanded as well and a general increase in population occurred. Another regional contributor was the establishment of Norton Air Force Base, which remained an active military facility until 1994. Because of Redlands' historic and cultural heritage, the City attracted commissioned military personnel as residents. The closure of Norton Air Force Base, coupled with a declining economy beginning in 1990, had a negative impact on the City's economic stability.

1.4.3. Climate

Redlands' climate is typical of Southern California inland areas. Residents experience mild winters, low annual rainfall, and prolonged, dry summers. (Table 2)

Table 2. Average Temperature and Precipitation in Redlands

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Max. Temp. (F)	64.7	66.1	69.1	73.7	78.5	86.7	94.5	94.2	90.1	81.0	72.7	65.8	**78.1**
Avg. Min. Temp.(F)	39.3	41.3	43.6	46.8	51.1	55.2	60.3	60.6	57.6	51.2	44.0	39.6	**49.2**
Avg. Total Precipitation	2.72	2.66	2.29	1.18	0.48	0.11	0.06	0.15	0.29	0.69	1.13	1.80	**13.55**

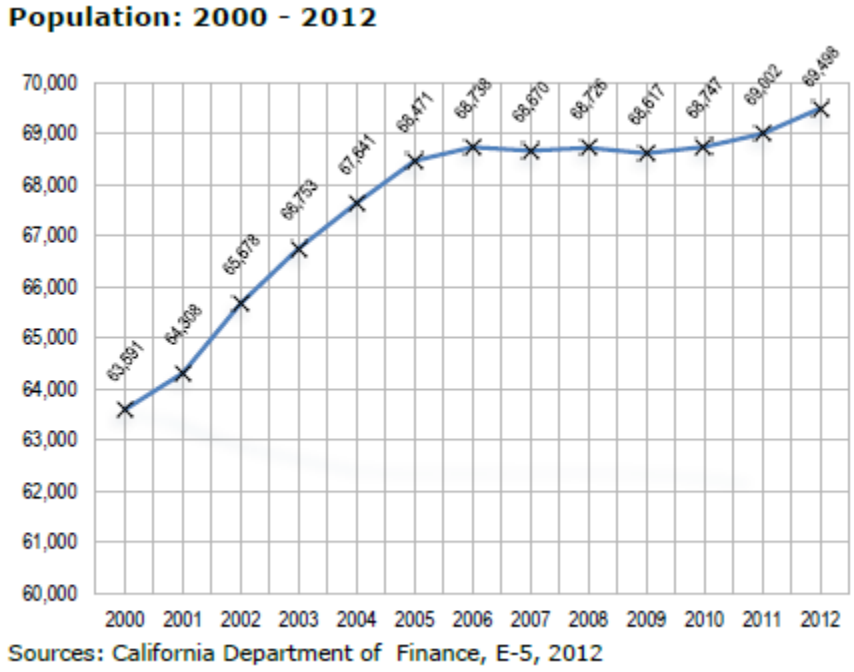
Redlands, CA – Period of Record Monthly Climate Summary

1.4.4. Demographics

The total population of San Bernardino County is approximately 2,081,313 people (*California Department of Finance, Demographics Unit, 2013*). Most of the County's population is in the valley areas located in the south western portion of the County. The County's population has grown by 18%, approximately 371,879 people, since 2000 (population in 2000 was approximately 1,709,434 people). This rate of growth was relatively slower than the population growth in three (3) neighboring counties (Kern, Imperial, Riverside), but much higher than the next three (3) other counties in Southern California (San Diego, Orange, San Luis Obispo).

The population in Redlands is estimated to be 69,916 (US Census, 2012), representing 3.5% of the population residing within San Bernardino County. Historical population estimates for the City are shown in Figure 3. The population in the City has doubled since 2005, with growth of approximately 9.3% between 2000 and 2012.

Figure 3. Historical Population Estimates for the City of Redlands, 2000-2012



According to 2000 census data (U.S. Census Bureau, 2010), the population distribution in the City of Redlands is comprised of 23.7% under 18 years old (including 6.0% under the age of 5), 13.1% age 65 and over, leaving 63.2% between the ages of 18 and 65. It was also noted that 24.8% of the population over the age of 5 reported speaking a language other than English at home. 89.9% of Redlands residents over the age of 25 are high school graduates, and 37.5% have attained a Bachelor's Degree or higher. Median household income for 2012 was reported to be $66,901, with 11.5% living below the poverty level.

The Southern California Association of Government Report (SCAG Repot, 2012) estimates that there are 26,685 housing units in the City of Redlands; 68.3% single family homes, 4.1% are mobile homes, 27.6% are small (2 to 4 unit) multi-family residences.

Population projections for San Bernardino County are available from the California Department of Finance (CA DOF, 1997b). After growing 26% in the decade between 2000 and 2010 (double the growth rate in the City of Redlands), County population growth is expected to slow slightly, with growth of 19% between 2010 and 2020, and an additional 15% between 2020 and 2030. This suggests continued growth in the City of Redlands, albeit at a slower rate than occurred in the last decade.

Estimates for population growth for the City of Redlands have been normalized between different data sets. The numbers represented in these estimates are from the Data Integrated Growth Forecast from the Southern California Association of Governments workgroup. Data on

population has been reconciled between data from the 2010 Census, California Employment Development Department (EDD), and California Department of Finance (DOF). Redlands

2008 – 68,576

2010 – 68747

2011 – 69,231

2020 – 75,494

2021 – 76,528

2035 – 87,865

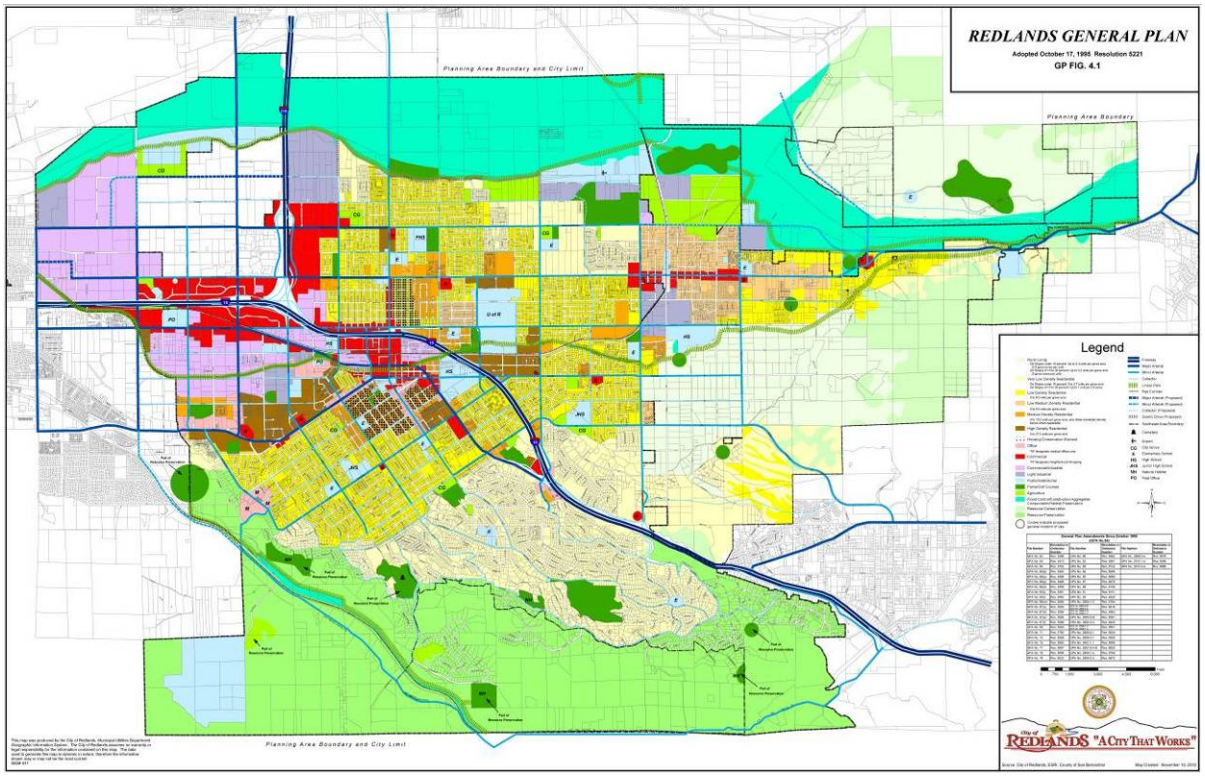
1.4.5. Major Employers in Redlands and Vicinity

NAME OF EMPLOYERS	NUMBERS OF EMPLOYEES
Environmental Systems Research Institute, Inc.	1,900
Redlands Unified School District	1,843
Redlands Community Hospital	1,250
United States Postal Service	1,400
University of Redlands	547
Lazy Boy West	391
Verizon	1,240
Wal-Mart	420
Loma Linda University and Medical Center	11,582
Jerry L. Pettis, Veterans Hospital	1,660

1.4.6. Existing Land Use

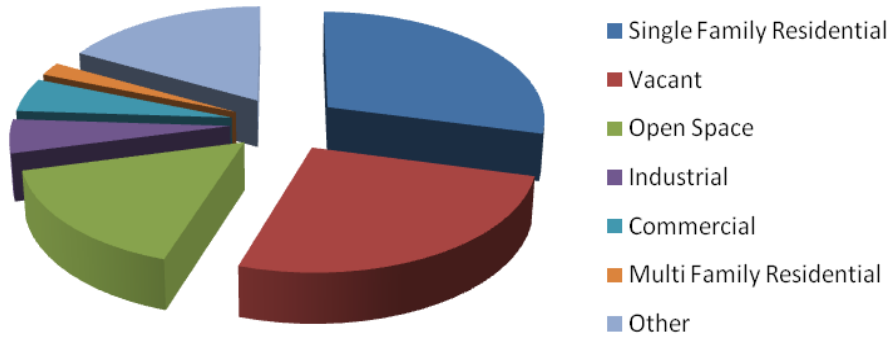
The existing land use in the City of Redlands consists of the following categories: agriculture, airport, commercial and services, industrial, mobile home parks, multi-family residential, open space and recreation, public facilities, schools, single family residential, transportation, utilities, vacant land and water facilities. The distribution of the land uses within the city limits can be seen in Figure 4.

Figure 4. Existing Land Use Map



Major components include: single family residential land use, which represents 29% of land use within the City; vacant land accounts for 26% of land use; open space and recreation land use makes up 16%; industrial land use accounts for 5%; commercial and services land use accounts for 5%; multi-family housing accounts for 2%; and the other categories comprise the remaining portions. (Figure 5).

Figure 5. Existing Land Use Distribution



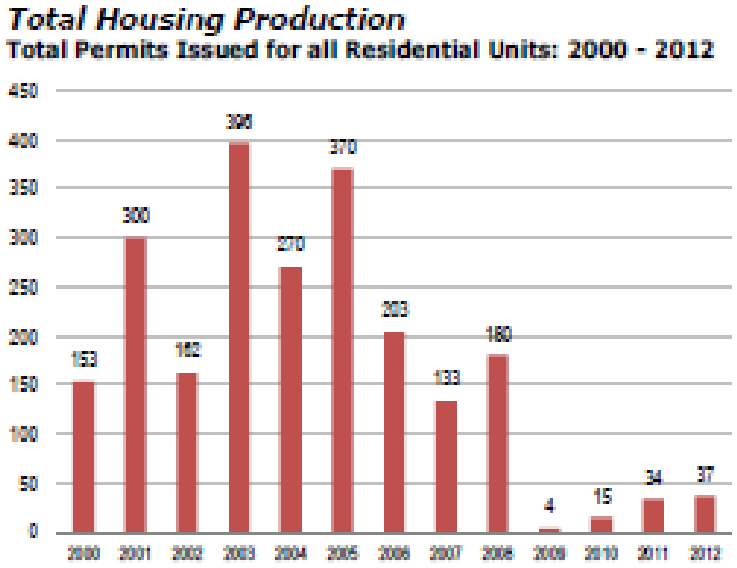
Commercial, Industrial, and Office development within the City of Redlands Planning area together account for 10% land use. Office development occurs throughout the City, but is particularly concentrated in areas such as the Downtown and Orange Tree Lane areas as well as in the vicinity of Redlands Community Hospital. There are several sites within Redlands that may be termed heavy industrial. Neighborhood shopping centers are distributed to serve most of the developed City.

1.4.7. Development Trends

The City of Redlands is considered "built out" by many. The majority of the projects in the city over the last few years have been redevelopment and infill-type of projects. Since the 2005 HMP, the Citrus Plaza, a 125-acre retail plaza opened to the public. This development represents a significant amount of retail activity and attracts shoppers throughout communities in the inland empire. It is a significant asset to the City's retail economy.

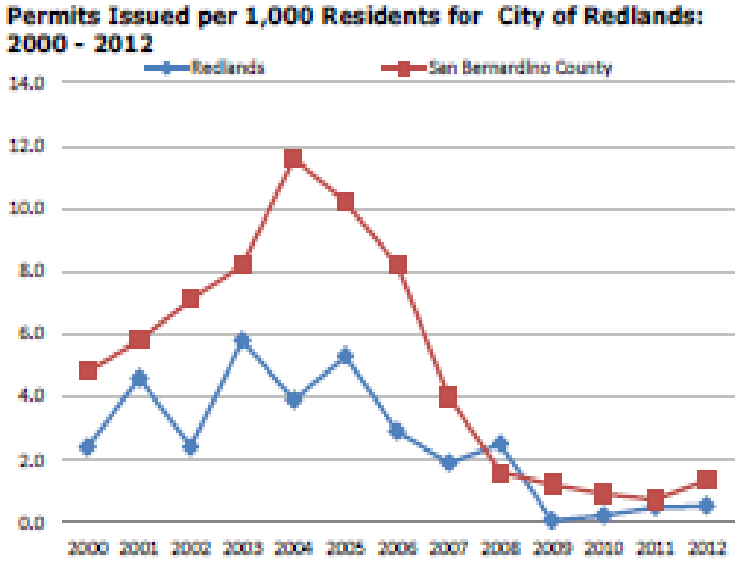
No significant growth is anticipated over the next five (5) years. There are projections for small infill and redevelopment projects, but not of any significant scale. However, the City will require that all future development will adhere to the current building codes and address any potential hazard effects. The City wants to attract development, but not to a point beyond the current limits of its build-out. There will be no significant changes to the overall character and land use trends over the next five years.

Figure 6. Single-Family Housing Production



Source: Construction Industry Research Board, 2000 - 2012

- Between 2000 and 2012, permits were issued for 2,257 new residential units.



Sources: Construction Industry Research Board, 2000 - 2012; SCAG

- In 2000, City of Redlands had 2.4 permits per 1,000 residents compared to the overall county figure of 4.8 permits per 1,000 residents.
- For the city in 2012, the number of permits per 1,000 residents decreased to 0.5 permits. For the county overall, it decreased to 1.4 permits per 1,000 residents.

Section 2. Planning Process

2.1. Local Planning Process and Preparing for the Plan

Hazard Mitigation Planning is a process Local governments, State, and Tribal use to identify risks and vulnerabilities associated with natural disasters, and to develop long-term strategies for protecting people and property from future hazard events.

Planning creates a way to solicit and consider input from diverse interests. Involving stakeholders is essential to building community-wide support for the plan. In addition to emergency managers, the planning process involves other government agencies (e.g., zoning, floodplain management, public works, community, and economic development), businesses, civic groups, environmental groups, and schools.

To assist with the updating of the Hazard Mitigation Plan (HMP), the City of Redlands Planning Team was established. The Planning Team is the lynchpin for all activities to update the HMP. The Planning Team was established to define and identify the strategies, goals, activities, and development of the HMP. The Planning Team represents a comprehensive team of subject matter experts from a range of areas that the team felt was affected by the plan or could provide great benefit to the team.

The Planning Team is led by representatives from the City of Redlands Fire Department and Quality of Life Department. The City of Redlands Fire Department and Quality of Life Department representatives will take on the responsibilities of a Project Manager and will facilitate and coordinate Planning Team activates. Additionally, the City of Redlands Fire Department and Quality of Life Department hired a consultant (ICF International) to provide technical support through the process and prepare the final HMP.

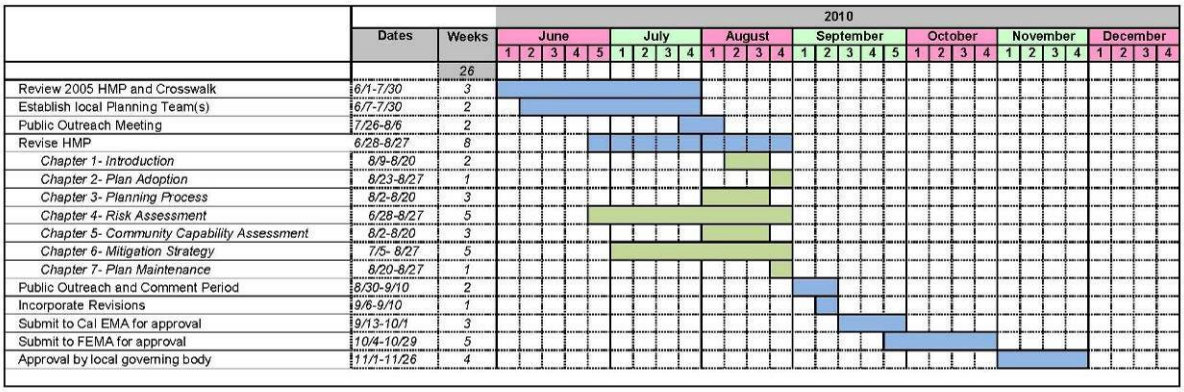
The Fire Department, Quality of Life Department, and ICF International also represented the City of Redlands at the San Bernardino County Operational Area (OA) Stakeholder meetings. San Bernardino County OES is leading the effort to coordinate Stakeholders in the Operational Area to update their local HMPs. This effort includes: providing technical support, establishing a platform to encourage the exchange of ideas, and help coordination among neighboring stakeholders. The Fire Department, Quality of Life Department, and ICF International were responsible for attending these meetings and incorporating the material into the City of Redlands planning process.

One of the resource materials provided through the OA Stakeholder meetings was a Table of Contents (TOC). The purpose of the TOC was to ensure all aspect of the HMP requirements were being met and could be found in similar sections in each of the Stakeholders updated HMPs.

This sample TOC was reviewed by the City of Redlands Planning Team and incorporated into the City's HMP update efforts. Using the TOC, the Planning Team conducted a section by section; page by page review of the 2005 HMP. To assist with this effort, a Project Timeline was developed and approved by the Planning Team.

The Draft Project Timeline (Figure 7) depicts the windows when each section of the 2005 HMP was tentatively to be reviewed and revised. Throughout the course of the project, the Project Timeline was adjusted to reflect current estimates.

Figure 7. Draft Project Timeline



	Dates	Weeks	2010																													
			June					July				August				September					October				November				December			
			1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4
		26																														
Review 2005 HMP and Crosswalk	6/1-7/30	3																														
Establish local Planning Team(s)	6/7-7/30	2																														
Public Outreach Meeting	7/26-8/6	2																														
Revise HMP	6/28-8/27	8																														
Chapter 1- Introduction	8/9-8/20	2																														
Chapter 2- Plan Adoption	8/23-8/27	1																														
Chapter 3- Planning Process	8/2-8/20	3																														
Chapter 4- Risk Assessment	6/28-8/27	5																														
Chapter 5- Community Capability Assessment	8/2-8/20	3																														
Chapter 6- Mitigation Strategy	7/5- 8/27	5																														
Chapter 7- Plan Maintenance	8/20-8/27	1																														
Public Outreach and Comment Period	8/30-9/10	2																														
Incorporate Revisions	9/6-9/10	1																														
Submit to Cal EMA for approval	9/13-10/1	3																														
Submit to FEMA for approval	10/4-10/29	5																														
Approval by local governing body	11/1-11/26	4																														

Based on the TOC, the Planning Team divided the update process into seven (7) phases; one for each section of the TOC. This approach allowed for a focused review of the material and provided an organized method to introduce new or updated material. During this review, the Planning Team validated information from the 2005 HMP, in addition to reviewing new material prepared for the update plan.

The planning team consisted of Fire Department, Quality of Life Department, and ICF International. After the internal initial review, the stakeholders were invited to provide comments during the business to business meetings which included: local businesses, faith-based, educational institutions, governmental and non-governmental organizations. They were advised that the HMP plan was in the process of being updated and solicited their input from their perspectives. They were invited to attend the HMP planning meetings through the Redlands Chamber of Commerce, City Council meetings and via the Operational Area Coordination Committee meetings.

The verbal comments from these stakeholder meetings were noted and summarized to be utilized during the next phase of the planning process. During the Planning Team meetings, members were assigned tasks, action items research projects to be completed prior to the next meeting.

Project prioritization involved comprehensive consideration of criteria/factors. While there is not a standard process followed by each of the City of Redlands departments; they all consider social, technological, administrative, political, legal, economic, and environmental factors.

2.1.1. Planning Team

As indicated above, the Planning Team is comprised of representatives from various City departments who have a role in mitigation type of activities/planning. Because Hazard Mitigation Planning involves more than just emergency management, the team included members from other related departments/fields (e.g., zoning, floodplain management, community, and economic development), businesses, civic groups, environmental groups, and schools. It is best when you keep Planning Teams to a manageable number of members. However, the challenge is ensuring that all perspectives are captured and/or included in the process. To achieve this, the Planning Team members acted as liaisons to the greater community; exchanging thoughts on the Hazard Mitigation Plan with other groups in the community. Each Planning Team member was responsible for communicating the direction and status of the planning effort to their outside members and in return they are expected to bring to the team outside perspectives.

Planning Team included representatives from the following City of Redlands Departments:

- **City Manager's Office**
  Carl Baker, Public Information Officer
- **Development Services Department**
  Chris Boatman, Assistant Planner
- **Development Services Department**
  Richard Pepper, Building Official
- **Fire Department**
  Jeff Frazier, Fire Chief
- **Fire Department**
  Scott McDonald, Battalion Chief
- **Innovation and Technology Department**
  Phillip Mielke, GIS Supervisor
- **Municipal Utilities and Engineering**
  Chris Diggs, Assistant Utilities Director
- **Municipal Utilities and Engineering**
  Fred Mousavipour, Assistant Engineering Director
- **Municipal Utilities and Engineering**
  Rosemary Hoerning, Director
- **Police Department**
  Rogelio Garcia, Lieutenant
- **Police Department**
  Shawn Ryan, Lieutenant
- **Quality of Life Department**
  Danielle Garcia, Field Services Manager
- **Quality of Life Department**
  Fred Cardenas, Quality of Life Director
- **Quality of Life Department**
  Rick Cross, Operations Superintendent

There were a series of meetings held with the Planning Team. Each meeting had a primary focus and provided an opportunity to discuss updates and exchange ideas. Below is a list of the Planning Team meetings (Table 3):

Table 3. Planning Team Meetings

Date	Activity
June 10, 2010	Attended Initial Kick-off meeting conducted by San Bernardino County Fire OES for Multi-jurisdictional Hazard Mitigation Plan
August 10, 2010	Introduction of Planning Team, Review 2005 Plan, Review of Mitigation Priorities, Review of Planning Guide, Strategy for Update
August 24, 2010	Invited stakeholders to attend the Business to Business meeting to solicit public comment and capture input for the revision to the HMP
Sept 2, 2010	Planning team met to conduct Risk Assessment, Review of 2005 Mitigation Strategies and discuss next steps
Sept 22, 2010	Risk Assessment Review by Planning Team, Mitigation Strategy Discussion, and next steps
Nov 10, 2010	Update of 2005 Projects, HAZUS Scenario Review and Discussion
March 8, 2011	Finalization of Section I and II
March 28, 2011	Vulnerability Assessment, Mitigation Goals and Objectives
April 15, 2011	Check-In on Team Progress, Gathering Data on History of Hazards in Community
June 30, 2011	HMP Rough Draft Compilation, Complete Section 1-4 and 6
August 9, 2011	Review of Preliminary Draft by Team
January 11, 2012	Plan Maintenance Design
June 6, 2012	Finalization of Disaster Council Roles
July 29, 2012	Completion of inventory of historical flood/earthquake/flooding events
August 14, 2012	Review of Draft by Team before Public Distribution

2.2. Regional Planning Process and Coordination with Other Jurisdictions, Agencies, and Organizations

The City took great efforts to engage and include as many members as possible. There are many agencies, organizations, businesses and non-governmental entities that contend with natural hazards in and around the City of Redlands. Capturing their input was critical to the success and comprehensiveness of the plans. The challenge was how to engage them without expanding the Planning Team to an unmanageable level. One of the first Planning Team meetings involved this discussion.

The Planning Team members gave special considerations as to what they thought needed to be in the HMP and attempted to identify a person who would represent the areas, thus keeping the Planning Team at a manageable level and still capturing other stakeholder input. As indicated above, the Planning Team members were responsible for liaison roles with outside groups to solicit input and concerns relative to natural and man-made hazards and to determine how their programs could best collaborate with the City's mitigation program.

The following agencies and organizations that were contacted include, but are not limited to, the following:

- San Bernardino County Fire Department Office of Emergency Services
- Non-Governments Organizations
- Educational Institutions
- Local Government Agencies
- Non-Profit Organizations
- Hospitals
- Governor's Office of Emergency Services

As previously mentioned, the City of Redlands was also an active member of the San Bernardino Operational Area Stakeholder Group meetings. These meetings provided an opportunity to coordinate with other cities/towns and special districts in the county. Through this venue, the Planning Team was able to reach out to adjacent jurisdictions and associated special districts to ensure that their efforts and findings were compatible.

As part of this effort, an OA Stakeholder Web Portal was developed to assist the jurisdictions update their HMPs, and encouraged sharing information, resources, and ideas necessary to complete the update process. The Web Portal also provide another venue to coordinate with other cities/towns and Special Districts. A list of the OA Stakeholder Meetings is listed below:

- **June 10, 2010** Stakeholders Meeting Ontario Police Department 10:00 a.m. to 12 Noon
- **July 1, 2010** Stakeholders Conference Call/Webinar 10:00 a.m. to 11:00 a.m.
- **July 7, 2010** Stakeholders Conference Call/Webinar 10:00 a.m. to 11:00 a.m.
- **July 15, 2010** Stakeholders Meeting Ontario Police Department 9:00 a.m. to 12 Noon
- **July 29, 2010** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **August 12, 2010** Stakeholders Meeting Ontario Police Department 10:00 a.m. to 12:00 a.m.
- **August 26, 2010** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **September 9, 2010** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **October 28, 2010** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **December 2, 2010** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **January 11, 2011** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **January 20, 2011** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **January 27, 2011** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **February 17, 2011** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.
- **March 10, 2011** Stakeholders Conference Call 10:00 a.m. to 11:00 a.m.

2.3. Public Involvement/Outreach

Public involvement was solicited throughout the update process, as well as, since the approval and adoption of the HMP in 2005. Since the 2005 HMP approval, the City has taken several steps to educate the public on the hazards facing the community and had several public forums where mitigation projects were discussed and identified. At all events, public opinion and comments are solicited.

The Planning Team also considered the possibility of including public members on the Planning Team. However, it was determined that having the Planning Team members liaison with the public would better serve and capture the public interest.

During this process, the City also used several platforms to reach out and inform the public of the HMP update. Public Involvement consisted of 1) public meetings; which gave the public the direct opportunity to comment on hazard specific information and projects, 2) City website postings, 3) CERT team's public hearings.

Below is a summary list of the public outreach:

2.3.1. Public Meetings

- Redlands Disaster Council
- Redlands City Council Meeting
- RUSD Local Mitigation Plan Citizens Committee Meeting
- San Bernardino Co FD OES Pre-Disaster Mitigation (PDM) Grant & Hazard Mitigation Plan Meeting
- Business to Business Hazard Mitigation Plan Meeting – August 24, 2010

2.3.2. City Website Postings

- Fire Chief Mass Email Campaign to former members of safety commissions, community disaster council members and other members of the community in October 2010
- Posting to Website on 10/4/2011 upon approval of the City Council

2.3.3. Public Hearings

- City Council Meeting to appropriate grant amount to implement the HMP Update process 12/7/2010
- City Council Meeting to approve contract with ICF to perform the update to the City's HMP 8/3/2010
- City Council Meeting to review and make recommendations on the HMP 8/4/2011

2.3.4. Adoption by Local Governing Body

The City Council is the legislative body of the City of Redlands. It decides policy for the municipal government, enacts laws, and oversees all activities of the City. The Council also serves as the governing body of the City of Redlands Redevelopment Agency.

The Council has significant control of the administrative function because it appoints the City Manager. It also directly appoints the City Attorney, the City's independent auditors, and all board and commission members who serve as unpaid advisors to the City Council.

The Hazard Mitigation Plan update for the City will be adopted by the City Council in an open forum available for public comment upon approval of the plan by FEMA and concurrence with the Governor's Office of Emergency Services.

Section 3. National Flood Insurance Program

3.1. City of Redlands and the Community Rating System

What is the Community Rating System and how does it affect me? As a "CRS Community," Redlands has committed to a variety of mitigation measures that will progressively lower flood insurance premiums for those residents whose properties are located within the floodplain and require the added level of insurance protection provided through the National Flood Insurance Plan. For more information about the Community Rating System and steps for the City to gradually increase our rating, please access http://www.fema.gov/business/nfip/crs.shtm.

The City of Redlands has participated with the NFIP since 10/01/2007 and is a class 9. We currently have the Flood Control, ADA Ramps, Sidewalks, Trees and Park (FAST) Program implemented to inform the City of Redlands residents of funding needs for critical infrastructure and to solicit residents input regarding the preparation of a possible ballot measure to provide revenue to meet those needs.

The City of Redlands sends out notifications to residents upon receipt of FEMA Letter of Map Revisions (LOMR) Letters. Residents that reside in flood prone zones are provided brochures about the National Flood Insurance Plan. Public notices are published in the San Bernardino County Sun newspaper, Federal Register and Flood Hazard Mapping website.

Our continued compliance include community outreach, LOMR notifications, Flood Insurance brochure and provide FEMA Mapping tools and provide tools on City of Redlands website.

There are no repetitive loss properties reported since the approval of the 2005 Hazard Mitigation Plan.

Section 4. Hazard Assessment

4.1. Assess the Hazard

As discussed, the planning process was organized around the Table of Content (TOC). One of the main sections in the TOC is Risk Assessment. The Risk Assessment section includes four (4) basic steps; 1) hazard identification and screening; 2) hazard profiling; 3) hazard exposure; and, 4) hazard vulnerability. The Planning Team had facilitated discussions around each of these steps.

The first step in this process was to identify all of the natural hazards present in the community. The Planning Team started with the 2005 HMP and augment as necessary. This augmentation considered both adding and removing of hazards to ultimately create a list of all potential natural hazards in the community. The Planning Team utilized several sources to ensure they were considering all potential hazards. A summary of the list of material reviewed is: the 2005 San Bernardino County Operational Area HMP, the State of California HMP, FEMA "How-to Guides", the 2005 City of Redlands Local HMP, and several other surrounding community Local HMPs. After the list of potential hazards in the community was generated, the hazards were screened.

The intent of screening of hazards is to help prioritize which hazard creates the greatest concern in the community. Because the 2005 HMP process used to rank hazards (Critical Priority Risk Index (CPRI) software) is not being utilized again, an alternative approach was implemented.

The Planning Team agreed to utilize a non-numerical ranking system for the HMP update process. This process consists of generating a qualitative ranking (High, Medium, or Low) rating for: 1) *Probability*; and, 2) *Impact* from each hazard. To further assist with the process, the following definition of "High", "Medium", and "Low" probability and impacts are being provided (NOTE: these definitions were utilized in the 2005 HMP process and can be found on page 27):

- **Probability**
  - *High* Highly Likely/Likely
  - *Medium* Possible
  - *Low* Unlikely
- **Impact**
  - *High* Catastrophic/Critical
  - *Medium* Limited
  - *Low* Negligible

The hazards were then placed into a matrix with the appropriate/corresponding box/cell Table 4 below is an example of how the process will capture the results.

Table 4. Sample Hazard Assessment Matrix

		Impact		
		High	Medium	Low
Probability	High			
	Medium			
	Low			

After all hazards had been analyzed; the Planning Team then determined which "*Probability*" and "*Impact*" category (i.e., High Impact; High Probability, Medium Impact) the community will focus on over the next five (5) years. An example of how the hazards may be prioritized is provided in Table 5 below (Red equaling high priority):

Table 5. Sample Hazard Prioritization Matrix

		Impact		
		High	Medium	Low
Probability	High			
	Medium			
	Low			

After identifying the "*Higher*" priority hazards in the community, each of the "*High*" priority hazards were profiled. The hazard profiling include the incorporation of all new information, material, and reports to better help the Planning Team and the community understand the hazard.

Additionally, for each of the profiled hazards, the Planning Team then analyze the community's exposure to each hazard (inventory of assets) and the potential impact under scenario events. The Planning Team used HAZUS results from a recent project completed within San Bernardino County to produce this information and is located with San Bernardino County Office of Emergency Services.

4.2. Set Goals

The Planning Team validated and identified new Goals and Objectives for the HMP update. The first step the Planning Team took was to review the hazard exposure and scenario impacts developed during the Risk Assessment portion of the process. With a firm understanding of the risk the community is potentially facing, the Planning Team then re-evaluated the 2005 Hazard Mitigation Plan Goals and Objectives; assessed their status and effectiveness in meeting the 2005 Mitigation Measures, and identified new Goals and Objectives located in Section 7.2 beginning on page 100. The following provides an overview of the City of Redlands 3 overall Mitigation Goals which remain the same priorities:

1. Goal No. 1 - Earthquakes

To reduce both the short and long term effects of earthquakes on the City of Redlands.

2. Goal No. 2 - Floods

To reduce both the short and long term effects of the 100-year flood plain as defined in the Flood Insurance Rate Map (FIRM) and the City of Redlands General Plan.

3. Goal No. 3 – Wildfires

To mitigate or reduce the risk of fires in the City of Redlands designated urban wildfire interface high fire hazard area.

As part of this process, the Planning Team also reviewed the City's General Plan, the State of California HMP, the San Bernardino County Operational Area HMP, Floodplain Management Plans, Task Force After-Action Reports and/or documents, and adjacent local jurisdiction HMPs to ensure the Goals and Objectives were comprehensive and compatible.

4.3. Review and Propose Mitigation Measures

After the Goals and Objectives were established, the Planning Team then turned to identifying projects under each Goal and Objective that could be implemented to help reduce and/or eliminate the impacts from the priority hazards. As part of this process, the Planning Team reviewed the projects in the 2005 HMP to determine which have been completed, which are ongoing, and which were deferred. For projects that were not completed the Planning Team validated whether or not the project was necessary.

With an understanding of past accomplishments and potential exposure from the Risk Assessment section, the Planning Team identified projects that will help reduce and/or eliminate the risk for the "High" priority hazards. After a list of all possible projects was identified, the Planning Team prioritized the projects.

To assist with this effort the Planning Team adopted the STAPLEE methodology. STAPLEE stands for:

- **Social**—The public must support the overall implementation strategy and specific mitigation actions. Therefore, the projects will have to be evaluated in terms of community acceptance.
- **Technology**—It is important to determine if the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. Determine whether the alternative action is a whole or partial solution, or not a solution at all.
- **Administrative**—Under this part of the evaluation criteria, examine the anticipated staffing, funding, and maintenance requirements for the mitigation action to determine if the jurisdiction/special district has the personnel and administrative capabilities necessary to implement the action or whether outside help will be needed
- **Political**—Understanding how your current community and State political leadership feels about issues related to the environment, economic development, safety, and emergency management. This will provide valuable insight into the level of political support you may have for the mitigation activities and programs. Proposed mitigation objectives sometimes fail because of a lack of political acceptability.
- **Legal**—Without the appropriate legal authority, the action cannot lawfully be undertaken. When considering this criterion, determine whether your jurisdiction has the legal authority at the State, or local level to implement the action, or whether the jurisdiction must pass new laws or regulations. Each level of government operates under a specific source of delegated authority. As a general rule, most local governments operate under enabling legislation that gives them the power to engage in different activities. Identify the unit of government undertaking the mitigation action, and include an analysis of the interrelationships between local, regional, State, and Federal governments. Legal authority is likely to have a significant role later in the process when your State, or community will have to determine how mitigation activities can best be carried out, and to what extent mitigation policies and programs can be enforced.
- **Economic**—Every local government experiences budget constraints at one time or another. Cost-effective mitigation actions that can be funded in current or upcoming budget cycles are much more likely to be implemented than mitigation actions requiring general obligation bonds or other instruments that would incur long-term debt to a community. Local communities with tight budgets or budget shortfalls may be more willing to undertake a mitigation initiative if it can be funded, at least in part, by outside sources. “Big ticket” mitigation actions, such as large-scale acquisitions and relocation, are often considered for implementation in a post-disaster scenario when additional Federal and State funding for mitigation is available.
- **Environmental**–Impact on the environment is an important consideration because of public desire for sustainable and environmentally healthy communities and the many statutory considerations, such as NEPA, to keep in mind when using Federal funds. The Planning Team needed to evaluate whether, when implementing mitigation actions, there would be

negative consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources.

In addition to the STAPLEE methodology, the Planning Team incorporated other criteria/factor questions into the process to help engage and solicit input from members. Examples of these criteria/factor questions are:

- **Does the Action:**
  - Solve the problem?
  - Address Vulnerability Assessment?
  - Reduce the exposure or vulnerability to the highest priority hazard?
  - Address multiple hazards?
  - Address more than one (1) Goal/Objective?
  - Benefits equal or exceed costs?
- **Can the Action:**
  - Be implemented with existing funds?
  - Be implemented by existing state or federal grant programs?
  - Be completed within the 5-year life cycle of the LHMP?
  - Be implemented with currently available technologies?
- **Will the Action:**
  - Be accepted by the community?
  - Be supported by community leaders?
  - Adversely impact segments of the population or neighborhoods?
  - Require a change in local ordinances or zoning laws?
  - Result in legal action such as a lawsuit?
  - Positively or negatively impact the environment?
  - Comply with all local, state, and federal environmental laws and regulations?
- **Is there:**
  - Sufficient staffing to undertake the project?
  - Existing authority to undertake the project?

After going through this process for each and every project, the Planning Team will then have the ability to identify the higher priority projects.

4.4. Draft the Hazard Mitigation Plan

The Hazard Mitigation Plan Update was drafted by the Quality of Life Department representative and the ICF team, based on input and comments provided by the Planning Team. As indicated previously, the Planning Team adopted the new Table of Content (TOC) format for the HMP update. The proposed TOC is closely related to the 2005 HMP format but there are slight differences. The Planning Team deemed this revision prudent and felt that it provided a better format of the HMP update. Where appropriate, information from the 2005 HMP was validated and/or revised to reflect current conditions and incorporated into the new format.

In addition to the TOC, the Planning Team also uses the FEMA Guidance and materials generated for the San Bernardino Operational Area HMP project. This material aided in the Planning Team's understanding of the level of detail and type of information that is excepting in each section.

Each section was reviewed and updated as necessary. While some Planning Team members were responsible for the updating select sections, all members were required to review and comment on the entire HMP. The recommendations were provided orally during the March 28, 2011 meeting and are as follows:

Community Development Services

- Develop capital improvement projects that will help mitigate the loss of life and property caused Fire, Flood, Earthquake and Drought.
- Recommend to adopt 2010 Building and Safety Codes

Municipal Utilities and Engineering

- Hire a consultant to develop a Drainage Master Plan for City of Redlands
- Partner with Southern California Edison, SoCal Gas Company and other special districts to maintain and replace old equipment.
- Recommend to update Ordinance 2151 Water Conservation Plan

Fire Department

- Provide weed abatement in fire prone areas based on Fire Hazard Severity Map in Figure 8 on page 28.
- Provide windshield surveys to identify hazards in the City.

Once the HMP update was drafted, the Planning Team provided opportunities for the public to review and comment on the plan. After the public comment period was closed, the Planning Team finalized the HMP update and forwarded to Cal EMA and FEMA for approval.

The documentation for the public comments is not available at this time and will be documented and updated during the plan review and update.

Section 5. Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. However, mitigation should be based on risk assessment.

A risk assessment measures the potential loss from a hazard event by assessing the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards, how much of the community could be affected by a hazard, and the impact on community assets.

In "Understanding Your Risks: Identifying Hazards and Estimating Losses" (FEMA, 2001), FEMA identifies four (4) major steps in the risk assessment process, as follows:

1. Identify hazards (Section 5.1)
2. Profile hazard events (Section 5.2)
3. Inventory assets (Section 5.3)
4. Estimate losses (Section 5.4).

As noted above, each of these steps is discussed in a separate sub-section of Section 5.

5.1. Hazard Identification

5.1.1. Hazard Screening Criteria

The City of Redlands HMP Planning Team assembled a list of potential hazards for screening, including the following fourteen (14) natural and manmade hazards:

- Wildfire
- Flooding
- Earthquake
- Energy/Power Outage/Excessive Heat
- Tornado
- Mudslide/Landslide
- Crop Losses/Freezing
- Dam Breach
- Windstorm
- Drought
- Disease
- Infestation
- Chemical Agents (Chemical, Biological, Radiological, Nuclear)
- Chemical/Hazardous Materials (HazMat) Spills.

5.1.2. Hazard Assessment Matrix

The intent of the hazard screening is to prioritize the hazards that are of the greatest concern to the City. Because the process used to rank hazards in the 2005 City of Redlands Local HMP, the Critical Priority Risk Index (CPRI) is not being utilized for the update, an alternative approach was taken.

The Planning Team implemented a qualitative ranking system for the hazard assessment update; a non-numerical ranking ("High", "Medium" or "Low") was determined by the Planning Team for each hazard's 1) probability of occurrence and 2) potential impact. In addition, the Planning Team assessed whether each hazard had the potential for mitigation.

For each identified hazard, the Planning Team discussed and evaluated hazard probabilities and potential impacts, utilizing the following categories and definitions (for consistency, these definitions are the same as those utilized in the 2005 HMP development process):

- **Probability**
  - *High: Highly Likely/Likely*. There may or may not have been historic occurrences of the hazard in the community or region but experts feel that it is likely that the hazard will occur in the community. Citizens feel that there is a likelihood of occurrence.
  - *Medium: Possible.* There may or may not have been a historic occurrence of the hazard in the community or region but experts feel that it is possible that the hazard could occur in the community. Citizens may feel that there is a likelihood of occurrence.
  - *Low: Unlikely.* There have been no historic occurrences of the hazard in the community or region and both experts and citizens agree that it is highly unlikely that the hazard will occur in the community.
- **Impact**
  - *High: Catastrophic/Critical.* Both experts and citizens feel that the consequences will be significant in terms of building damage and loss of life.
  - *Medium: Limited, but not insignificant.* Consequences are thought to be modest in terms of building damage and loss of life, limited either in geographic extent or magnitude.
  - *Low:* Negligible.

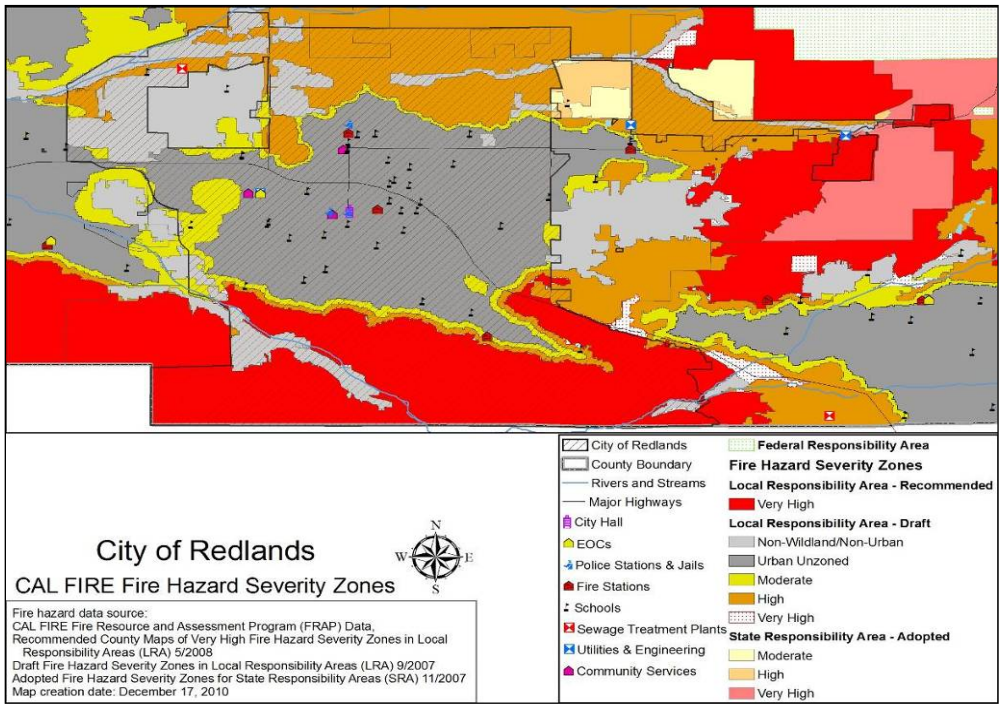
The hazard assessments for the fourteen (14) hazards identified by the Planning Team are summarized below.

1) Wildfire

Probability—**High,** *Impact*—**Medium**

Significant wildfires have occurred in the past, and conditions exist that make future fires likely. Redlands is located in a region with relatively high temperatures, low humidity, and low precipitation during the summer, followed by a fall season that includes high velocity, very dry Santa Ana winds. The California Department of Forestry and Fire Protection's (CAL FIRE) map of fire hazard severity zones is given in Figure 8.

Figure 8. Fire Hazard Severity Zones in the Vicinity of the City of Redlands



Historically, fires in the City of Redlands have started in either San Timoteo or Live Oak Canyon and burn from a western to easterly direction, driven by prevailing winds and topography. These wildfires have created the following damage: In the last 20 years, there were 30 fire perimeters. These fires damaged 14 structures, 75 properties (parcels) and a total of 452 acres. The vulnerability still exists that can impact homes and historical structures; however mitigation activities are on-going to reduce loss of said structures.

The Planning Team noted that there are potential mitigation activities to reduce wildfire risk. Please refer to Section 7.2.1 Page 100. These include, for example, on-going activities such as implementing building construction standards and means for private on-site water storage

facilities for sites that are not served by the fire district, and requiring defensible space around all new construction.

2) Flooding

Probability—**High,** *Impact*—**High**

Destructive flooding is a common occurrence in the City of Redlands. As shown by the Flood hazard areas mapped by FEMA in the recently updated Digital Flood Insurance Rate map (DFIRM) Additionally, the City of Redlands has the potential to be at risk for alluvial fan flooding, as mapped by the Alluvial Fan Task Force (Figure 9) .Areas potentially containing Alluvial Fans as mapped by the Alluvial Fan Task Force (2010); regional (top), Close-up of Redlands and Vicinity (bottom)

Figure 9. FEMA Flood Hazard Areas for the City of Redlands

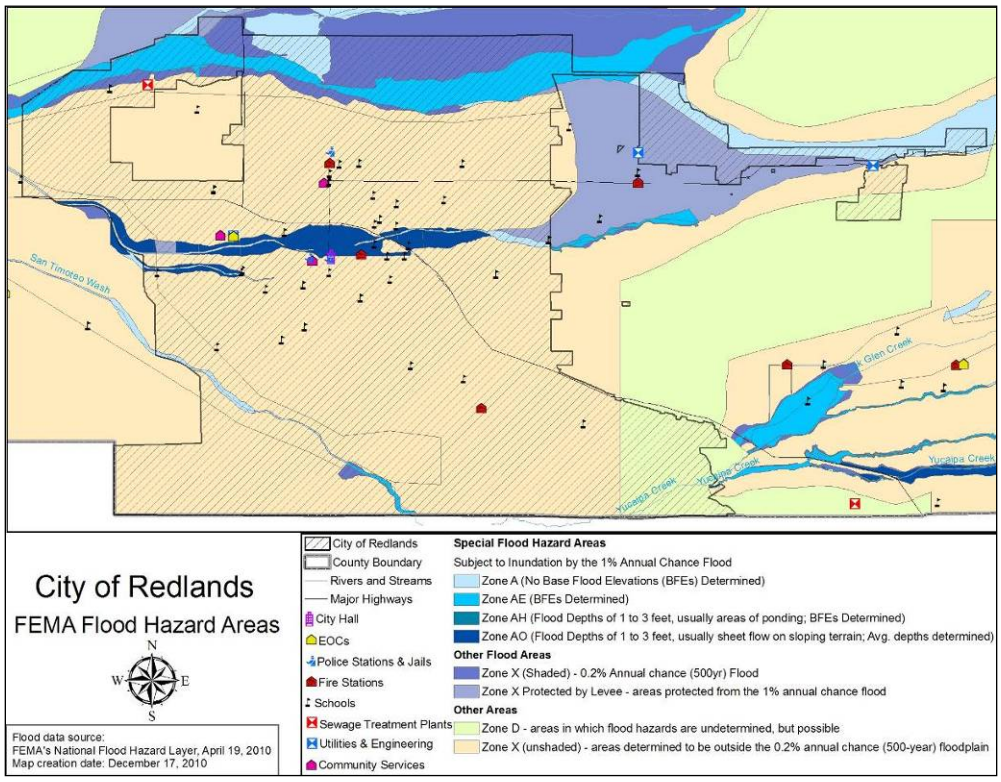
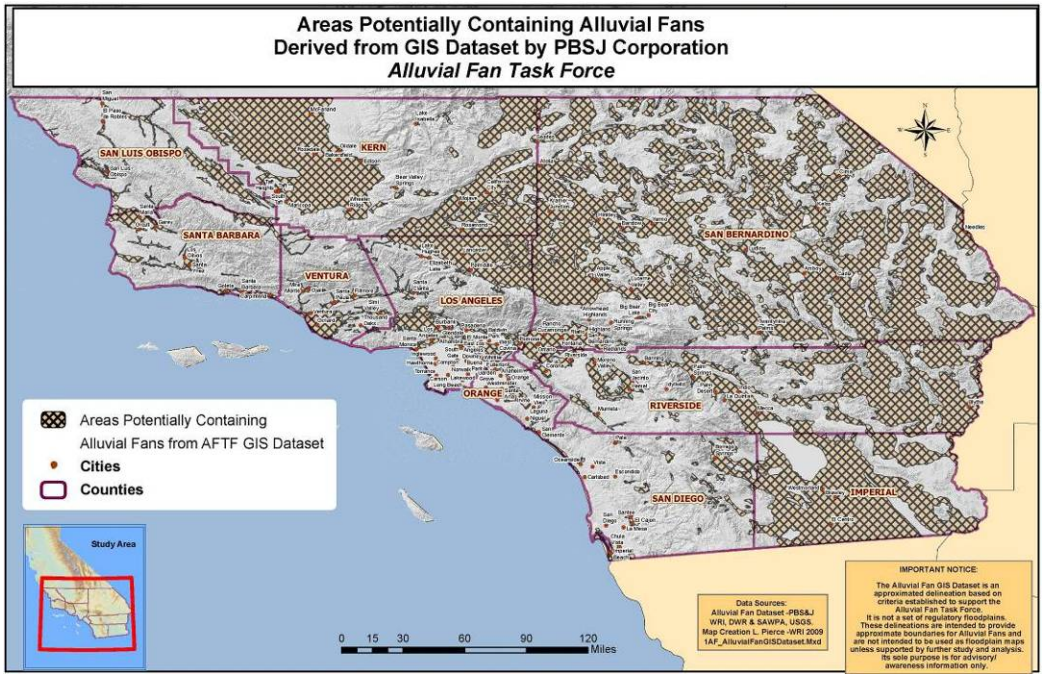
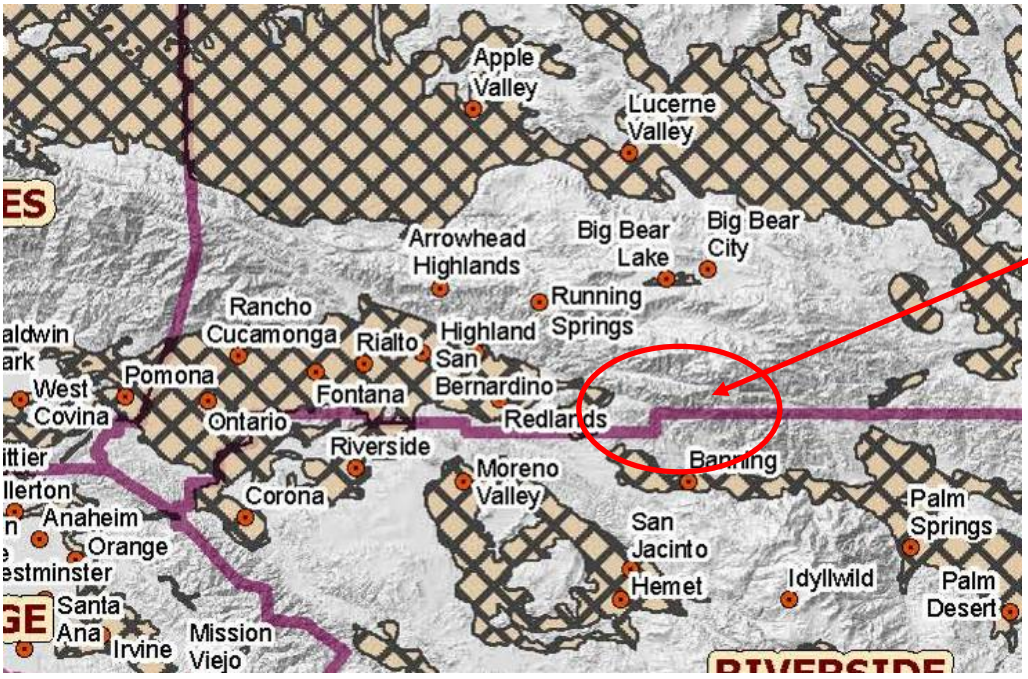


Figure 10. Areas Potentially Containing Alluvial Fans as mapped by the Alluvial Fan Task Force (2010); Regional (top), Close-up of Redlands and Vicinity (bottom)





Significant flood events impacting the City of Redlands include the December 1966 Flood (which resulted in $2.4 million in response and recovery costs to impacted cities), the September 1976 Flood ($5.4 million), and the February 1980 Flood ($420,000). More recently, there was a major flood in 1993, Federally Declared Disaster 979 resulted in $4.2 million in damage and resulted in the collapse of two major bridges. In the past 3 years, there have been several Federally Declared Disasters that include the County of San Bernardino as a designated county. Damage estimates for these events have not exceeded $1 million on any one event. The most severe of the recent flooding events occurred December 2010 - January 2011, during which time the City incurred upwards of $600,000 in damage to its public infrastructure.

The Planning Team noted that there are potential mitigation activities to reduce flood risk. These include on-going activities, such as policies in the General Plan ensuring that property built on flood plains subject to the 100-year flood are provided adequate protection from floods, and preserving as open space areas that can't physically be mitigated.

The impacts remain high and will result in loss of property and structures in the community will result in billions of dollars in response and recovery.

3) Earthquake

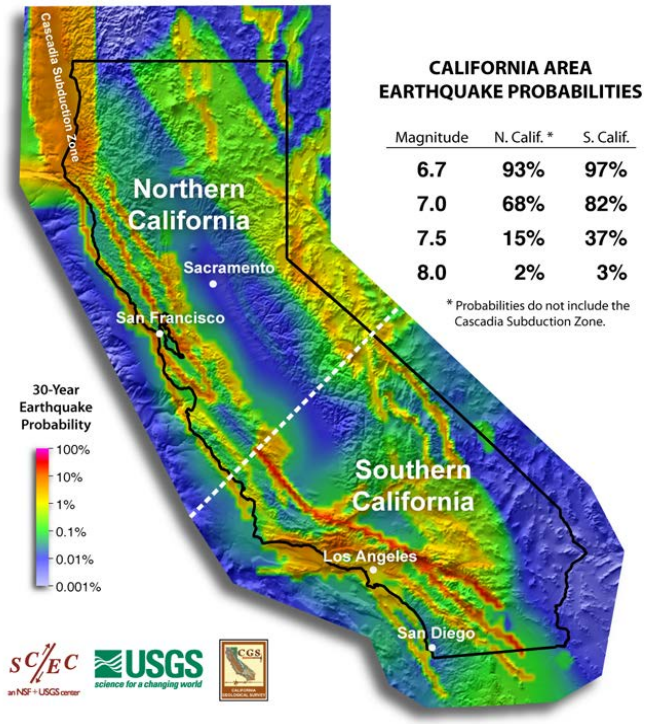
Probability—**High**, *Impact*—**High**

The probability of a significant (M6.7 or greater) earthquake occurring in Southern California in the next 30 years has been estimated to be 97% by the 2007 California Working Group on Earthquake Probabilities[1], as shown in Figure 11. California Area 30-Year Earthquake Probabilities. (USGS Open-File Report 2007-1437)

Earthquakes have the potential to cause widespread building damage, economic loss, and population impacts such as injury, death, and displacement.

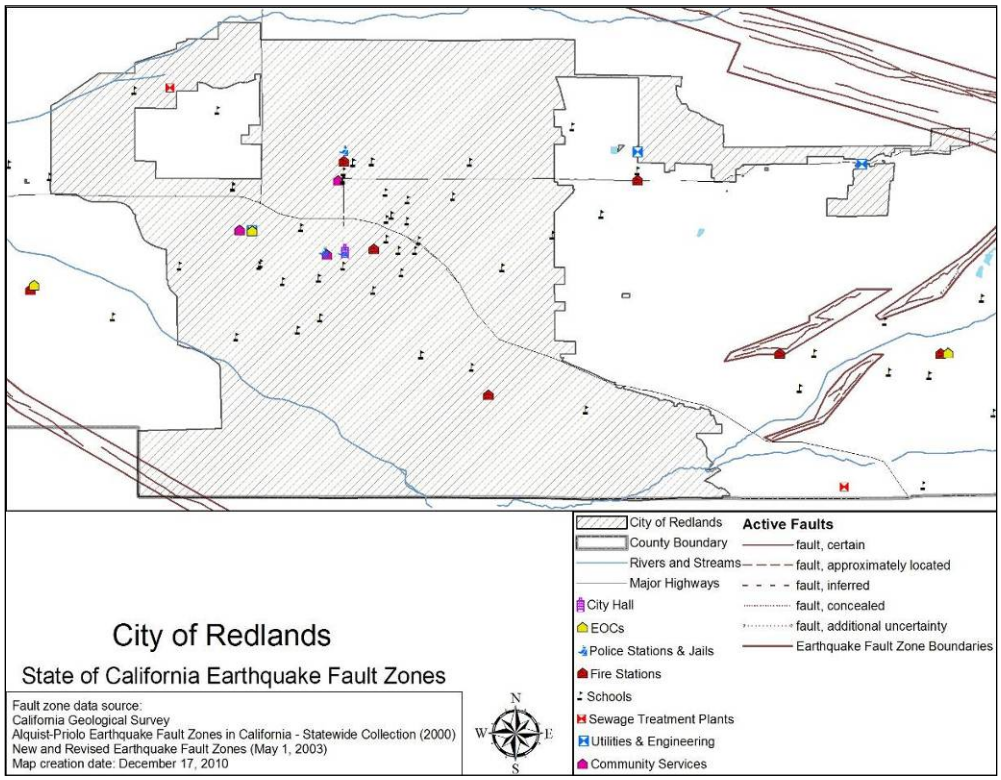
[1] 2007 Working Group on California Earthquake Probabilities (2007 WGCEP), 2008, ***The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2)***: U.S. Geological Survey Open-File Report 2007-1437 and California Geological Survey Special Report 203 [http://pubs.usgs.gov/of/2007/1437/].

Figure 11. California Area 30-Year Earthquake Probabilities
(USGS Open-File Report 2007-1437)



The City of Redlands is geographically located between active traces of the San Andreas Fault (located to the northeast of the City) and the San Jacinto Fault (located to the southwest of the City). Only small sections of the City are subject to surface fault rupture hazards, as shown in the Alquist-Priolo Earthquake Fault Hazard Zones in Figure 12. Alquist-Priolo Earthquake Fault Hazard Zones in the City of Redlands, the City would be subject to significant ground shaking and associated secondary hazards (e.g., liquefaction) from earthquake events on the San Andreas, San Jacinto, and other nearby faults. For example, for the M7.8 “ShakeOut” scenario earthquake on the Southern San Andreas Fault, building damage alone in the City of Redlands is expected to exceed $1.1 billion dollars. (See page 81-83) for additional information on ShakeOut and other Earthquake scenarios molded of the risk assessment).

Figure 12. Alquist-Priolo Earthquake Fault Hazard Zones in the City of Redlands



The Planning Team concluded that there are potential mitigation activities to reduce the risk of damage in earthquakes. These include structural mitigation of vulnerable building structures and infrastructure facilities.

4) Energy/Power Outage/Excessive Heat

Probability—**Medium**, *Impact*—**Medium**

According to the CDC[2], "…conditions of extreme heat are defined as summertime temperatures that are substantially hotter and/or more humid than average for location at that time of year." Exposure to extreme heat can result in illness (such as heat stroke or heat exhaustion) or death for those at greatest risk, including[3]:

- Infants and children up to four years of age;
- People who overexert during work or exercise;
- People 65 years of age or older;
- People who are ill or on certain medications; and
- People who are overweight.

While extreme heat can occur virtually anywhere in San Bernardino County, measures to prevent illness are generally common sense, including staying cool indoors, keeping hydrated, limiting physical activity, and monitoring those at highest risk.

During conditions of extreme heat, the increased use of electricity can result in power emergencies, including power outages.

Recent extreme heat events within San Bernardino County include a 2006 Excessive Heat & Power Outage event affecting the Valley communities, which escalated to a Stage One CAISO Power Emergency, and a 2010 incident impacting the Southeastern Desert Region. Therefore, the Planning Team determined that both the probability and impact of excessive heat and associated power outage are Medium, and that mitigation measures were possible.

5) Tornado

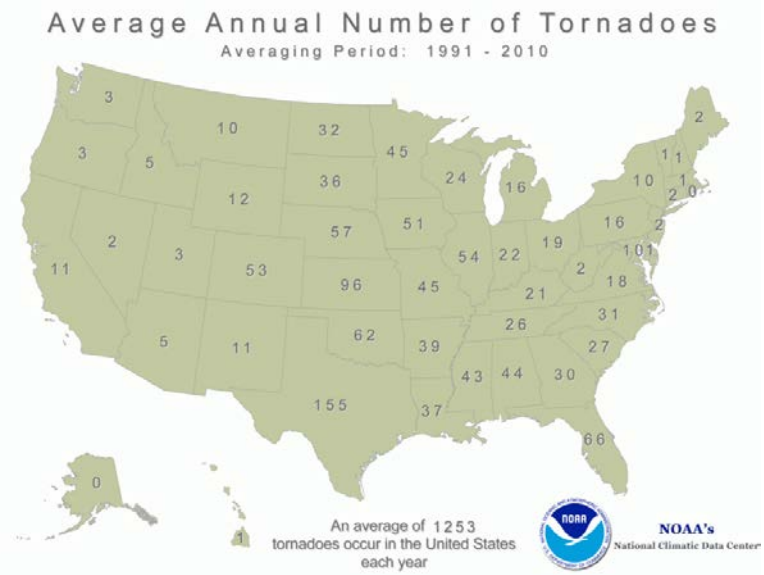
Probability—**Low**, *Impact*—**Medium**

Tornadoes occur infrequently in California, which has a statewide average of just 5 tornadoes a year. This is significantly less than states located in the US' "tornado alley", which can experience as many as 50–100 tornadoes per year, as shown in Figure 13**.** In addition, most California tornadoes are considered "weak"; the historical average occurrence rate of Strong – Violent (F2-F5) tornadoes in California is zero, as shown in Figure 14.

[2] http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp

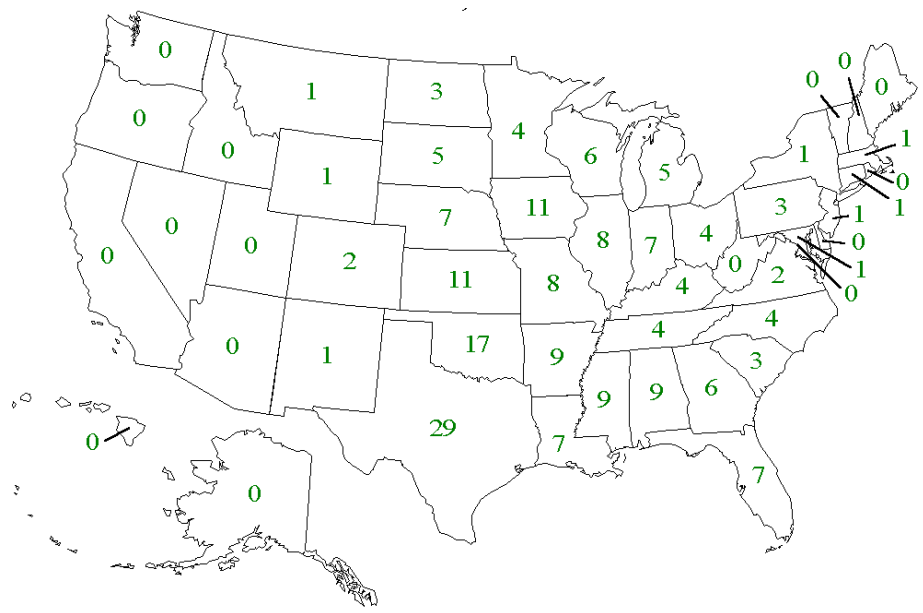
[3] California Department of Health Services "Fast Facts – Preventing Summer Heat Injuries", PS18, http://www.cdph.ca.gov/Pages/NR2009-60.aspx

Figure 13. Average Annual Number of Tornadoes by State, 1991-2010



National Climactic Data Center, 2008, http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html

Figure 14. Average Annual Number of Strong-Violent (F2-F5) Tornadoes by State, 1950–1995



(National Climactic Data Center, 2008, http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html

There were no significant tornado events in San Bernardino County between 2005 and 2010. Accordingly, the Planning Team concluded that while the probability of tornado occurrence in

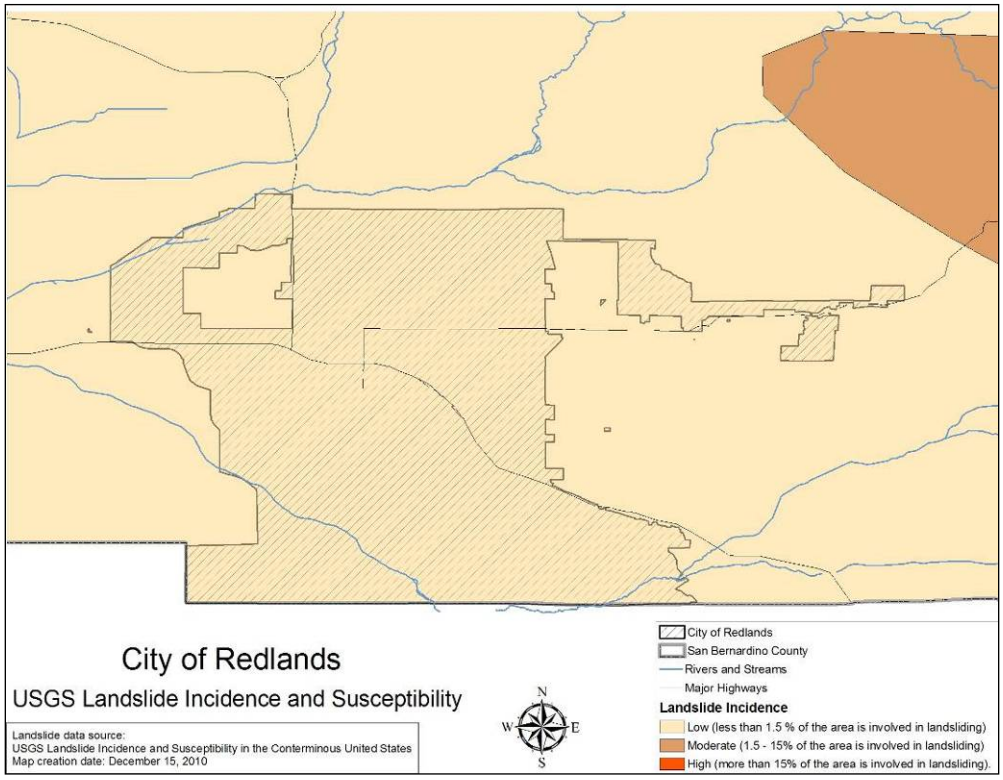
the City of Redlands was low, the potential impact and vulnerability was considered to be a slight threat, but no potential for mitigation at this time.

6) Mudslide/Landslide

Probability—**Medium**, *Impact*—**Medium**

Landslides are the downward and outward movement of earth materials on a slope. Causes include earthquakes, reservoir draw-downs, heavy precipitation, and floods. According to the USGS, landslides can be considered "…a major geologic hazard because they occur in all 50 States, and they cause $1-2 billion in damages and more than 25 fatalities on average each year."[4] As shown in Figure 15, the City of Redlands is located in an area of low landslide incidence on the USGS' Landslide Incidence and Susceptibility in the Conterminous United States map (Overview map, 2001), which shows areas of landslides and areas susceptible to future land sliding (defined to include most types of gravitational mass movement such as rock falls, debris flows, and the failure of engineered soil materials).

Figure 15. Landslide Incidence in the Vicinity of the City of Redlands



In addition to landslides, mudslides and debris flows can occur in areas previously damaged by wildland fires. Debris flows triggered by intense rainfall can be fast-moving and highly destructive, and can occur without warning. These debris flows can destroy vegetation, block storm drains, and cause damage to structures in their path. The City has had no previous

[4] http://www-atlas.usgs.gov/mld/lsoverp.html

occurrences of landslides and the vulnerability to the community has remained low since approval of the 2005 LHMP.

The Planning Team concluded that the probability for landslide occurrence in the City of Redlands is Medium, with a Medium potential impact, with the potential for mitigation.

7) Crop Losses/Freezing

Probability—**Medium**, *Impact*—**Medium**

The top ten agricultural products in San Bernardino County include milk, eggs, cattle & calves, alfalfa, replacement heifers, bok choi, oranges, trees & shrubs, indoor decorative and ground cover (2009 Crop & Livestock Report, San Bernardino County Department of Agriculture/Weights & Measures[5]). Common agriculture in Redlands includes citrus, other orchard crops, row crops, dairies, and Christmas tree farms.

Despite a two-thirds decline in acreage during the previous 30 years, 4,888 acres (16 percent of the Planning Area) remain in citrus. Other agriculture (other orchard crops, row crops, livestock, dairies, and Christmas tree farms) occupies 918 acres. With relatively low cost water supplied by mutual water companies, good productivity, and 90 percent of the fruit commanding premium prices for export to Asia, the Redlands citrus industry stabilized during the 1980s. However, a majority of the citrus acreage is owned by investors, both local and absentee, who must be presumed to be holding it for urban development. (General Plan – Section 7.41)

Extreme cold can result in significant damage to crops, as well as damage to homes and businesses (e.g., from burst pipes), and can cause significant health problems, such as hypothermia and frostbite. Recent extreme cold events within San Bernardino County include the January 2007 Extreme Cold Emergency that damaged citrus, row, field and nursery crops county-wide, including agriculture in Redlands and other cities in the Valley region.

The City of Redlands has several agriculture growers that produce citrus and other crops. This will cause an economic impact in the community as well as surrounding communities.

8) Dam Breach

Probability—**Low**, *Impact*—**Medium**

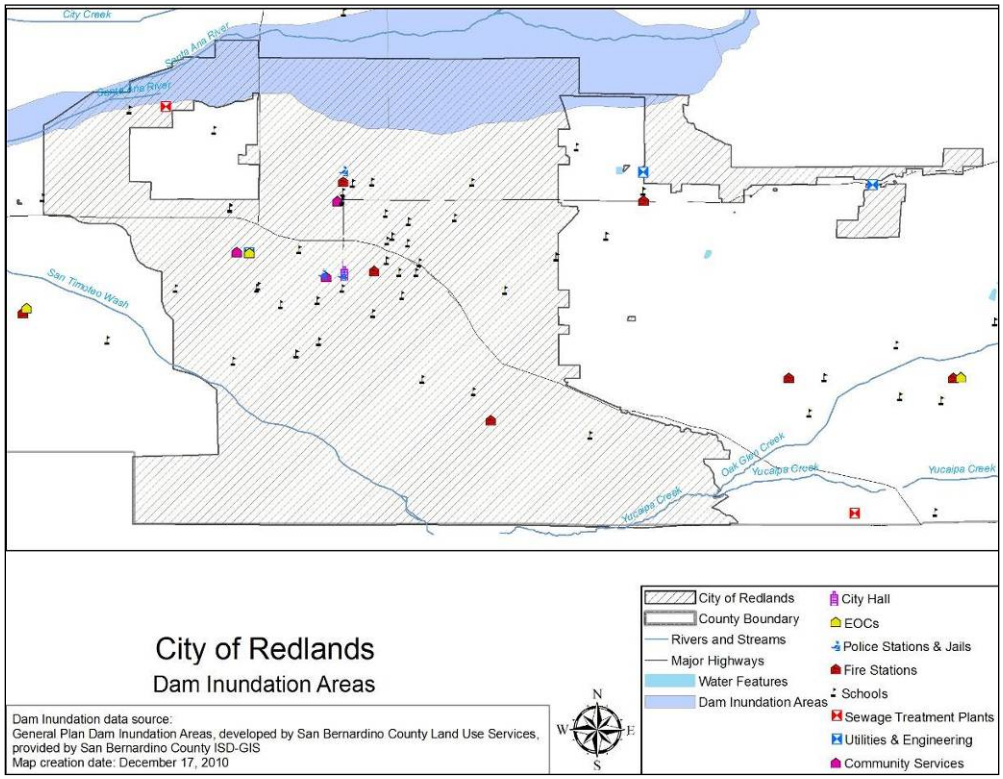
As shown in **Figure** , the northernmost portions of the City of Redlands, along the Santa Ana River margin, are located within the potential dam inundation area for Seven Oaks Dam as mapped by San Bernardino County ISD/GIS as part of the San Bernardino County General Plan. Construction of this modern dam by the U.S. Army Corps of Engineers was completed in 1999. Designed for flood control, its location near the San Andreas Fault resulted in the dam's being designed to resist earthquake damage for events as large as a M8 earthquake[6].

Dam failure or inundation resulting from over-topping was considered by the Project Team to be possible (Medium Probability), with the resulting impacts assumed to be Low. There were no

[5] http://www.sbcounty.gov/awm/docs/2009CropReport.pdf
[6] http://www.sbcounty.gov/flood/dampage.htm

dam breaches since approval of the 2005 LHMP and no vulnerability at this time. Therefore, the Planning Team concluded that there was not viable mitigation activities associated with dam inundation risk.

Figure 16. Dam Inundation Areas in the City of Redlands



The Planning Team concluded that there was not viable mitigation activities associated with dam inundation risk.

9) Windstorm

Probability—**Medium**, *Impact*—**Medium**

There are several explanations for winds but the most common is the movement of air between "High" and "Low" pressure cells in the atmosphere. The majority of damaging winds (or windstorms) result from *Santa Ana wind conditions*, as well as, *thunderstorms*.

Santa Ana winds, which commonly occur between October and February, and can, reach speeds of more than 100 miles per hour; while the National Weather Service defines a severe thunderstorm as:

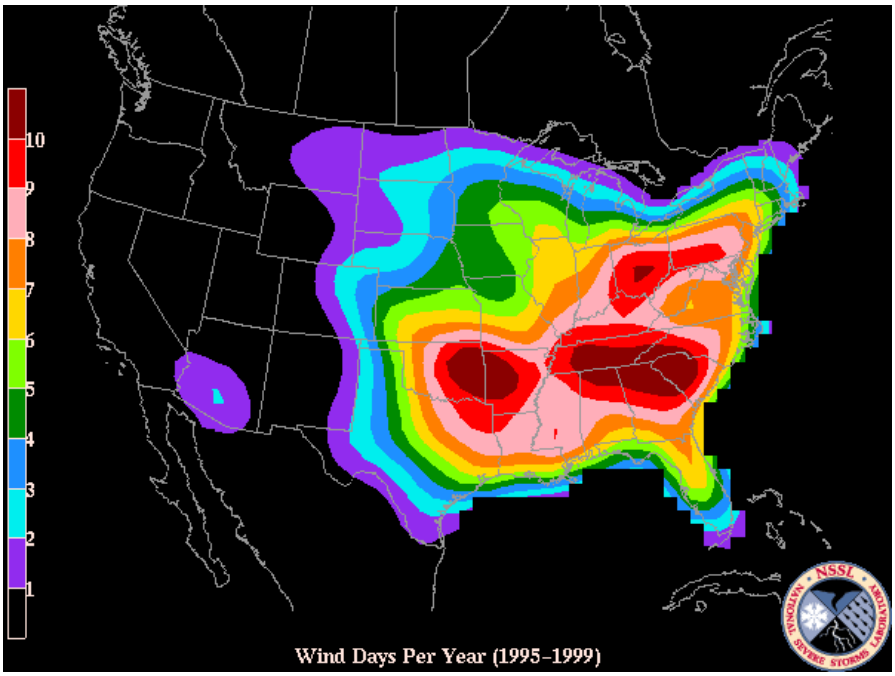
> "A thunderstorm that produces a tornado, *winds of at least 58 mph (50 knots)*, and/or hail at least ¾" in diameter. Structural wind damage may imply the occurrence of a severe thunderstorm. A thunderstorm wind equal to or greater than 40 mph (35 knots) and/or hail of at least ½" is defined as approaching severe."

(*http://www.weather.gov/glossary/index.php?letter=s*)

Santa Ana winds are warm, dry winds which descend from the high desert, down the mountains into the Southern California Basin7. The most significant hazard associated with Santa Ana winds is an increased wildfire danger, but Santa Ana winds can also cause downed trees and power lines, and property damage, as well as causing potentially hazardous conditions for RV's, semi-trailers, aircraft and boaters.

Hazards associated with thunderstorms include lightning, as well as potential straight-line winds, hail, tornadoes, and flash floods. Straight-line winds are any winds not associated with the rotation of a tornado, and are responsible for most thunderstorm wind damage[8]. Straight-line wind speeds can exceed 125 mph, and knock down trees and power lines. Figure 17 shows the mean number of days per year with one or more thunderstorm events (with thunderstorm winds of 50 knots or greater, or causing damage), within 25 miles of a given point, using data from 1995–1999. As shown in Figure 17 the threat of thunderstorm wind in the vicinity of the City of Redlands in San Bernardino County is low relative to much of the US.

Figure 17. Thunderstorm Wind Threat 1995–1999



NOAA National Severe Storm Laboratory, http://www.nssl.noaa.gov/hazard/img/twin9599.gif

There have been no windstorms that have caused damage nor impacted the City since approval of the 2005 LHMP. The Planning Team concluded that the probability of windstorm (primarily Santa Ana winds) was high, but the direct impact from the winds was determined to be medium, with potential for mitigation.

7 http://www.theweatherprediction.com/weatherpapers/049/index.html

8 "Thunderstorms, Tornadoes, Lightning…Nature's Most Violent Storms," NOAA/NWS, http://www.weather.gov/os/severeweather/resources/ttl7-09.pdf

10) Drought

Probability—**High**, *Impact*—**High**

Between the years of 2005 to 2010, neither the San Bernardino County nor the State of California has experienced any type of drought to the magnitude that they are experiencing now. The current drought condition expects to be minimal to the city. However, over 75% of the City limits are classified as high, very high, or extreme wildlands fire danger, thus the impact of a drought will lend itself to the potential for dangerous wildland fires.

Recently, the State of California has proclaimed a State of Emergency due to extremely dry conditions that have persisted since 2012 and may continue beyond the control of services, personnel, equipment and facilities of any single local government and requires the combined forces of a mutual aid region or regions to combat.

The dry conditions and lack of precipitation present a high vulnerability on the community and will result in urgent problems; drinking water supplies are at risk in many California communities; fewer crops can be cultivated and farmers' long-term investments are put at risk; low-income communities heavily dependent on agricultural employment will suffer heightened unemployment and economic hardship; animals and plants that rely on California's rivers, including many species in danger of extinction, will be threatened; and the risk of wildfires across the state is greatly increased.

The City of Redlands has implemented a water conservation plan that seeks to reduce the nonessential use of water to conserve city water supplies. The conservation plan establishes mandatory water restrictions within the City to discourage waste, there are four stages of restrictions that are enforced based on the current drought conditions.

- **Stage I,** Voluntary Conservation Measures: Water users are requested to limit their water use from June 1 to October 1 of each year to an amount necessary for health, safety, economic necessity and irrigation.
- **Stage II,** Mandatory Compliance; Water Alert: restricts water usage for irrigation and washing of automobiles to specific days of the week between the hours of 12:00 PM and 8:00 PM
- **Stage III,** Mandatory Compliance; Water Warning: extends the irrigation restriction by prohibiting watering with buckets and drip irrigation except during designated hours. Prohibits the watering of golf courses.
- **Stage IV,** Mandatory Compliance; Water Warning: prohibition of irrigation and washing automobiles apply to commercial car washes, commercial nurses and commercial farmers. These activities can only be conducted between the hours of 10:00 A.M. and 6:00 PM.

11) Disease

Probability—**High**, *Impact*—**Low**

Several diseases, including various types of pandemic influenza, have the potential for community-wide impacts, including direct population impacts (illness, death) as well as economic impacts resulting from lost work time and decreased economic productivity.

Influenza (the flu) is a disease that attacks the respiratory system (nose, throat, and lungs). Although mild cases may appear to be similar to cold, influenza is typically more severe, with various symptoms including fever, coughing, sore throat, runny or stuffy nose, headaches, body aches, chills and fatigue. Serious complications associated with the flu include bacterial pneumonia, ear and sinus infections, dehydration and the worsening of chronic medical conditions.

Annual outbreaks of the seasonal flu usually occur during the late fall through early spring. Most people have natural immunity, and a seasonal flu vaccine is generally available. According to the CDC, in a typical year, approximately 5 to 20 percent of the population gets the seasonal flu and flu-related deaths range from 3,300 to 48,600 (average 23,600)9. A flu pandemic occurs when a new influenza A virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. The 20th century saw three such pandemics, the most notable of which was the 1918 Spanish influenza pandemic that was responsible for 20 million deaths throughout the world.

Bird flu (H5N1) is an influenza A virus subtype that is highly contagious among birds; although rare, some human infections with the H5N1 (Bird) flu virus have occurred. Most confirmed cases have occurred in Asia, Africa, the Pacific, Europe and the Near East. According to the CDC, there are currently no confirmed human cases of H5N1 infections, but the Bird flu remains a serious concern with the potential to cause a deadly pandemic.

H1N1 (Swine) flu was first detected in the United States in April 2009. This virus was a unique combination of influenza virus genes never previously identified in either animals or people. The H1N1 flu virus caused more illness in young people and pregnant women than is usual for prior flu seasons, and was declared a Worldwide Pandemic by the World Health Organization.

The Planning Team concluded that the probability of future disease outbreaks, such as a flu pandemic, is high. Based on recent experience, the local impact is expected to be low but can have an effect on the communities resulting in business closures, hospitals overwhelmed and not enough vaccines.

[9] http://www.flu.gov/individualfamily/about/index.html

12) Infestation

Probability—**Medium**, *Impact*—**Medium**

Infestation refers to the cause and effect of inspects on the local population and economy. Emergencies related to insect infestation have impacted San Bernardino County and its local jurisdictions in the last decade, including an increased fire risk due to Bark Beetle infestation of trees in 2003, and mosquito-borne West Nile Virus in 2007. Since 2002, the Bark Beetle infestation has required removal of 99,500 acres of affected trees in the San Bernardino National Forest, as well as on private lands, at a cost of $4 million in grants and matching funds. However, both the Bark Beetle and West Nile Virus infestations are under control and did not seriously impact the City of Redlands. Additionally, while future infestation issues are possible, the impact on the City of Redlands is generally expected to be limited and no major impact to the community.

13) Chemical Agents (Chemical, Biological, Radiological, Nuclear)

Probability—**Low**, *Impact*—**Medium**

Terrorism has become an undeniable reality throughout the United States. In addition to the use of conventional weapons, there is increasing concern that terrorist groups may resort to the use of biological, chemical, radiological or nuclear weapons. Because terrorist groups look for high value targets (visually recognized) and areas where they can cause the greatest amount of destruction, the Planning Team concluded that the probability of such an event occurring within the City of Redlands was low, and thus the potential impact was medium. The impact on the community will be the same as any other communities, disruption in services, contaminated water and food supplies, lack of medical supplies and economic loss due to major highway running through the City.

14) Chemical/Hazardous Materials Spills

Probability—**High**, *Impact*—**Medium**

Hazardous materials are used in manufacturing, agriculture, service industries (e.g., gas stations, dry cleaners), health care, and even in households. Many of these chemicals can be harmful to the health of those exposed, and to the environment.

The Fire Department has the responsibility for responding to hazardous materials incidents, and has responded to more than 40 incidents in each of the last four years (2007 – 2010). The Planning Team concluded that the probability of future hazardous materials release is High, with Medium Impact. The impact on the community will be the same as any other communities, disruption in services, contaminated water and food supplies, lack of medical supplies and economic loss due to major highway running through the City.

5.1.3. Hazard Prioritization

The hazards are the same as in the 2005 plan; however the Planning team has re-prioritized the hazards. The probabilities and impacts of the various hazards analyzed in the Hazard Assessment were combined with the evaluation of potential for mitigation measures to develop a prioritized ranking of hazards for consideration in this Hazard Mitigation Plan (HMP). Below Table 6. Hazard Assessment for the City of Redlands) is a summary of the City of Redlands Planning Team's final results of all of the hazards assessed for the City:

Table 6. Hazard Assessment for the City of Redlands

Hazard	Probability	Impact	Potential for mitigation Measures? (Y/N)	Final Category
Wildfire	High	Medium	Y	High/Medium
Flooding	High	High	Y	High/High
Earthquake	High	High	Y	High/High
Energy/Power Outage/ Excessive Heat	Medium	Medium	Y	Medium/ Medium
Tornado	Low	Medium	N	Low/Medium
Mudslide/Landslide	Medium	Medium	Y	Medium/ Medium
Crop Losses/Freezing	Medium	Low	Y	Medium/Low
Dam Breach	Low	Low	N	Low/Low
Windstorm	Medium	Medium	Y	Medium/ Medium
Drought	High	High	Y	High/High
Disease	High	Low	Y	High/low
Infestation	Medium	Medium	Y	Medium/ Medium
Chemical Agents (CBRN)	Low	Medium	Y	Low/Medium
Chemical /HAZMAT Spill	High	Medium	Y	High/Medium

The probability and impact rating of the various hazards were then placed into a matrix (Table 7). The matrix was then reviewed by the Planning Team. This is an important step. Previously, the hazards were assessed individually; this step allowed the Planning Team to conduct a

comparison of the hazards. The Planning Team then considered any reconsiderations or adjustments to their original determinations.

Table 7. Hazard Prioritization Matrix for the City of Redlands

		Impact		
		/ High	**/ Medium**	**/ Low**
Probability	**High /**	• Flooding • Earthquake • Drought	• Wildfire • Chemical/Hazardous Materials Spill	• Disease
	Medium /		• Energy/Power Outage/ Excessive Heat • Mudslide/Landslide • Infestation • Crop Losses/ Freezing • Windstorm	• Dam Breach
	Low /		Tornado Chemical Agents (CBRN)	

With the assessment finalized, the Planning Team then discussed which rating(s) the city would focus on over the next five (5) years. The Planning Team came to consensus that all hazards that fell within the "High" Probability and "High" Impact and all hazards that fell within the "High" Probability and "Medium" Impact were the city's top priorities over the next five (5) years; areas shown in GREEN on the matrix.

As shown on the matrix, *Flooding*, *Drought* and *Earthquake* were rated as "High" Probability and "High" Impact, while *Wildfire* and *Chemical/Hazardous Materials Spills* were rated as "High" Probability and "Medium" Impact; these hazards were considered by the Planning Team to be the greatest threats to the City of Redlands and concluded that their mitigation focus moving forward would be on these five (5) hazards.

The remaining hazards were determined to be of lower priority; the RED and WHITE boxes represent the lower (second and third tier) priority hazards. In light of that, the following sections will only profile the five (5) high priority hazards (*Flooding*, *Earthquake*, *Wildfire*, and *Chemical/Hazardous Materials Spills and Drought*) in more depth (Section 5.2), discuss the exposure of assets to these hazards in the unincorporated County (Section 5.3), and estimate losses or assess risk for significant events associated with these hazards (Section 5.4).

5.2. Hazard Profile

This section provides an overview and information on previous occurrences of each of the high priority hazards affecting the City of Redlands; *Flooding*, *Earthquake*, *Wildfire* and *Chemical/Hazardous Materials Spill*, and Drought.

5.2.1. Flood Hazards

General Definition

Floods are one of the most common and widespread of all natural disasters. Most communities in the United States have experienced some kind of flooding, after spring rains, heavy thunderstorms, or winter snow thaws.

A flood, as defined by the National Flood Insurance Program is: "A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is your property) from:

- Overflow of inland or tidal waters,
- Unusual and rapid accumulation or runoff of surface waters from any source,
- Mudflow, or
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above."

Floods can be slow or fast rising but generally develop over a period of days. Flooding tends to occur in the summer and early fall because of the monsoon and is typified by increased humidity and high summer temperatures. The standard measure for flooding is the "100-year flood", a benchmark used by the Federal Emergency Management Agency (FEMA) to establish a standard of flood control in communities throughout the country. The 100-year flood is also referred to as the "regulatory" or "base" flood. The term 100-year flood is often incorrectly used and can be misleading. The correct designation is “the 1% annual chance flood”, meaning there is a 1% chance that a flood of that intensity and elevation will occur in any given year, not that the flood will occur once every hundred years.

Local Overview

Floods inundate portions of the City of Redlands almost every year. Records show that by 1988, 23-medium to large floods had occurred since construction of Mission Zanja in 1819. Since 1988, additional declared flood disasters have occurred, each producing proportionate damage to the community.

The County of San Bernardino Flood Control District initiated a report following the floods of January and February 1969, which summed up the repetition of flood damage in Redlands and vicinity. It stated that "A review of the occurrence of past floods of serious magnitude in San Bernardino Valley shows that one may be expected on the average of every 20 to 21 years.

'Great floods' have been recorded for the years 1825, 1862, 1867, 1884, 1891, 1916, 1938, 1969 and 1993. Available records indicated that the greatest of these by far was the flood of January 1862. If the reconstructed data for that storm is reasonably accurate, it would have been approximately a once-in-350-years flood!"

Four (4) streams drain Redlands, each of which represents a potential flood hazard at peak flows; 1) the Santa Ana River/Mill Creek (located at the northern edge of the City), 2) the Mission Zanja (also known as Mill Creek Zanja and Mission Storm Drain), 3) San Timoteo Creek and 4) Live Oak Creek.

The Santa Ana River/Mill Creek (at the northern end of the City), which emerges from its mountain canyon 5 miles northeast of Redlands, spreads out in shallow, braided channels more than a 1.5 mile-wide wash, mantled with fluvial debris. In 1965, 1966, 1969, 1976, 1980, 1992, 1993, and 1995 the flood waters from the upper regions of the Santa Ana River/Mill Creek were responsible for extensive damage to Orange Street and Alabama Street, ranging from washouts from five to six-foot high flood waters, to extensive, permanent damages from uncontrollable runoff from the upper regions of the San Bernardino mountains.

The Mission Zanja (in the southwest part of the City), also known as Mill Creek Zanja and Mission Storm Drain, is part of the area's history. The Mission Zanja was constructed for water supply in 1819. Diverting water from Mill Creek, the Zanja carried water for 12 miles to support the San Bernardino Assistance and surrounding farms and ranches. Today, as it traverses an east/west direction, the Zanja drains major portions of the City through various storm drain systems. During significant storm periods, the Zanja poses a serious threat to the community, and the U. S. Army Corps of Engineers is currently funding the design and construction of facilities to remove the flood hazard. The Mission Zanja, from the 2800 block of Mentone Boulevard to the west edge of Sylvan Park, is a designated landmark, and part of the National Register of Historic Places.

Redlands' vulnerability to raging Santa Ana River and Mill Creek Zanja floodwaters was demonstrated by the destructive floods of 1862, 1938, and 1969. Since then, numerous improvements have reduced hazards to lives and property. Additional flood improvements included the Seven Oaks Dam, Mill Creek levee renovation, and the San Timoteo Canyon channel and debris basins.

Recent Flood Events

The most recent event is still an active Federal Declaration. Disaster number 1952, severe winter storms, flooding, debris and mud flows occurred between December 17, 2010 and January 4, 2011. A total of 12 counties were included in President Obama's major disaster declaration. Damages incurred by the City during this event exceeded $580,000.

Disaster number 1884 was a less severe event, but damage was incurred nonetheless. As a result of this event, the California Governor requested a major disaster declaration due to severe winter storms, record breaking snow, flooding, and debris and mud flows during the period of January 17 to February 6, 2010. The City of Redlands incurred damages of over $10,000.

Lastly, the severe storms of December 27, 2004 – January 11, 2005 occurred. Disaster number 1577 included a total of over $40,000 in damages were sustained as a result of the storm.

5.2.2. Earthquake Hazards

General Description

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates.

Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

Earthquakes strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world. Recent estimates of expected annualized earthquake loss for the U.S. totals $5.3 billion per year, with 66% ($3.5 billion) concentrated within the State of California, and $397 million in Riverside and San Bernardino Counties (FEMA, 2008[10]).

There are 45 states and territories in the United States at “moderate” to “very high” risk from earthquakes, and they are located in every region of the country. California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes—most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter scale. These earthquakes were felt over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

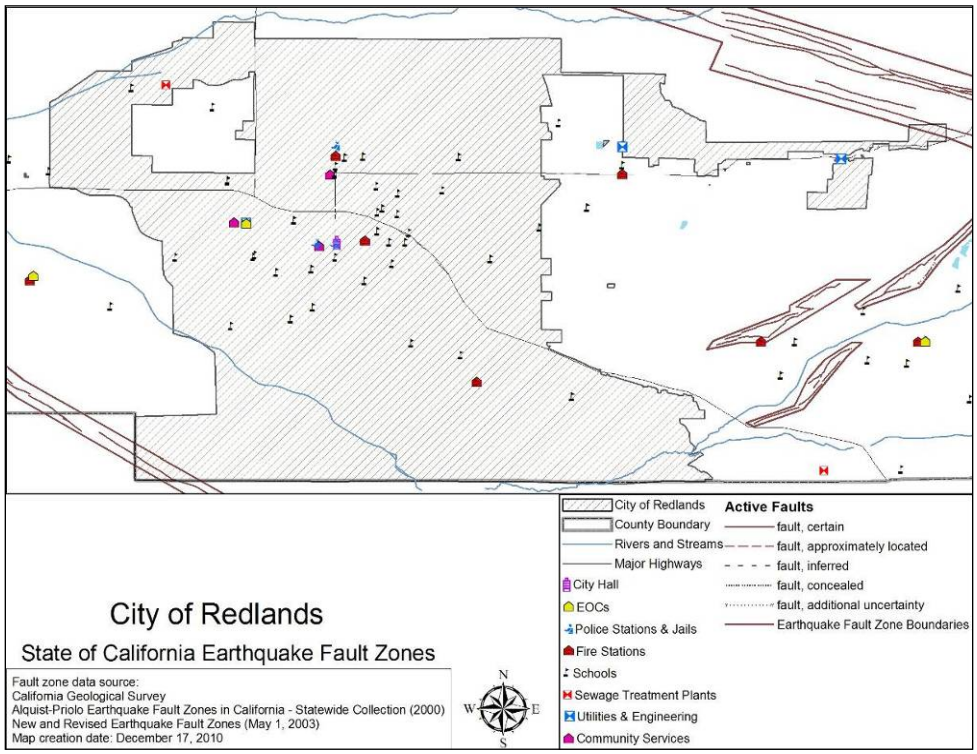
Local Overview

The San Jacinto Fault forms the southwestern boundary of the San Bernardino Valley and intersects the City of Redlands at its southwest corner, as shown in Figure 18.

[10] “HAZUS® MH Estimated Annualized Earthquake Losses for the United States”, FEMA 366, April, 2008.

The fault zone extends approximately 120 miles in distance from its point of origin in the San Bernardino Valley at the San Andreas Fault. The formation of this juncture exists within the geographical location of the Devore Pass. The southernmost section of the zone travels northwest of El Centro[11].

Figure 18. Alquist-Priolo Earthquake Fault Zones in the Vicinity of the City of Redlands



The San Bernardino segment of the San Andreas Fault is located to the east of the City of Redlands. This 50 km segment is considered to be "the currently active segment of the San Andreas fault system to the northwest of Gorgonio Pass"[12].

The Crafton Hills Fault Zone is a series of normal faults, each about 10 km in length or less, located just to the east of the City of Redlands, between the San Jacinto and San Andreas Faults[13].

Hazards associated with earthquakes include surface fault rupture, strong ground shaking, and secondary effects such as earthquake-induced liquefaction (loss of strength or cohesion in unconsolidated, lose or sandy soils) and landslides. Maps of liquefaction and landslide susceptibility in the vicinity of the City of Redlands are shown in Figure 19.

[11] "Planning Scenario, for a Major Earthquake on San Jacinto Fault Zone in the San Bernardino Area", California Geological Survey Special Publication 102, 1993.
[12] http://www.data.scec.org/fault_index/sanberna.html
[13] http://www.data.scec.org/fault_index/crafton.html0>

There are considerable areas of Very High and High liquefaction susceptibility in areas of sandy soil associated with the Santa Ana River, the Mission Zanja, and San Timoteo Creek, but the City of Redlands is located within an area of Low landslide susceptibility, as shown in Figure 20.

Figure 19. Liquefaction Susceptibility in the Vicinity of the City of Redlands

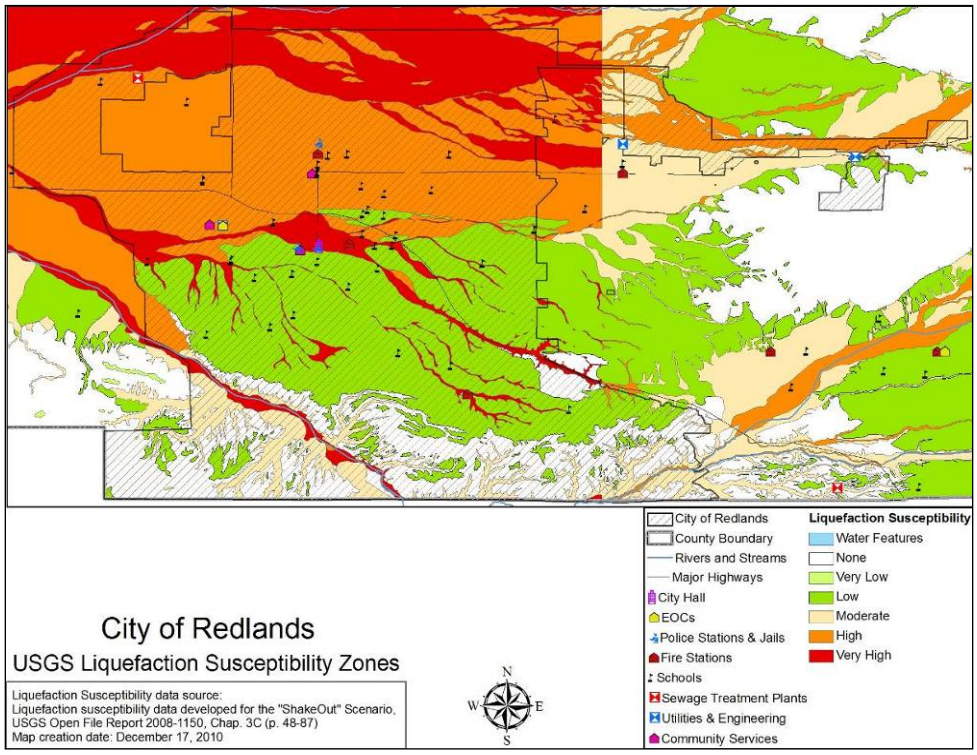
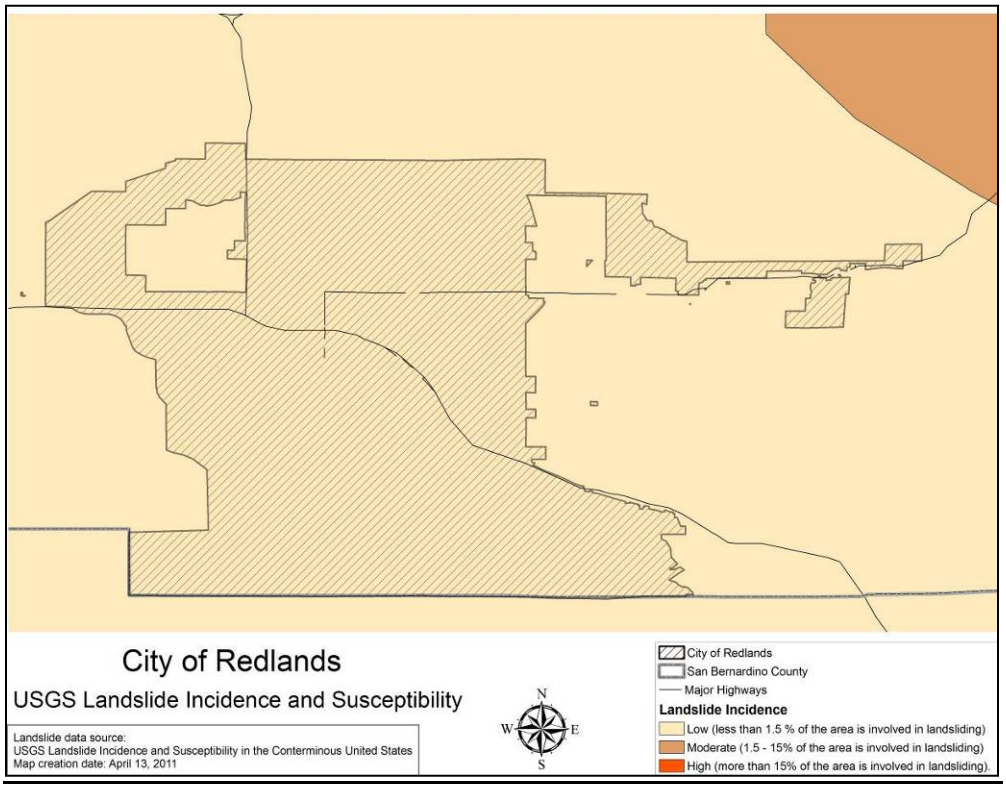


Figure 20 Landslide Incidence and Susceptibility in the Vicinity of the City of Redlands



Recent Earthquake Events

Southern California area has experience several Earthquakes from 2008 to 2014. The most recent Earthquake was March 2014 an M 5.1 which occurred in La Habra, California. The main shock was followed by over hundred aftershocks. This event resulted in no casualties and minor to moderate damages across Southern California region.

January 2014, The City of Fontana area experienced an M 4.4 earthquake; this event had no causalities and minor damages to the area.

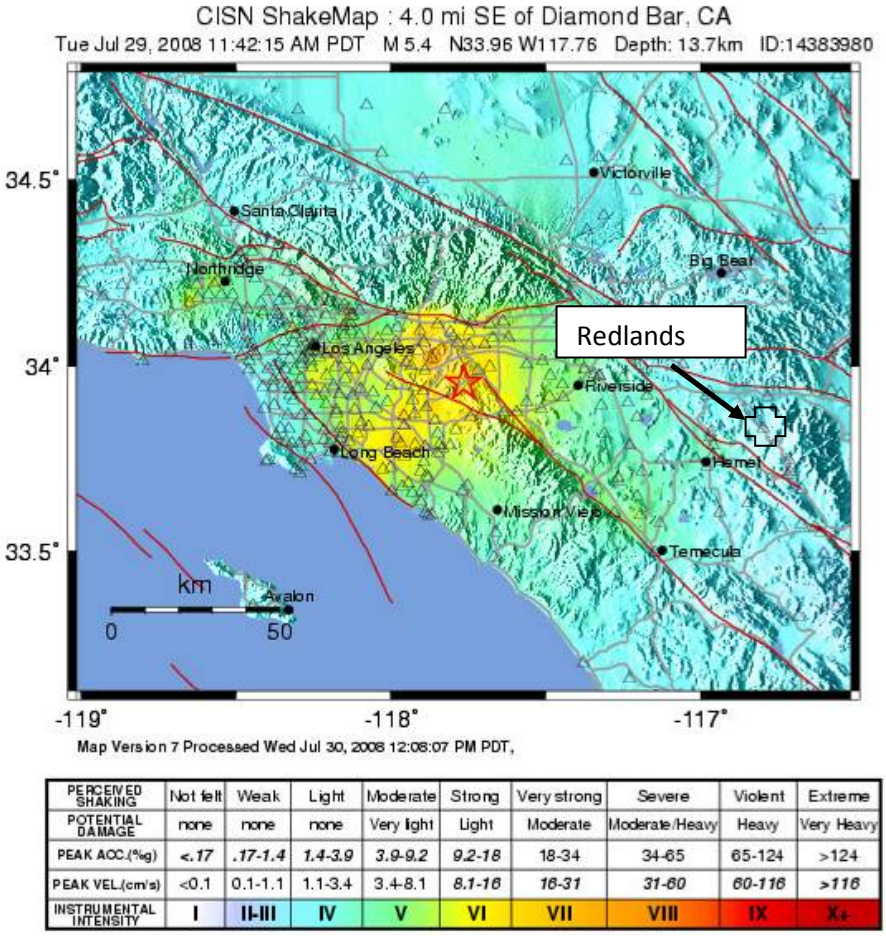
April 2010, El Mayor-Cucapah Earthquake along the US Mexico Border, this event M7.2 earthquake caused major damages to the area and Imperial County. The main shock was followed by a large cluster of aftershocks with the M of 5.7. This event occurred on a northwest striking fault that follows the trend of the Elsinore fault in this region.

May 2009, The City of Los Angeles area experienced an M 4.7 earthquake; this initial focal mechanism is consistent with slip on the Newport-Inglewood fault. This event had no causalities and minor damages to the area.

In July of 2008, an M 5.4 earthquake occurred in Chino Hills, on a fault structure later identified as the “Yorba Linda Trend”. This event resulted in no casualties and only minor damage across southern California; a Federal disaster was not declared.

The USGS Shake Map for this event is provided in Figure 21 shaking within the City of Redlands was light.

Figure 21. USGS Shake Map for the 2008 M5.4 Chino Hills Earthquake



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

http://earthquake.usgs.gov/earthquakes/shakemap/sc/shake/14383980/

While no recent earthquake has significantly impacted the City of Redlands, research by the 2007 California Working Group on Earthquake Probabilities indicates that the probability of a significant earthquake (M6.7 or greater) occurring in Southern California in the next 30 years is an estimated 97%, as shown previously in Figure 11. California Area 30-Year Earthquake Probabilities

(USGS Open-File Report 2007-1437)

For a record of historical earthquake in the City of Redlands, please refer to Table 28 on page 117.

5.2.3. Wildfire Hazards

General Description

There are three (3) different classes of wild land or wildfires: 1) surface; 2) ground; and, 3) crown. A “Surface fire” is the most common type and burns along the floor of a forest, moving slowly and killing or damaging trees. A “Ground fire”; usually started by lightning, are fed by subterranean roots, and smolder on or below the forest floor. A “Crown fire” spread rapidly by wind and move quickly by jumping along the tops of trees. Wildfires are usually signaled by dense smoke that fills the area for miles around. Wildfires present a significant potential for disaster in the southwest, a region of relatively high temperatures, low humidity, and low precipitation during the summer, and during the spring, moderately strong daytime winds. Combine these severe burning conditions with people or lightning and the stage is set for the occurrence of large, destructive wildfires.

Local Overview

Due to a combination of topography, weather, and fuel, and exacerbated by potentially high winds and limited access, much of the City of Redlands is highly susceptible to wildland fire hazards. The slopes of San Timoteo and Live Oak canyons, the Badlands to the south, and the Crafton Hills to the east are not only difficult for firefighters and their equipment to reach, but the hill’s steepness and configuration can result in the rapid upslope spread of fire.

Limited rainfall, low humidity, and seasonal high temperatures continue to contribute to the desiccation of the grasses and chaparral which cover the foothills, providing prime fuel for intense burns. Although some of the canyons are shielded from the direct impact of the powerful, dry Santa Ana winds, their occurrence generally aggravates the fire hazard. In addition, the presence of human activities in or near a wildland area dramatically increases the risk of a major fire due to careless smokers, illegal campfires, and other related risks. As noted above, the canyon areas located at the southwest of the City (and the surrounding areas) are the zones of highest hazard.

Recent Wildfire Events

In the last five years, the total loss due to fire damage within the City of Redlands has been $10,748,635. Property value directly saved as a result of emergency response has been valued at $149,864,448. These numbers were compiled using the Property Information Management System from the San Bernardino County Office of Assessor’s website.

The City of Redlands, as it is comprised of over 75% wildfire terrain, faces an ever-increasing set of complex challenges. Housing development continues to expand into wildfire-prone environments. Climate change appears to be influencing more frequent drought conditions. Increases in population and land use are resulting in greater wildfire risk. As a result, more intense wildfires with higher threat levels to people and property can be expected. In addition, government agencies must increasingly deal with budget reductions that impact fire personnel and resources.

Figure 22. Fire History for the City of Redlands and Vicinity, 2005-2009

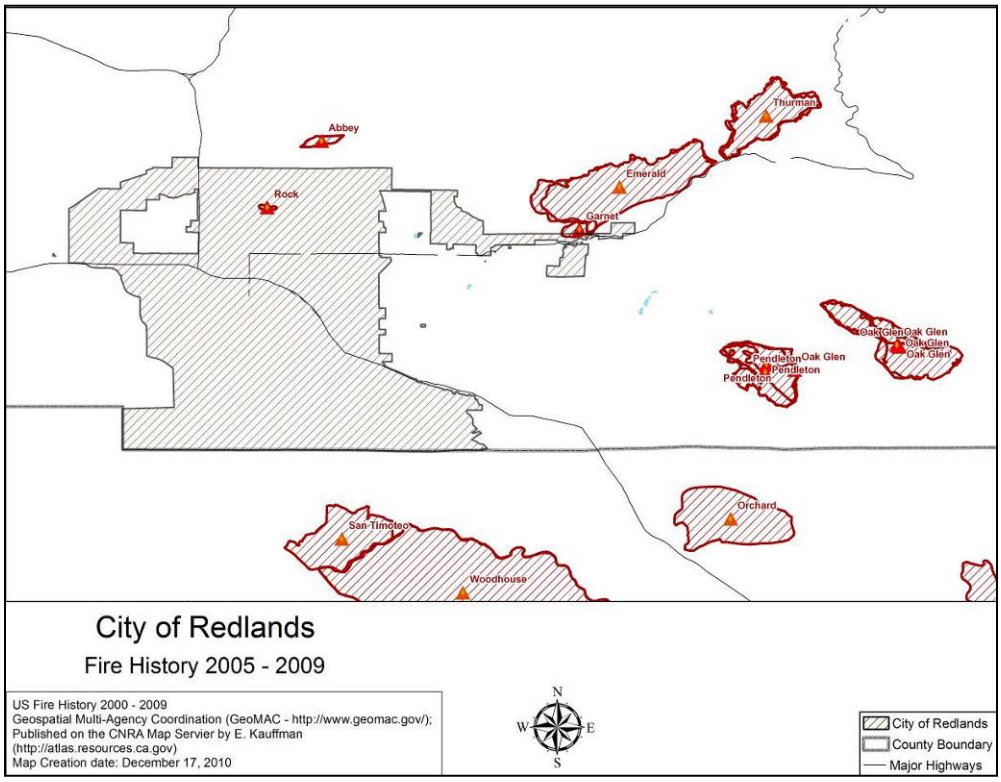


Table 8. Recent Fires Occurring in the Vicinity of the City of Redlands, 2013-2015

Incidents by descriptions (Redlands and the vicinity)	Date Range	How many fires
Residential fires (in and the vicinity of Redlands) Total	**1/1/2005-12/31/2010**	**11**
Residential Fires (In and the vicinity of Redlands)	1/1/2005-12/31/2005	3
	1/1/2006-12/31/2006	2
	1/1/2008-12/31/2008	1
	1/1/2009-12/31/2009	1
	1/1/2010-12/31/2010	4
Non-Residential Fires	**1/1/2005-12/31/2013**	**279**
	1/1/2010-12/31/2010	**56**
Natural vegetation fire, other		9
Forest, woods or wildland fire		2
Brush, or brush and grass mixture fire		24
Grass fire		20
Cultivated vegetation, crop fire, other		1
	1/1/2011-12/31/2011	**82**
Natural vegetation fire, other		20
Forest, woods or wildland fire		6
Brush, or brush and grass mixture fire		40
Grass fire		14
Cultivated vegetation, crop fire, other		2
	1/1/2012-12/31/2012	**72**
Natural vegetation fire, other		13
Forest, woods or wildland fire		14
Brush, or brush and grass mixture fire		32
Grass fire		6
Cultivated vegetation, crop fire, other		2
Cultivated orchard or vineyard fire		3
Cultivated trees or nursery stock fire		2
	1/1/2013-12/31/2013	**69**
Natural vegetation fire, other		13
Forest, woods or wildland fire		11
Brush, or brush and grass mixture fire		27
Grass fire		14
Cultivated vegetation, crop fire, other		1
Cultivated orchard or vineyard fire		1
Cultivated trees or nursery stock fire		2

In addition to larger fires occurring outside of the City, the Redlands Fire Department has responded to smaller fires occurring within the City, such as the 2009 Helen Fire.

On September 22, about 1:30 in the afternoon, Redlands Emergency Communications Group Chief Radio Officer reported smoke in the area of Helen Drive and East Sunset Drive South. Initial reports were one to two acres of light fuels with a rapid rate of spread. Within 10 minutes, all Redlands Fire Department apparatus were overwhelmed. Forty-five minutes after the initial report the fire had grown to 15 acres. With the assistance of other local agencies, including Cal Fire, which provided aircraft, hand crews, fire engines and command staff, the fire was suppressed at 21.3 acres, only partially damaged four residences and destroyed one out-building. In addition, there was a small spot fire ¼ mile from the main fire, which the aircraft noticed, enabling the firefighters to quickly knockdown the spot fire before damaging any of the homes, which were immediately threatened.

Figure 23. Helen Fire Radius

5.2.4. Chemical/Hazardous Material Spill Hazards

General Description

Hazardous materials are used in manufacturing, agriculture, service industries (e.g., gas stations, dry cleaners), health care, and even in households. Many of these chemicals can be harmful to the health of those exposed, and to the environment. There are several types of hazardous materials releases:

- **Fixed-Site Releases** - releases involving the production and manufacturing, handling, and storage of a hazardous product at a single facility as well as any releases that may occur at a designated hazardous waste disposal site.
- **Transportation-Related Releases -** Includes releases that occur while the hazardous material is in transit from one facility to another or en-route to be disposed of at a designated hazardous waste disposal site (e.g., on highways, railways, airports, or in pipelines).
- **Intentional Releases - i**ncludes criminal acts and acts of terrorism in which a hazardous material is used to intentionally cause injuries and/or fatalities, damage the environment and/or property, or advance a political or social agenda.

According to the US DOT, most hazardous materials release events between 1982 and 1991 occurred during transport; 81.4% of hazardous materials releases occur on highways, 14.7% on railways, with other events accounting for 3.9% of releases [FEMA, 1997[14]].

Regulatory Context

The Emergency Planning and Community Right-to-Know Act (EPCRA) were created to help communities plan for emergencies involving hazardous substances. EPCRA has four (4) major provisions: one (1) deal with emergency planning and three (3) deals with chemical reporting. EPCRA local emergency planning requirements (Sections 301 to 303) stipulate that every community in the United States must be part of a comprehensive emergency response plan. Facilities are required to participate in the planning process.

- State Emergency Response Commissions (SERCs) oversee the implementation of EPCRA requirements in each state.
- Local Emergency Planning Committees (LEPCs) work to understand chemical hazards in the community, develop emergency plans in case of an accidental release, and look for ways to prevent chemical accidents. LEPCs are made up of emergency management agencies, responders, industry and the public. According to the EPCRA chemical reporting requirements, facilities must report the storage, use, and release of certain hazardous chemicals.
- Emergency Planning Notification (Section 302(c))
- Emergency Release Notification (Section 304)

[14] Federal Emergency Management Agency. 1997. *Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy*

- Hazardous Chemical Storage Reporting Requirements (Sections 311-312)
- Toxics Release Inventory (TRI) Reporting (Section 313)
- Trade Secrets (Section 322).

Local Overview

The City of Redlands Fire Department Hazardous Materials Response Team consists of five (5) active members, with three (3) members trained to the "Specialist" Level, and three (3) members trained to the "Technician" Level. All trained personnel are also members of the San Bernardino County Inter-Agency Hazardous Materials Response Team, and respond countywide, through a countywide mutual aid agreement. Personnel maintain their skills by attending monthly training sessions.

Redlands is covered by the LEPC for California Region VI (CA105), located in Hemet. The City is a member of a Countywide Hazardous Materials Response Team. As a part of this, all City of Redlands Fire Department field employees are trained in Hazardous Materials First Responder Certifications. The Countywide team would provide a response if the level of hazard were above the certified level of City Staff. From there, the County Hazardous Materials response team would provide for the evacuation, mitigation and facilitation of cleanup efforts in the event of an accidental release of hazardous materials.

The City of Redlands Fire Department has responded to several hazardous materials incidents within the past seven years (2007–2013), as shown in Table (9).

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Table 9. Recent Hazardous Materials Incidents Requiring Fire Department Response

Hazardous Material	Date Range	Number of Incidents by Year
Total HazMat Incidents	**1/1/2007-12/31/2007**	**49**
Flammable gas or liquid condition, other		5
Gasoline or other flammable liquid spill		19
Gas leak (natural gas or LPG)		18
Oil or other combustible liquid spill		1
Toxic condition, other		0
Chemical hazard (no spill or leak)		0
Chemical Spill or leak		5
Radioactive condition, other		0
Biological hazard, confirmed or suspected		1
Total HazMat Incidents	**1/1/2008-12/31/2008**	**68**
Flammable gas or liquid condition, other		5
Gasoline or other flammable liquid spill		15
Gas leak (natural gas or LPG)		32
Oil or other combustible liquid spill		7
Toxic condition, other		1
Chemical hazard (no spill or leak)		2
Chemical Spill or leak		4
Radioactive condition, other		1
Biological hazard, confirmed or suspected		1
Total HazMat Incidents	**1/1/2009-12/31/2009**	**58**
Flammable gas or liquid condition, other		3
Gasoline or other flammable liquid spill		13
Gas leak (natural gas or LPG)		32
Oil or other combustible liquid spill		5
Toxic condition, other		0
Chemical hazard (no spill or leak)		4
Chemical Spill or leak		0
Radioactive condition, other		0
Biological hazard, confirmed or suspected		1
Total HazMat Incidents	**1/1/2010-12/31/2010**	**42**
Flammable gas or liquid condition, other		4
Gasoline or other flammable liquid spill		5
Gas leak (natural gas or LPG)		22
Oil or other combustible liquid spill		5
Toxic condition, other		0
Chemical hazard (no spill or leak)		4

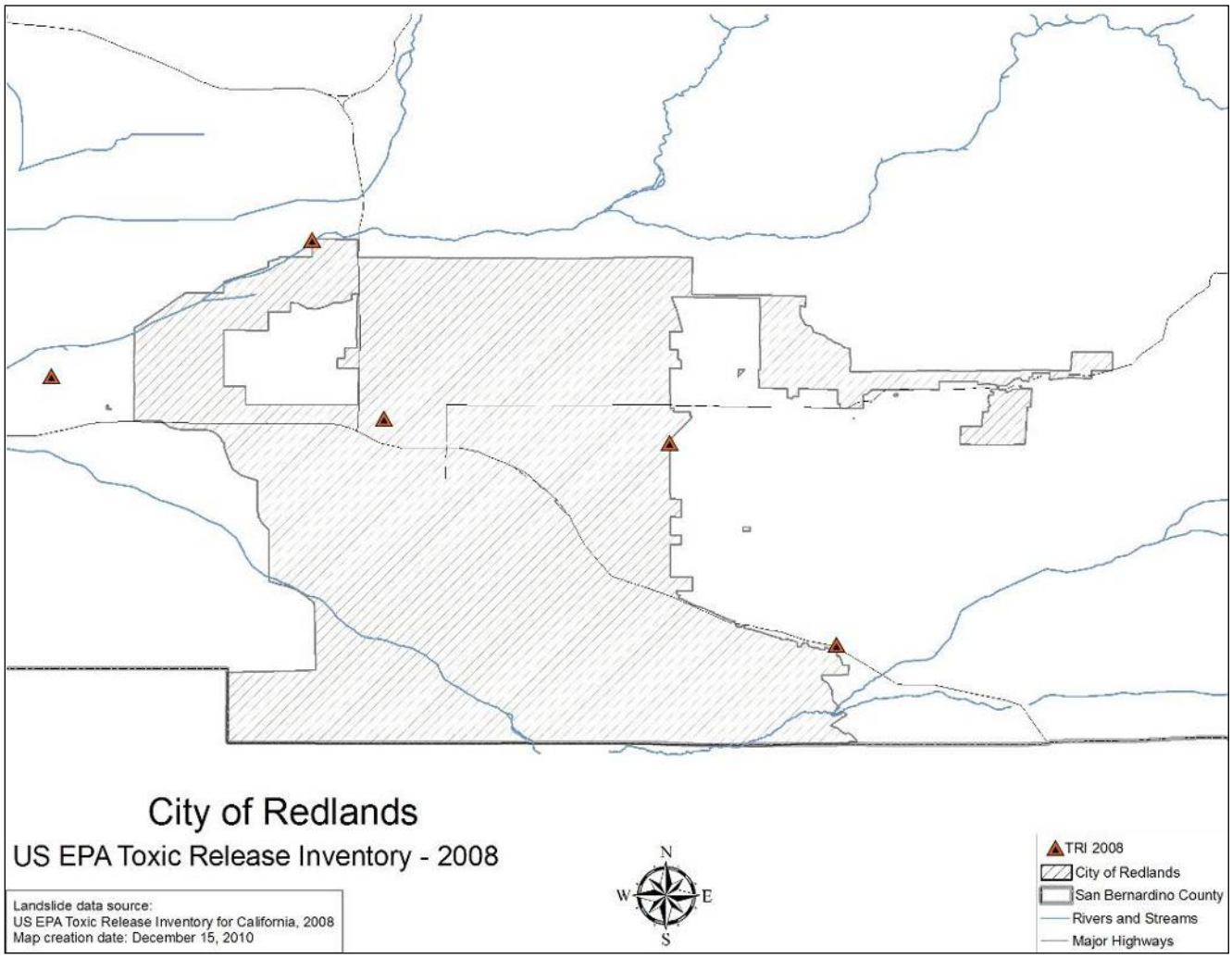
Chemical Spill or leak		2
Radioactive condition, other		0
Biological hazard, confirmed or suspected		0
Total HazMat Incidents	**1/1/2011-12/31/2011**	**167**
Hazardous condition, other		12
Flammable gas or liquid condition, other		6
Gasoline or other flammable liquid spill		11
Gas leak (natural gas or LPG)		28
Oil or other combustible liquid spill		2
Toxic condition, other		1
Chemical hazard (no spill or leak)		3
Chemical spill or leak		2
Carbon monoxide incident		4
Electrical wiring/equipment problem, other		21
Heat from short circuit (wiring), defective/worn		2
Overheated motor		3
Light ballast breakdown		2
Power line down		44
Arcing, shorted electrical equipment		17
Biological hazard, confirmed or suspected		1
Accident, potential accident, other		1
Aircraft standby		1
Vehicle accident, general cleanup		5
Attempt to burn		1
Total HazMat Incidents	**1/1/2012-12/31/2012**	**154**
Hazardous condition, other		10
Flammable gas or liquid condition, other		2
Gasoline or other flammable liquid spill		10
Gas leak (natural gas or LPG)		22
Oil or other combustible liquid spill		4
Toxic condition, other		2
Chemical hazard (no spill or leak)		5
Chemical spill or leak		3
Carbon monoxide incident		5
Electrical wiring/equipment problem, other		17
Heat from short circuit (wiring), defective/worn		3
Overheated motor		2
Light ballast breakdown		1
Power line down		50
Arcing, shorted electrical equipment		9
Biological hazard, confirmed or suspected		1

Accident, potential accident, other		3
Aircraft standby		2
Vehicle accident, general cleanup		1
Attempt to burn		2
Total HazMat Incidents	**1/1/2013-1/31/2013**	**138**
Hazardous condition, other		4
Flammable gas or liquid condition, other		1
Gasoline or other flammable liquid spill		6
Gas leak (natural gas or LPG)		32
Oil or other combustible liquid spill		8
Chemical hazard (no spill or leak)		1
Chemical spill or leak		7
Carbon monoxide incident		21
Electrical wiring/equipment problem, other		1
Heat from short circuit (wiring), defective/worn		3
Overheated motor		2
Light ballast breakdown		34
Power line down		8
Arcing, shorted electrical equipment		3
Accident, potential accident, other		4
Building or structure weakened or collapsed		1
Explosive, bomb removal (for bomb scare, use 721)		1
Attempted burning, illegal action, other		1

** Note: data through 2013.*

Only a few of these incidents have involved in a physical release of toxic materials. The US Environmental Protection Agency maintains the Toxics Release Inventory (TRI), a database with detailed information on nearly 650 chemicals and chemical categories that over 23,000 industrial and other facilities manage through disposal or other releases, recycling, energy recovery, or treatment (see: www.epa.gov/tri). These facilities are required by law to report annually on the disposal or other releases related to these chemicals. Figure 24 shows the location of the four "release" incidents in the TRI database that occurred within the City of Redlands in 2008.

Figure 24. US EPA Toxic Release Inventory (2008) in the Vicinity of the City of Redlands



Recent Hazardous Materials Events

The California Department of Toxic Substances Control (DTSC), via its EnviroStor Data Management System[15], provides access to detailed information on hazardous waste permitted and corrective action facilities, as well as existing site cleanup information. The list of permitted facilities and cleanup sites within the City of Redlands that are regulated by DTSC, where extensive investigation and/or cleanup actions are planned or have been completed is given in Table 10.

Table 10. Hazardous Waste Permit Sites in Redlands (DTSC EnviroStor Data)

Site / Facility Name	Site / Facility Type	Cleanup Status	Status Date	Location	Zip
Crafton-Redlands Area	State Response	Refer: RWQCB	4/22/1996	Bunker Hill Groundwater Sub-Basin	92374
Edison/ Redlands II (Redlands BL) MGP	Voluntary Cleanup	Active - Land Use Restrictions	7/30/2002	501-525 W. Redlands Bl. At Kendall	92373
EPTC-San Bernardino	Haz Waste - Non-Operating	Closed	7/19/2006	2492 San Bernardino Ave	92374
Jorco Chemical Company	Voluntary Cleanup	No further action needed	6/14/2012	32185 East Outer Highway 10	92373
Judson Street Elementary	School	No further action needed	11/28/2001	Judson/Pennsylvania Ave	92374
So Cal Gas/ Redlands I (State St.) MGP	Voluntary Cleanup	Active	7/28/2000	State Street At Redlands Bl.	92373
Teledyne Battery Products	Corrective Action	Active	1/1/2008	840 W Brockton Ave	92373
Teledyne Battery Products	Haz Waste - Non-Operating	Closed		840 W Brockton Ave	92374

[1] http://www.envirostor.dtsc.ca.gov/public/

A significant hazardous materials events in San Bernardino County include the February 1996 train derailment in the Cajon Pass (Figure 25) A 49-car Burlington Northern-Santa Fe freight train en-route from Barstow, California, to Los Angeles, derailed near Cajon Junction, killing the conductor and a trainman, and seriously injuring the engineer. The derailment resulted in a rail car pile-up which included five cars containing hazardous materials. The train ignited, and continued to burn for several days, requiring immediate closure of I-15, extended closure of SR-138, and a secondary closure of I-15 three days later due to the potential explosion of a tank car containing butyl acrylate. In addition to the train crew casualties, 32 people suffered minor

injuries (21 police officers, 8 California Transportation Department personnel, and 3 civilians). The total economic cost of the incident reached almost $9.5 million, including equipment, environmental and other costs[16].

Figure 25. Aftermath of the 1996 Cajon Pass Train Derailment

http://photos.orr.noaa.gov//Photos/PCD1756/IMG0012.JPG

5.2.5. Drought

Recently, the State of California has proclaimed a State of Emergency due to extremely dry conditions that have persisted since 2012 and may continue beyond the control of services, personnel, equipment and facilities of any single local government and requires the combined forces of a mutual aid region or regions to combat.

The dry conditions and lack of precipitation present a high vulnerability on the community and will result in urgent problems; drinking water supplies are at risk in many California communities; fewer crops can be cultivated and farmers' long-term investments are put at risk; low-income communities heavily dependent on agricultural employment will suffer heightened unemployment and economic hardship; animals and plants that rely on California's rivers, including many species in danger of extinction, will be threatened; and the risk of wildfires across the state is greatly increased.

[16] http://www.ntsb.gov/publictn/1996/rar9605.pdf

5.3. Inventory Assets

This section provides a summary of the buildings in the city, as well as, identifies buildings that have been listed as "critical" to the city. In addition to summarizing the buildings in the city, this section also provides an overview of the "exposure" of the buildings to the priority hazards in the city. The "exposure" overview includes varying levels of "exposure"; this section does not estimate the potential loss or replacement costs of the buildings. This information is found on Table 12 on Page 65.

5.3.1. Buildings

Buildings within the City of Redlands include those used for Residential, Commercial, Industrial and other occupancies. Data on the total square footage and the number of buildings is stored within FEMA's HAZUS (Hazards U.S.) GIS-based loss estimation software, developed to allow communities to estimate potential impacts from earthquakes, floods and hurricane winds. For the City of Redlands HMP, improved HAZUS "General Building Stock" inventory databases, developed for the FEMA-funded San Bernardino County Essential Facilities Risk Assessment (SBEFRA) Project (FEMA, 2009) were utilized. These improved databases were developed using 2008 Assessor's parcel data, and include 45% more building square footage than the default HAZUS database (FEMA, 2009), representing a significant improvement over the default database.

Building inventory data for those census tracts within the City of Redlands have been extracted from the improved SBEFRA HAZUS databases. Table 11 provides a breakdown of building and content replacement value, square footage and building count by General occupancy (residential, commercial, industrial and other uses). The total estimated replacement cost of buildings in the City of Redlands exceeds $7 billion. As shown, residential buildings account for the majority of the buildings (93%) and the building value (64%). However, the average building value for commercial buildings (approximately $2.53 million) greatly exceeds that for residential buildings (approximately $233,000).

Table 11. Summary of Building Inventory by General Occupancy for the City of Redlands

Building Inventory Information by General Occupancy	Building Replacement Value ($1,000)	Contents Replacement Value ($1,000)	Building Square Footage (1,000 Sq. Ft.)	Building Count
Residential	$4,586,535	$2,293,253	39,193	19,661
Commercial	$2,000,690	$2,077,158	20,969	790
Industrial	$154,116	$231,174	2,020	116
Other	$449,264	$219,703	2,817	524
TOTAL	**$7,190,605**	**$4,821,288**	**64,998**	**21,091**

Table 12 provides a different breakdown of the same database, this time summarizing the building replacement value and estimated count by construction type. It should be noted that HAZUS tabulates inventory data by occupancy category, so that building counts by occupancy, if derived from Assessor's data, are "true" counts. Similar data reported by construction type are estimated by multiplying the occupancy data by an assumed construction distribution (e.g., office buildings may be 40% steel moment-frame, 30% concrete shear wall, etc.). Accordingly, construction type estimates have more uncertainty, and should be assumed to represent an order-of-magnitude estimate, rather than a precise figure. For example, the estimated number of unreinforced masonry (URM) buildings from the SBEFRA database is 59. This is the same order of magnitude, but not identical to, the figure of 77 URM buildings reported by the California Seismic Safety Commission (CSSC, 2006). As shown in the table, the majority of the construction is assumed to be wood frame, which is generally assumed to be fairly resistant to earthquake damage (except for the case of soft-story wood frame buildings). The more vulnerable construction types include URM, pre-cast concrete (including tilt-up construction), manufactured housing, and non-ductile concrete construction (a subset of the general concrete category). These construction types represent a small percentage of the building inventory within the City of Redlands.

Table 12. Summary of Building Inventory by Building Type for the City of Redlands

Selected Building Inventory Data by General Building Type	Building Replacement Value ($1,000)	Building Replacement Value (%)	Estimated Building Count	% of Building Count
Concrete	$572,025	8.0%	223	1%
Manufactured Housing	$47,818	0.7%	1,039	5%
Precast Concrete	$388,399	5.4%	99	0.5%
Reinforced Masonry	$617,472	8.6%	398	2%
Steel	$264,195	3.7%	142	1%
Unreinforced Masonry	$73,705	1.0%	59	0.3%
Wood Frame (Other)	$1,406,583	19.6%	990	5%
Wood Frame (Single-family)	$3,820,407	53.1%	18,141	86%
TOTAL	**$7,190,605**		**21,091**	

According to the City of Redlands General Plan the projected population at build-out in the year 2020 is 90,000. The City of Redlands Housing Element suggests that there will be an additional 30,720 residential structures; an additional 8,646,200 square feet of commercial development; 10,048,400 square feet of additional office development, and 21,641,990 square feet of projected industrial development by build-out 2020.

Future critical facilities include at least one fire station and a Justice/Civic Center. Locations of these facilities are based on General Plan build-out in 2020.

5.3.2. Critical Facilities

Critical facilities include those buildings and facilities providing essential services to the community. Within HAZUS, essential facilities are defined to include Police Stations, Fire Stations, Hospitals, Emergency Operations Centers (EOCs), and schools. The FEMA-funded SBEFRA project assembled detailed, facility-specific HAZUS-compatible databases for essential facilities throughout San Bernardino County, including data for the City of Redlands. Data for Redlands' police station, fire stations, and the EOC are summarized in Table 13. In addition to the "essential facilities" included in the SBEFRA study, the City of Redlands has identified other critical facilities, as listed in Table 15 provides a summary of the exposure of these critical facilities to mapped flood, earthquake and fire hazards.

Table 13. Critical Facilities in the City of Redlands

Facility Name	Address	Year Built	Bldg. Area (Sq. Ft.)	Structure Type (HAZUS Model Building Type)	Building Replacement Cost
Fire Department (FD)					
Station 261	525 E. Citrus Ave.	1948 remodeled 2001	4,200	Wood Frame (W1)	$1.98M est.
Station 262	1690 Garden St.	1969	2,500	Wood Frame (W1)	$1.18M est.
Station 263	10 W. Pennsylvania Ave.	1985	3,000	Wood Frame (W1)	$1.42M est.
Station #264 Modular	1270 W. Park Ave	1984	8,800	Wood Frame (W2)	$4.16M est.
Emergency Management					
EOC	1270 West Park Ave. (Bldg. C)	1985	6,200	Concrete Block/ Reinforced Masonry (RM1L)	$3.0M est.
Police Department (PD)					
Redlands Police Department ***(closed)***	212 Brookside Ave.	1962	13,500	Tilt-up Concrete (PC1)	$6.1M

** The new building housing Station #264 was not included in the 2007-2009 SBEFRA Study.*

Table 14. Additional Critical Facilities in the City of Redlands

Facility Name	Address	Year Built	Bldg. Area (Sq. Ft.)	Structure Type (HAZUS Model Building Type)	Building Replacement Cost
Police Department (including Community Services)					
Police Annex (PA)	30 Cajon Street		20,000		
Community Policing Station, North Substation (CP)	1568 N. Orange St.		1,400		
Animal Control (AC)	504 N. Kansas St.		Approx. 750		
Joslyn Senior Center (JSC)	21 Grant St.		8,700		
Redlands Community Senior Center (RCSC)	111 W. Lugonia Ave.		27,500		
Municipal Utilities & Engineering (MU&E)					
Corp.Yard, including HAZMAT Storage (CY)	1270 W. Park Avenue, Bldgs. A, B, D-M		67,400		$3.4M
Henry Tate Water Treatment Plant (HT)	3050 Mill Creek Rd., Mentone		N/A		$20.0M
Hinkley Surface Water Treatment Plant (HS)	1604 Crafton Ave.		26,614		$20.0M
Highland Ave. Water Complex	Highland Ave.		N/A		$30.0M
Municipal Utilities & Engineering—Wastewater (MU&E-WW)					
Redlands Wastewater Treatment Facility	1950 N. Nevada St.		N/A		
City Hall					
City Hall Government Facilities, 1 City Plaza (CH)	35 Cajon Street		20,054		$7.82M

Note: The City of Redlands additional critical facilities information was not obtained as part of the original study; this information will be obtained with the next revision of Hazard Mitigation Plan.

The shot screen information below indicates the total assets for the City of Redlands for 2013 and 2014.

	Governmental Activities		Business-type Activities		Total		Increase/ (Decrease)
	2014	2013	2014	2013	2014	2013	Percent of Change
Land	$ 29,581,544	$ 29,547,984	$ 28,325,632	$ 28,325,632	$ 57,907,176	$ 57,873,616	0.06%
Buildings & Improvements	21,519,092	20,940,296	84,524,441	84,524,441	106,043,533	105,464,737	0.55%
Machinery/Equip./Vehicles	19,129,999	19,593,586	16,707,103	14,806,399	35,837,102	34,399,985	4.18%
Infrastructure	188,246,264	187,329,185	136,483,417	131,546,315	324,729,681	318,875,500	1.84%
Water Stock	408,125	408,125	9,581,460	9,281,460	9,989,585	9,689,585	3.10%
Rights of Way	437,893,258	431,692,774	-	-	437,893,258	431,692,774	1.44%
Construction in Progress	25,270,714	14,124,958	47,182,429	39,138,502	72,453,143	53,263,460	36.03%
Accum. Depreciation	(110,416,173)	(106,130,761)	(141,549,207)	(137,247,434)	(251,965,380)	(243,378,195)	3.53%
Total	$611,632,823	$597,506,147	$181,255,275	$ 170,375,315	$ 792,888,098	$767,881,462	3.26%

Source: City of Redlands Comprehensive Annual Financial Report (CAFR)

As shown in the table, most critical facilities are outside the flood hazard areas as currently mapped (i.e., located within Zone X (Unshaded) - areas determined to be outside the 0.2% annual chance (500-year) floodplain), although one Fire Station (#261) is located within the 100 year (1% annual chance) flood zone, and the Hinkley Surface Water Treatment Plant (HS) is located within the 500 year flood zone, but is protected by levees from the 100 year flood. In addition, none of the critical facilities are located within a mapped dam inundation area.

None of the identified critical facilities are located within a mapped earthquake fault zone, but all are located in areas potentially subject to liquefaction during a strong earthquake (3 in areas of Low Susceptibility, 2 in Moderate, 8 in High and 3 in Very High).

Most (13) of the critical facilities are located outside the mapped Fire Hazard Severity Zones (FHSZs) (i.e., located within areas designated as “Urban Unzoned”). The remaining 3 facilities are located in a Moderate FHSZ (Fire Station 262), or High FHSZ (Henry Tate Water Treatment Plant and Hinkley Surface Water Treatment Plant).

Table 15. Hazard Exposure of City of Redlands Critical Facilities

		Facility Type	SBEFRA Study Essential Facilities				Additional Critical Facilities		
			FD	EOC	PD	PD (& CS)	MU&E	MU&E-WW	City Hall
		Total # of Buildings	**4**	**1**	**1**	**5**	**3**	**1**	**1**
Flood Hazards	Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance (100-year) Flood	Zone A - no base flood elevations determined	0	0	0	0	0	0	0
		Zone AE - base flood elevations determined	0	0	0	0	0	0	0
		Zone AH - Flood depths of 1 - 3 feet (usually areas of ponding); base flood elevations determined	0	0	0	0	0	0	0
		Zone AO - Flood depths of 1 - 3 feet (usually sheet flow on sloping terrain); average depths determined.	1 (261)	0	0	0	0	0	0
	Other flood areas	Zone X (Shaded) - areas of 0.2% annual chance (500 yr.) flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile.	0	0	0	0	0	0	0
		Zone X Protected by Levee - areas protected by levees from the 1% annual chance flood	0	0	0	0	1 (HS)	0	0
	Other Areas	Zone D - areas in which flood hazards are undetermined, but possible	0	0	0	0	0	0	0
		Zone X (Unshaded) - areas determined to be outside the 0.2% annual chance (500-year) floodplain	3 (262, 263 & 264)	1	1	5	2	1	1

		Facility Type	SBEFRA Study Essential Facilities			Additional Critical Facilities			
			FD	EOC	PD	PD (& CS)	MU&E	MU&E-WW	City Hall
Dam Inundation		In mapped dam inundation area	0	0	0	0	0	0	0
Earthquake Hazards	Liquefaction Susceptibility	None	0	0	0			0	
		Very Low	0	0	0			0	
		Low	1 (262)	0	1	1 (JSC)		0	
		Moderate	0	0	0		2 (HT, HS)	0	
		High	2 (263 & 264)	1	0	3 (CP, AC, RCC)	1 (CY)	1	
		Very High	1 (261)	0	0	1(PA)		0	1
	Alquist-Priolo Earthquake Fault Zone	Inside mapped fault zone	0	0	0	0	0	0	0
Hazard Fire Severity Zones	Local Responsibility Area	Very High	0	0	0	0	0	0	0
		High	0	0	0	0	2 (HT, HS)	0	0
		Moderate	1 (262)	0	0	0	0	0	0
		Urban Unzoned	3	1	1	5	1 (CY)	1	1
		Non-Wildland/Non-Urban	0	0	0	0	0	0	0
	State Responsibility Area	Very High	0	0	0	0	0	0	0
		High	0	0	0	0	0	0	0
		Moderate	0	0	0	0	0	0	0

5.3.3. Other Facilities

Other facilities included in this plan are the Redlands Unified School District and the University of Redlands. Both provide a high degree of community support and resources in the event of a natural disaster. While the University of Redlands and the Redlands Unified School District consider the identified facilities as critical to their individual organizations, the City recognizes the importance of these facilities, but does not deem them critical to the management of the City itself.

The University of Redlands is located off the I-10 freeway in the City of Redlands. The private university has a 160 acre campus and an undergraduate enrollment of approximately 3,000 students. The University of Redlands is:

- Ranked by U.S. News & World Report as an A+ School and Best Value
- Among the top 10 western regional universities with one of the lowest student-to-faculty ratios, as ranked in U.S. News & World Report
- Among the top 5 percent of colleges nationwide, as ranked by Forbes[17]

Redlands Unified School District (RUSD) enrollment was estimated to be 21,427 for the 2008-2009 school years, with 8,907 elementary school students, 4,854 middle school students, 7,299 high school students and 367 continuation and alternative education students[18]. The 2009 FEMA-funded SBEFRA project assembled a very detailed school building inventory database covering 592 buildings at 29 site locations, developed from 2008 insurance appraisal data. The assembled inventory data for RUSD is summarized by school site in Table 16.

Table 15 provides a summary of the exposure of the RUSD school/facility sites to mapped flood, earthquake and fire hazards. It should be noted that individual building locations on each campus are not known; each campus/facility site is represented by a single address and associated point location. Accordingly, the resulting hazard exposure does not reflect potential hazard variability across campuses, and should be considered approximate.

As shown in the table, most of the RUSD campuses (374 of 592 buildings) are outside the flood hazard areas as currently mapped (i.e., located within Zone X (Unshaded) - areas determined to be outside the 0.2% annual chance (500-year) floodplain). Redlands High School (83 buildings) and the Supply Center (5 buildings) are located within the 100 year (1% annual chance) flood zone, while Crafton Elementary (21 buildings), Mentone Elementary (26 buildings), and Redlands East Valley High (83 buildings) are located within the 500 year flood zone, but are protected by levees from the 100 year flood. In addition, none of the school/facility sites are located within a mapped dam inundation area.

The only campus which falls within a mapped earthquake fault zone is Fallsvale Elementary, which is already closed. Most school facilities/campuses are located in areas with at least some level of susceptibility to liquefaction in a strong earthquake; 37% of buildings are located in

[17] http://www.redlands.edu/about-redlands/259.aspx
[18] http://www.ed-data.k12.ca.us/profile.asp?Tab=0&level=06&reportnumber=16&county=36&district=67843

areas of Low Susceptibility, 9% in Moderate Susceptibility, 37% in High Susceptibility, and 17% in Very High Susceptibility (see Table for a list of sites falling within in each category).

Most of the school sites (70% of buildings) are located outside mapped Fire Hazard Severity Zones (FHSZs) (i.e., are located within areas designated as "Urban Unzoned"). Hazard exposure of the remaining schools includes one campus in the Very High FHSZ within the Local Responsibility Area (Cram Elementary), one campus in the Very High FHSZ within the Federal Responsibility Area (Fallsvale Elementary), and six campuses in the High FHSZ within the Local Responsibility Area (Arroyo Verde, Highland Grove, Mariposa, and Mission Elementary Schools, Beattie Middle School, and Redlands East Valley High School).

Table 16. Redlands Unified School District Inventory Data by School Site (Assembled for FEMA's San Bernardino County Essential Facilities Risk Assessment Project, 2009)

School/ Facility Name	Address	Year Built*	Total # of Bldgs.	Total Bldg. Area (Sq. Ft.)	Building Replacement Value ($1,000)	# of Portable Buildings
Arroyo Verde Elementary School	7701 Church Street, Highland, CA 92346	1989-1990	24	50,911	7,564.68	11
Beattie Middle School	7800 Orange St., Highland CA, 92346	2004	8	92,310	26,053.12	3
Bryn Mawr Elementary School	11680 Whittier Ave., Loma Linda CA, 92354-4154	1990	26	63,605	10,806.60	11
Citrus Valley High School	800 West Pioneer Ave., Redlands, CA, 92374	Opened August 2009**	N/A	N/A	N/A	N/A
Clement Middle School	501 East Pennsylvania Ave., Redlands CA, 92374-2496	1961-1964	35	133,124	20,428.36	25
Cope Middle School	1000 West Cypress Ave., Redlands CA, 92373-5722	1956-1957	42	160,739	25,046.61	24
Crafton Elementary School	311 North Wabash Ave., Redlands CA, 92374-4261	1936-1965	21	69,931	9,224.26	12
Cram Elementary School	29700 Water St., Highland CA, 92346	1997	27	52,814	7,696.27	19
Fallsvale Elementary School ***(closed)***	40600 Valley of the Falls Drive, Forest Falls, CA, 92339	1982	3	6,161	748.19	0
Franklin Elementary School	850 East Colton Ave., Redlands CA, 92374-3635	1955 & 1969	7	70,450	11,455.98	2
Highland Grove Elementary School	7700 Orange St., Highland CA, 92346	2005	6	46,549	11,375.73	0
Judson & Brown Elementary School	1401 East Pennsylvania Ave., Redlands CA, 92374	2006	9	42,344	13,216.96	0
Kimberly Elementary School	301 West South Ave., Redlands CA, 92373-7039	1956-1963	21	74,670	9,357.75	13
Kingsbury Elementary	600 Cajon St., Redlands CA, 92373-5938	1968	12	62,205	8,618.97	6

School/ Facility Name	Address	Year Built*	Total # of Bldgs.	Total Bldg. Area (Sq. Ft.)	Building Replacement Value ($1,000)	# of Portable Buildings
School						
Lugonia Elementary School	202 East Pennsylvania Ave., Redlands CA, 92374-2344	1955 & 1963	19	58,856	9,258.99	7
Mariposa Elementary School	30800 Palo Alto Dr., Redlands CA, 92373-7490	1964	16	56,613	7,664.47	10
McKinley Elementary School	645 West Olive Ave., Redlands CA, 92373-5167	1938 & 1966	12	52,529	8,222.37	6
Mentone Elementary School	1320 Crafton Ave., Mentone CA, 92359-1318	1949	26	43,566	6,651.36	19
Mission Elementary School ***(closed)***	10568 California Street, Redlands, CA 92374	1938, 1965 & 1970	11	62,341	11,004.51	6
Moore Middle School	1550 East Highland Ave., Redlands CA, 92374-5518	1965	25	144,730	22,765.39	15
Orangewood High School (Continuation)	515 Texas St., Redlands CA, 92374-3071	1940, 1955, 1990 & 1992	19	42,142	5,845.34	8
Redlands East Valley High School	31000 East Colton Ave., Redlands CA, 92374	1995	83	326,895	55,068.16	69
Redlands High School	840 East Citrus Ave., Redlands CA, 92374-5399	1928 – 1970	83	393,384	64,529.62	48
Smiley Elementary School	1210 West Cypress Ave., Redlands CA, 92373-5726	1952, 1963 & 1980	11	68,896	9,502.79	1
Victoria Elementary School	1505 Richardson St., San Bernardino CA, 92408-2965	1949 - 1967	22	49,264	7,027.26	12
Central Administration/ Enrollment Center	7 West Delaware St., Redlands, CA 92374	1970 & 1991	3	11,830	1,744.39	0
District Office - North	20 West Lugonia Ave., Redlands, CA 92346	1970	4	30,213	5,793.59	3
District Office - South	25 West Lugonia St., Redlands, CA 92346	1937 & 1992	9	13,979	2,699.90	5
Supply Center	250 Church Street, Redlands, CA 92374	1973	5	37,192	3,744.82	2
Transportation	956 East Citrus Ave., Redlands, CA 92374	1929	3	6,670	527.12	1
TOTAL			**592**	**2,324,913**	**383,643.56**	**338**

* *Year built reflects construction dates for permanent buildings; portable buildings may have been brought in later, and at various times.*

** *Citrus Valley High School was not included in the SBEFRA Project Risk Analysis, which utilized insurance appraisal data from 2012.*

Figure 26. Redlands Unified School District School Campuses and Facility Sites

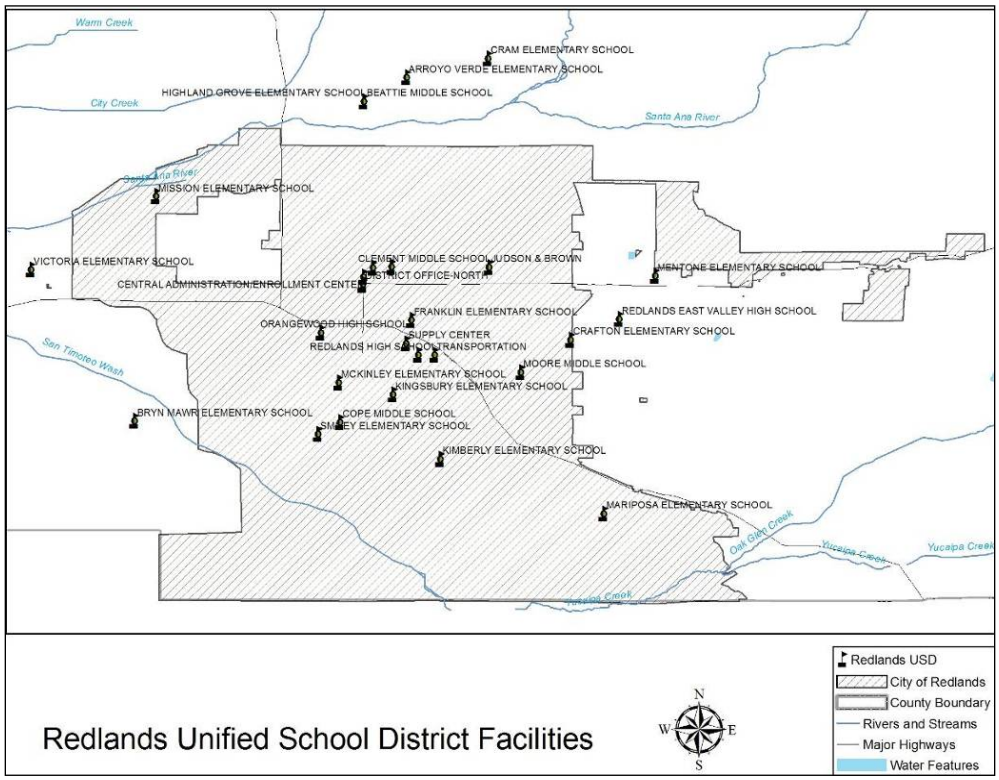


Table 17. Hazard Exposure of the Redlands Unified School District
(Total Number of Buildings = 592)

Hazard Zones			# Bldgs.	%	Impacted Campuses
Flood Hazards	Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance (100-year) Flood	Zone A*	0	0%	
		Zone AE*	0	0%	
		Zone AH*	0	0%	
		Zone AO*	88	15%	Redlands High, Supply Center
	Other flood areas	Zone X (Shaded)*	0	0%	
		Zone X Protected by Levee *	130	22%	Crafton Elem., Mentone Elem. Redlands East Valley High
	Other Areas	Zone D*	0	0%	
		Zone X (Unshaded)*	374	63%	Arroyo Verde Elem., Beattie Middle, Bryn Mawr Elem., Central Admin./Enrollment Center, Clement Middle, Cope Middle, Cram Elem., District Office-North, District Office-South, Fallsvale Elem., Franklin Elem., Highland Grove Elem., Judson & Brown Elem., Kimberly Elem., Kingsbury Elem., Lugonia Elem., Mariposa Elem., McKinley Elem., Mission Elem., Moore Middle, Orangewood High, Smiley Elem., Transportation, Victoria Elem.
Dam Inundation		In Mapped Dam Inundation Area	0	0%	
Earthquake Hazards	Liquefaction Susceptibility	None	0	0%	
		Very Low	0	0%	
		Low	220	37%	Bryn Mawr Elem., Cope Middle, Crafton Elem., Cram Elem., Franklin Elem., Kimberly Elem., Kingsbury Elem., Mariposa Elem., McKinley Elem., Moore Middle, Smiley Elem.
		Moderate	53	9%	Arroyo Verde Elem., Fallsvale Elem., Mentone Elem.
		High	219	37%	Central Admin./Enrollment Center, Clement Middle, District Office-North, District Office-South, Judson & Brown Elem., Lugonia Elem., Mission Elem., Orangewood High, Redlands East Valley High, Supply Center, Victoria Elem.
		Very High	100	17%	Beattie Middle, Highland Grove Elem., Redlands High, Transportation
	Alquist-Priolo Earthquake Fault Zone	Inside Mapped Fault Zone	3	1%	Fallsvale Elem.

Hazard Zones			# Bldgs.	%	Impacted Campuses
Fire Hazard Severity Zones	Local Responsibility Area	Very High	27	4%	Cram Elem.
		High	148	25%	Arroyo Verde Elem., Beattie Middle, Highland Grove Elem., Mariposa Elem., Mission Elem., Redlands East Valley High
		Moderate	0	0%	
		Urban Unzoned	414	70%	Bryn Mawr Elem., Central Admin., Clement Middle, Cope Middle, Crafton Elem., District Office-North, District Office-South, Franklin Elem., Judson & Brown Elem., Kimberly Elem., Kingsbury Elem., Lugonia Elem., McKinley Elem., Mentone Elem., Moore Middle, Orangewood High, Redlands High, Smiley Elem., Supply Center, Transportation, Victoria Elem.,
		Non-Wildland/ Non-Urban	0	0%	
	State Responsibility Area	Very High	0	0%	
		High	0	0%	
		Moderate	0	0%	
	Federal Responsibility Area	Very High	3	1%	Fallsvale Elem.

* *See Table 4-12 for full Flood Zone Descriptions*

5.4. Vulnerability Assessment

This section provides an assessment of the vulnerability of the City of Redlands' assets to each of the significant hazards confronting the community. It summarizes the expected damage to buildings in the general building stock, expected performance of critical facilities, and impacts on the City's population.

5.4.1. Methodology

The vulnerability and risk assessment for the City of Redlands utilized a combination of quantitative and qualitative approaches:

- For *Flood* and *Wildfire*, a simpler quantitative approach was implemented, whereby the city's improved inventory data were overlain onto available hazard maps to quantify potential exposure (i.e., assets at risk) to each hazard.
- For *Earthquakes*, a quantitative analysis was implemented to estimate potential damage, loss and population impacts using FEMA's HAZUS-MH software, in conjunction with improved inventory data developed under the FEMA-funded San Bernardino County Essential Facilities Risk Assessment (SBEFRA) project.
- For *Hazardous Materials Spills*, a qualitative approach was taken, whereby previous experience and expert judgment were utilized to assess potential impacts in future events.

- For *Drought*, a quantitative approach was implemented to create a water conservation program to assist the city as well as State of California during the current drought conditions.

5.4.2. Vulnerability Assessment Results for Flooding

Building Vulnerability Assessment for Flooding

FEMA's SBEFRA Project implemented county-wide flood risk assessments for San Bernardino County, utilizing improved general building stock inventory data generated from Assessor's data. Three (3) flood scenarios were analyzed using the updated (2008) DFIRM data; a 100-year flood, a 100-year flood without levee protection, and a 500-year flood. **Table** provides the losses estimated for the County in each of these scenarios. Unfortunately, these results can't be disaggregated to the individual City level using publicly-available information.

However, we do know that the City of Redlands represents 4% of the building value of the entire County. If we were to make a simplifying assumption of a uniform distribution of flood risk across the County, the City could be expected to suffer as much as $18 million in economic loss due to building damage in a 100-year flood, $64 million in a 100-year flood event without levee protection, and $108 million in a 500-year flood event. Because in reality we know that flood risk is not uniform County-wide, these estimates should be used simply as an order of magnitude estimate of potential loss.

Table 18. Regional Flood Impacts to San Bernardino County, as estimated by FEMA's SBEFRA Project (2009)

	Regional Risk Assessment Results	Flood Scenario		
		100-year Flood (1% Annual Chance Flood)	100-yr Flood (without levee protection)	500-year Flood (0.2% Annual Chance Flood)
Regional Risk	Economic loss due to building damage ($B)	0.46	1.6	2.7
	Total building-related direct economic loss ($B)	1.4	5.4	8.6
	Number of buildings in the Complete Damage State	345	350	1,105
	Total # Displaced Households	14,828	52,856	86,062
	Total # people needing short-term shelter	32,095	138,991	231,452
	Debris Generated (million tons)	0.1	0.23	0.37

Source: FEMA's San Bernardino County Essential Facilities Risk Assessment (SBEFRA) Study (2009), http://www.fema.gov/library/viewRecord.do?id=3804

To determine a more robust estimate of the magnitude of potential flood risk faced by the City of Redlands, a quantitative assessment of exposure to flooding was performed. The improved census-block level building data generated by the SBEFRA project was overlain onto maps of flood hazard (FEMA's National Flood Hazard Layer) to quantify the amount of the building inventory that falls within each hazard zone. The results of this overlay are provided in Table 19. It should be noted that the totals in this table (e.g., total building exposure value, total building square footage, etc.) will vary slightly from those presented in previous sections, because they were developed from census tract data. Table 18 was developed by identifying individual census blocks falling within the boundaries of each hazard zone, and will therefore produce a more refined overlay assessment than a similar analysis conducted using census tract data.

As shown in the Table 19, most of the city's buildings (95% of buildings, 92% of building value) are located outside of mapped areas subject to flooding, i.e., are located within "Zone X (unshaded)—Areas determined to be outside the 0.2% annual chance (500-year) floodplain". However, $410 million (6%) of the City's building value (3.2% of the buildings by count) is subject to inundation by the 1% Annual Chance (100-year) Flood. Should these buildings suffer flood losses on the order of 12–16% (e.g., the expected range of damage possible for: a two-story home with no basement, a typical retail store, a typical office, or a typical industrial facility, each with two feet of flood water, as modeled by the HAZUS software's damage function library), building damage could reach $50–65 million dollars, significantly more than was estimated from countywide loss estimates assuming uniform risk.

Further, while most of the building value at risk in the 100-year floodplain is commercial development (67%), more than 400 residential buildings are also exposed. Very little inventory (<1%) is exposed to the 500-year flood hazard (Zone X (Shaded)—0.2% Annual chance (500yr) Flood), and just 1% is located in areas of levee protection for the 100-year flood (Zone X Protected by Levee—Areas protected from the 1% annual chance flood).

The City of Redlands is an NFIP participating community. A recent check of repetitive and severe repetitive loss properties conducted by FEMA Region IX's NFIP Unit indicates that there are no repetitive or severe repetitive loss properties in the City of Redlands.

Table 19. Redlands Building Inventory Exposure to Flood Hazards

Building Inventory Data by General Occupancy	Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance (100-year) Flood				Other flood areas		Other Areas		
	Zone A	Zone AE	Zone AH	Zone AO	Zone X (Shaded)	Zone X Protected by Levee	Zone D	Zone X (Unshaded)	TOTAL
Building Replacement Value ($1,000)									
Residential	3,316	0	0	72,993	0	23,917	59,597	4,329,967	4,489,790
Commercial	26,136	0	0	250,414	575	16,444	4,946	1,256,213	1,554,728
Industrial	19,010	0	0	18,101	0	6,370	0	92,749	136,230
Other	7,159	0	0	13,473	0	9,224	0	405,384	435,240
Total	**55,621**	**0**	**0**	**354,981**	**575**	**55,955**	**64,543**	**6,084,313**	**6,615,988**
% of Total	**1%**	**0%**	**0%**	**5%**	**0.01%**	**1%**	**1%**	**92%**	**100%**
Contents Replacement Value ($1,000)									
Residential	1,658	0	0	36,494	0	11,958	29,798	2,164,974	2,244,882
Commercial	26,136	0	0	250,414	575	16,444	4,946	1,332,681	1,631,196
Industrial	28,515	0	0	27,152	0	9,555	0	139,124	204,346
Other	10,738	0	0	13,371	0	1,538	0	182,862	208,509
Total	**67,047**	**0**	**0**	**327,431**	**575**	**39,495**	**34,744**	**3,819,641**	**4,288,933**
% of Total	**2%**	**0%**	**0%**	**8%**	**0.01%**	**1%**	**1%**	**89%**	**100%**
Building Square Footage (1,000 Sq. Ft.)									
Residential	31	0	0	722	0	227	530	36,978	38,488
Commercial	237	0	0	2,196	4	124	60	13,011	15,633
Industrial	252	0	0	240	0	85	0	1,210	1,788
Other	15	0	0	105	0	70	0	2,548	2,738
Total	**535**	**0**	**0**	**3,264**	**4**	**506**	**590**	**53,748**	**58,647**
% of Total	**1%**	**0%**	**0%**	**6%**	**0.01%**	**1%**	**1%**	**92%**	**100%**
Building Count									
Residential	27	0	0	376	0	149	324	18,611	19,487
Commercial	8	0	0	174	1	8	8	509	708
Industrial	2	0	0	25	0	2	0	67	96
Other	2	0	0	12	0	21	0	480	515
Total	**39**	**0**	**0**	**587**	**1**	**180**	**332**	**19,667**	**20,806**
% of Total	**0.2%**	**0%**	**0%**	**3%**	**0.005%**	**1%**	**2%**	**95%**	**100%**

Notes: Zone A - No Base Flood Elevations (BFEs) Determined

Zone AE - BFEs Determined

Zone AH - Flood Depths of 1 to 3 feet, usually areas of ponding; BFEs Determined

Zone AO - Flood Depths of 1 to 3 feet, usually sheet flow on sloping terrain; Avg. depths determined

Zone X (Shaded) - 0.2% Annual chance (500yr) Flood

Zone X Protected by Levee - Areas protected from the 1% annual chance flood

Zone D - Areas in which flood hazards are undetermined, but possible

Zone X (unshaded) - Areas determined to be outside the 0.2% annual chance (500-year) floodplain

Critical Facility Vulnerability Assessment for Flooding

Table summarized the exposure of the City's essential facilities to flood and other hazards. As shown, just one fire station (Station 261) was located in an area subject to inundation in the 100-year flood (Zone AO), while one treatment plant (Hinkley Surface Water Treatment Plant) is located within the 500 yr. flood zone, in an area protected from the 100 year flood by levees (Zone X Protected by Levee). All other mapped critical facilities are located in areas determined to be outside the 500-year floodplain (Zone X Unshaded).

FEMA's SBEFRA project produced facility-level flood risk assessment results for the 100-year, 100-year without levee protection, and 500-year flood scenarios for the identified essential facilities (as listed in Table 13). Redlands' existing fire stations, police station and EOC were all determined to be functional in each of the three flood scenarios. (Similar results are not available for the additional critical facilities, which were not included in the SBEFRA study).

Other Facility Vulnerability Assessment for Flooding

Flood hazard exposure of the Redlands Unified School District's facilities was summarized previously in Table 8. As shown in the table, most of the RUSD campuses (374 of 592 buildings) are outside the currently mapped flood hazard areas (i.e., are located within Zone X (Unshaded) - areas determined to be outside the 0.2% annual chance (500-year) floodplain). However, Redlands High School (83 buildings) and the District's Supply Center (5 buildings) are located within the 100 year (1% annual chance) flood zone (Zone AO), while Crafton Elementary (21 buildings), Mentone Elementary (26 buildings), and Redlands East Valley High (83 buildings) are located within the 500 year flood zone, but are protected by levees from the 100 year flood (Zone X Protected by Levee).

5.4.3. Vulnerability Assessment Results for Earthquake

Regional (i.e., community-wide) earthquake losses and population impacts, and critical facility damage and functionality have been estimated using HAZUS (HAZUS®MH MR-4[19]), incorporating the improved regional building and essential facility inventory databases developed under FEMA funding for the San Bernardino County Essential Facilities Risk Assessment (SBEFRA) Project. The risk assessment of critical facilities considers only those essential facilities (fire stations, police facilities, EOCs and schools) for which HAZUS-compatible databases were developed as part of the SBEFRA Project.

A summary of the HAZUS regional risk assessment results for the City of Redlands are provided on Pages 82-83 for three earthquake scenarios, each including the impacts of liquefaction; the M7.8 Shakeout Scenario, a M6.7 San Jacinto scenario earthquake and a M6.7 Chino Hills Scenario earthquake. HAZUS results reported here include various direct economic losses (damage to buildings and their contents, commercial inventories, as well as building-damage related income losses, e.g., wage losses, relocation costs, rental income losses, etc.), population impacts (displaced households, shelter requirements, and casualties of various

[19] HAZUS MH MR-4 was the latest version available at the time the Hazard Mitigation Plan Update process was begun for San Bernardino County (Spring, 2010). An updated version (MR-5) was released in December 2010.

severity levels, including death), estimates of debris generated, and damage state distributions for various building types.

It should be noted that the casualty figures reported here are not direct HAZUS outputs; they are estimates in more medically-meaningful categories derived from HAZUS outputs using a "calibration" methodology developed using historic injury data from the 1994 Northridge and other California earthquakes (Seligson & Shoaf, 2003). The method was also recently applied for the San Andreas "ShakeOut" Scenario developed by the USGS and others for the 2008 Golden Guardian statewide disaster exercise (Jones et al., 2008).

As noted previously, HAZUS estimates earthquake impacts at the census tract level. Accordingly, building count totals will be consistent with the data presented in **Table 11** and **Table 12**, but may differ from totals reported in the flood risk assessment in **Table ,** which were developed at the census block level.

Table 20. HAZUS-Estimated Earthquake Impacts for the City of Redlands

		Earthquake Scenario		
		M7.8 ShakeOut Scenario (including Liquefaction)	M6.7 San Jacinto Fault (including Liquefaction)	M6.7 Chino Hills Fault (including Liquefaction)
Direct Economic Losses for Buildings ($1,000)				
	Total Building Exposure Value	**7,190,605**		
Stock / Capital Losses	Cost of Structural Damage	245,830	48,248	1,022
	Cost of Non-Structural Damage	858,890	190,323	10,548
	Total Building Damage (Str. + Non-Str.)	1,104,721	238,572	11,570
	Building Loss Ratio %	15.4%	3.3%	0.2%
	Cost of Contents Damage	324,650	80,134	6,038
	Inventory Loss	13,510	3,066	280
Income Losses	Relocation Loss	121,663	29,579	277
	Capital-Related Loss	56,578	10,669	119
	Rental Income Loss	77,740	16,676	259
	Wage Losses	79,015	16,096	164
	Total Direct Economic Loss	**1,777,877**	**394,792**	**18,706**
	% of Countywide Loss	8.2%	7.8%	0.6%
Casualties				
Day Casualties	**Casualties—2 pm**			
	Fatalities	26	1	0
	Trauma injuries	7	0	0
	Other (non-trauma) hospitalized injuries	47	0	0
	Total Hospitalized Injuries	**54**	**0**	**0**
	Injuries requiring Emergency Department Visits	963	69	1
	Injuries treated on an Outpatient basis	1,632	133	2
	Total Injuries	**2,675**	**203**	**3**
	Hospital visits requiring EMS transport	78	3	0

		Earthquake Scenario		
		M7.8 ShakeOut Scenario (including Liquefaction)	M6.7 San Jacinto Fault (including Liquefaction)	M6.7 Chino Hills Fault (including Liquefaction)
Night Casualties	**Casualties—2 am**			
	Fatalities	7	0	0
	Trauma injuries	2	0	0
	Other (non-trauma) hospitalized injuries	13	0	0
	Total Hospitalized Injuries	**15**	**0**	**0**
	Injuries requiring Emergency Department Visits	615	65	2
	Injuries treated on an Outpatient basis	1,117	133	4
	Total Injuries	**1,754**	**198**	**6**
	Hospital visits requiring EMS transport	39	2	0
Shelter				
Shelter	Number of Displaced Households	2,728	728	2
	Number of People Requiring Short-term Shelter	938	229	1
Debris (thousands of tons)				
Debris	Brick, Wood & Other (Light) Debris	175	39	1
	Concrete & Steel (Heavy) Debris	452	54	1
	Total Debris	**627**	**93**	**2**
Building Damage Count by General Building Type				
Concrete	None	20	61	217
	Slight	39	80	6
	Moderate	44	69	0
	Extensive	41	13	0
	Complete	78	1	0
	Total	**223**	**223**	**223**
Manuf. Housing	None	0	11	714
	Slight	0	86	263
	Moderate	1	521	62
	Extensive	17	391	0
	Complete	1,022	29	0
	Total	**1,039**	**1,039**	**1,039**
Precast Concrete	None	22	30	94
	Slight	43	45	5
	Moderate	31	23	0
	Extensive	3	1	0
	Complete	0	0	0
	Total	**99**	**99**	**99**

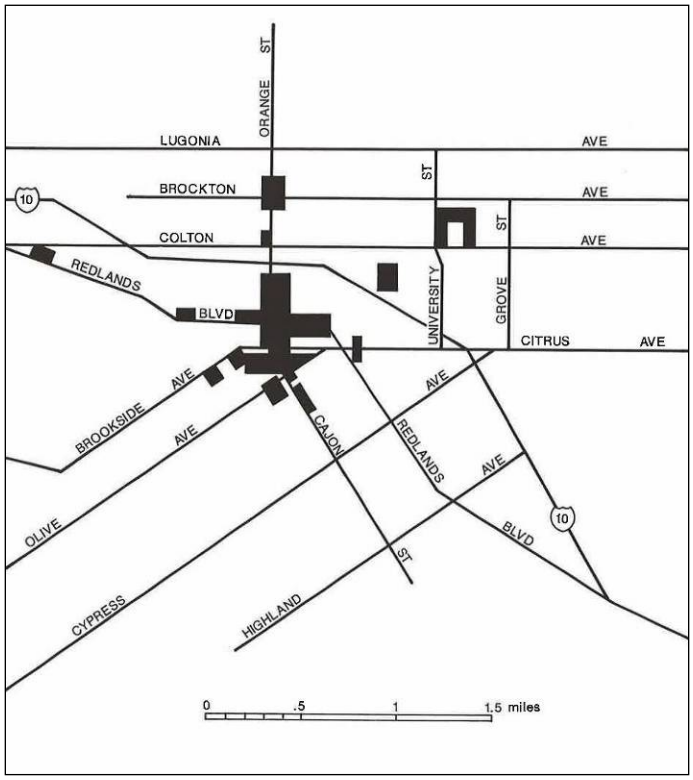
		Earthquake Scenario		
		M7.8 ShakeOut Scenario (including Liquefaction)	M6.7 San Jacinto Fault (including Liquefaction)	M6.7 Chino Hills Fault (including Liquefaction)
Reinforced Masonry	None	97	178	390
	Slight	112	135	7
	Moderate	107	75	1
	Extensive	42	10	0
	Complete	40	0	0
	Total	**398**	**398**	**398**
Building Damage Count by General Building Type (Continued)				
Steel	None	6	34	138
	Slight	14	53	4
	Moderate	39	49	0
	Extensive	43	6	0
	Complete	40	0	0
	Total	**142**	**142**	**142**
Unreinforced Masonry	None	1	5	48
	Slight	3	13	10
	Moderate	6	25	2
	Extensive	4	14	0
	Complete	44	2	0
	Total	**59**	**59**	**59**
Wood Frame (Other)	None	188	374	970
	Slight	320	435	19
	Moderate	176	168	0
	Extensive	111	12	0
	Complete	195	1	0
	Total	**990**	**990**	**990**
Wood Frame (Single-family)	None	6,691	9,534	17,778
	Slight	8,987	7,653	357
	Moderate	2,267	884	6
	Extensive	190	59	0
	Complete	7	11	0
	Total	**18,141**	**18,141**	**18,141**
ALL BUILDING TYPES	None	7,026	10,226	20,349
	Slight	9,519	8,499	671
	Moderate	2,671	1,814	71
	Extensive	451	506	0
	Complete	1,425	45	0
	Total	**21,091**	**21,091**	**21,091**

Unreinforced masonry buildings present one of the most serious life-safety risks of all building types. This has been demonstrated in many moderate to severe earthquakes, including recent events that have occurred both in the United States (e.g., the 1989 Loma Prieta, 2001 Nisqually, and 2003 San Simeon earthquakes) and around the World.

The reported number of unreinforced masonry (URM) buildings in the City of Redlands is 77, as tabulated by the California Seismic Safety Commission (CSSC), based on the City's response to a 2004 survey. In addition, the CSSC also reports that 54 of the buildings have made no mitigation progress (CSSC, 2005, 2006). Areas where URM buildings are concentrated, as identified by the California Geological Survey (CGS, 1993), are shown in Figure 27. (As discussed in Section 4.3.2, the number of URM structures predicted by the building type distribution implemented in the SBEFRA project and reported in **Table** is slightly lower, but of the same order of magnitude as available survey data; 59 vs. 77. Accordingly, damage is being discussed here in terms of percentages).

As shown in Figure 27**,** URM buildings are expected to suffer significant damage in the San Andreas "ShakeOut" earthquake scenario, with 75% of the URM buildings expected to suffer "Complete" damage (i.e., are expected to be a total financial loss). Further, as many as 15% of the buildings in the "Complete" damage state are expected to experience at least partial collapse.

Figure 27. Distribution of URM Buildings in the City of Redlands



Critical Facility Vulnerability Assessment for Earthquake

Damage and functionality of essential facilities identified in the FEMA-funded SBEFRA project were estimated for the earthquake scenarios identified above using HAZUS. Results are presented in Table 21. As shown, three of the four fire stations existing in 2009 are expected to be less than 50% functional in a M7.8 earthquake on the San Andreas fault (ShakeOut scenario), although physical damage is likely to be considered Moderate or less (none of the stations are have probabilities of experiencing moderate or greater damage exceeding 50%). In this same event, the EOC is expected to have functionality between 50-75%, while the Redlands Police Department is expected to have less than 50% functionality and its probability of being in the Moderate or greater damage state exceeds 50%. The Police Department is also expected to have less than 50% functionality in the M6.7 San Jacinto earthquake scenario.

Similar results are not available for the additional critical facilities, which were not included in the SBEFRA study.

Table 21. HAZUS-Estimated Essential Facility Earthquake Impacts for the City of Redlands

	Facility Type	Earthquake Scenario		
		M7.8 ShakeOut Scenario (including Liquefaction)	M6.7 San Jacinto Fault (including Liquefaction)	M6.7 Chino Hills Fault (including Liquefaction)
Fire Stations	**Redlands Fire Department**			
	Total Number of Buildings	**4**		
	Damage			
	# Buildings with >50% Probability of Moderate or Greater Damage	0	0	0
	# Buildings with >50% Probability of Complete Damage	0	0	0
	Functionality			
	Functionality < 50 % on Day 1	3 (Sta. 261, 263, 264)	0	0
	Functionality 50 - 75% on Day 1	1 (Sta. 262)	4	0
	Functionality >75% Day 1	0	0	4
EOCs	**City of Redlands**			
	Total Number of Buildings	**1**		
	Damage			
	# Buildings with >50% Probability of Moderate or Greater Damage	0	0	0
	# Buildings with >50% Probability of Complete Damage	0	0	0
	Functionality			
	Functionality < 50 % on Day 1	0	0	0
	Functionality 50 - 75% on Day 1	1	0	0
	Functionality >75% Day 1	0	1	1

	Facility Type	Earthquake Scenario		
		M7.8 ShakeOut Scenario (including Liquefaction)	M6.7 San Jacinto Fault (including Liquefaction)	M6.7 Chino Hills Fault (including Liquefaction)
Police Facilities	**Redlands Police Department**			
	Total Number of Buildings	**1**		
	Damage			
	# Buildings with >50% Probability of Moderate or Greater Damage	1	0	0
	# Buildings with >50% Probability of Complete Damage	0	0	0
	Functionality			
	Functionality < 50 % on Day 1	1	1	0
	Functionality 50 - 75% on Day 1	0	0	0
	Functionality >75% Day 1	0	0	1

Other Facility Vulnerability Assessment for Earthquake

Because San Bernardino County's school districts participated in the FEMA-funded SBEFRA project, it was possible to develop damage and functionality estimates for the Redlands Unified School District's facilities in each of the three scenario earthquakes. An overall summary of the District's performance, in terms of damage and functionality on the day of the earthquake, is given in Table 21 and Table 22 provides damage information for each campus in the two earthquake events shown to cause potential damage (the M7.8 ShakeOut Scenario and the M6.7 San Jacinto Scenario earthquakes), while Table 23 provides campus level functionality estimates for all three events.

As shown in Table 21 79 buildings have a high likelihood (>50% probability) of experiencing Moderate or greater damage in the M7.8 ShakeOut Scenario earthquake on the San Andreas Fault; 17 of these are likely (have >50% probability) to suffer Complete damage. These 79 buildings are located on 19 different campuses (see; Table 22 the campuses with the most buildings in this category are Redlands High School (29) and Clement Middle School (10). In the San Jacinto scenario earthquake, there are 18 buildings on 9 campuses likely to experience Moderate or greater damage.

Overall, 519 of the 592 buildings are expected to have initial functionality of less than 50% on Day 1 following the M7.8 ShakeOut scenario earthquake; these buildings are spread across virtually all facility locations (see Table 15) number decrease to 101 buildings on 16 campuses with less than 50% functionality following a M6.7 San Jacinto scenario earthquake, with no buildings expected to have less than 50% functionality following a M6.7 Chino Hills scenario earthquake.

Table 22. HAZUS-Estimated Earthquake Impacts for the Redlands Unified School District—District Summary

Facility Type	Earthquake Scenario		
	M7.8 ShakeOut Scenario (including Liquefaction)	M6.7 San Jacinto Fault (including Liquefaction)	M6.7 Chino Hills Fault (including Liquefaction)
Total Number of Buildings	**592**		
Damage			
# Buildings with >50% Probability of Moderate or Greater Damage	79	18	0
# Buildings with >50% Probability of Complete Damage	17	0	0
Functionality			
Functionality < 50 % on Day 1	519	101	0
Functionality 50 - 75% on Day 1	73	448	1
Functionality >75% Day 1	0	43	591

Table 23. HAZUS-Estimated Earthquake Damage for the Redlands Unified School District—Campus Summary

Name	# Bldgs.	M7.8 ShakeOut Scenario (including Liquefaction)		M6.7 San Jacinto Fault (including Liquefaction)
		# Buildings with >50% Probability of Moderate or Greater Damage	# Buildings with >50% Probability of Complete Damage	# Buildings with >50% Probability of Moderate or Greater Damage
Arroyo Verde Elem.	24	0	0	0
Beattie Middle	8	0	0	0
Bryn Mawr Elem.	26	0	0	0
Central Admin./Enrollment Center	3	1	0	0
Clement Middle	35	10	0	0
Cope Middle	42	0	0	0
Crafton Elem.	21	7	1	1
Cram Elem.	27	1	0	0
District Office-North	4	1	0	0
District Office-South	9	1	1	1
Fallsvale Elem.	3	0	0	0
Franklin Elem.	7	5	0	0
Highland Grove Elem.	6	0	0	0
Judson & Brown	9	0	0	0
Kimberly Elem.	21	0	0	0
Kingsbury Elem.	12	1	0	1
Lugonia Elem.	19	4	0	0
Mariposa Elem.	16	0	0	0
McKinley Elem.	12	2	2	2
Mentone Elem.	26	1	0	0
Mission Elem.	11	3	2	2
Moore Middle	25	1	0	0
Orangewood High	19	4	3	3
Redlands East Valley High	83	1	0	0
Redlands High	83	29	5	5
Smiley Elem.	11	0	0	0
Supply Center	5	3	2	2
Transportation	3	1	1	1
Victoria Elem.	22	3	0	0
Total	**592**	**79**	**17**	**18**

Table 24. HAZUS-Estimated Earthquake Post-Earthquake Functionality for the Redlands Unified School District—Campus Summary

Name	# Bldgs.	M7.8 ShakeOut Scenario (including Liquefaction)		M6.7 San Jacinto Fault (including Liquefaction)			M6.7 Chino Hills Fault (including Liquefaction)	
		<50%	50 – 75%	<50%	50 – 75%	>75%	50 – 75%	>75%
Arroyo Verde Elem.	24	24	0	0	22	2	0	24
Beattie Middle	8	8	0	0	8	0	0	8
Bryn Mawr Elem.	26	0	26	26	0	0	0	26
Central Admin./ Enrollment Center	3	3	0	1	2	0	0	3
Clement Middle	35	35	0	0	35	0	0	35
Cope Middle	42	23	19	11	31	0	0	42
Crafton Elem.	21	21	0	1	20	0	0	21
Cram Elem.	27	27	0	0	1	26	0	27
District Office-North	4	4	0	0	4	0	0	4
District Office-South	9	9	0	1	8	0	0	9
Fallsvale Elem.	3	3	0	0	0	3	0	3
Franklin Elem.	7	7	0	0	7	0	0	7
Highland Grove Elem.	6	6	0	0	6	0	0	6
Judson & Brown	9	9	0	0	9	0	0	9
Kimberly Elem.	21	6	15	0	21	0	0	21
Kingsbury Elem.	12	12	0	5	7	0	0	12
Lugonia Elem.	19	19	0	0	19	0	0	19
Mariposa Elem.	16	5	11	0	16	0	0	16
McKinley Elem.	12	12	0	3	9	0	0	12
Mentone Elem.	26	26	0	0	26	0	0	26
Mission Elem.	11	11	0	3	8	0	0	11
Moore Middle	25	25	0	1	24	0	0	25
Orangewood High	19	19	0	4	15	0	0	19
Redlands East Valley High	83	83	0	1	70	12	0	83
Redlands High	83	83	0	8	75	0	0	83
Smiley Elem.	11	9	2	11	0	0	0	11
Supply Center	5	5	0	2	3	0	0	5
Transportation	3	3	0	1	2	0	1	2
Victoria Elem.	22	22	0	22	0	0	0	22
Total	**592**	**519**	**73**	**101**	**448**	**43**	**1**	**591**

5.4.4. Vulnerability Assessment Results for Wildfire

Building Vulnerability Assessment for Wildfire

To estimate the potential magnitude of wildfire risk faced by the City of Redlands, a quantitative assessment of exposure to Fire Hazard Severity Zones, as mapped by the California Department of Forestry and Fire Protection's (CAL FIRE), was performed. The improved census-block level building data generated by the SBEFRA project was overlain onto Fire Hazard Severity Zone maps (shown in Figure 8 on page 28) to quantify the amount of the building inventory that falls within each hazard zone. The results of this overlay are provided in **Table** Page 90. It should be noted that mapped fire hazard severity zones affecting the City are all within Local Responsibility Areas.

As noted previously in the flood vulnerability assessment section, the totals in this table (e.g., total building exposure value, total building square footage, etc.) will vary slightly from those presented in **Table 13** and **Table14** which were developed from census tract data. Table was developed by identifying individual census blocks falling within the boundaries of each Fire Hazard Severity Zone, and will therefore produce a more refined overlay assessment than a similar analysis conducted using census tract data.

As shown in the table 25, most of the city's buildings (80% of buildings, 77% of building value) are located outside of mapped wildfire hazard areas (i.e., are located in "non-wildland/non-urban" or "urban unzoned" areas). However, 10% of the City's building value is located in the area of Very High Fire Hazard Severity, with an additional 4% located in High Severity, and 9% in Moderate Severity. Most of the exposure to these fire hazard severity zones is residential construction; 1688, 870 and 1367 residential buildings are located in the Very High, High and Moderate Zones respectively, valued at more than $611 million, $242 million, and $365 million.

Table 25. Redlands Building Inventory Exposure to Wildfire Hazards

Building Inventory Data by General Occupancy	Cal Fire—Fire Hazard Severity Zones in Local Responsibility Areas					
	Very High	High	Moderate	Non-wildland/ Non-urban	Urban Unzoned	Total
Building Count						
Residential	1,688	870	1,367	379	15,183	19,487
Commercial	24	4	89	22	569	708
Industrial	0	0	33	2	61	96
Other	17	4	8	16	470	515
Total	**1,729**	**878**	**1,497**	**419**	**16,283**	**20,806**
% of Total	**8%**	**4%**	**7%**	**2%**	**78%**	**100%**
Building Square Footage (1,000 Sq. Ft.)						
Residential	4,456	1,904	2,987	701	28,440	38,488
Commercial	217	207	1,503	6,533	7,173	15,633
Industrial	0	0	696	26	1,066	1,788
Other	59	13	33	79	2,555	2,738
Total	**4,732**	**2,124**	**5,219**	**7,338**	**39,234**	**58,647**
% of Total	**8%**	**4%**	**9%**	**13%**	**67%**	**100%**
Building Replacement Value ($1,000)						
Residential	611,516	242,849	365,552	54,011	3,215,862	4,489,790
Commercial	28,447	17,177	173,989	515,605	819,510	1,554,728
Industrial	0	0	52,426	2,170	81,634	136,230
Other	8,845	1,413	5,181	12,938	406,863	435,240
Total	**648,808**	**261,439**	**597,148**	**584,724**	**4,523,869**	**6,615,988**
% of Total	**10%**	**4%**	**9%**	**9%**	**68%**	**100%**
Contents Replacement Value ($1,000)						
Residential	305,758	121,425	182,778	27,006	1,607,915	2,244,882
Commercial	30,827	17,177	187,873	515,605	879,714	1,631,196
Industrial	0	0	78,640	3,255	122,451	204,346
Other	2,873	1,413	3,957	2,748	197,518	208,509
Total	**339,458**	**140,015**	**453,248**	**548,614**	**2,807,598**	**4,288,933**
% of Total	**8%**	**3%**	**11%**	**13%**	**65%**	**100%**

Critical Facility Vulnerability Assessment for Wildfire

Table summarized the exposure of the City's essential facilities to wildfire and other hazards. As shown in the table, most of the critical facilities (13 of 16) are located outside the mapped Fire Hazard Severity Zones (FHSZs) (i.e., located within areas designated as "Urban Unzoned"). The remaining 3 facilities are located in a Moderate FHSZ (Fire Station 262), or High FHSZ (Henry Tate Water Treatment Plant and Hinkley Surface Water Treatment Plant).

Other Facility Vulnerability Assessment for Wildfire

Fire hazard severity zone exposure for the Redlands Unified School District's facilities was summarized previously in **Table .** As shown in the table, most of the school sites (70% of buildings) are located outside of mapped Fire Hazard Severity Zones (FHSZs) (i.e., are located within areas designated as "Urban Unzoned"). Hazard exposure of the remaining schools includes one campus in the Very High FHSZ within the Local Responsibility Area (Cram Elementary, 27 buildings), one campus in the Very High FHSZ within the Federal Responsibility Area (Fallsvale Elementary, which is closed, 3 buildings), and six campuses (148 buildings) in the High FHSZ within the Local Responsibility Area (Arroyo Verde, Highland Grove, Mariposa, and Mission Elementary Schools, Beattie Middle School, and Redlands East Valley High School).

5.4.5. Vulnerability Assessment Results for HazMat

All property and occupants of the City of Redlands are potentially susceptible to a hazardous material release. The magnitude and severity of the exposure resulting from a release will depend on a variety of factors (e.g., the kind of material released, its toxicity, the duration of the release, etc.) and current conditions (e.g., wind and weather conditions, terrain, etc.). The probability of hazardous materials releases, in general, is considered high, although the likelihood of a significant or catastrophic hazardous materials release would be somewhat lower. There is no standard regional risk assessment methodology available for use in predicting both the probability of a release, and the associated impacts.

The City of Redlands Fire Department conducts a weekly collection of household hazardous and electronic wastes for the convenience of its residents; these materials are disposed of through the San Bernardino County HHW and e-Waste programs. There are no other permitted collection sites within the City of Redlands, however, the Interstate 10 Freeway runs throughout the City and presents a major transportation corridor for potential transports of freight containing hazardous materials being taken to a final collection point.

Section 6. Community Capability Assessment

6.1. Agencies and People

Key Personnel

The City of Redlands is a full service, general law city. The major services provided include: Police, Fire, Water, Waste Water, Solid Waste, Engineering, Public Works and Community Development. The City is governed by a five-member City Council. Daily operations are directed by the City Manager. The City has recruited and funded the position of Emergency Operations Manager, who reports directly to the City Manager.

The City Organization is as follows:

ORG CHART

Each City department plays a role with regard to emergency preparedness and response and each department is responsible for ensuring coordination with the other departments. In an emergency, all employees are disaster service workers. "Subject to such disaster service activities as may be assigned to them by their supervisors, or by law." (CA CG §3100)

All departments have received training in the Incident Command System and are trained to a minimum standard of ICS 200. Additionally all personnel are receiving, Standardized Emergency Management System (SEMS) and National Incident Management System (NIMS) training at the 700 and 800 levels. In the event of a disaster, District personnel have been assigned positions in the Emergency Operation Center. Each individual has been trained to meet the needs of his / her assignment. A chart of the position assignments is shown below:

POSITION	PRIMARY	ALTERNATE
MANAGEMENT		
EOC Director	City Manager	Emergency Operations Mgr.
Public Information Officer	City PIO	FD or PD PIO
Liaison Officer	Assistant to City Manager	Assistant to City Manager
Safety Officer	Building Inspector I	Building Inspector II
Agency Representative	General Manager	FD PIO
Security Officer	Police Commander I	Police Commander II
EOC Manager	Emergency Operations Mgr.	Fire Chief
City Council	Council Member I	Council Member II
Legal Advisor	City Attorney	
FINANCE		
Section Chief	Financial Director	Assistant Finance Director
Cost Recovery Unit	Financial Analyst I	Financial Analyst II
Time Unit	Financial Analyst I	Financial Analyst II
Compensation / Claims Unit	HR/Risk Manager I	HR/Risk Manager II
Cost Analysis Unit	Auditor I	Auditor II
LOGISTICS		
Section Chief	HR Director	HR Analyst
Information Systems Branch	IT Specialist	IT Specialist
Communications Unit	IT Specialist	IT Specialist
Info Technology Unit	IT Specialist	IT Specialist
Transportation Unit	EMS Coordinator	Fire Prevention Officer
Personnel Unit	HR Director	Risk Management
Procurement Unit	Purchasing Manager	Analyst
Facilities Unit	Quality of Life Director	Field Services Supervisor
OPERATIONS		
Section Chief Fire	Fire Chief	Fire Inspector
Section Chief MUED	MUED Director	MUED Asst. Director
Section Chief QOL	QOL Director	Field Services Sup.
Section Chief Law	PD Chief	PD Commander
Coroner Unit	SB County Coroner	SB County Designee
Medical / Health Branch	EMS Coordinator	Fire Captain
Care & Shelter Branch	Red Cross	EMS Coordinator
Water & Power Unit	MUED Director	MUED Asst. Director

Alert List

The Emergency Operation Manager is responsible for developing and maintaining an emergency alert list, which will be used to notify the key City personnel. Each department will develop their own departmental alert list, which will be used by the departments to alert departmental personnel. Special rules related to disaster service workers are outlined in California Labor Codes Sections 3211.9, 3352.94, 4351, 4381, 4453, and 4702.

City EOC

The City Manager, Fire Chief, Police Chief and Emergency Operations Manager of the City of Redlands have overall responsibility for coordinating the City's response to each emergency.

Special Districts

Special Districts with responsibilities under this plan will coordinate all planning efforts with the City's Emergency Operations Manager.

6.2. Incorporation into Existing Plans

The City of Redlands has incorporated the Hazard Mitigation plan into the General Plan, City of Redlands Municipal Codes, Capital Improvement and several other plans that deal with hazard identification and mitigation in some form. These plans include the following:

- City Emergency Operation Plan – In process of being updated
- Water System Emergency Response Plan
- Water Conservation Management Plan (Title 13 – 13.06.010)
- Fire Protection Master Plan (Title 15, Section 15.20.580)
- Spill Prevention Control & Countermeasure Plan
- Storm Water Pollution Prevention Plan (Title 3 3.48.020 and 3.56.020)
- Business Emergency Contingency Plan
- Capital Improvement Plan 2013-2018
- Sewer Capital Improvement (Title 3 – 3.44.020)
- Vegetation Management (Title 15, Section 15.20.560)
- Wildland-Urban Interface Fire Area (Title 15, Section 15.20.550)
- Earthquake – Hazardous Building (Title 15, Section 15.52.020)

The City of Redlands utilizes an all hazard approach by obtaining information from the other respective Departments within the City to incorporate existing plans. Once the Local Hazard Mitigation Plan is approved by Federal Emergency Management Agency (FEMA), this plan will be provided to the other City Departments for reference. Upon the annual review of other plans such as: General Plan, Master Drainage Plan, Emergency Operations Plan, Capital Improvement Plan and other vital plans, relevant elements from the LHMP will be integrated into the updates.

6.3. Regulations, Codes, Policies, and Ordinances

The City abides by and is governed by California 2010 Building Codes adopted in February 2014, including sections on electric, plumbing, mechanical, green, and residential requirements, standards and regulations:

- California Building Code
- California Electrical Code
- California Plumbing Code
- California Mechanical Code
- California Fire Code (Title 24, Part 9) and International Fire Codes (Title 15 – 15.20.010)

The City has also adopted Zoning Ordinances that are not part of the California Code but are part of the General Plan. These ordinances regulate land use and map the official land use and hazard overlay districts, to include safety hazard and environmental protection areas.

General Plan

All cities and counties in California are required to adopt a General Plan that lays out major policy goals. The General Plan includes elements, which are sections that address a variety of important topics. The element most closely related to this Hazard Mitigation Plan is the Safety Element, which focuses on reducing risks posed by natural and technological hazards and other human caused emergency events.

The Safety and Hazardous Waste Element

The aim of the Safety and Hazardous Waste Element is to reduce the potential risk of death, injury, property damage, and economic and social dislocation resulting from fires, floods, earthquakes, landslides, and other hazards. The Safety and Hazardous Waste Element identifies all significant hazards and risks in a community and defines policies to mitigate and respond to those risks.

6.4. Mitigation Programs

The City of Redlands currently has the following mitigation programs to address the top Hazards which are Flood, Wildfire, Earthquakes, Drought and Hazardous Material.

6.4.1. Flood Programs

The City has implemented the FAST Program

- (FAST) Flood Control, ADA Ramps, Sidewalks, Trees and Parks
- Community Outreach through CERT, Market night and Safety Fairs
- Pamphlets provided to residence on flood insurance, and flood preparedness.

6.4.2. Wildfire Programs

The City has an on-going Weed Abatement Program to manage weeds and brush and provided the defensible space 100 foot clearance for areas prone to fire due to high vegetation area.

6.4.3. Earthquakes/Geologic Hazards Programs

Since 1982, the City of Redlands has participated in long term recovery programs for earthquakes, wildfires and floods. This program provides continued stability to sustain and continue infrastructure services.

6.4.4. Drought Programs

The City of Redlands is in the process of updating Ordinance 2151 Water Conservation Plan to address the current drought. The plan will implement a plan to conserve city water supplies, thereby minimizing the effect of a shortage of water supplies on city users.

6.4.5. Hazardous Materials Programs

The City of Redlands in coordination with the County of San Bernardino is providing an outreach program to limit the negative impacts associated with inappropriate discard of hazardous material into the environment. This outreach program will provide community awareness of how to dispose of the hazardous material. The outreach material will be provided at emergency preparedness fairs and fire safety fairs.

6.5. Fiscal Resources

The City's Operating Budget for 2013-14 is $63,352,530 of general revenue not dedicated to a government enterprise fund. Available financial resources for the City of Redlands are as follows:

- General Tax Revenue (property, sales, etc.) $39,625,613
- General Government Revenue (business license, motor vehicle fees) $6,705,923
- Charges for Service (development fees, community service, etc.) $4,984,235

- Interfund Transfers to General Fund (gas tax, etc.) $4,620,217
- Other Sources $7,416,542

Any mitigation projects would need to be part of the City's budget planning process. Additional funding could potentially come from hazard mitigation grants, such as the Hazard Mitigation Grant Program and the Pre-Disaster Mitigation Program.

Section 7. Mitigation Overview

The City of Redlands mitigation strategy is derived from the in-depth of existing vulnerabilities and capabilities outlined in previous sections of this plan, combined with a vision for creating a disaster resistant and sustainable community for the further. This vision is based on informed assumptions, recognizes both mitigation challenges and opportunities, and is demonstrated by the goals and objectives outline throughout the plan.

The City will also work with San Bernardino County Operational Area, Redlands Emergency Communications Group, East End COAD and many other programs providing training, exercises, workshops and volunteer management with Non-profit organizations, faith-based organizations, businesses, and other local municipalities and programs, including Community Action Partnership.

7.1. Mitigation Update Report

Please see Tables A-1 and A-2 on pages116-128 for mitigation status updates.

7.2. Mitigation Goals, Objectives, and Projects

The goal of the City of Redlands is to maintain and enhance a disaster resilient community by reducing the risk of potential loss of life, property and environment from the impacts of natural disasters.

The Mitigation goals of the City of Redlands focus on five key areas which include Earthquakes, Flood, Wildfire, Hazardous Materials and Drought. The City of Redlands has established objectives to support the completion of the above mentioned goals and proposed improvement projects that can help prevent or reduce the effects of a natural disaster

The following section provides an overview of the Mitigation Goals and Objectives

1. Earthquakes

Description: To reduce both the short and long term effects of earthquakes on the City of

Redlands.

Objectives:

- Protect public health and safety by preparing for, responding to, and recovering from the effects of an Earthquake

2. Floods

Description: To reduce both the short and long term effects of the 100-year flood plain as defined in the Flood Insurance Rate Map (FIRM) and the City of Redlands General Plan.

Objectives

- Require that all future buildings within slow surface drainage areas be placed above such areas or on properly designed foundation systems.
- Allow density transfer to areas of a site not located within inundation areas.

3. Wildfire

Description: to mitigate or reduce the risk of fires in the City of Redlands designated urban wild land interface high fire hazard area.

Objectives:

- Work with state and federal agencies for joint enforcement of adopted wild land prevention codes.
- Investigate and pursue additional funding mechanisms available to fund City fire protection.
- Require building construction features appropriate to the wildfire hazard.

4. Drought

Description: To reduce the nonessential use of water to conserve city water supplies thereby minimizing the effect of a shortage of water supplies on city users.

Objectives

- Implement water conservation efforts to maximize the use of existing water resources
- Promote more effective use of groundwater storage through increased groundwater recharge and conjunctive use among agencies.

5. Hazardous Material

Description: Reduce the quantity and frequency of household hazardous waste being dumped in the community and/or entering the landfill.

Objectives

- Operate and Maintain the Household Hazardous Waste Collection Site.
- Collect, categorize lab pack and store Household Hazardous Waste for proper disposal.
- Collection of electronic waste under Cal-Recycle guidelines.

7.2.1. Flood

The potential severity of flooding events requires careful long-range planning, and balancing uses. Growing environmental consciousness has led to a new understanding of the types of flood control measures appropriate to Southern California. Costs of an unmitigated disaster must be weighed against costs of land, construction, and maintenance, and enhanced with long-range environmental concerns, such as groundwater recharge and habitat preservation. Flood and drainage ways also have regional significance as areas of mineral resources and recreational uses.

Policies guiding these efforts, as stated in the City of Redlands General Plan include:

- Protect lives and property and ensure that structures proposed for sites located on flood plains subject to the 100-year flood are provided adequate protection from floods.
- Preserve as open space those areas that cannot be mitigated for flood hazard.
- Support a multi-use concept of flood plains, flood-related facilities, and waterways.
- Where feasible given flood control requirements, maintain the natural waterways and flood plains to ensure adequate groundwater recharge and water quality, preservation of habitat, and access to mineral resources.
- Support the intent of the County of San Bernardino's flood control policies as specified in the County General Plan.
- Cooperate with all public and private agencies involved to ensure that flood control improvements do not disrupt environmentally sensitive areas beyond a level of immitigability.

Infrastructure Subject to Flooding

1) Santa Ana River Wash

Many flood vulnerabilities exist along the Santa Ana River, including:

a) Roadway Crossings

Three major arterial roadways cross the Santa Ana River wash within the City of Redlands.

b) State Route 30

Under the jurisdiction of the California Department of Transportation (Caltrans), State Route 30 is a four-lane freeway constructed in the late 1980's and early 1990's. The river crossing is a bridge constructed to Federal Highway Administration standards, capable of withstanding a 100-year flood event.

c) Alabama Street and Orange Street are arterial roadways under the jurisdiction of the City of Redlands. Both roadways currently exist as two-lane facilities and both are master-planned for a minimum of four lanes. The Orange Street crossing is currently constructed as "dip" crossings with culvert systems capable of carrying a 10-year or better storm flood before water crosses the roadway surface. Alabama Street may be capable of carrying a 1-year storm. Since its construction in 1995, it has been closed on ten occasions to allow excess flow without endangering public safety. Both crossings are equipped with gates and road closure plans,

implemented when flooding occurs. During Santa Ana River flows in excess of a 2-year storm, both roadways are closed to all through traffic, with all traffic being diverted to State Route 30. Substantial damage can occur to both roadways including the potential for washouts during any flood event exceeding a 2-year flood. Both crossings have been replaced twice: once in 1993 (FEMA 979), and once in 1995 (FEMA 1044/1046). Warm, tropical rain falling at higher elevations, combined with melting snow, and excess rain at lower levels, created severe flooding conditions in the Santa Ana River. Rainfall, mud, debris, and boulders swept away both roadway crossings, which had been replaced in 1995. New replacement costs were incurred for $529,000.

2) Redlands Municipal Airport

Redlands Municipal Airport is a general aviation facility with 230-based aircraft and 65,300 annual flight operations. The airport lies immediately next to the Santa Ana River in the northeast corner of the City of Redlands. The airport is along the southerly bank of the river approximately 30 feet above the river floor.

An earthen dike and a revetment fence maintained by the San Bernardino County Flood Control District (SBCFCD) protect the airport. The dike and fence may not be capable of containing a 100-year flood. If floodwaters breach the dike, airport property would be eroded and the potential is high for damage to the runway, navigational lighting and airport drainage systems. No damage occurred at the Airport as a result of the Winter Storms, 1995. Additionally, work performed in 2011 added an updated drainage system to the taxiway of the airport to more effectively convey surface flows during heavy or sustained rain.

3) California Street Landfill/Wastewater Treatment Plant

The Wastewater Treatment Plant is located adjacent and south of the California Street landfill. A storm drain was constructed in 1993 that provides 100-year protection to the wastewater treatment plant from local flooding along Nevada Street and areas south of the treatment plant.

The California Street Landfill and Wastewater Treatment Plant are the primary and sole facilities that service the population of the City of Redlands. Both the landfill and wastewater treatment plant are protected from flows in the Santa Ana River along this reach by an earth and rock levee, which has a post and wire revetment located at the toe of the landfill slope. The levee and revetment are owned by the San Bernardino County Flood Control District, and were constructed approximately 30 years ago.

The historic location of the main channel flow of the Santa Ana River in this reach has been in the northerly portion of the floodplain (away from the landfill and wastewater treatment plant). This location was controlled and maintained by the San Bernardino County Flood Control Department by “center cutting” or grading the channel to the northerly portion of the floodplain as necessary. This practice continued until recent environmental changes resulted in restrictions to grading activities in the channel. This reach of the river is habitat to a now federally listed as endangered plant species, the Santa Ana River Woolly star (Woolly star). Because of potential impacts to the Woolly stars and its habitat, grading and channel maintenance activities in the area along the reach of the landfill and wastewater treatment plant have been restricted.

Over the past few years, without the channel grading, flows in the river have meandered southerly placing the low flow channel adjacent to the landfill and wastewater treatment plant. As a result, the revetment, which is no longer maintained by the San Bernardino County Flood Control District, may not be relied upon to provide long-term flood protection to critical facilities such as the wastewater treatment plant and landfill. According to the San Bernardino County Flood Control District, post and wire revetments are no longer built or maintained by the San Bernardino County Flood Control District, and existing levees are reinforced with large rock or riprap in areas which the San Bernardino County Flood Control District deems critical.

Storm flows during the winter of 1995 (estimated to be a 10-15 year event) were concentrated against a portion of the revetment, causing damage not only to that structure, but erosion of the levee which protects the landfill and wastewater treatment plant. An estimate to provide emergency repairs to the damaged levee by the Office of Emergency Services (OES) was set at $62,000. Although the San Bernardino County Flood Control District provided riprap to the City for emergency repairs to the levee, the San Bernardino County Flood Control District has prioritized other projects along the Santa Ana River for long-term improvements. As a result, limited, if any, funds are available from the San Bernardino County Flood Control District to provide enhanced protection or annual maintenance to the levee.

Due to the environmental constraints presented by the Woolly star plant, it is not anticipated that channel grading will be resumed. Without such channel control, it is likely storm water will continue to flow more southerly, following the low flow channel established in winter 1995 storms. It is anticipated that in the best case, smaller storm events such as those in winter 1995, will result in repetitive damage to the revetment and levee, causing the need for annual repairs of at least the magnitude estimated to repair the 1995 damages by OES.

4) San Timoteo Canyon/Live Oak Canyon

San Timoteo Creek and Live Oak Creek traverse the south and southwesterly portions of the City of Redlands. These streams flow generally through rural areas. Some local development has occurred in the area with several structures being within the 100-year flood zones. Local streets and roads are subject to infrequent flooding and closures due to water and mudflows in the canyon areas. General maintenance along the San Timoteo creek is performed by the SBCFCD.

Mudslides in San Timoteo Canyon created damages associated with debris removal. Additionally, severe ditch and shoulder erosion, as well as culvert damage, forced closure of the road for several days. Federal Highways Administration/ER funds have been approved for $220,000 to make necessary repairs.

More recently, during the severe Winter Storms of December 2010 – January 2011, extreme mudflows actually caused motorists to become stranded in San Timoteo Canyon. Additionally, damage to public and private property was incurred and a State and Federal Disaster were declared.

5) Mill Creek/Mission Zanja

The Mill Creek Zanja serves as the principle storm drain for the eastern and southeastern portions of the City of Redlands. This drain carries the single greatest impact for flooding to the City of Redlands. Since the watershed for this drain includes portions of City and County territory, a regional solution to flooding along the drain must be sought.

Several attempts have been made to set assessments or development impact fees to fund improvements along this drain. Due to the extremely high cost of improvements, such efforts have failed. The Army Corps of Engineers was in the development stages of constructing a full Federal project to provide channel improvements and storm protection for the City of Redlands, however due to a variety of jurisdictional and funding constraints; the project has been halted at this time.

The Zanja bears a National Register Designation, and portions within Sylvan Park were again damaged as a result of continued erosion from floodwater.

6) Local Storm Drain Systems

A number of local storm drain systems run through the City of Redlands. Several of these have experienced local flooding during recent storm events. Several drains are proposed in areas with the greatest potential for local flooding:

- Church Street from Pennsylvania Avenue to the Santa Ana River
- Judson Street from Brockton Avenue to the Mill Creek Zanja
- Mt. View Avenue from Lugonia Avenue to the Santa Ana River
- Lugonia Avenue from Alabama Street to the Mission Channel
- Lugonia Avenue and Texas Street.

Judson Street, from Brockton Avenue to the Mill Creek Zanja, exhibits the greatest ability to produce direct and indirect damage costs to both public and private facilities. Due to the increased density of development in both the City and the County, storm water flows are exacerbated. Of the $321,000 associated with Emergency Protective Measures and Debris removal alone during the winter storms of 1993, it is estimated that 75% of that sum was generated to aid citizens in this northeast quadrant of the City of Redlands.

During the 1995 Winter Storms, the majority effort involving Emergency Protective Measures and Debris Removal was concentrated in this area.

The City of Redlands General Plan, Health and Safety Element, evaluates the flood hazards that exist within the City of Redlands. The guiding and implementing policies are incorporated within this document, as attached. Mitigation provided by General Plan Policy is also provided.

Table 26 summarizes the implementation strategies for categories of projects addressing the top hazards in the San Bernardino County Unincorporated Area Hazard Mitigation Plan. The Table includes implementation strategies for the wildfire, earthquake/geologic hazards and flood.

7.2.2. Earthquake

The City of Redlands have several historic landmarks that include the Kimberly and Morey Mansions and Asistencia Mission de San Gabriel. There are several establishments with unreinforced masonries throughout the City. The City has adopted the current 2013 building and fire codes ordinance 2803 to protect existing and new critical infrastructures. San Bernardino County and other special interest groups have been instrumental in restoring the historical buildings within the City. The restored structures house a wedding chapel, cactus garden, bell tower, wishing well, and a museum with exhibits that depict Native American and early pioneer life.

7.2.3. Wildfire

The Redlands Fire Department's policies emphasize structural fire preventative measures. The City has implemented building construction standards and means for private on-site water storage facilities for sites that are not served by the Fire Department, and require defensible space around all new construction. The City continues to work to prevent wild land and urban fire, and protect lives, property, and watershed from fire dangers. In doing so, the department has implemented the following policies as cited in the City of Redlands, 1995 General Plan, as amended in 1997.

1. Work to prevent wild land and urban fire, and protect lives, property, and watershed from fire dangers.
2. Adhere to the requirements for high fire hazard areas designated by the Redlands Fire Department on the official Roof Classification Zone Map, updated as of June, 1994, and as specified in the document on file at the Redlands Fire Department describing High Fire Hazard Area Fire Safety Modification Zones.
3. Monitor fire-flow capability throughout the Planning Area, and improve water availability if any locations have flows considered inadequate for fire protection.
4. Monitor methane gas production at active and inactive landfills, and take preventive action if gas production creates a significant fire hazard.
5. Devise alternative fire protection standards suitable for Rural Living areas not exposed to high wildland fire hazards.
6. Consult the San Bernardino County Fire Safety Overlay Ordinance (July, 1989 Development Code) for possible appropriate implementation measures for development in the foothills area.

7.2.4. Hazardous Material

The City of Redlands has implemented the household hazardous material waste program to reduce the quantity and frequency of household hazardous waste being dumped in the community and entering the landfills. This will prevent the ground water from being contaminated.

7.2.5. Drought

The City of Redlands is addressing the drought, by developing a drought emergency plan by emergency plan and establishing a memorandum of understanding and contracts with water districts and suppliers. The City has also implemented a water conservation plan to educate the citizens on water conservation.

7.3. Mitigation Priorities

Table 26. Implementation Strategy Summary

Action	Lead Agency	Hazard	Funding Source
Saltana Cypress Storm Drain Phase 2 B Construction of Storm Drains High Priority	San Bernardino County Flood Control (NRCS)	Flood	$6.3 Million
South Saltana Cypress Storm Drain Phase 2C Storm Drain Construction North Hwy 60 to reduce flooding in residential neighborhood. High Priority	San Bernardino County Flood Control (NRCS)San	Flood	$4.9 Million
Vegetation Management High Priority	City of Redlands Fire Department	Fire	$18,600
Fire Resistant Community Project to promote fire safety Medium Priority	City of Redlands Fire Department	Fire	Pending securing funding
Drought (Develop drought emergency plan) Medium Priority	City of Redlands MUED	Drought	Pending securing funding
Household hazardous waste program (to reduce hazardous waste within the community and entering the sewers and landfills High Priority	City of Redlands Fire	HazMat	$180,000 per year
Earthquake establish community preparedness outreach to mitigate risk and hazards and create inventory database of critical infrastructures. High Priority	City of Redlands Emergency Management	Earthquake	$40,000

Please refer to the Table A2-A6 on pages 121-125 for a comprehensive list of mitigation priorities. The projects that are unfunded will be reviewed with the next capital improvement plan in 2015/2016.

7.4 Implementation Strategy

The City of Redlands has several Safety Elements in its General Plan that includes a discussion of Fire, Earthquake, Flooding, and other Hazards Specific to the jurisdiction. This plan will be implemented upon final approval from FEMA. In addition; the City has adopted Ordinances 2639 and 2485 that require the Emergency Operations Manager to be responsible for the development and update of the City of Redlands hazard mitigation plan, which requires mitigation for identified natural hazards.

Section 8. Plan Maintenance

8.1. Monitoring, Evaluating and Updating the Plan

Plan Maintenance Process

The City of Redlands will continue to monitor and evaluate our Hazard Mitigation Plan (HMP) within the 5 year cycle on an annual basis. As the City monitors these hazards and learn how to mitigate these hazards more efficiently, additional projects may be developed over time. The current goals and objectives; capital improvement projects and mitigation efforts will be reviewed and measured against the expected outcomes during this annual review; not limited to:

- The nature, magnitude, and/or type of risks have changed.
- The current resources are appropriate for implementing the plan.
- There are implementation problems, such as technical, political, legal, or coordination issues with other agencies.
- The outcomes have occurred as expected (a demonstration of progress).
- The agencies and other partners participated as originally proposed.
- Federal, State or local laws and regulations mandate changes.

If we discover changes in hazards, resources, laws and regulations have occurred during the evaluation; we will update the HMP Revision Page, and notify San Bernardino County Fire Department OES.

Our Planning team members and Emergency Operations Manager will be in charge of the monitoring, evaluation and updating of the HMP.

8.2. Implementation through Existing Programs

The City of Redlands is aware of the hazards that face our community as historic incidents prove that natural disasters are a common occurrence in this area. The City will continue to strive toward protecting the life, property and economy of the city.

As further plans are developed, the Hazard Mitigation Plan will be an asset in future plans development efforts.

8.3. Continued Public Involvement

The City of Redlands will provide opportunities to neighboring jurisdictions to obtain and share information with their stakeholders and the public through the Operational Area Coordinating Council (OACC), community based organizations and private entities. The city provides public forms with our quarterly Disaster Council which gives the public and local emergency managers the opportunity to collaborate and coordinate prior to an emergency occurring.

The City will also inform the public through our website (www.cityofredlands), local Redlands television station, Twitter and Facebook.

Section 9. Annex

9.1. Summary of Historical Flood Events

Table provides a summary of losses incurred in historic flooding events. The flood events and their impacts on the City of Redlands are described in the following section.

Table 27. Response and Recovery Costs for Historic Flood Events

Hazard: Flooding		Response and Recovery Costs					
Name	Date	City Town	County	State	Federal	Other	Total
FEMA 1952-DR-CA	1/26/2011	$0	$0	$0	$0	$0	600,000
FEMA 1884-DR-CA	3/8/2010	$0	$0	$0	$0	$0	10,000
FEMA 1203-DR-CA	2/26/1998	$0	$0	$0	$1,096	$300	$1,396
FEMA 1046-DR-CA	3/1/1995	$0	$0	$8	$20	$0	$28
FEMA 979-DR-CA	1/5/1993	$0	$0	$2,996	$28,872	$0	$31,869
FEMA 935-DR-CA	2/16/1992	$9	$0	$88	$237	$0	$334
February 1980 Floods	2/1/1980	$420	$0	$0	$0	$0	$420
September 1976 Flood	9/29/1976	$5,400	$0	$0	$0	$0	$5,400
February 1969 Flood	2/22/1969	$486	$62,004	$0	$0	$0	$62,490
Flood of Jan 1969	1/25/1969	$102	$46,370	$0	$0	$0	$46,472
OEP-233-DR	12/5/1966	$2,400	$0	$0	$0	$0	$2,400
OEP-211-DR	11/20/1965	$0	$0	$0	$0	$0	$0
November 1965 Flood	11/20/1965	$304	$3,400	$1,500	$0	$0	$5,204
August 1965 Flood	8/11/1965	$35	$0	$0	$0	$0	$35
April 1965 Flood	4/8/1965	$38	$0	$0	$0	$0	$38
Totals:		**$9,194**	**$111,774**	**$4,592**	**$30,226**	**$300**	**$756,086**

1. FEMA 1952-DR-CA 1/26/2011

The City of Redlands sustained more than 600,000 in damages costs associated with Emergency Protection and debris removal. The amounts included salaries, benefits, overtime and other professional and special contractual services for repairs and maintenance supplies.

Several repairs of damages in various locations in the amount of $282, 050; $7,870 for repairs of damages on Bond Avenue, Fern Avenue, and Brookside Avenue; $4,000 with for geologic evaluations services; $10,722 for restriping San Timoteo Road from Alessandro Road to Fern Street; $12, 585 for emergency street sweeping of San Timoteo Canyon; and $6,487 for surfacing of damaged playground at Jennie Davis Park.

2. FEMA 1884-DR-CA 3/8/2010

The City of Redlands sustained significant amount of damages due to the heavy rains and associated flooding.

3. FEMA 1203-DR-CA 2/26/1998

Redlands experienced a continuing series of storms. On February 27 and 28, 1998, the strongest storm created a 2-day event that resulted in considerable damage and private property loss.

4. FEMA 1046-DR-CA 3/1/1995

The second storm series resulted in more than $12,000 in damage costs associated with Emergency Protective Measures and Debris Removal. A small storm drain collapse at Church and State Streets created another $4,000 in damage, and another mudslide in San Timoteo Canyon created damages associated with debris removal of approximately $20,000. Additionally, severe ditch and shoulder erosion and culvert damage occurred between Pilgrim Road and Rancho Caballo, at an approximate cost of $200,000. The water line, which supplies potable water from Monkey Face Falls to the residents of Mountain Home Village, was further buried after damage from two previous disasters. Due to a potential $500,000 cost for debris removal, the water line was relocated at a cost of less than $50,000. The most significant damage, however, was the loss of the temporary emergency crossings at Orange and Alabama Streets. Warm tropical rain, coupled with an extreme snowmelt, created severe flooding conditions in the Santa Ana River. Mud, debris, and boulders swept away both roads, which were replaced in 1993 (FEMA 979) at a cost of $570,000. New replacement costs were incurred for $529,000.

5. FEMA 979-DR-CA 1/5/1993

The Winter Floods of 1993 produced the most significant damage to the City of Redlands in recent history. Recurrent flooding during the months of December through March resulted in an over saturation of soil which promoted long-term effects of storm waters in the City and region. Tropical rains melted a heavy snow pack at the higher elevations, producing increased flood activity.

With approximately $6.5 Million in damages, but no loss of life, these storms finally claimed both the Alabama Street and Orange Street bridges. Demolition of the old Orange Street Bridge and construction of temporary replacement dip crossings resulted in costs of $570,000 and both crossings were opened in July 1993; replacement of the bridges is estimated to cost approximately $5.0 million by 1995. The Mission Zanja again produced flooding along its banks at Sylvan Blvd. and Judson Street, resulting in channel improvements at that intersection in excess of $27,000. Partial collapse of the Zanja occurred again in Sylvan Park. Landslides crushed the Monkey Face Falls waterline, which provides water to residents of Mountain Home Village. One additional water line, serving sparse residences north of the Santa Ana River, was washed out. Repair was affected in October 1993, following subsidence of the Santa Ana River. Tipping fees to the County landfill exceeded $185,000. Several city-owned buildings sustained water damage, including the Smiley Library, which is on the National Register of Historic Places. Fire and Police Department emergency services topped $95,000, with no loss of life. Emergency Protective Measures and Debris Removal accounted for another $125,000 in emergency services. Landslides occurred in the San Timoteo/Live Oak Canyon area, resulting in road closures for a portion of the three-month Declaration period. Final clean-up efforts were accomplished in April 1993 at a cost of $30,000.

6. FEMA 935-DR-CA 2/16/1992

In February 1992, significant flooding occurred as a result of major storm systems moving through Southern California. The three-day storm system produced most of the 14.96 rainfalls for 1991-92.

Historically, the Santa Ana River and Mission Zanja were the cause of the most significant damages, and due to extensive build out of the southeast area, storm runoff produced increased flooding of the Country Club area. Most significantly, water run-off from the populated Country Club area traversed a private elementary school as well as Ford Street and developed subdivisions to the north. School property was damaged as a result of flood waters flowing through the school's parking lot and only street entrance, resulting in a lawsuit against the City. In 1993-94 the City constructed the Ford Street Storm Drain at a cost of $450,000, and future flooding in that area has been nonexistent. The Bear Valley Pipeline, generally located in Mill Creek near Greenspot Road and Florida Street, sustained $92,000 in damage to approximately 400 feet of steel pipe and supports. The Mill Creek Zanja at Sylvan Blvd. at Judson Street eroded significantly, threatening flooding of neighborhood homes as floodwaters spilled over into the public right-of-way, and causing $12,000 in damage. Public safety, spillway erosions, landfill tipping fees, and debris removal alone resulted in $160,000 in damages for a 3-day period of time. There was no loss of life or public property.

7. FEBRUARY 1980 FLOODS 2/1/1980

The floods of February 1980 produced a mirror image of prior floods, as extensive damage again occurred as a result of rising storm waters and runoff from the upper regions of the Santa Ana River. The Santa Ana River at Alabama Street changed course and completely washed out the road in two locations, plugged existing culverts, eroded shoulders at various locations, scoured the existing A.C. pavement and washed out the existing pipe on the north end of the

river. Emergency - reopening of Alabama Street occurred on June 10, 1980, after four months' construction, at a cost of $106,390. During the construction phase, additional pipes were added to increase the capacity of the existing pipes. Minor erosion damage occurred on various City streets and some private property. The Zanja experienced collapse between Redlands Boulevard and State Street near Kendall Drive, as well as in a portion of the channel in Sylvan Park. City crews instituted repairs at nominal cost.

8. SEPTEMBER 1976 FLOOD 9/29/1976

On September 24, 1976, an intense local thunderstorm dropped most of its precipitation in a 20-30-minute period. At one spot, 3 ½ inches of rain fell during this time. This heavy rain produced an extremely high rate of runoff, which quickly exceeded the capacity of local drainage systems. Major overflows occurred on the eastern edge of Redlands' downtown business district, flooding the area and depositing mud up to three feet deep. Damages to houses, businesses, roads, and flood control facilities reached $2 million.

Mission Zanja overflowed again in 1978, depositing water up to 30 inches deep in some places and causing an estimated $100,000 in damages.

Ref: "Study of Potential Changes to Mission Zanja in Downtown Redlands for Flood Control", US Army Corps of Engineers, Los Angeles District, and Information Bulletin, July 1984.

9. FEBRUARY 1969 FLOOD 2/22/1969

The January and February 1969 floods were the most damaging floods of record in San Bernardino County. Unprecedented damages were sustained by property in the County. The storms and floods caused the deaths of at least 13 persons.

"An intense downpour on January 25, 1969, climaxed a nine-day period of heavy precipitation. From 10 to 20 inches of rain fell in the lowlands, from 25 to more than 50 inches in the mountains. Emergency crews prevented large property damage with sandbagging and other emergency work. Flooding could have been worse, but the ground was not saturated prior to the storms, so water was able to percolate into the ground.

One month later, February 22-25, 1969, another storm series hit. Since the ground was by then saturated, property damage was more severe. The runoff from the storms resulted in the greatest flood of record on many streams in the upper Santa Ana River basin. Flooding from Mission Zanja deposited debris on streets, eroded road shoulders and parts of the Zanja's rock and mortar channel, washed out the bridge at New Jersey Street, damaged several residences, and inundated four citrus packing plans and several commercial businesses. Estimated damages were $304,000." (US Army Corps of Engineers, LA District, Information Bulletin, July 1984.)

Flood damages in San Bernardino County from both floods were more than $54,000,000. In the Santa Ana River drainage areas, the flood damages from the January flood were slightly greater than the flood damages from the February flood ($22,165,000 in January and $20,622,000 in February). However, in the Mojave River drainage areas, monetary damages from the February

flood were more than 10 times greater than those caused by the January flood ($1,020,000 in January and $10,380,000 in February.)

Damages to residential property in the County were widespread, totaling about $12,000,000. Damages in the Cucamonga area were particularly heavy: More than $2,000,000 in damages occurred to residential property, and hundreds of people were forced to leave their homes – some for as long as 3 months. Damages to businesses and industrial property in San Bernardino County also were great, totaling more than $8,000,000. Damages to business and industrial property were also especially severe in the Cucamonga area, where more than $5,000,000 in damages was sustained. Agricultural losses were very severe. Intangible losses in the County were also great. Except for fatalities and injuries sustained during the floods, probably the greatest intangible damages sustained were the damages to morale of people whose homes were damaged or destroyed in the January and February floods. Other intangible damages included the disruption of normal community business and social activities, transportation and communications facilities, and public-utility services. Flood-damaged sewer lines and sewage-treatment plants posed a threat to the lives and health of many residents of San Bernardino County.

10. FLOOD OF JAN 1969 1/25/1969

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11. OEP-233-DR 12/5/1966

"During the first third of December 1966, a series of three storms swept through San Bernardino County. December 5 recorded the fourth most severe rainfall period in 76 years of San Bernardino rainfall history with a near-record 4.23."

On December 5, nearly one-half mile of Alabama Street was washed out during flows up to five feet deep. Violent flows from the Santa Ana River also severely eroded the north levee protecting the Redlands Sewage Treatment Plant. The Zanja again overflowed east of Wabash Avenue, poured through an orange grove and flooded the Crafton School Yard. On December 6, overflow from the unimproved "Little Zanja" was widespread. The University area, as well as the Central Business District, was layered with tons of mud and debris after two successive days of flooding. The north approach to the Kansas Street Bridge was washed away, and flows undercut the abutment, dropping the north end of the bridge about two feet. The bridges at both Iowa and New Jersey Streets suffered similar damages.

12. OEP-211-DR 11/20/1965

From November 20 to 27, 1965, a series of five storm periods, ranging from light to severe, inflicted extensive damage in the region. The most severe of these storms occurred between November 20 and 25, when eleven deaths (six in San Bernardino County) were attributed to the storms. Property damage estimates greater than $11 million were recorded.

Within Redlands' jurisdiction, Alabama Street suffered extensive damage due to flood waters from the upper regions of the Santa Ana River/Mill Creek. Resultant flows put the Redlands Sewage Treatment Plan out of operation, took the city's largest water reservoir off line and produced significant damage throughout the northern portion of Redlands and its Central Business District. The Mission Zanja Creek, which flows through Redlands from a controlled diversion of Mill Creek for irrigation purposes, produced significant levels of mud and debris deposits, and flooded homes along Sylvan Boulevard. Water carried tons of mud from construction-bared slopes along Palo Alto Drive across Country Club Drive and through the

storm drain channel, which bisects the golf course. Many intersections throughout the City were flooded, with gutters filled to overflowing with heavy runoff. Floodwater from the overflow of the Zanja flooded the basement of the Crafton Elementary School.

13. NOVEMBER 1965 FLOOD 11/20/1965

On November 20-25, 1965, a damaging general storm occurred throughout Southern California, following on the heels of a smaller general storm, which occurred about a week earlier. The antecedent rainfall conditions from the earlier storm left watersheds with a residual moisture content in the soils thus contributing to the accelerated runoff that occurred as a result of the intense precipitation on November 22. Above freezing temperatures in the mountain areas further contributed to increased runoff.

The storm has been placed in the category of a small flood likely to recur every five to fifteen years. Mill Creek flow was of about a 15-year frequency, the Santa Ana Canyon flow about a 5-year frequency, and Cucamonga Creek somewhat greater that a 10-year frequency. By comparison, the 1938 flood produced a surge of about a 50-year frequency on Mill Creek and the Santa Ana River, while Cucamonga Creek was rated higher than a 100-year frequency. Major flood-producing waters emanated from the highest watersheds in the 10,000-foot ranges.

14. AUGUST 1965 FLOOD 8/11/1965

In what was called an “electrifying” flash flood, muddy water cascaded destructively through the City’s streets. The muddy runoff overtaxed the capacities of storm drains and spewed across streets and highways into low-lying areas. Water swept into the basements of the Crafton and Kingsbury schools and flowed through the lobby of Provident Federal Savings at Orange and State and into the basement where the vaults were flooded. Two youths were rescued after they were swept 1 ¾ miles along a storm drain system, portions of which are buried pipe extending through downtown Redlands.

15. APRIL 1965 FLOOD 4/8/1965

During this flood event, fast-moving water spilled out of the debris-choked channel in numerous spots, creating a serious flood hazard to low-lying homes between Dearborn and University Streets. City officials generally blamed poor maintenance of the Zanja for the flood. One house at Lincoln and Laramie Streets was partially flooded while foot-deep water swirled through the yards of many homes along the Zanja. Small bridges used for access from Sylvan Boulevard to homes on the other side were under water, but withstood the pressure.

9.2. Summary of Historical Earthquake Events

In June of 1992, the Mw[20] 7.3 Landers Earthquake ruptured 85 km (53 miles) along a series of faults in a roughly contiguous fault system, including the Johnson Valley, Landers, Homestead Valley, Emerson and Camp Rock faults. A map of strong ground shaking from this event is shown in **Figure A4-1;** strong shaking was felt in the City of Redlands. The largest aftershock of the Landers earthquake was the Mg 6.4 Big Bear Earthquake, which caused damage and landslides in the Big Bear area. Declared as Disaster FEMA-947-DR CA, these earthquakes resulted in structural damage to many residential dwellings in Redlands, including chimneys and foundation slippage. Light damage was done to the A. K. Smiley Library; the stack wing was subsequently retrofitted under using funding from the Hazard Mitigation Grant Program (HMGP). **Table** summarizes the impact and cost of this event.

[20] Moment Magnitude, Mw

Table 28. Response and Recovery Costs for Historic Earthquake Events

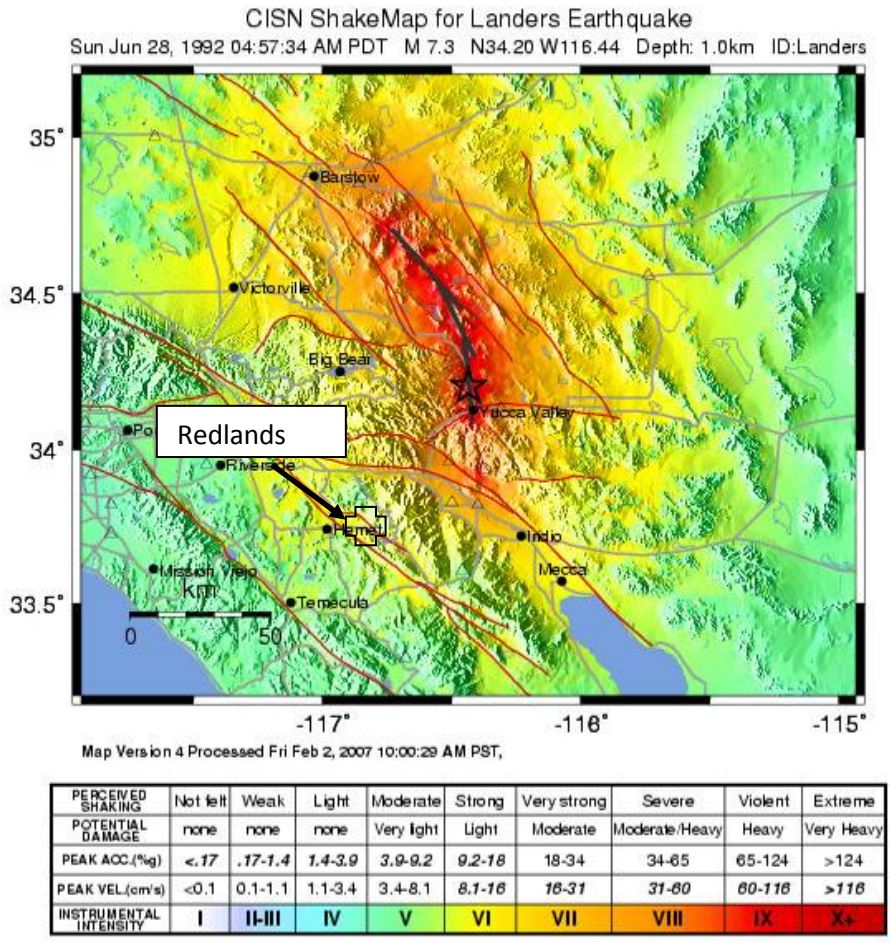
(Dollar Amounts in Thousands)

Name	Date	City/ Town	County	State	Federal	Other	Total
FEMA-947-DR CA	6/28/1992	$15	$0	$137	$610	$0	$763
Total		**$15**	**$0**	**$137**	**$610**	**$0**	**$763**

Date	Location in miles away from City center	Magnitude
07/08/1986	33.07	6.1
02/28/1990	30.18	5.7
04/04/2010	149.75	5.7
11/27/1992	25.48	5.6
07/29/2008	33.88	5.5
06/28/1992	19.86	5.3
07/09/1992	23.41	5.3
08/17/1992	20.70	5.3
02/10/2001	20.99	5.3
12/16/1988	29.31	5.2
12/04/1992	27.11	5.2
2/22/2003	25.94	5.2
12/06/2008	130.36	5.1
03/29/2014	51.46	5.1
04/06/1994	10.44	5
06/30/1979	21.05	4.9
06/29/1992	29.72	4.9
06/16/2005	9.92	4.9
07/14/1973	32.83	4.8
10/02/1985	4.23	4.8
05/18/2009	62.82	4.7
01/15/2014	17.47	4.4

Figure 28. USGS Shake Map for the 1992 M7.3 Landers Earthquake

(http://earthquake.usgs.gov/earthquakes/shakemap/sc/shake/Landers/)



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

9.3 Summary of Historical Wildfire Events

Table 29 provides a summary of losses incurred in historic wildfire events. The fire events and their impacts on the City of Redlands are described in the following section. No losses incurred by the city of Redlands since 2001.

Table 29. Response and Recovery Costs for Historic Wildfire Events
(Dollar Amounts in Thousands)

Hazard: Wildfires		Response and Recovery Costs					
Name	Date	City Town	County	State	Federal	Other	Total
Reche/Redlands Fires	7/4/2001	$21	$0	$0	$0	$0	$21
Compost Fire	7/16/1998	$24	$0	$0	$0	$0	$24
Canyon Fire	9/9/1996	$82	$0	$0	$0	$0	$82
Totals:		**$127**	**$0**	**$0**	**$0**	**$0**	**$127**

1. Reche/Redlands Fires 7/4/2001

This wind-driven fire originated in Riverside County, in an area known as Reche Canyon. The fire burned northeast over a period of approximately 2 hours, entering San Bernardino County and threatening residents in the area of San Timoteo Canyon and Pilgrim Road. We were notified by Riverside County that the fire was moving into our county and expected to burn into San Timoteo Canyon. They requested us to assemble engines for structure protection along Pilgrim Road in San Timoteo Canyon. The fire was diverted away from these structures because of backfiring operations, air support and hand crews into San Timoteo. Overall, the fire damaged approximately 700 acres by containment.

2. Compost Fire 7/16/1998

This fire occurred within the High Fire Hazard Area of the City of Redlands. This area is subject to a great deal of commuter and transient activity between counties. Fire was located at 1901 Alessandro Road, and caused by illegal dumping of organic materials within the San Timoteo Canyon. Chemical reaction resulted in spontaneous combustion of the compost heap at Sunset Hills Kennels. A unified command was established, including numerous Strike Teams, Hand Crews, Fixed Wing Aircraft, Helicopters and Manpower. The fire consumed 140 acres, and resulted in one firefighter injury.

3. Canyon Fire 9/9/1996

Sparking from railroad train traffic ignited this vegetation fire, which started adjacent to the Southern Pacific tracks north of San Timoteo Canyon Road and west of Alessandro Road. The high temperature was 99 degrees, with humidity at 24%. The fire was one-quarter acre in size, with medium fuel and moderate rate of spread. Winds were out of the west and steady, at 10 miles per hour. Limited access and erratic winds increased the spread of the fire, which spotted along the base of the hills, west of Smiley Ridge. The fire spread north, up the west slope of the Smiley Ridge subdivision. Winds increased, causing a spot fire in the flats east of Alessandro, adjacent to Sunset Hills Ranch. Increased erratic winds caused another spot fire to occur north of the first, now in heavier brush. Incoming resources attempted a hose lay up the flanks, but terrain and weather conditions advanced the spot out of reach. Due to topography and weather conditions, additional resources were ordered. Due to the fires potential, a unified command was established and structure groups assigned. Aircraft dropped on all flanks of the fire, and dozers cut lines on two divisions. Hand crews were also placed on all Divisions to facilitate a line between the burned and unburned areas. The fire was 50% contained around midnight and 70% contained by 0600 hours on 9/10/96. The fire consumed 250 acres, with no loss of structures. Effective suppression tactics, ignition resistant construction requirements, residential sprinklers, and fuel modification allowed this fire to move eastward with no structure loss or damage. The fire then presented the potential of structure loss in older existing neighborhoods where these types of fuel modification had not been conditioned 15-20 years previous. This posed a threat for conflagration potential, and this is where the Fire Department would like to address hazard mitigation through grant implementation for existing property owners. Costs shown in damage figures are strictly related to overhead, manpower and equipment.

9.4. Mitigation Flood Projects Summary

Table A-1. Flood Projects—Completed

Flood Control Project #	Details
F01087-3	*Name:* **West State Street Storm Drain, Segment 3** *Description:* Jacking of reinforced concrete pipe as part of a larger storm drain project to reduce flooding in an industrial area. *Status:* **Complete** *Completion Date:* 2005 *Total Cost:* $3,974,000 *Funding Description:* San Bernardino County Flood Control
F01577	*Name:* **County Line Channel** *Description:* Constructed concrete channel improvements *Status:* **Complete** *Completion Date:* 2005 *Total Cost:* $2,825,000 *Funding Description:* San Bernardino County Flood Control
F01646	*Name:* **San Timoteo Creek Basins** *Description:* Constructed channel improvements and 18 basins along the creek *Status:* **Complete** *Completion Date:* 2005 *Total Cost:* $57.5 million *Funding Description:* San Bernardino County Flood Control
	Name: **2014 Storm Drain Repair** *Description:* regained Structural integrity and improved the overall functionality of the storm drain system. *Status:* **Complete** *Completion Date:* 2015 *Total Cost:* $ 70,250.00 *Funding Description:* City of Redlands general fund

Table A-2. Flood Projects—Proposed

Project #	Title	Sponsor	Description
	Mission Zanja	City of Redlands	Prevent Flooding by improving drainage in the Mission Zanja area *Status:* Proposed in the 2014 master plan of drainage Completion Date: Proposed timetable for completion has not been set *Local Priority:* High *Total Cost:* $15.92 Million *Funding Description:* Unavailable at this time *Project Selected for:* Necessary improvements to prevent flood damage *Hazard Mitigated:* Potential failure & flooding downstream *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High
	Reservoir Canyon	City of Redlands	Prevent Flooding by improving drainage in the Reservoir Canyon area *Status:* Proposed in the 2014 master plan of drainage Completion Date: Proposed timetable for completion has not been set *Local Priority:* High *Total Cost:* $3.33 Million *Funding Description:* Unavailable at this time *Project Selected for:* Necessary improvements to prevent flood damage *Hazard Mitigated:* Potential failure & flooding downstream *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High
	Downtown	City of Redlands	Prevent Flooding by improving drainage in Downtown area *Status:* Proposed in the 2014 master plan of drainage Completion Date: Proposed timetable for completion has not been set *Local Priority:* High *Total Cost:* $10.21 Million *Funding Description:* Unavailable at this time *Project Selected for:* Necessary improvements to prevent flood damage *Hazard Mitigated:* Potential failure & flooding downstream *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High

Project #	Title	Sponsor	Description
	South City	City of Redlands	Prevent Flooding by improving drainage in the South City area *Status:* Proposed in the 2014 master plan of drainage Completion Date: Proposed timetable for completion has not been set *Local Priority:* High *Total Cost:* $5.98 Million *Funding Description:* Unavailable at this time *Project Selected for:* Necessary improvements to prevent flood damage *Hazard Mitigated:* Potential failure & flooding downstream *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High
	North City	City of Redlands	Prevent Flooding by improving drainage in North City area *Status:* Proposed in the 2014 master plan of drainage Completion Date: Proposed timetable for completion has not been set *Local Priority:* High *Total Cost:* $4.69 Million *Funding Description:* Unavailable at this time *Project Selected for:* Necessary improvements to prevent flood damage *Hazard Mitigated:* Potential failure & flooding downstream *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High

Table A-3. Drought Projects --- Proposed

Project #	Title	Sponsor	Description
(Ord. 2151 § 1, 1991)	Water Conservation Plan	City of Redlands	Enforces water restrictions to reduce the nonessential use of water to conserve city water supplies *Status:* Continuous project that will be adjusted based on the city's water needs and drought conditions Completion Date: Ongoing *Local Priority:* High *Total Cost:* 20,000 *Funding Description:* General Fund *Project Selected for:* Water Conservation *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High

Table A-4. Wildfire Projects --- Proposed

Project #	Title	Sponsor	Description
	Vegetation Management mitigation inspection	City of Redlands	Identify parcel in high fire zone area , Inspect each parcel for fire code and vegetation management *Status: Annual Project* Completion Date: Ongoing Local priority high Total Cost:18,600 *Funding Description:* General Fund *Project Selected for: Wildfire Prevention* *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High
	Vegetation Reduction	City of Redlands	*Reducing weed abatement and defensible spacing* *Status: Annual Project* Completion Date: Ongoing Local priority High Total Cost:20,000 *Funding Description:* General Fund *Project Selected for: Wildfire Prevention* *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High
	Fire Resistant community Project	City of Redlands	Fire resistant outreach to the community promoting fire safety *Status: Annual Proposed* Completion Date: Ongoing Local priority Medium Total Cost: *Funding Description:* General Funded *Project Selected for: Wildfire Prevention* *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High

Table A-5. HAZ-MAT --- Proposed

Project #	Title	Sponsor	Description
	Household Hazardous Waste	City of Redlands	Reduce the quantity and frequency of household hazardous waste being dumped in the community and/or entering the landfill. *Status:* Ongoing Completion Date: Ongoing *Local Priority:* High *Total Cost:* $180,000 per year *Funding Description:* User fee included in Water and Waste Water Billing *Project Selected for:* Protect the environment *Hazard Mitigated:* Reduced threat of ground water contamination. *Resources to Implement:* Moderate *Cost to Implement:* Low *Time to Implement:* Ongoing
	County Hazardous Materials Responders	County of San Bernardino and City of Redlands	Limit the negative impacts associated with the inappropriate discharge of Hazardous Materials into the environment. *Status:* Ongoing Completion Date: Ongoing *Local Priority:* High *Total Cost:* $50,000 per year *Funding Description:* General fund and Household Hazardous Waste *Project Selected for:* Respond quickly and effectively to contain hazardous materials discharges. *Hazard Mitigated:* Hazardous Materials Spills *Resources to Implement:* High *Cost to Implement:* Moderate *Time to Implement:* Ongoing
	Self-Contained Breathing Apparatus	City of Redlands	Provide proper PPE *Status:* Seeking Assistance to Firefighters Grant Completion Date: Proposed timetable for completion has not been set *Local Priority:* High *Total Cost:* $750,000 *Funding Description:* Unavailable at this time *Project Selected for:* Necessary replacement of older equipment to maintain safety *Hazard Mitigated:* Haz Mat, Fires, WMD, CBRN *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* High

Table A-6. Earthquake --- Proposed

Project #	Title	Sponsor	Description
	Education and Outreach	City of Redlands	Provide education to homeowners that have older homes that are required retrofitting to prevent displacement of structures foundation and encourage them to secure large furniture and appliances. *Status:* Pending Completion Date: TBD 2016-2017 *Local Priority:* High *Total Cost:* $5,000 per year *Funding Description:* General fund *Project Selected for:* Retrofit older buildings for un-reinforced masonry. *Hazard:* Earthquake – Structural *Resources to Implement:* Low *Cost to Implement:* Low *Time to Implement:* 12-15 months
	Structural Retrofitting	City of Redlands	Prevent City owned facilities from unnecessary injury, structural shifting and damage by retrofitting the facilities with un-reinforced masonry. *Status:* Pending securing funding. Completion Date: TBD *Local Priority:* High *Total Cost:* $150,000 Approx. $6,000 per structure *Funding Description:* TBD – Pending securing funding *Project Selected for:* Retrofit City owned buildings for un-reinforced masonry. *Hazard:* Earthquake – Structural Retrofitting *Resources to Implement:* High *Cost to Implement:* High *Time to Implement:* 18-24 months

9.5. Additional Proposed Priority Projects with Mitigation Benefits

Designed or proposed specifically as mitigation projects, the City undertakes many activities that incorporate mitigation elements and integrate risk reduction as an additional benefit. The following describes a number of these projects which exemplify how the City's integrates hazard mitigation into county- wide programs. Projects have been grouped by the following categories: Studies/Plans, Codes/Ordinances, Infrastructure and Preparedness/Response.

PRIORITY HAZARDS	PROJECT	COST AND COMPLETION
#1 - Drought	Develop a drought emergency plan and trigger criteria to activate said plan. Establish MOU/Contracts with Water Districts and Suppliers	Completion Date: 12-18 Months Local Priority: High Total Cost: Unknown Funding: TBD Project: Develop emergency plan to implement as back up Resources: Personnel Cost to Implement: Low Time to Implement: Medium
#2 - Earthquake	Establish community preparedness and outreach on risks and hazards, emergency notification system and establish an inventory database of critical infrastructures and commercial buildings that are vulnerable due to unreinforced masonry.	Completion Date: 12-18 Months Local Priority: High Total Cost: $40,000 Funding: Unsecured at this time Project: Utilized Hazus to identify buildings and structures that are in high shaking zones. Resources: Personnel/GIS Mapping Cost to Implement: Medium Time to Implement: Medium
#3 – Hazardous Materials Chemical Spills	Create a Freeway closure task force to develop a master plan to include: Cal Trans, Highway Patrol, Police, Fire and Emergency Management, Environmental Health, Surrounding City and local government personnel.	Completion Date: 12-18 Months Local Priority: High Total Cost: Unknown Funding: TBD Project: Develop emergency freeway evacuation plan and alternate transportation route Resources: Personnel Cost to Implement: Low Time to Implement: Medium

9.6. Studies/Plans

The City of Redlands utilized the plans on following pages to identify risks and threats to develop mitigation strategies to minimum loss of life, property and environment. The plans provided an in depth overall impact to the community.

Title: San Bernardino County Desert Area Groundwater Inventory and Atlas.

***Sponsor*:** San Bernardino County Fire Department Office of Emergency Services.

Description: As of January 2011, the California Department of Water Resources anticipates releasing the Final Local Groundwater Assistance (LGA) Guidelines later this calendar year. In December 2009, the draft LGA Guidelines and Proposal Solicitation Package (PSP) was available for public comment. The comment period ended on January 12, 2010.

Local public agencies with authority to manage groundwater resources are encouraged to apply Examples of projects that may be considered are: Groundwater data collection, modeling, monitoring and management studies; monitoring programs and installation of equipment; basin management; development of information systems; and other groundwater related work.

The County of San Bernardino Board of Supervisors may consider an action directing staff to apply for the grant when it becomes available for a Desert Area Groundwater Inventory (DGI) and Atlas. The DGI falls within the scope of the Local Groundwater Assistance (LGA) Program, which is funded with Prop 84 IRWM funds anticipated to be available for fiscal year 2010-2011. Grants are limited to $250,000 per recipient, and total funding is $4.7 million.

California Department of Water Resources will give priority to local agencies with adopted groundwater management plans (SB1938 compliant), and which demonstrate collaboration with other local agencies in managing groundwater basins. County's groundwater management ordinance satisfies this requirement.

By having a Desert Area Groundwater Inventory and Atlas, this would enable the County to have a database providing locational and water depth information for specific regions of the County that currently do not have a groundwater inventory. This Inventory and Atlas would provide information applicable for flood mitigation or ground water availability for usage during severe drought. The location and water depth in the inventory are important for an earthquake hazard analysis, if liquefaction potential exists. Since there is not a Desert Area Groundwater Inventory currently, and if liquefaction is a concern in a specific region of the County, then the water depth data would estimate the vertical distance from the land surface to the top of the groundwater aquifer (i.e., the groundwater-saturated layer.)

Tentative Schedule for the LGA Grant

Date	Event
TBD	Release Final LGA Guidelines and PSP
TBD	Proposal Applications Due
TBD	Public Release of Draft Award Recommendations

Fund Source: Proposition 84

Title: Drainage Studies

Sponsor: Department of Public Works - Solid Waste Management Division

Description: Drainage studies including review of upstream properties, site drainage area, potential upstream development, and site specific development will help to mitigate damage from future storm events. San Bernardino County owns landfill sites, transfer stations and closed disposal sites where combined site property totals several hundred acres. Landfills and disposal site properties include acreage that has been constructed to design grades and may include improved drainage systems. Also, within most landfill and disposal site properties there are many acres of property that remain in its natural state including native vegetation and natural grades. During severe weather events both engineered areas and undisturbed areas are subject to erosion from storm run-off. The erosion can range from minor to severe depending on the storm event and amount of precipitation. Most sites where engineered drainage systems are in place hold up well experiencing only minor erosion and debris flow. However, during major storm events, runoff from native and unimproved areas carrying solids and debris flow may compromise downstream drainage systems and overwhelm system facilities. Much of the damage to landfill and disposal sites during the December 2010 Winter Storm event was caused by erosion with sediment carried from undeveloped/undisturbed areas or where no improved drainage system is in place.

Other events that may cause damage to property and structures include earthquakes, wildfires, high winds, extreme freezes, and lightning storms.

- Earthquakes have the potential of causing damage to site roadways, structures, and systems including concrete drainage systems, Landfill Gas systems (LFG) and Leachate Collection Recovery Systems (LCRS). With earthquakes there is always the potential of slope failure and slides on the landfill surface. Damage to any of these facilities has the potential to result in an inability to temporarily service the community.
- Many of the County's landfills, transfer stations, and closed disposal sites are situated in areas subject to wildfires. In 2003, the Old Fire burned through three separate sites and caused major damage at the Heaps Peak Transfer Station when the fire burned through the office building and Transfer Station site.

- High Winds can cause damage to temporary drainage structures, fencing, and metal structures. During past high wind events, Transfer Stations have experienced roof panels being torn from the beams. Landfill sites with exposed geo-synthetic liners may experience damage if the winds lift and tear the liners.
- In January 2007, the County experienced a loss of over $21,000 in damage when water pipes at three separate Transfer Stations froze, then burst, causing damage to offices and electrical equipment.
- Lightning storms have the potential to damage electrical components in scale houses, in-ground scales, LFG, and LCRS.

9.7. Codes/Ordinances

Title: Amendment to Title 6 County Code to Adopt by Reference the 2010 Editions of the California Building Standards Codes

Sponsor: All Departments

Description: An amendment to Title 6 of the County of San Bernardino Code to adopt by reference the 2010 Editions of the California Building Standards Codes went before the Board of Supervisors on November 2, 2010 and was continued for a second reading on November 16, 2010 and approved unanimously. The amendment became effective on January 1, 2011.

The County of San Bernardino amendment to Title 6 of the County Code to adopt by reference the 2010 Editions of the California Building Standards Codes repealed the current chapters of Division 3 of Title 6 that reflect the 1994/1995 editions of the California Building Standards Codes and adopt the 2010 editions of these codes by reference.

The California Building Standards Commission approved the California Building Standards Code (Code) for a statewide effective date of January 1, 2011 and requires this Code apply in all parts of the state. This Code consists of the California Building, Residential, Plumbing, Mechanical, Electrical, Energy, Historical Buildings, Existing Building (Unreinforced Masonry) and the Green Building Standards Codes. Since this 2010 Edition was adopted by local ordinance the prior editions of this code will be repealed and the most recent editions of the codes with applicable amendments requiring express findings and certain appendices necessary for the health and safety of the citizens of this County will be in effect within the unincorporated areas of San Bernardino County. The benefit of adopting this Code is that it provides consistency and clarification for the building community as well as building inspectors and plans examiners. State law (Health & Safety Code 18941.5 and 17958.7) requires the local government make express findings in order to amend building standards and the amendments must be necessary due to local climatic, geological, or topographical conditions.

Those amendments and findings are included in the County's ordinance and were filed with the California Building Standards Commission.

The recommended modifications not requiring express findings are administrative or procedural in nature and concern the local implementation issues that are not covered by building standards.

An example of this type of modification is to the California Residential Code, Section R105.3.1.1 which requires the Board of Appeals to confirm substantial valuations in the flood plain. The traditional purpose of the Board of Appeals has been reserved for a contested decision of the Building Official, and it is felt that it should remain as such.

With respect to grading and excavation regulations found in Appendix J of the 2010 State published code, the 2001 California Building Code dealt with grading with more clarity in regards to what activities require a permit and set forth rules to ensure large grading projects are

scrutinized in greater detail than smaller projects by requiring more reporting and inspection of such work. The grading chapter in the 2001 Code has been trusted and in use in its primary form for years. The 2010 Appendix J grading chapter needs substantial amendment and modification to address all grading issues and is not recommended for adoption in its present form. The Board adopted the 2001 Appendix Chapter 33 regulations as part of this proposed ordinance. Relocation permit requirements have been moved to a new section of the Code, and it retains specific standards for relocation procedures in details not found in the 2010 State-published code. Clarification of the types of buildings affected by the new regulations has also been made.

Administrative changes to the 2010 California Existing Building Code (Part 10 of Title 24) were approved to outline the procedures required to set allowable time limits for the retrofit and repair of unreinforced masonry buildings. Staff is also recommending that authorization be given to the Building and Safety Division of the Land Use Services Department to issue Administrative Citations as an alternative means of enforcement of the County Code provisions.

Express findings are made for changes to the California Plumbing Code, Appendix K regarding the soil conditions that exist in this county. These changes are supported by the Environmental Health Division. These express findings are iterated in the ordinance and will be filed with the Building Standards Commission as required by law in order to become effective.

Title: Water Efficient Landscape Ordinance

Sponsor: All Departments

Description: Over the years, the State of California has been promoting water conservation for all new development within the State. In a drought-prone California, where approximately 60 percent of all residential water is used in landscape applications, California lawmakers have adopted such legislation as Assembly Bill (AB) 325 (1990), AB 2717 (2004), and AB 1881 (2006) that outline, and in some instances mandate, the practice of water conservation in landscape applications. As part of AB 325, the Department of Water Resources (DWR) was charged to assemble a task force of stakeholders representing the landscape, water, and building industries as well as cities, counties, and other agencies that would help DWR prepare and promote the State's first Model Water Efficient Landscape Ordinance (MWELO).

While AB 325 did not require cities, counties, and other agencies within the State to comply with the first adopted MWELO, it did encourage local agencies to implement water conservation techniques into their local ordinances and codes. The County adopted Administrative Guidelines which were amended several times and ultimately given the status of "regulation" when they were incorporated into the Development Code (Chapter 83.10) during the 2007 General Plan Update process.

In 2006, State lawmakers adopted AB 1881, which gave guidelines and timelines for revision of the State's MWELO and mandated that every city, county, or other agency within the State of California adopt the State's revised MWELO, or be in compliance with it through their own ordinance, by January 2010. Local agencies are required to report their final action, along with findings of ordinance effectiveness, to DWR by January 2011. While this process was underway, Senate Bill X7-7 was enacted (2009). This bill requires the State of California to

achieve a 20 percent reduction in urban per capita water use by December 31, 2020; additionally, it requires the State to make incremental progress towards this goal by reducing per capita water use by at least 10 percent by December 31, 2015. These requirements were incorporated into the MWELO and, in February 2008, DWR made a draft of the State's revised MWELO available to all cities, counties, and other agencies within the State. The final version of the revised MWELO was released in September 2009.

Upon review of the final version of the State's MWELO and the provisions of AB 1881, staff determined the County would need to revise Development Code Chapter 83.10 which sets forth landscaping and irrigation standards within the unincorporated areas of the County. This would in part, become a mitigation measure to assist with any drought hazard the County may encounter. In the meanwhile, the County began enforcing the State's revised MWELO in January 2010, as required by law. Once the proposed changes to the Development Code have been adopted by the Board of Supervisors, staff will notify and forward all required information regarding the adoption and effectiveness of the County's Water Efficient Landscaping Ordinance to the State DWR as required by January 2011.

The proposed Development Code Amendment will revise the landscaping standards to reflect the changes governed by and to be as effective as, the State of California's revised Model Water Efficient Landscape Ordinance, while continuing to recognize the unique character of the regions that make up the County of San Bernardino.

The ***proposed revisions*** will require the applicant/developer to:

- Design and install systems that meet more effective and efficient water conservation standards in all landscaped areas on a project site, including residential;
- Comply with the revised standards for all new and rehabilitated landscape areas regardless of square footage for projects that are not homeowner installed and for all new and rehabilitated landscape areas, that are homeowner installed, that are 5,000 square feet or greater. This includes the following:
  - Submit a comprehensive Landscape Documentation Package, which has been prepared by a landscape architect licensed to work in the State of California or other licensed professional authorized to design and prepare Landscape Plans within the State of California;
  - Submit estimated annual water budget calculations for compliance with water conservation practices and the efficient use of water for each new or rehabilitated landscape. Calculations for the annual water budget for a project/site specific landscape shall use the formulas for the Maximum Applied Water Allowance (MAWA) and the Estimated Annual Water Use (EAWU) outlined in the ordinance;
  - Submit a Landscape Certificate of Compliance prepared by the landscape professional who prepared the Landscape Documentation Package conveying the project's compliance with the requirements of Development Code prior to final inspection;
  - Planting material within landscaped areas shall be chosen based on the information found in the Water Use Classification of Landscape Species, third edition (WUCOLS III)

and the climate zone for the region based on information found in Sunset Western Garden Book;

- Irrigation systems shall be equipped with a "smart" irrigation controller, which automatically adjusts the frequency and/or duration of irrigation events in response to changing environmental conditions.
- Submit a rough and/or precise grading plan on all projects proposing more than 50 cubic yards of grading;
- Submit a soil management report, that includes recommendations for soil modification and/or amendment;
- Submit a project-specific regular maintenance schedule and two project-specific irrigation schedules for those projects subject to the ordinance.

Other provisions of the new regulations include standards for non-potable/recycled water use where it is available and new enforcement standards for compliance with water conservation practices.

Since the State law became effective on January 1, 2010, the Landscape Plan Review Fee was adjusted (Ordinance #4412, June 22, 2010) to reflect the increase in staff time necessary to meet these additional requirements.

The Planning Commission considered this ordinance on October 21, 2010. There was no one at the hearing who wished to address the Commission on this issue. The Commission recommended that the Board adopt the ordinance as presented on a vote of four commissioners in favor and one absent.

The proposed amendment is exempt from the California Environmental Quality Act (CEQA) in accordance with Section 15061(b) (3) of the CEQA Guidelines as the proposed change does not have the potential to cause a significant effect on the environment.

The proposed Ordinance is to be presented to the County of San Bernardino Board of Supervisors for adoption in the first quarter of 2011. Utilizing either the State Water Efficient Landscape Ordinance, which is in effect currently, or the County's specific Water Efficient Landscape Ordinance; the drought mitigation for this hazard is positive.

9.8. Infrastructure

Title: Critical Route Planning Committee

Sponsor: San Bernardino County Fire Department Office of Emergency Services

Description: San Bernardino County Fire Department Office of Emergency Services has a "Critical Route Planning Committee" that is developing countywide routes and alternate routes for use in evacuating residents from a disaster area while simultaneously allowing first responders' access into a disaster area without congestion and gridlock. The Committee members are from County departments, City and Town representatives, and key state and federal agencies. The Critical Route Planning effort is being coordinated with surrounding counties to prevent congestion and gridlock at the County boundaries. The Critical Route Planning Committee Routes and maps should be completed in 2011.

Title: Arrowbear Drive Realignment and Widening

Sponsor: San Bernardino County

Description: The Arrowbear community off State Highway 18 has limited access to State Highway 138. The existing bridge/spillway and road needs to be realigned and widened to facilitate access by emergency personnel during wildfires and flooding.

Strategy: Remove and replace existing bridge/spillway, realign and widen the road

Status: Proposed

Completion Date: Future project

Local Priority: 1

Total Cost: $2,000,000

Funding Description: Seek grant funding

Title: Cedar Glen Fire Access

Sponsor: San Bernardino County Fire Department Office of Emergency Services

Description: Lack of paved roads inhibits traffic circulation and the ability to enter and exit the area without backtracking during wildfire emergencies.

Strategy: Construct road and drainage improvements to Little Bear Creek Road and Elder Drive

Status: Proposed

Completion Date: Future project

Local Priority: 1

Total Cost: $2,500,000

Funding Description: Seek grant funding

Title: Institution Road

Sponsor: San Bernardino County

Description: Institution Road is the only paved access road for the Glen Helen Rehabilitation Facility and is often closed due to flooding and debris flows

Strategy: Create an all-weather access road for the Glen Helen Rehabilitation Facility, by constructing pipes, arch culverts or other bridge structures

Status: Proposed

Completion Date: Future project

Local Priority: 1

Total Cost: $6,000,000

Funding Description: Seek grant funding

9.9. Preparedness/Response

Title: City of Redlands Disaster Council

Sponsor: City of Redlands

Description: In October 2013, the City of Redlands has re-implemented its Disaster Council. The meetings are Chaired by the Mayor and Co-Chaired by the City Manager. Disaster Council meetings provide for communication and coordination between the public and private sectors in the City in analyzing and developing plans, projects, policies, and procedures for emergency operations.

Title: Community Emergency Response Team (CERT)

Sponsor: City of Redlands

Description: The City of Redlands recently re-implemented CERT training in October 2013. This three day course will provide the citizens of Redlands the much needed training to prepare in an event of emergency or a disaster.

Currently, the city has 150 people trained in personal preparedness.

Title: Emergency Notification System

Sponsor: City of Redlands

Description: In February 2014, the City of Redlands implemented its Emergency Notification System. This system will communicate emergency and other urgent messages to residents and community members within Redlands.

The system uses both text and voice messages to keep residents and community members in Redlands informed in case of emergencies that affect areas in which they live or work. With this information, residents and businesses can make arrangements to help ensure the safety of family members, employees, pets, and property in the event of fires, floods, earthquakes, or other types of disasters.

In the event of an emergency, residents and community members will receive a message with the latest information and safety instructions.

The system is programmed to know whether or not the message has been delivered to a person, recorded to voicemail, or was not delivered due to a telephone system error. The system will continue to attempt to deliver its message until the message is successfully delivered to a person, or until the message expires.

The system utilizes the area's 9-1-1 database, provided by the local telephone company, and thus is able to contact land-line telephones whether listed or unlisted.

Title: Mass Care and Shelter

Sponsor: San Bernardino County Fire Department Office of Emergency Services

Description: After the 2003 Wild land Fires, the County and American Red Cross recognized the need to provide services beyond basic care and short-term sheltering, especially during large fires, floods, and earthquakes. Under the 2007/2008 City of Los Angeles Regional Catastrophic Planning Grant Program (RCPGP), three employees were hired to address the issue and support mass care projects.

The Mass Care & Shelter Plan and Concept of Operations, outlines the framework of a new one-stop shelter concept, Shelter Operations Compound (SHOC). It combines a shelter, a Local Assistance Center (LAC) and a Non- LAC Unit in one easy location. Residents can access public information and referral services through the LAC, and then take a short walk to the Non-LAC Unit for communication, postal services, and other private organizations/business at little to no cost. The completion of the Plan in 2012 will help to sync local resources, encourage local self-sufficiency, foster partnership between public and private agencies, and serve as a reference document for the region.

To increase Mass Care and Shelter capability of the county, grants from 2008-2009 Homeland Security Grant Program (HSGP) and 2009 Riverside Regional Urban Area Security Initiative (UASI) funded the Mass Care and Shelter Trailer/Cache Program. In December 2012, the program will have procured 36 trailers/caches equipped with mass care and shelter supplies, strategically placed throughout the County and ready for rapid deployment. It is expected to serve over 7,200 residents. In addition to enhancing the comfort levels of shelter residents, the program will produce standardized documents and protocols for procuring and maintaining Mass Care and Shelter trailers/caches. These plans and programs will help the County prepare for and mitigate damages from hazards. The City of Redlands obtained one of the 200 person trailers in December 2013.

Title: California Disaster Corps

Sponsor: San Bernardino County Fire Department Office of Emergency Services

Description: San Bernardino County is one of five counties in the State of California that received a grant from California Volunteers to develop a "first-in-the-nation" Disaster Corps Program. The grant provides for materials and two grant-funded contract positions to coordinate and administer the new program. California Disaster Corps is the realization of a vision by Governor Arnold Schwarzenegger "to professionalize, standardize and coordinate highly trained disaster volunteers statewide."

The San Bernardino County Disaster Corps Program will help mitigate the effects of a major disaster, such as an earthquake, by insuring members are prepared to care for themselves, those in their home and others in their immediate neighborhood. This will relieve the need for response by professional rescuers and allow them to focus much-needed resources on more critical life-saving needs. Disaster Corps Members will participate in educating the community in personal preparedness as well. Once fully trained, Disaster Corps Members will act as a valuable, well-trained volunteer resource to assist professional responders in extinguishing small fires, light search and rescue, and disaster medical operations during a large incident. Additional Disaster Corps abilities may include mass-care and shelter operations. The San Bernardino County Office of Emergency Services plans to complete the training, preparation and organization of the initial 200-member Disaster Corps Program in 2012.

Title: 2012 Golden Guardian Exercise

Sponsor: San Bernardino County Operational Area

Description: The San Bernardino County Operational Area will be participating in the 2012 Golden Guardian Exercise (GG12) which will focus on the Southern California Regional Catastrophic Plan (SCRCP). This plan is based on a 7.8 magnitude earthquake scenario along the southern section of the San Andres Fault.

The purpose for participation in the 2012 Golden Guardian Exercise is to address the County's potential to respond to a catastrophic earthquake event based on the plan, and to better prepare for such an occurrence. The goal of the exercise will be to conduct an effective multiagency/multi-jurisdictional evaluation of the Regional Catastrophic Plan with our Operational Area response partners.