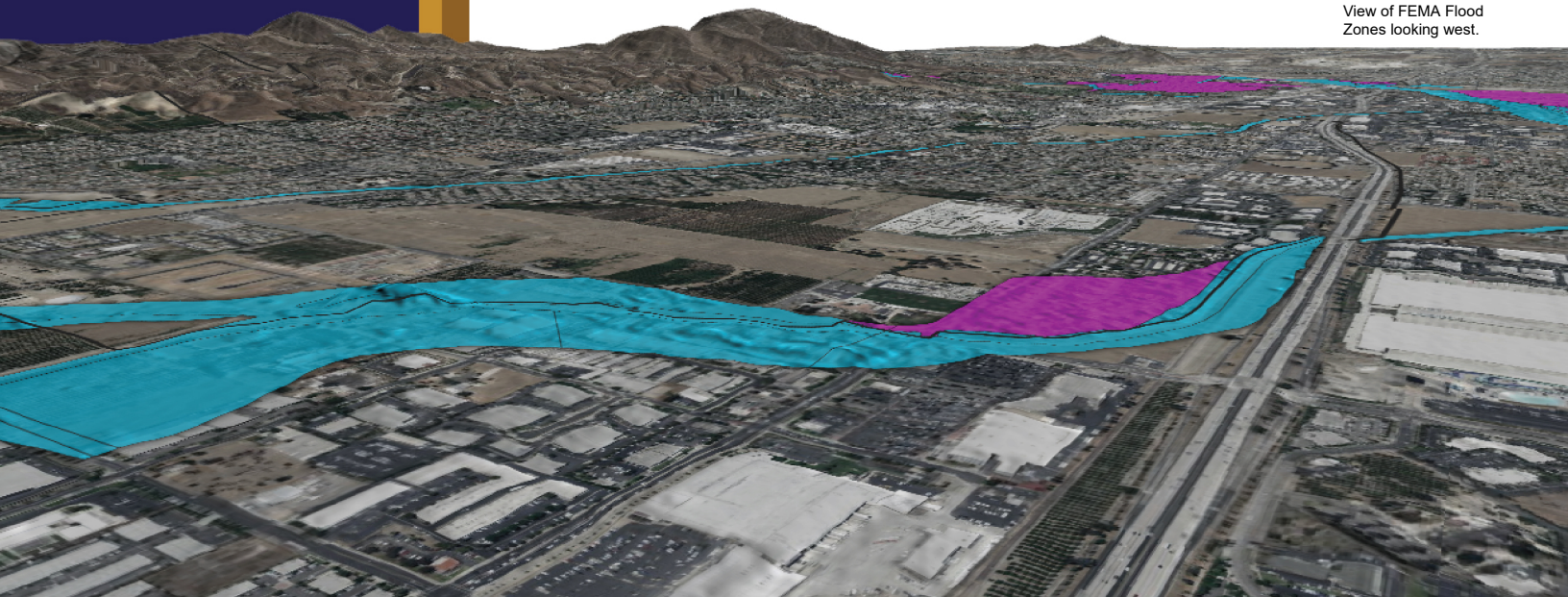
CITY OF LOMA LINDA

LOCAL HAZARD MITIGATION PLAN

CITY OF LOMA LINDA
FIRE DEPARTMENT
25541 BARTON ROAD
LOMA LINDA, CA 92354



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View of FEMA Flood Zones looking west.

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Section 1. Introduction

Natural disasters cause death and injuries, as well as significant damage to our communities, businesses, public infrastructure, and environment. These damages result in people's displacement and tremendous costs due to response and recovery dollars, economic loss, and burden. The 2021 City of Loma Linda Hazard Mitigation Plan Update is an effort undertaken by the City to mitigate the effects of natural hazards and return to "the norm" sooner with fewer impacts on people and infrastructure.

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. While natural disasters cannot be prevented from occurring, the effects of natural disasters can be reduced or eliminated through a well-organized public education and awareness effort, preparedness activities, and mitigation actions.

After disasters, repairs and reconstruction are often completed in such a way as to restore to pre-disaster conditions. Such efforts expedite a return to normalcy; however, the replication of pre-disaster conditions results in a cycle of damage, reconstruction, and repeated damage. Hazard mitigation ensures that such cycles are broken and that post-disaster repairs and reconstruction result in increased resiliency for the City of Loma Linda residents, business owners, and city officials.

The HMP update 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 comply with regulations and Federal mitigation grant conditions. In that spirit, this HMP is an update of the 2011 City of Loma Linda Hazard Mitigation Plan. This HMP presents updated information regarding hazards affecting the City of Loma Linda.

1.1 The City of Loma Linda

The City of Loma Linda was incorporated on September 29, 1970. Loma Linda is located in San Bernardino County between the Cities of Grand Terrace and Redlands. This eight-square-mile community has an average elevation of 1,053 feet. (City of Loma Linda Local Hazard Mitigation Plan, 2011)

The City of Loma Linda is located in the Santa Ana River watershed, which includes much of Orange County, the northwestern corner of Riverside County, the southwestern corner of San Bernardino County, and a small portion of Los Angeles County. The Santa Ana River bisects the City of Colton, just to the northwest of the City limits. San Timoteo Creek, a tributary of the Santa Ana River, bisects the City of Loma Linda. (City of Loma Linda General Plan, 2009)

1.2 Purpose of the Plan

Hazard mitigation intends to reduce and/or eliminate loss of life and property. FEMA defines hazard mitigation as "any action taken to reduce or eliminate the long-term risk to human life and property from

natural hazards." FEMA defines a "hazard" 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 HMP demonstrates plans and actions for reducing or eliminating risk in the City of Loma Linda. The HMP process encourages communities to develop goals and projects to reduce risk and build a more disaster-resilient community by analyzing potential hazards.

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 by identifying measures that make the City of Loma Linda safer and more disaster resilient *before a disaster occurs*. Mitigation generally involves altering natural and human-made physical environments, significantly reducing 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. With an approved and adopted HMP, the City of Loma Linda will be eligible for federal disaster mitigation funds/grants under the Hazard Mitigation Assistance Program, discussed in Section 6, aimed to reduce or eliminate risk.

1.3 Authority

In 2000, FEMA adopted revisions to the Code of Federal Regulations. This revision is known as the "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 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 and agencies.

Senate Bill No. 379 will, upon the next revision of a local hazard mitigation plan on or after January 1, 2017, or, if the local jurisdiction has not adopted a local hazard mitigation plan, beginning on or before January 1, 2022, require the safety element to be reviewed and updated as necessary to address climate adaptation and resiliency strategies applicable to that city or county.

1.4 What's New

This section includes background information on the 2011 HMP and this HMP Update. The 2011 mitigation actions were reviewed and have been changed, updated, and revised to reflect new priorities in this HMP. Only the information and data still valid from the 2011 Plan were carried forward as applicable to this HMP update. The sections below describe the planning process for this update. This update profiles the following nine hazards: wildfire, earthquake, drought, climate change, hazardous materials, terrorism, flood, slope failure, airplane hazards.

1.4.1 New Hazard Profiles

In addition to the hazards profiled in the 2011 HMP (earthquake, flooding, and wildfire), this update recognizes drought, climate change, hazardous waste & materials, human-caused hazards including terrorism and airplane hazards, and slope failure. This decision was based on changes in priorities and development that were acknowledged during the hazard prioritization process performed by the Planning Committee during Meeting #1 and is explained in detail in Section 4.

1.4.2 Integrating the HMP into Other Planning Mechanisms

Over the past decade, the 2011 HMP was incorporated into other planning mechanisms, demonstrating progress in local hazard mitigation efforts.

- The City's General Plan was adopted in 2009 and incorporated the hazard mitigation plan by reference.
- The City improved its water conservation standard during the 2015-2017 droughts, utilizing data from the HMP to aid in its decision making.
- The City has continued to address flooding through resiliency projects for the San Timoteo Creek Channel.
- The City regularly updates building codes consistent with the most up-to-date California building codes and uses the opportunity to revisit the hazard mitigation plan in that context. This includes the adoption of the wildland-urban interface code, first adopted in 2008. The last revisions were in 2019.

Section 5.3 is a Capabilities Assessment of the City's current capabilities, and Section 6.5 identifies future opportunities to expand or improve integration of the HMP with others planning mechanisms.

1.4.3 Mitigation Successes

The City has been guiding and implementing policies and mitigation actions in the 2011 Loma Linda HMP through various ongoing projects, plans, and programs. The City has made improvements toward reducing natural hazard risks to life and property. The City completed three of the four identified mitigation actions from the 2011 Plan, and the fourth mitigation action is ongoing. Section 5.4.4 summarizes those completed mitigation actions with additional detail highlighted below.

New mitigation actions were developed to reflect changes in priorities and development and further explained in Section 5.5.

Table 1-1. Completed Mitigation Actions

Hazard Type	Status	Year	Primary Agency	Title/Description
Earthquake	Completed/ Under Construction	2005	Loma Linda University Medical Center	Loma Linda University Medical Center: Seismic Retrofit Project

Earthquake	Completed	2011	Public Works	Anderson Bridge Seismic Retrofit to bring bridge up to current earthquake standards.
Flood	Partially Completed	2011	City of Loma Linda	Zanja Channel Improvement to improve channel flow in conjunction with the realignment of Redlands Blvd. and California Street project.

1.4.3.1 Success Story: Loma Linda University Medical Center

Figure 1-1. Emergency Water Tanks for Med. Center

The new Loma Linda University Medical Center is scheduled to open in the summer of 2021. The new tower will be the tallest hospital in California and the highest building in San Bernardino County at 268 feet. The current hospital did not meet seismic standards for medical facilities. The new Center includes many seismic safety features. As the Center describes, "[a]t its foundation, the building sits on 126 building isolators. Each weighing nearly 10 tons, the isolators are designed to absorb horizontal ground motion during an earthquake while allowing the building to only move in a minimal way. Surrounding the building is a four-foot 'moat,' which will allow for additional protection to the building in an earthquake." (Loma Linda University Health, 2019) The facility includes four 25,000-gallon water tanks as an emergency water supply to keep operations running in case of an emergency that interrupts regular water supplies, as seen in **Figure 1-1**. The Center also includes flexible pipes shown in **Figure 1-2**. The Medical Center has plans for a vertical seismic retrofit which has been purchased and now needs to be installed onto the building.

Figure 1-2: Flexible pipes in new Loma Linda University Medical Center

Source: Loma Linda University Health Vision 2020

1.5 Community Profile

1.5.1 Physical Setting

The City of Loma Linda follows a roughly square pattern of approximately eight square miles. It lies in the southern portion of the San Bernardino Valley. Loma Linda is bordered on the east by the City of Redlands, on the north by the City of San Bernardino (and I-10 freeway), on the west by the City of Colton, and on the south by the Badland Hills and the Riverside County line. Loma Linda is a part of the Santa Ana River watershed. It gradually rises in elevation from 1053 feet to 1850 feet, progressing south toward Badland Hills and the Riverside County line.

1.5.2 History

Loma Linda was initially settled during the Spanish/Rancho period, beginning in 1769 and continuing through 1848. It began when an Asistencia, also known as an outpost of the San Gabriel Mission, was erected in the region. When the mission era began to recede, the region became a part of a land grant

known as Rancho San Bernardino. The area then transitioned into an agricultural area known for producing citrus crops.

Towards the end of the 1800s, railroad companies began to encourage the development of tourist hotels along their routes. Loma Linda became one of these developments, and it was known as Mound City. While the original community was initially established in 1876, by the early 1880s, the property had been acquired by the Mound City Land and Water Company. The company developed a water pipeline that ran northwest from the Scott Canyon Drainage to the platted community cottages, shops, and the $30,000 Mound City Hotel. However, the planned residential development project ultimately failed.

A second plan was then initiated, this time in the last decade of the 1800s. A group of Los Angeles businessmen and physicians purchased the hotel and reopened it as a health resort and convalescent hospital resort called Loma Linda, which means "pretty hill" in Spanish. They promoted it as "The Switzerland of America where health and pleasure are twins." This plan also failed, and the Loma Linda Hotel closed again in 1904. After that, it was referred to as Lonely Linda for a time.

In 1905, the Seventh-day Adventist Church purchased the former resort property, re-opened the sanitarium, and established a nursing school. The "College of Medical Evangelists" was opened in 1909, becoming Loma Linda University in 1961.

The College developed into a renowned regional medical center, and the town expanded as a college community. Orchards continued as an important portion of the economic base into the 1920s and remain part of the character of Loma Linda. By the 1940s, the community had matured into a developed suburb of San Bernardino. Loma Linda was incorporated as a city in 1970. (City of Loma Linda Local Hazard Mitigation Plan, 2011)

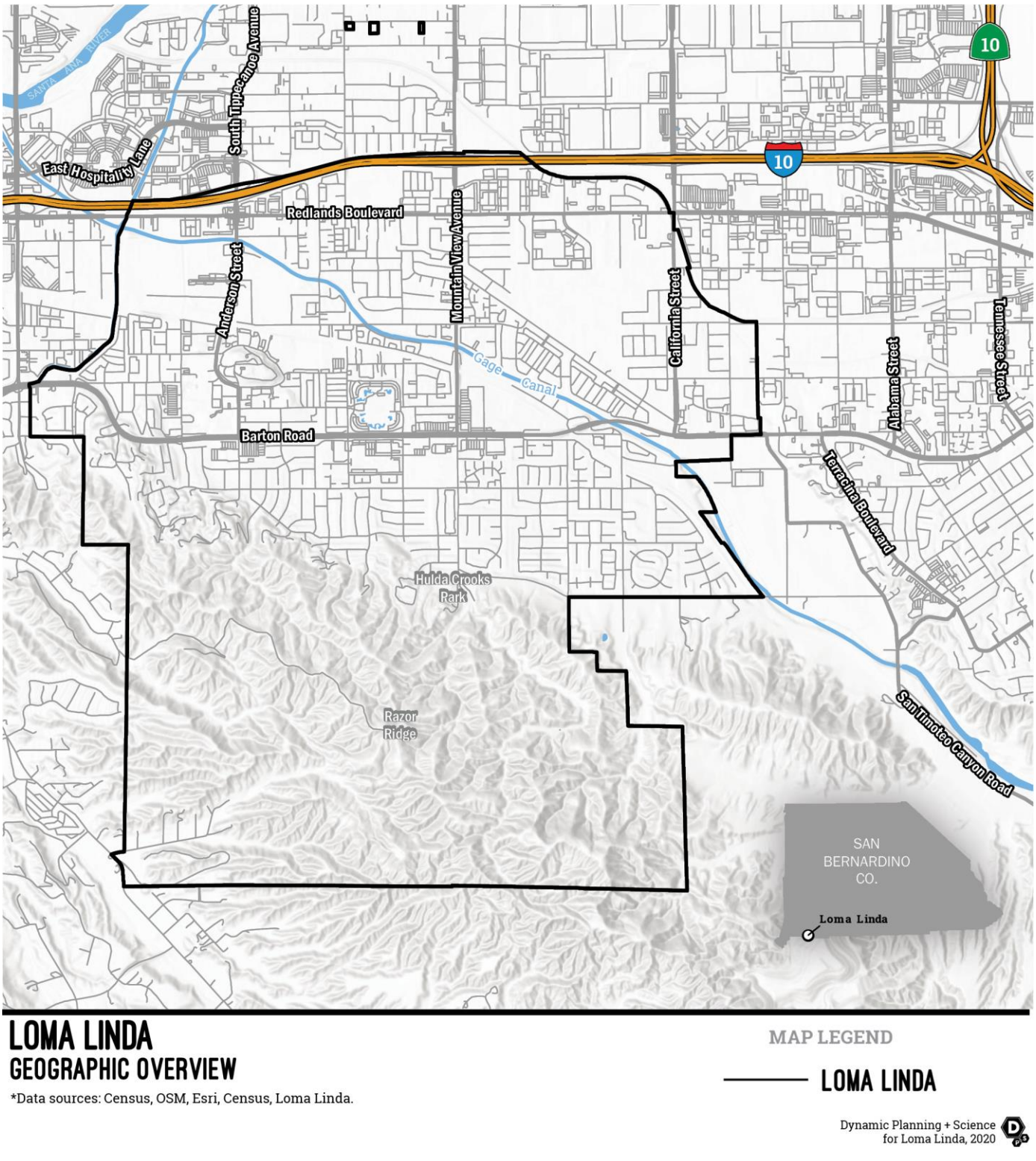

Figure 1-3: Location of the City of Loma Linda, CA

1.5.3 Climate

The City of Loma Linda is located in an area within the South Coast Air Basin (Basin). The Basin includes Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino Counties. The terrain and geographical location determine the Basin's climate. The Pacific Ocean forms the southwestern boundary of the Basin, and high mountains surround the other outer edges. The region lies in the semi-permanent high-pressure zone of the eastern Pacific. The resulting climate is mild and tempered by cool ocean breezes. This climatological pattern is rarely interrupted. However, periods of extremely hot weather, winter storms, and Santa Ana wind conditions do occur.

Winds in the vicinity of the Planning Area blow predominantly from the east-southeast, with relatively low velocities. Wind speeds in the Planning Area average about four mph. Summer wind speeds average slightly higher than winter wind speeds. Low average wind speeds and a persistent temperature inversion limit the vertical dispersion of air pollutants throughout the Basin. Strong, dry, north or northeasterly winds known as Santa Ana winds occur during the fall and winter months, dispersing air contaminants. The Santa Ana conditions tend to last for several days at a time. (City of Loma Linda General Plan, 2009)

1.5.4 Demographics and Vulnerable Populations

The population, economic, and housing factors of the City of Loma Linda are described in this section. Understanding these socioeconomic factors is imperative to determining the potential impacts a natural hazard event can have on the City's population and economy.

1.5.4.1 Population

According to the 2019 US Census, the population of Loma Linda was 24,482. The City of Loma Linda has 3,094 people per square mile. According to the US Census population estimates, the City's population has grown by 5% from 2010 to July 1st, 2019. (United States Census Bureau, 2019)

The racial makeup of Loma Linda is primarily White (54.3%). Asians account for 25.8 % of the population, followed by Hispanics or Latinos at 24.7% percent, and Black or African American at 12.2%. Mixed race persons make up 4.2% of the City. Native Americans constitute only 0.2% of the population, and Native Hawaiian and Other Pacific Islanders make up 1.3%. (United States Census Bureau, n.d.)(*Id.*)

1.5.4.2 Introduction to Vulnerable Populations

Importantly, demographics help identify which populations may be particularly vulnerable to hazard events. Some populations are at greater risk because of age, resources, physical abilities, or other factors. Vulnerability in the face of a hazard event is not a fixed characteristic; the same person may be at risk for some hazards but not at risk for others. For example, a low-income family without a car may be at risk for a wildfire or flood if a quick evacuation is necessary but prepared in the event of an earthquake. Some individuals are highly and permanently vulnerable to many hazards, such as the frail elderly, people living with chronic sensory, mobility, or cognitive impairments, and individuals dependent upon assistive

devices or complex medical regimens to survive. (National Center for Disaster Preparedness, 2020) Vulnerable populations also may be living in hazard-prone areas, compounding their risk.

In the context of all-hazards preparedness and response planning, **at-risk individuals** (often used interchangeably with "**vulnerable populations**") are defined federally as "children, pregnant women, senior citizens, and other individuals who have access or functional needs in the event of a public health emergency." (42 U.S.C. § 2802(b)(4)(B)(2019)) Examples of these populations may include but are not limited to, individuals with disabilities, individuals who live in institutional settings, individuals from diverse cultures, individuals who have limited English proficiency or are non-English speaking, individuals who are transportation-disadvantaged, individuals experiencing homelessness, individuals who have chronic medical disorders, and individuals who have a pharmacological dependency.

Natural resource managers may reduce the vulnerability of certain populations by increasing the adaptive capacity of affected communities. Examples include cost-sharing to reduce fuels, stabilize structures, or implement flood-reducing measures or educational programs offered in English and Spanish and targeted to specific populations. Specifically, planning for vulnerable populations in hazard mitigation can help prioritize resources where they will be the most effective.

This section explores the various demographic and economic circumstances surrounding common vulnerable populations.

1.5.4.2.1 Income and Housing Condition

Income or wealth is one of the most critical factors in natural hazard vulnerability. This economic factor affects the vulnerability of low-income populations in several ways. Lower-income populations are less able to afford housing and other infrastructure that can withstand extreme events. Low-income populations are less able to purchase resources needed for disaster response and are less likely to have insurance policies that can contribute to recovery efforts. Lower-income elderly populations are less likely to have access to medical care due to financial hardship. Because of these and other factors, low-income residences are far more likely to be injured or left without food and shelter during and after natural disasters.

Figure 1-4 shows the median household income distribution for the City of Loma Linda from 2013-2017. The "median" is the value that divides the distribution of household income into two equal parts (e.g., the middle). The average median household income in the City of Loma Linda between 2014 and 2018 was $53,371; in the United States, during the same period, the median house household income was $60,293. (United States Census Bureau, 2019)

The most vulnerable residents (in terms of income and housing condition) to natural hazards are located northwest of Barton Road.

1.5.4.2.2 Age

Children and the elderly tend to be more vulnerable during an extreme natural disaster. They have less physical strength to survive disasters and are often more susceptible to certain diseases. Elderly populations often also have declining vision and hearing and often miss reports of upcoming natural hazard events. Children, especially young children, cannot provide for themselves. In many cases, both children and the elderly depend on others to care for them daily.

Finally, both children and the elderly have fewer financial resources and frequently depend on others for survival. For these populations to remain resilient before and after a natural hazard event, it may be necessary to augment city residents with resources provided by city, state, and federal emergency management agencies and organizations.

As seen in **Figure 1-5**, the block groups with the highest concentration of people under 18 years old are located in the northern portion of the City (North of Barton Road). **Figure 1-6** shows that the highest concentration of people over the age of 65 is in the southwest portion of the City.

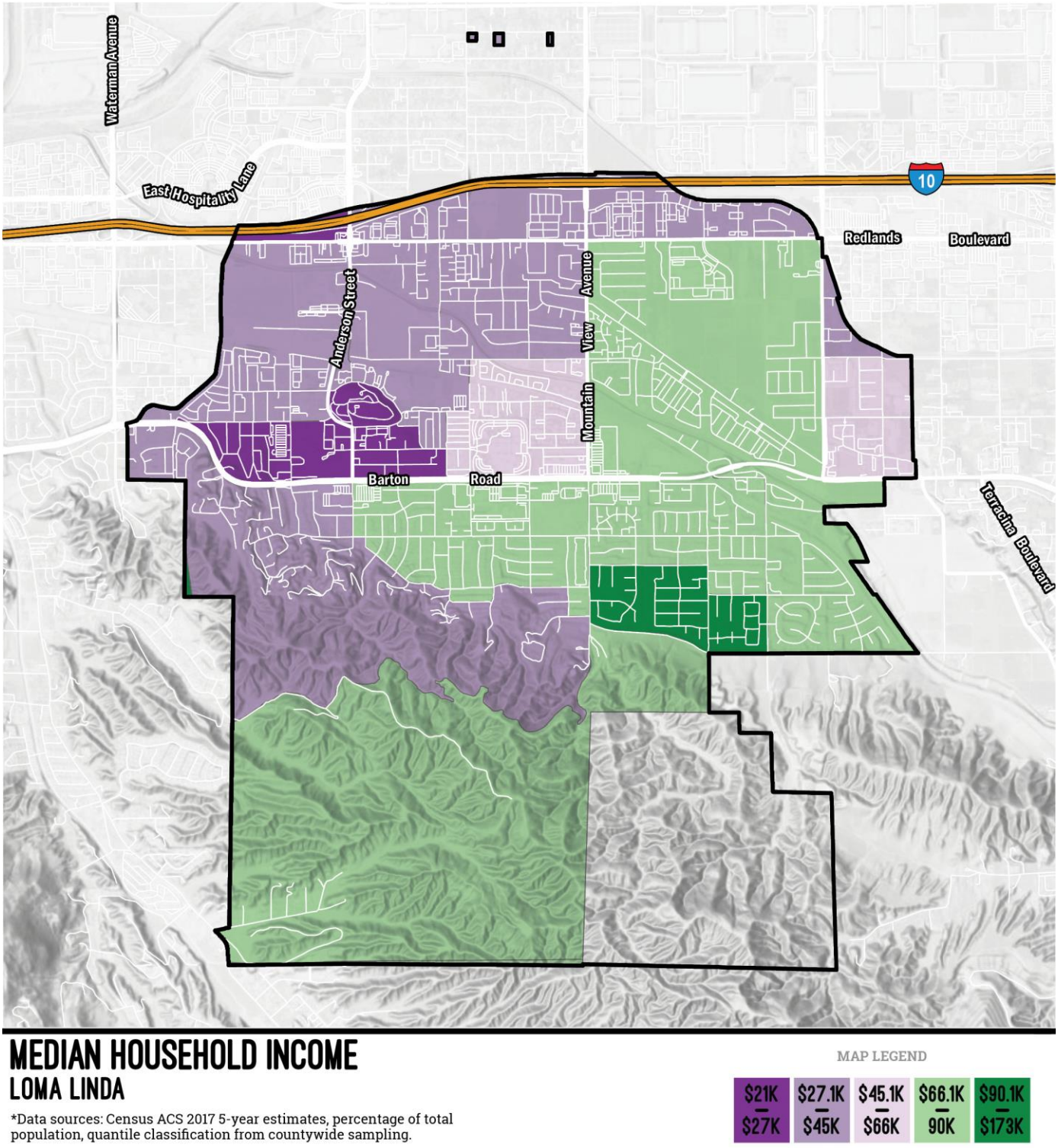

Figure 1-4: Median Household Income Distribution in Loma Linda

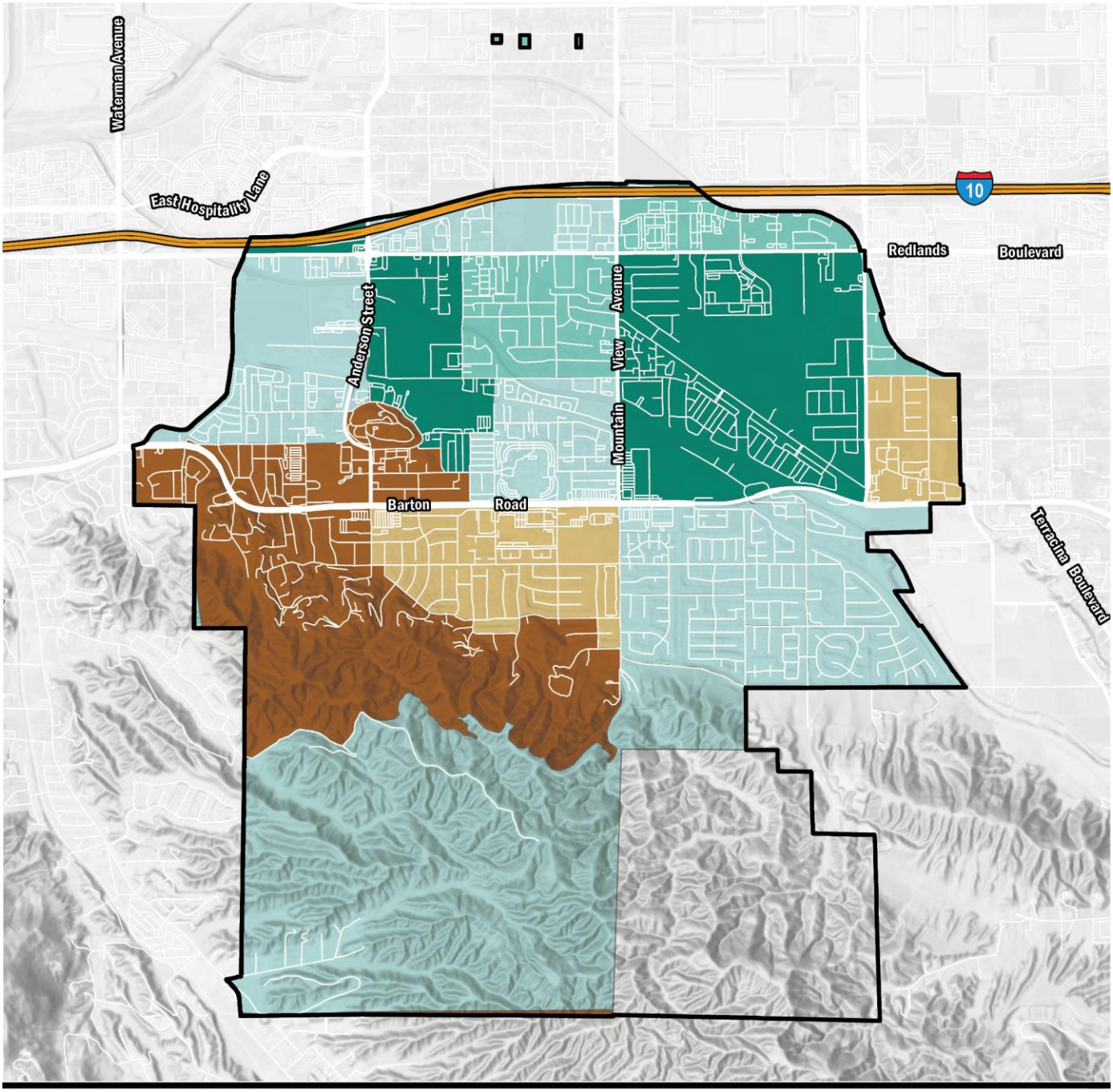

Figure 1-5: Population Under 18 Years Old in Loma Linda

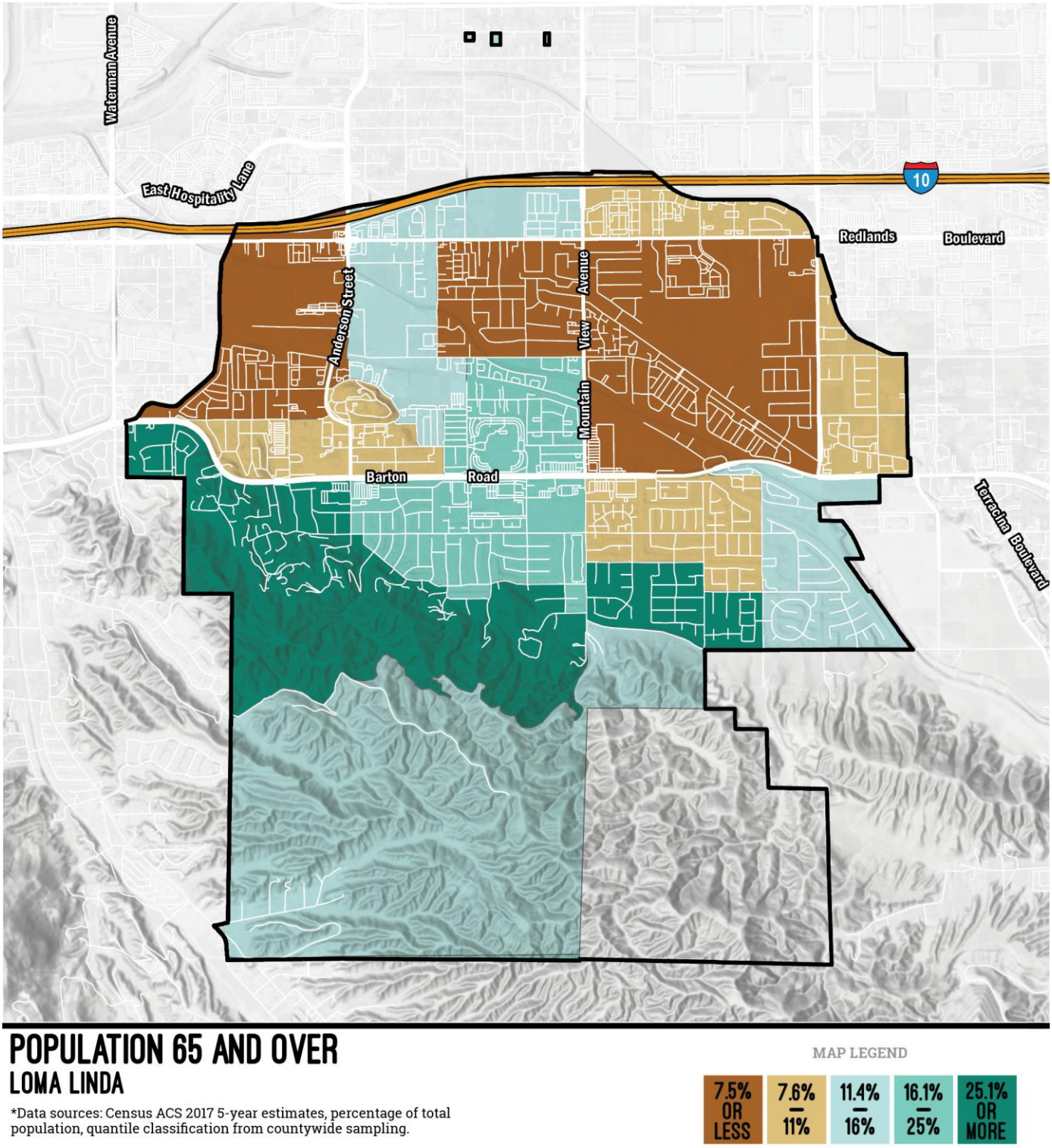

Figure 1-6: Population Over 65 Years Old in Loma Linda

1.5.4.3 Employment

The US Census Bureau reports that 55.1% of the population makes up the civilian labor force (percent of population 16 years or older, between 2014-2018). From 2014-2018, the median household income (in 2018 dollars) was $53,371. **Table 1-2** lists the top jobs by occupation in San Bernardino County ranked from greatest to least. The largest number of employees within the City are employed in the transportation and material moving industry. Conversely, building and grounds cleaning and maintenance has the fewest within the top ten employers.

Table 1-2: Top 10 Jobs by Occupation in Riverside-San Bernardino-Ontario Region[1] in May 2019

Occupation	Percent of total employment (in %)	Mean hourly wage (in $)
Transportation and Material Moving	13.5	17.96
Office and Administrative Support	11.9	20.35
Food Preparation and Serving Related	10.2	13.73
Sales and Related	10.1	19.26
Educational Instruction and Library	6.8	32.35
Healthcare Support	5.7	14.85
Healthcare Practitioners and Technical	5.3	47.27
Construction and Extraction	5.3	26.92
Management	4.3	54.62
Business and Financial Operations	3.6	33.45
Building and Grounds Cleaning and Maintenance	3.0	16.52

1 This region includes Loma Linda.

Source: Bureau of Labor Statistics, May 2018, https://www.bls.gov/regions/west/ca_riverside_msa.htm.

1.5.5 Existing Land Use

The existing land uses within the City and its sphere of influence are residential, commercial, and industrial. Residential land uses form the largest percentage of developed uses. Of the residential uses, single-family residential development occurs within a significant portion of the jurisdiction. Other types of residential uses within the City include rural residential (typically adjacent to orange groves or within the hillside areas of the City), multifamily residential, and mobile homes.

Commercial uses make up a small percentage of the land use within Loma Linda. Commercial uses are made up of both general commercial and office commercial uses. Large commercial or office uses within the city include the auto dealerships south of the Interstate 10 freeway, the offices within the Corporate Business Center, and the Stater Bros. Market. Institutional land uses within the City include medical, university, schools, churches, public facilities, utilities, and utilities combined with agricultural uses. Of these sub-categories, utilities, university uses, and medical uses are the most well-represented

institutional uses within the City. Loma Linda University (LLU) and the Loma Linda University Medical Center and Children's Hospital (LLUMC/CH) are significant institutional uses.

1.5.6 Development Trends and Hazard Vulnerabilities

Loma Linda is a vibrant community with a sturdy religious, educational, and healing arts foundation. The Loma Linda University Medical Center (LLUMC) and the Jerry L. Pettis Memorial Veterans Medical Center (VA Medical Center) are both internationally known. The City is seeking to expand upon this economic base with medical support services, research facilities, professional offices, and lodging accommodations.

In addition to increasing the range of commercial and industrial opportunities, Loma Linda has been engaged with managing residential growth to provide an appropriate distribution of housing opportunities, including executive housing, traditional single-family neighborhoods, and affordable housing for very low and low-income households and senior housing. From 2014-2024 the Employment Development Department forecasts that the top 50 growing occupations of the Inland Empire, which includes Loma Linda and nearby areas, will add approximately 79,530 jobs. It is predicted that this added growth will mean increased pressure for the City to expand its housing capacity. (SCAG Economic Conference Preparation Report, 2017)

The City has seen limited growth in hazard-prone areas over the past 20 years, including:

- **San Timoteo Creek Project reduces populations in flood zones.** The Army Corps of Engineers and the San Bernardino County Flood Control District completed channelization and various other improvements to San Timoteo Creek. The project included 3.6 miles of concrete (trapezoidal or rectangular) channel, 2.2 miles of flow-through, 18 sediment control basins, and 1.4 miles of earthen low-flow channels on the upstream end of the creek. As a result of the project, thousands of residences were removed from the floodplain. In 2007, FEMA issued a Letter of Map Revision (LOMR) showing the significantly reduced flood hazard area. (FEMA, 2019)
- **Slow Growth Initiative includes wildfire and slope failure protections.** A 2006 voter-approved slow-growth initiative, Measure V, included extensive limitations on hillside development within Loma Linda. The density requirements make development on the hillsides effectively impossible. Moreover, the City owns considerable acreage on the hillsides that further limit development.

The City does have considerable older development, especially residential development in the northwestern part of town near the university. These homes are vulnerable to the considerable earthquake potential facing the City. However, new construction standards mean that development trends are only reducing earthquake vulnerability.

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Section 2. Plan Adoption

2.1 Adoption by Local Governing Body

To comply with DMA 2000, the City Council officially adopted this Hazard Mitigation Plan upon plan approval from Cal OES and FEMA. The adoption recognizes the City's commitment to reducing the impacts of natural hazards. See the Record of Adoptions below.

2.2 Promulgation Authority

This Hazard Mitigation Plan was reviewed and approved by the Loma Linda City Council:

Phill Dupper – Mayor

Ron Dailey – Mayor Pro-Tempore

Rhodes Rigsby – Councilmember

John Lenart – Councilmember

Bhavin Jindal – Councilmember

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Section 3. Planning Process

3.1 Preparing for the Plan

This section describes each stage of the planning process used to develop the 2021 HMP. The 2021 HMP planning process provides a framework for document development and follows the FEMA recommended steps. The 2021 HMP follows a prescribed series of planning steps, including organizing resources, assessing risk, developing the mitigation plan, drafting the plan, reviewing and revising the plan, and adopting and submitting the plan for approval. Each step is described in this section.

3.2 The Planning Process

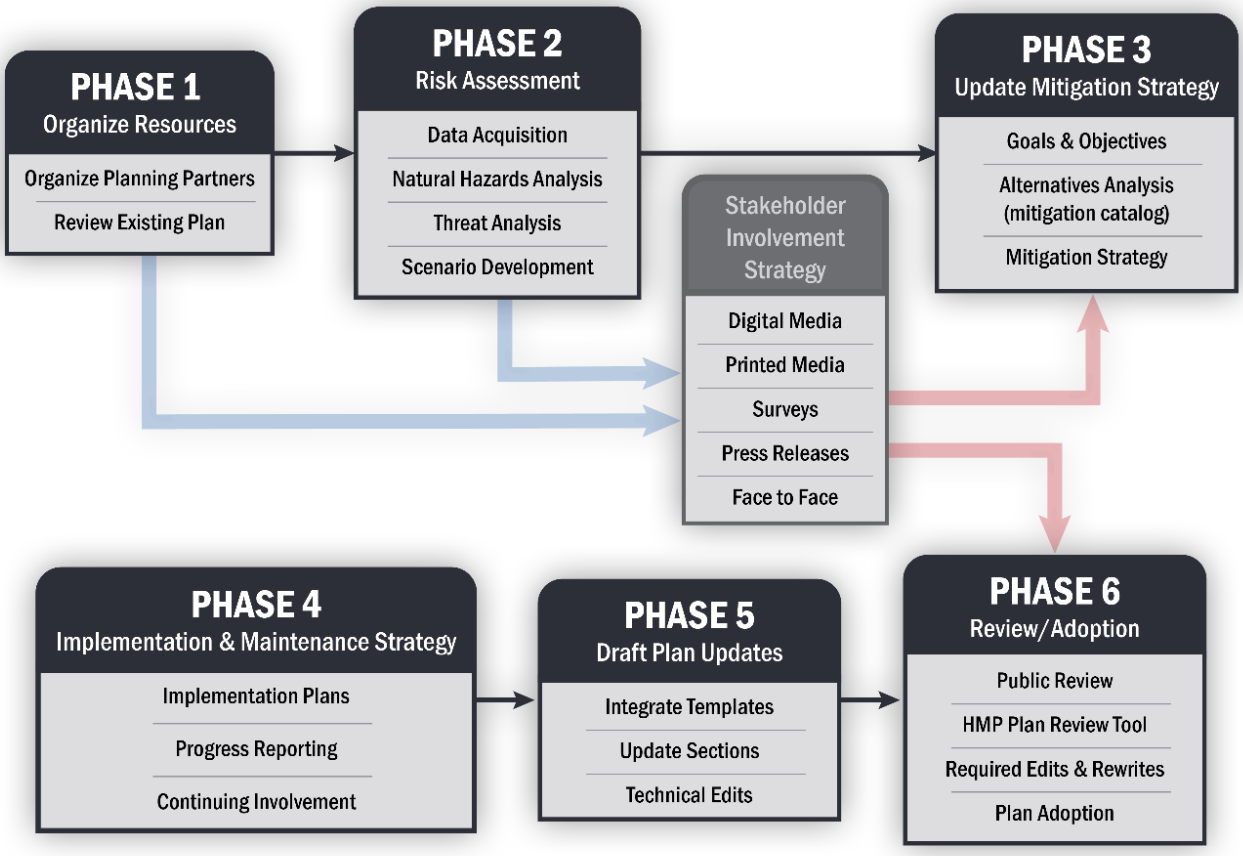

Figure 3-1: City of Loma Linda Planning Process

3.3 Organize Resources

This section describes the first step of the 2021 HMP planning process- Organizing Resources. Organizing resources consists of planning team development and document review tasks.

3.3.1 Building the Planning Team

The Planning Team, key to the backbone of the planning process, was critical for developing the 2021 HMP. The Planning Team consisted of a City Planning Committee, engaged City Residents and Regional Stakeholders, and an HMP consultant for plan development and facilitation.

Figure 3-2. City HMP Planning Team

The Planning Team participated in planning team meetings and review of the draft HMP. Not all members of the Planning Team attended stakeholder group meetings. Some participated by reviewing draft documents, gathering information and data, assisting with public outreach, or at other stages of the process.

3.3.1.1 Project Management Team

At the core of the 2021 HMP planning process is the Planning Committee. The Planning Committee was integral in ensuring the success of the planning process and plays a vital role in future implementation and maintenance. The Planning Committee is a subset of the overall Planning Team and primarily includes City staff and leaders who engaged in a more detailed vulnerability assessment for the City, including interviews and group discussions helping define the areas of concern for each hazard.

Table 3-1: 2021 HMP Project Management Team

Planning Committee Members	Title / Role
City Administration	
Shannon Kendall, **Project Lead**	Joint Emergency Services Coordinator (with City of Colton)
Jarb Thaipejr	City Manager/Director of Public Works
Konrad Bolowich	Assistant CM/Director of IT & Community Development
Sonia Fabela	Director of Finance
Barbara Nicholson	City Clerk and HR
City Public Works	
Eleazar Rubalcava	Public Works Superintendent
John Trujillo	Public Works Lead Tech
City Planning	
Lorena Matarrita	Associate Planner

Planning Committee Members	Title / Role
Jeff Peterson	Associate Engineer
City Fire	
Dan Harker	Fire Chief
Tom Ingalls	Fire Marshal
City Utilities	
Russ Handy	Supervisor Water/Wastewater
Kyle MacGavin	Information Systems Analyst
Shawn MacGavin	Information Systems Analyst

3.3.1.2 Planning Committee

The Hazard Mitigation Planning Committee consisted of multiple key decision-makers from city departments. The committee members served as liaisons to other city staff and the greater community.

The Planning Committee was involved in the following planning processes:

- Structured coordination and meetings
- Collection of valuable local information and other requested data
- Decision making on plan process and content
- Development of mitigation actions
- Review and comment on plan drafts
- Coordination of the public input process

The HMPC includes the Project Management Team in **Table 3-1** and other stakeholders listed in **Table 3-2**.

Table 3-2: 2021 LHMP Stakeholder List

Planning Committee / Stakeholder Members	Name/Title / Role
County	
San Bernardino County OES	Carrie Cruz: Emergency Services Officer
Partner Agencies	
Loma Linda CERT	Frank Sirna: Lead Volunteer, Instructor
American Red Cross	Robert Anderson: Disaster Program Manager
Omni Trans	Barbara Erwin: Safety, Security, and Regulatory Compliance Manager
Redlands Unified School District	Ken Morse: Operations Coordinator and Facility Planning
Loma Linda Academy (K-12)	Mark Brettnacher: Director of Plant Services
Loma Linda University Health (LLUH)	Eric Schilt: Vice President of Planning, Design and Construction
Loma Linda University Health (LLUH)	Brett McPherson: Director of Environmental Health & Safety
Loma Linda University Health (LLUH)	Ehren Ngo: Emergency Operations Manager

Planning Committee / Stakeholder Members	Name/Title / Role
Loma Linda Veterans Hospital - Pettis Memorial	Robert McCray: Chief of Safety
Loma Linda Veterans Hospital - Pettis Memorial	Elfega (Ellie) Bergthold: Emergency Manager
Caltrans (District 8)	Nicholas Novelich: Emergency Operations
BNSF Rail	James Farner: Manager, HazMat Field Ops and ER
Union Pacific Rail	Robert Bavier: Manager, HazMat
CalFire	Ray Martinez: (Battalion Chief) Southern Region, Land Use Planning
CalFire	John Toon: (Battalion Chief) Training Chief, San Bernardino Unit
CalFire	Melissa Curtis: Southern Region, Land Use Planning
City of Redlands	Esther Martinez: Emergency Operations Specialist
City of Grand Terrace	Haide Aguirre: Assistant Planner
City of San Bernardino	Nick Oldendorf: Emergency Manager, Police Sergeant
Regional Utilities	
Southern California Edison	Mark Cloud: Government Affairs Representative
Southern California Gas Co.	Kristine Scott: Public Affairs Manager
Southern California Gas Co.	Geoffrey Danker: Policy & Environmental Strategy
Cal OES (Hazard Mitigation Pre-Disaster & Flood Mitigation)	
Cal OES	Sonia Brown: Senior Emergency Services Officer

3.3.1.3 HMP Consultant Team

To assist the HMP Planning Committee, the City enlisted Atlas Planning Solutions and Dynamic Planning + Science due to its expertise in assisting public sector entities with developing hazard mitigation plans and strategies for particular hazard-prone areas. This team supported the City by facilitating the planning process, data collection, and meeting material and document development. The HMP Consultant Team, as shown in **Table 3-3**, consists of a variety of hazard mitigation and certified urban planning professionals.

Table 3-3: HMP Consultant Team

HMP Update Project Team	Consulting Firm	HMP Update Project Team Role
Aaron Pfannenstiel, AICP	Atlas Planning Solutions (APS)	Project Manager
Suzanne Murray	APS	QA/QC Reviewer
Crystal Stueve	APS	Associate Planner
Robert Jackson	APS	Assistant Planner
Ethan Mobley, AICP	Dynamic Planning + Science (DP+S)	Assistant Project Manager
Brian Greer	DP+S	GIS Specialist/Spatial Analyst
Torie Jarvis, JD	DP+S	Planning Manager
Alex Krebs	DP+S	Associate GIS Specialist
Daniel Spivak	DP+S	Associate Planner
Ty Johnson, AICP	DP+S	Associate Planner

3.3.1.4 Planning Committee Meetings

The HMP Planning Committee met throughout the development of the updated HMP document. **Table 3-4** summarizes the meetings conducted throughout the planning process, including meeting date, type, and topics discussed. Meeting documentation, including agendas, hazard maps, PowerPoint presentations, minutes, sign-in sheets, and other relevant handouts, are provided in Appendix B.

Table 3-4: Meeting Summary

Date	Meeting Type	Topics
July 29, 2020	Planning Committee Meeting #1	▪ *Review Project Goals & Expectations* ▪ *Review 2011 LHMP Hazards of Concern* ▪ *Review 2011 Critical Facilities* ▪ *Review 2011 Mitigation Strategy* ▪ *Data Needs* ▪ *Community Engagement and Outreach*
November 17, 2020	Planning Committee Meeting #2	▪ *Meeting #1 Recap* ▪ *Risk Assessment Data Review* ▪ *Risk Assessment Mapping Platform Tool Review* ▪ *Discussion of hazard-specific areas of concern* ▪ *Community Engagement and Outreach Update*
TBD	Planning Committee Meeting #3	▪ *Review of the Administrative Draft LHMP Document*

3.4 Public Involvement/Outreach

Public involvement is a major and required component of any HMP update. The Loma Linda 2021 HMP Update Public Outreach Strategy was developed to maximize public involvement throughout the planning process. The HMP Public Outreach Strategy details the utilization of websites, local media, and

community-based services and establishments to engage the public throughout the HMP planning process.

An online community survey was distributed via the City's Hazard Mitigation Plan website, flyer inserts within monthly water bills, the City's video bulletin board, and City's Local TV Channel.. A total of 57 survey responses were collected. The responses were used to determine the incentives needed for homeowners to protect their homes from natural disasters, which were integrated into the mitigation actions. The survey results can be found in Appendix B.

The results of the survey indicated the following:

- 18 respondents have been affected by a disaster
- Approximately 65% of respondents are somewhat concerned or very concerned about climate change
- A majority of respondents identified trainings, education, and effective emergency communications/notifications as the best way to assist residents and businesses
- The top three hazards of concern based on responses include Sesimic Hazards, Wildfire, and Flooding (see word cloud. Below)

The public also reviewed and provided comments on a draft of the HMP, when it was released for review on July XX, 2021.

3.5 Assess the Hazard

In accordance with FEMA requirements, the 2021 LHMP Planning Committee identified and prioritized the natural hazards affecting Loma Linda and assessed their vulnerability. Results from this phase of the HMP planning process aided subsequent identification of appropriate mitigation actions to reduce risk in specific locations from hazards. This phase of the HMP planning process is detailed in Section 4.2.

3.5.1 Identify/Profile Hazards

Based on a review of past hazards and a review of the existing plans, reports, and other technical studies/data/information, the 2021 HMP Planning Committee determined if the existing hazards were still valid and identified new hazards that could affect the City. Updated content for each hazard profile is provided in Section 0.

3.5.2 Assess Vulnerabilities

Hazard profiling exposes the unique characteristics of individual hazards and begins the process of determining which areas within Loma Linda are vulnerable to specific hazard events. The vulnerability assessment included field visits and a GIS overlaying method for hazard risk assessments. Vulnerable populations, infrastructure, and potential loss estimates impacted by natural hazards were determined using these methodologies. Detailed information on the vulnerability assessment for each hazard is provided in Section 4.2.

3.6 Develop Mitigation Plan

The 2021 LHMP was prepared in accordance with DMA 2000, the California Office of Planning and Research (OPR), and FEMA's HMP guidance documents. This document provides an explicit strategy and blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and Loma Linda's ability to expand on and improve these existing tools. Developing the mitigation plan involved identifying goals, assessing existing capabilities, reviewing the 2011 HMP goals, and identifying new mitigation actions. This step of the HMP planning process is detailed in Section 5 and summarized below.

3.6.1 Identify Goals

To meet FEMA requirements, the Planning Committee reviewed the 2011 HMP policies and determined current validity. The policies have been updated to meet the current hazard environments. See Section 5.5.

3.6.2 Develop Capabilities Assessment

A capabilities assessment is a comprehensive review of all the mitigation capabilities and tools currently available to the City to implement the mitigation actions prescribed in the 2021 HMP. The HMP Planning Committee identified the technical, financial, and administrative capabilities to implement mitigation actions, as detailed in Section 5.3.

3.6.3 Identify Mitigation Actions

As part of the 2021 LHMP planning process, the HMP Planning Committee reviewed and analyzed the mitigation actions identified in the 2011 HMP and provided data and information on the status of the existing mitigation actions. Once the review and analysis of the 2011 HMP mitigation actions were

complete, the HMP Planning Team identified and developed new mitigation actions with implementation elements during Planning Meeting #3 and various interviews and discussions with the Planning Committee. Mitigation actions were prioritized, and detailed implementation strategies were developed during Planning Team Meeting #3. A detailed approach to reviewing the existing mitigation actions, identifying and prioritizing new mitigation actions, and creating the implementation strategy is provided in Section 5.4.4.

3.6.4 Draft HMP Update

Once the risk assessment and mitigation strategy were completed, information, data, and associated narratives were compiled into the 2021 HMP. Section 1.4 provides detailed information on updates as part of the 2021 HMP.

3.6.5 Plan Review and Revision

Once the Draft 2021 HMP was completed, a public and government review period was established for official review and revision. Public comments were accepted, reviewed, and incorporated into this update. Applicable comments from the public have been received and addressed prior to the *"authorization to submit"* to FEMA and Cal OES review parties.

3.6.6 Plan Adoption and Submittal

This plan has been submitted and approved by FEMA and adopted by the City. A copy of the resolution is provided in Section 2.

3.6.7 Plan Maintenance

Updated plan maintenance procedures, found in Section 6, include the measures Loma Linda and partnering agencies and stakeholders will take to ensure the HMP's continuous, long-term implementation. The procedures also include how the HMP will be regularly monitored, reported upon, evaluated, and updated to remain a current and meaningful planning document.

Section 4. Risk Assessment

The risk assessment is the process of measuring the potential impact on life, property, and economic impacts resulting from natural hazards. The Risk Assessment identifies the qualitative and quantitative vulnerabilities of a community based on currently available data. The results of the risk assessment allow for a better understanding of the impacts of natural hazards on the community and provide a foundation in which to develop and prioritize mitigation actions to reduce damage from natural disasters through increased preparedness and response times and the better allocation of resources to areas of greatest vulnerability.

This Risk Assessment Section evaluates 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 City could be affected by a hazard, and the impact on City assets. The Risk Assessment approach consists of three (3) components:

- Hazard Identification – Identification and screening of hazards (Section 4.1)
- Hazard Profiles – Review of historical occurrences and assessment of the potential for future events (Section 0)
- Vulnerability Assessment – Determination of potential losses or impacts to buildings, infrastructure, and population (Section 4.3)

4.1 Hazard Identification and Screening

Per FEMA Guidance, the first step in developing the Risk Assessment is identifying the hazards. The City's HMP Planning Team reviewed several previously prepared hazard mitigation plans and other relevant documents to determine the universe of natural hazards that have the potential to affect the City and the nearby region. **Table 4-1** provides a crosswalk of hazards identified in the 2011 Loma Linda Hazard Mitigation Plan Draft, 2009 Loma Linda General Plan, 2016 San Bernardino County Hazard Mitigation Plan, and 2018 CA State Hazard Mitigation Plan. Nine different hazards were identified based on a thorough document review. The crosswalk was used to develop a preliminary hazards list providing a framework for City HMP Planning Team members to evaluate which hazards were truly relevant to the City and which ones are not. For example, volcanic activity was considered to have no relevance to the City, while earthquake/geologic hazards and wildfire were indicated in every hazard documentation.

Table 4-1: Document Review Crosswalk

Hazards	2011 Loma Linda HMP	2009 Loma Linda General Plan	2016 San Bernardino County MJHMP	2018 California State HMP
Climate Change		■	■	■
Dam Failure				■
Drought		■	■	■
Earthquake	■	■	■	■
Flood	■	■	■	■
Landslide	■		■	■
Levee Failure			■	■
Human-Caused	■	■	■	■
Pandemic Disease				■
Severe Weather			■	■
Soil Hazards		■	■	■
Terrorism & Tech Hazards	■		■	■
Volcano				■
Wildfire	■	■	■	■

4.2 Hazard Prioritization

The Planning Committee's hazard prioritization process combines historical data, local knowledge, and consensus opinions to produce a matrix that illustrates whether each profiled hazard is an extreme, high, or medium priority. The criteria below were used to evaluate hazards and identify the highest-risk hazard in Loma Linda. The results of the prioritization process for the City of Loma Linda are shown in **Figure 4-1**.

The City of Loma Linda completed the hazard prioritization process, and this important initial stage informed the rest of the planning process.

The following questions and guidance shaped the ranking on the matrices:

Probability What is the likelihood of a hazard event occurring in a given year?

- Unlikely- less than 1% annual probability or rarely occurs in the region or community
- Possible- 1%-10% annual probability or could occur. Uncommon in the region or community
- Likely- 10%- 100% annual probability or recurrent. Not frequent in the region or community

- Highly likely- 100% annual probability or frequently occurs in the region or community

Impact In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?

- Minor - Very few injuries, if any; only minor property damage and minimal disruption on quality of life; temporary shutdown of critical facilities.
- Limited - Minor injuries only; 10%-25% of property in the affected area is damaged or destroyed; complete shutdown of critical facilities for more than one day.
- Critical - Multiple deaths or injuries possible; 25%-50% of property in the affected area is damaged or destroyed; complete shutdown of critical facilities for more than one week.
- Catastrophic - High number of deaths or injuries possible; more than 50% of property in the affected area damaged or destroyed; complete shutdown of critical facilities for 30 days or more.

	Impact					
	High		Medium		Low	
High		Wildfire Seismic	Drought			
Medium		Haz Mat	Climate Change Flood Terrorism Slope Failure Airplane Crash			
Low						

Figure 4-1: Loma Linda Hazard Prioritization

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Hazard Profiles

The natural hazard profiles in this section provide a baseline definition and description in relation to the City. The hazards symbolized below are profiled individually in this section and are in order by priority. For reference, each hazard symbol is placed at the beginning of each profile. The hazard profiles in this section provide a baseline for the Vulnerability Assessment, where the vulnerability to each profiled hazard is quantified in terms of population and assets affected. Hazard profiles in this Section are as follows:

Wildfire
SECTION 0

Earthquake
SECTION 4.2.2

Drought
SECTION 4.2.3

Climate Change
SECTION 4.2.4

Hazardous Waste & Materials
SECTION 4.2.5

Human-Caused Hazards
SECTION 4.2.6

Flood
SECTION 4.2.7

Slope Failure
SECTION 4.2.8

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4.2.1 Wildfire Hazard Profile

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or human activity such as smoking, campfires, equipment use, and arson. The 2018 California State Hazard Mitigation Plan defines wildfires as:

> *any free-burning vegetative fire that initiates from an unplanned ignition, whether natural (e.g., lightning) or human-caused (e.g., powerlines, mechanical equipment, escaped prescribed fires), where the management objective is full suppression.* (California Office of Emergency Services, 2018, p. 507)

Wildfires are costly, putting lives and property at risk and compromising rivers and watersheds, open space, timber, range, recreational opportunities, wildlife habitats, endangered species, historic and cultural assets, scenic assets, and local economies. Wildfires may increase vulnerability to flooding due to the destruction of forest and ground cover within watersheds. The potential for significant damage to life and property increases in areas where development is adjacent to densely vegetated areas, known as wildland-urban interface (WUI) areas. (FEMA, 2020) **See Figure 4-2** for a depiction of a WUI.

While some fires are allowed to burn naturally in order to maintain or restore the health of forest lands, out of control wildfires need to be prevented through cooperative, community, and land management planning. (United States Forest Service, n.d.)

Wildfire hazard is a significant and recurrent threat in the City and has the potential to destroy buildings, cause damage to vital infrastructure, injure people, and can result in loss of life, agricultural land, and animals. High summer temperatures, low humidity, and high winds result in dry brush and atmospheric conditions that can accelerate fires through steep terrain. In San Bernardino County, wildfire season generally commences in summer when temperatures are high, humidity is low, and conditions remain dry. The season continues into fall when the County experiences high velocity, dry winds coming out of the desert. (San Bernardino County Multi-Jurisdictional Hazard Mitigation Plan, 2017) Climate change is projected to exacerbate or, at best, continue fire events across California. (Cal OES, 2018, p. 511)

Where there is easy public access to dry vegetation, fire hazards increase due to a greater chance of human carelessness. The intrusion of residential development into the lower foothills to the south and southwest of the City creates problems in controlling wildland fires due to limited firefighting facilities and the lack of direct access to the areas, which increases response times. These developments have also moved closer to higher-risk wildfire hazard areas, increasing the number of people and buildings at risk, as illustrated in **Figure 4-2**. (City of Loma Linda Local Hazard Mitigation Plan, 2011)

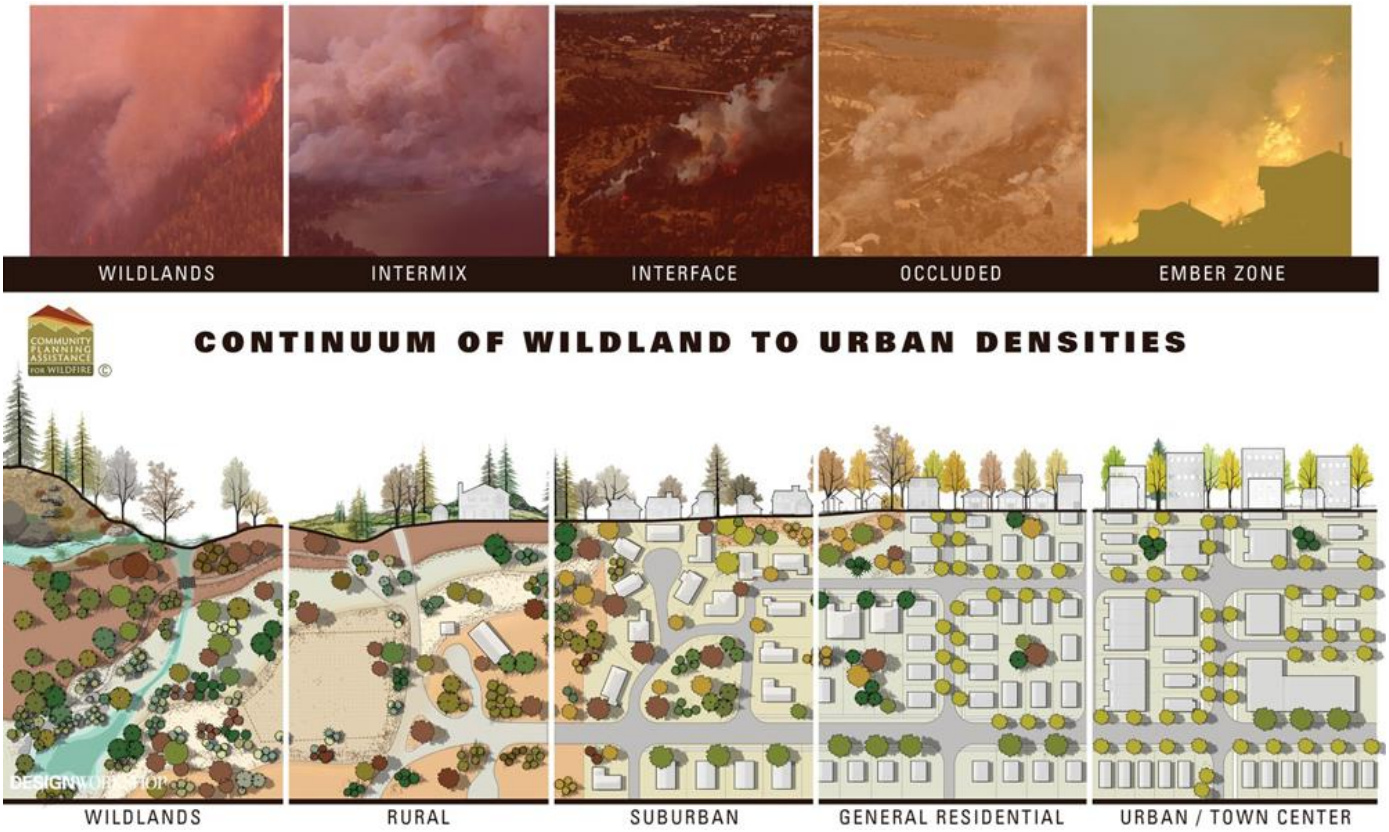


Figure 4-2: Urban Wildland Interface
Source: Redwood City California, Fire Department (https://www.redwoodcity.org/departments/fire-department/fire-prevention/defensible-space/california-wildland-urban-interface-code-information)

4.2.1.1 Plans, Policies, and Regulatory Environment

Wildfire Protection Responsibility in California

Local, state, tribal, and federal organizations all have legal and financial responsibility for wildfire protection. In many instances, two fire organizations have dual primary responsibility on the same parcel of land—one for wildfire protection and the other for structural fire protection. In 1981, The California State Legislature outlined various wildfire responsibility areas to address wildfire jurisdictions. These responsibility areas can be found in Cal. Pub. Res. Code § 4291.5 and Cal. Health & Safety Code § 13108.5, and are described below:

- **Federal Responsibility Areas (FRAs)**—FRAs are fire-prone wildland areas owned or managed by a federal agency such as the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Department of Defense. Primary financial and rule-making jurisdiction authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually the responsibility of the relevant local government agency, not the federal land management agency.

- **State Responsibility Areas (SRAs)**—SRAs land in California, where the California Department of Forestry and Fire Protection (CAL FIRE) has legal and financial responsibility for wildfire protection. CAL FIRE administers fire hazard classifications and building standard regulations in these areas. SRAs are defined as lands that:
    - are not federally-owned,
    - have wildland vegetation cover rather than agricultural or ornamental plants,
    - have row crops or seasonal crops, or
    - have watershed, range, or forage values.

  CAL FIRE adopts SRA boundaries and updates them every five years. Where SRAs contain structures or development, the relevant local government agencies have fire protection responsibility for those improvements.

- **Local Responsibility Areas (LRAs)—**LRAs include land in cities, cultivated agricultural lands, unincorporated non-flammable areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city or county fire departments, fire protection districts, or CAL FIRE under contract to local governments. LRAs may still include areas of flammable vegetation and WUI. The wildfire-prone areas within the City of Loma Linda are entirely within the Local Responsibility Area.

Healthy Forests Restoration Act (2003)

The federal Healthy Forests Restoration Act (HFRA) appropriates funding to address five main sub-categories of the National Fire Plan (NFP): preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters. San Bernardino Community Wildfire Protection Plans have integrated these sub-categories through the following four best practices:

1. identifying and prioritizing fuels reduction opportunities across the landscape
2. addressing structural ignitability
3. assessing community fire suppression capabilities
4. collaborating with stakeholders

Loma Linda Building and Fire Code (2019)

The City adopted the 2019 California Building Code and 2019 Fire Code. (Cal. Code of Regs. § 24 (2019)), These codes include provisions that regulate the exterior materials and construction methods for wildfire protection (Building Code, Chapter 7a (2019). The Fire Code safeguards the public health, safety, and general welfare from the hazards of fire, explosion, or dangerous conditions in new and existing buildings, structures, and premises and provides safety and assistance to firefighters and emergency responders during emergency operations. (Loma Linda Municipal Code ("LLMC"), § 15.28) Loma Linda has also adopted the International Wildland-Urban Interface Code. (LLMC § 15.30)

California Code, Public Resources Code § 4291

These regulations require property owners in mountainous areas, forest-covered lands, or any covered land with flammable material to create at minimum a 100-foot defensible space (or to the property line) around their homes and other structures.

Weed Abatement

To reduce the threat of wildfires, the City of Loma Linda participates in weed abatement inspections conducted by Loma Linda Fire Prevention personnel bi-annually. The inspections occur in the spring, from March through April, and fall, from September through November.

City of Loma Linda General Plan

The 2009 City of Loma Linda General Plan includes several policies in the Public Health and Safety Element to mitigate the effects of wildfire. The Plan's Guiding Policy directs the City to minimize any threats to people, property, and the environment resulting from wildfires. The Plan also includes several Implementing Policies. These policies direct the City to require the review of all development applications in high-risk wildfire areas. They also direct the City to use fire-resistant building materials, prevention and control measures, and adequate access for fire emergency response personnel. The General Plan Safety Element is currently undergoing review and update to ensure compliance with the latest government code requirements.

4.2.1.2 Past Occurrences

Four major factors contribute to historic wildfire events:

1. Extreme vegetation diversity
2. Diverse fire weather and fire behavior
3. Dynamic fire history
4. Complex land use patterns

See **Table 4-2** for a list of wildfire events in Loma Linda. These are also displayed in **Figure 4-4**.

Table 4-2: Loma Linda Wildfires

Date	Name	Size in Acres
2001	Reche Fire	1,798
2010	Scott Fire	95

Source: California Fire, Incident Database

4.2.1.3 Location/ Geographic Extent

Fire Hazard Severity Zones have been identified along the southern portion of the City. Residential uses have been constructed within these areas that back up to natural vegetation areas susceptible to fires. **Figure 4-3** illustrates the limits of the Fire Hazard Severity Zones for the City. Wildland-urban interface

fires may occur in areas where urban land uses abut native areas. Under these conditions, wildfires may threaten urban uses.

4.2.1.4 Severity and Extent

The severity of the wildfire hazard is determined by the relationship between three factors: fuel classification, topographic slope, and critical fire weather frequency. The City of Loma Linda has a significant amount of wildfire fuels at the city's southern end. Critical fire weather conditions occur in periods of low relative humidity, high heat, and high winds. Future incidents may be more severe as climate variance trends towards increased heatwaves and drier microclimates.

Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. In addition, wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding due to the impacts of silt in local watersheds.

A visual of the size of areas burned during a wildfire in or near the City is shown in **Figure 4-4**.

4.2.1.5 Frequency/ Probability of Future Occurrences

Generally, the City of Loma Linda faces a wildland fire threat annually. Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in the air. When combined with high winds and years of drought, these conditions increase the potential for a wildfire to occur. Urban wildfires often occur in areas where development has expanded into rural areas. A fire along this urban/rural interface can result in major losses of property and structures. Generally, three major factors sustain wildfires and allow for predictions of a given area's potential to burn; fuel, topography, and weather.

Fuel is the material that feeds the fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles and leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also, to be considered as a fuel source are human-made structures and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread.

The volume of available fuel is described in terms of fuel loading. Certain areas in and surrounding the City of Loma Linda are extremely vulnerable to fires due to the presence of dense grassy vegetation combined with a growing number of structures being built near and within rural lands. The majority of past wildfire events near the City of Loma Linda occurred in the summer months (typically June through August). The frequency of wildfire events may increase because of increasingly drier conditions caused by climate change. Fire risk will also continue to grow as more people build in WUI areas, which increases fuel loads and the risk of human-caused fires.

Figure 4-3 depicts the fire return interval for the City of Loma Linda. The areas with the highest likelihood of burning within the next 30 years are located along the City's southern border in the Badland hills region.

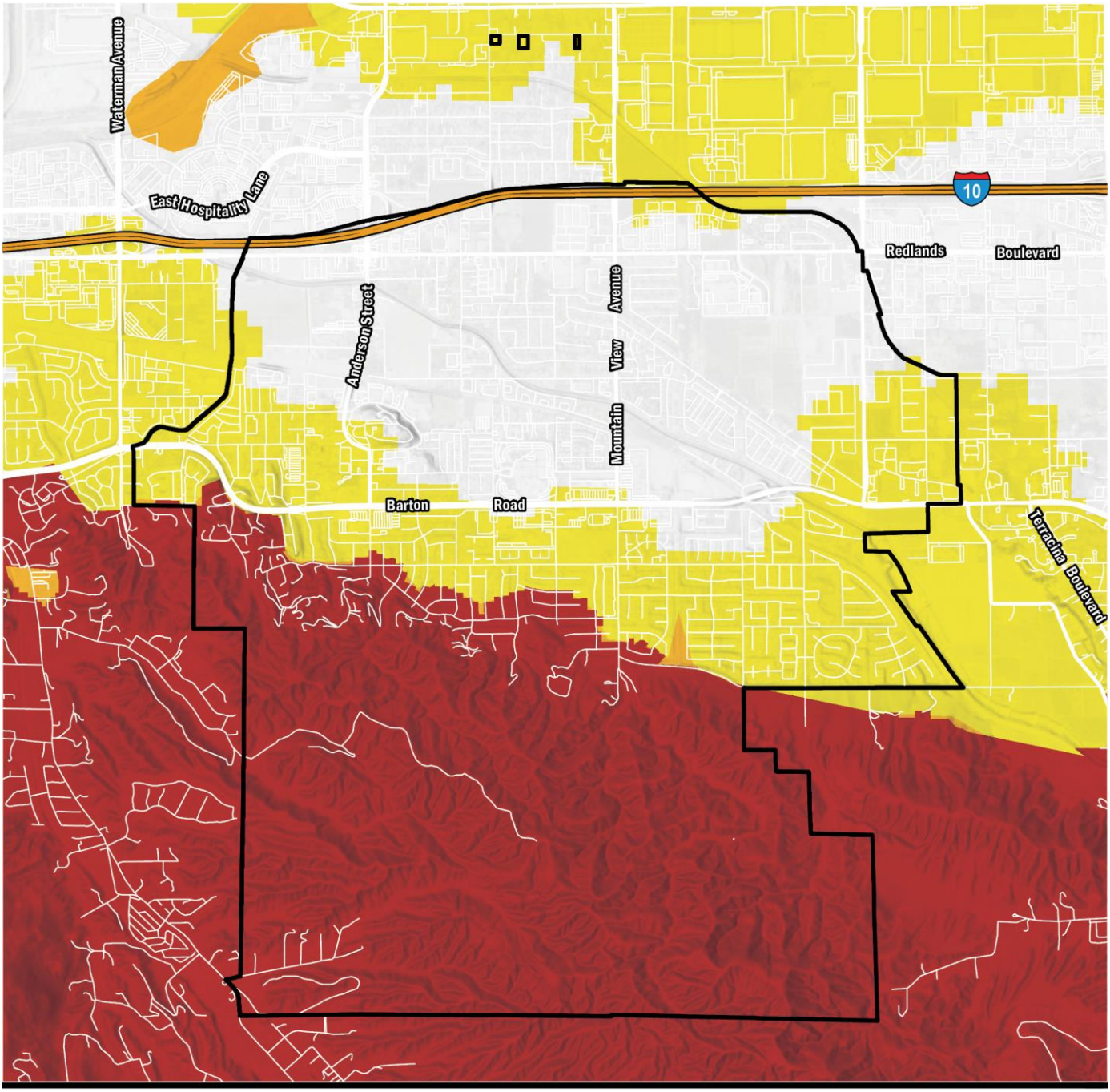


Figure 4-3: City of Loma Linda Wildfire Risk Exposure

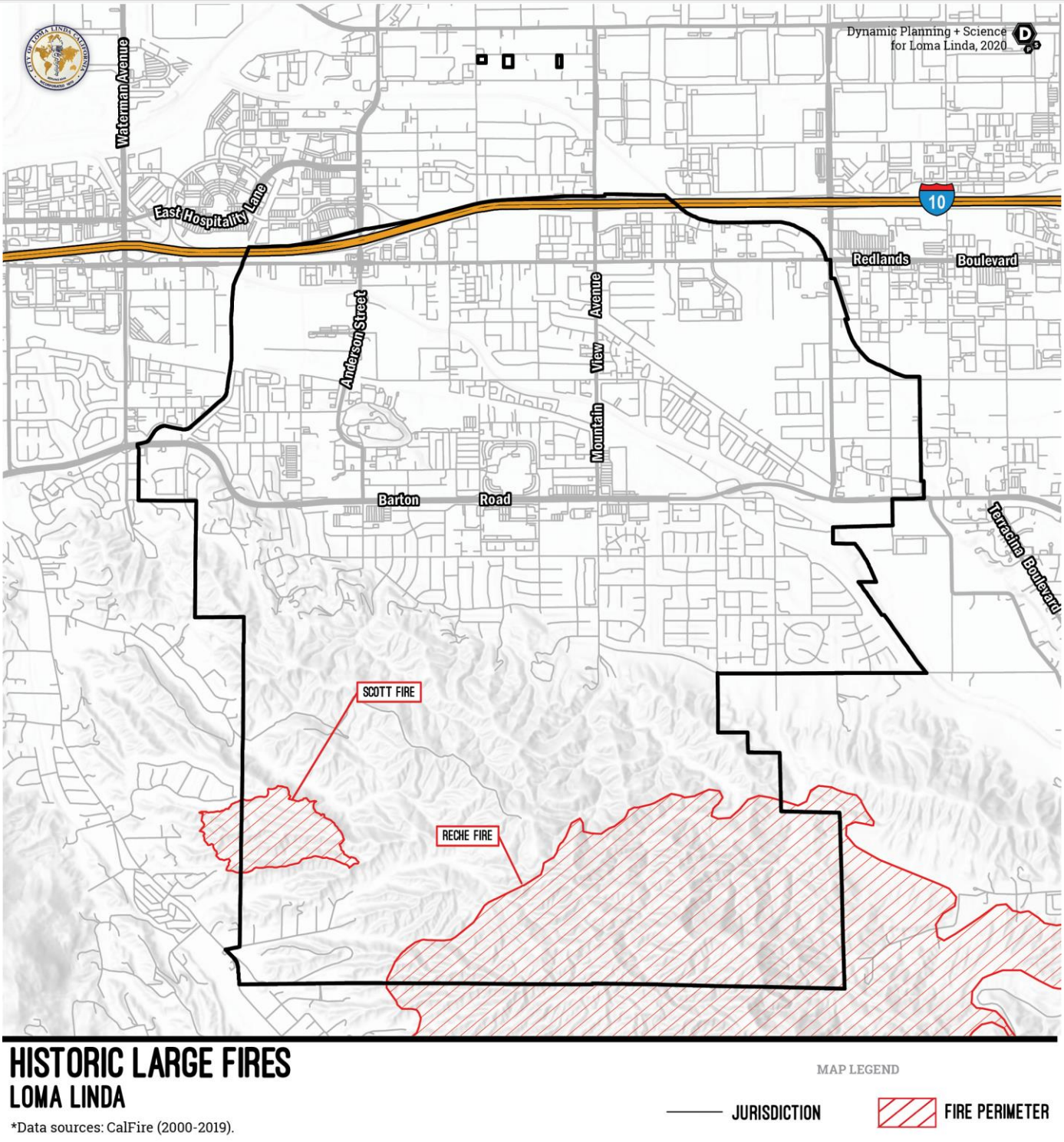


Figure 4-4: Historic Wildfires in and Near Loma Linda

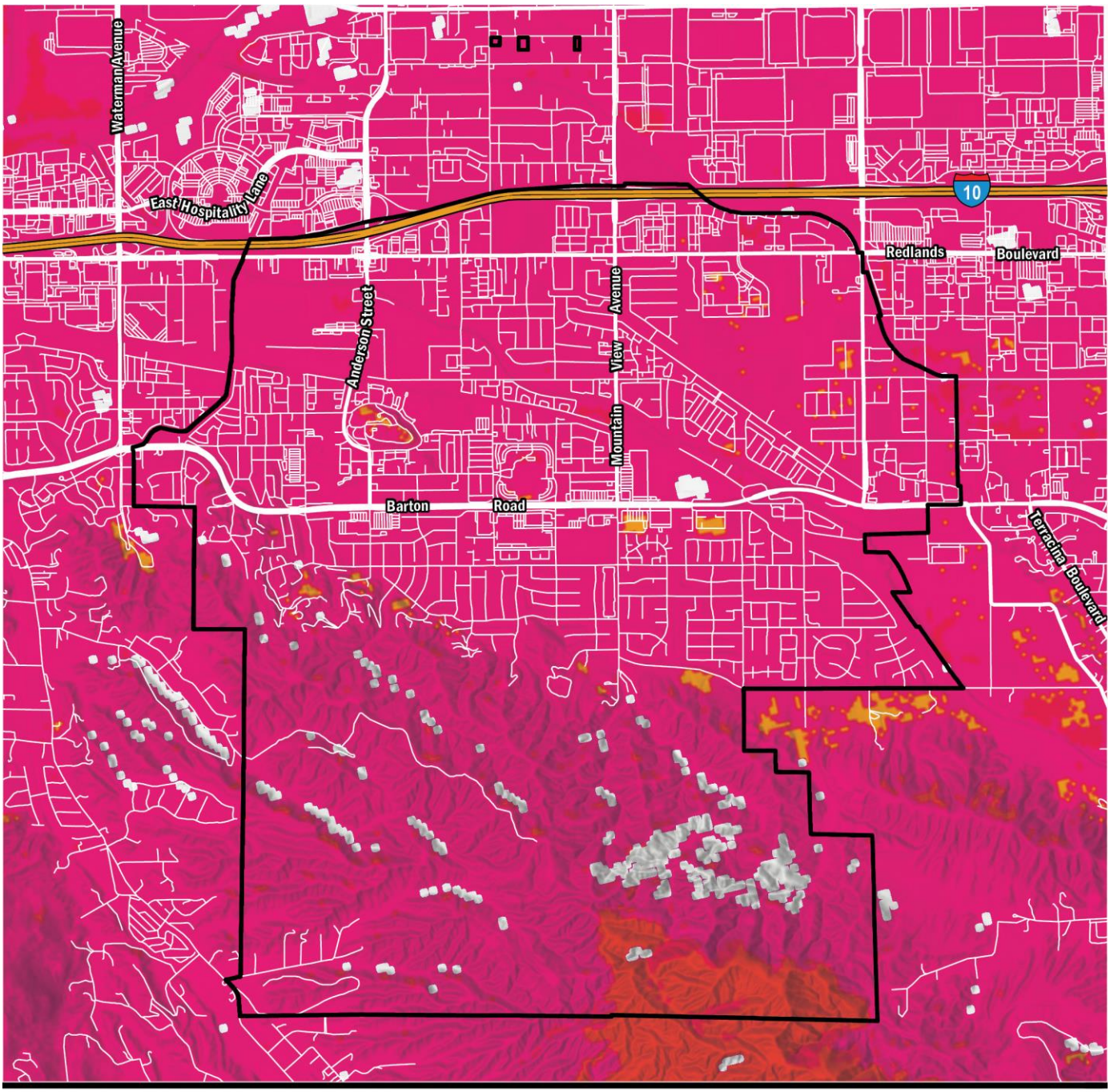


Figure 4-5: Mean Wildfire Return Intervals

4.2.2 Earthquake Hazard Profile

An earthquake is the sudden shaking of the ground caused by seismic waves passing through the Earth. Seismic waves are produced when energy stored in the Earth's crust is suddenly released, usually when masses of rock straining against one another suddenly fracture and "slip." Earthquakes associated with this type of energy release are called tectonic earthquakes. The energy also can be released by elastic strain, gravity, chemical reactions, or even the motion of massive bodies. Earthquakes most often occur along geologic *faults*, narrow zones where rock masses move in relation to one another. (USGS, n.d.)

Earthquakes have different properties depending on the type of fault that causes them. See **Figure 4-6**. The usual fault model has a "strike" (that is, the direction from north taken by a horizontal line in the fault plane) and a "dip" (the angle from the horizontal shown by the steepest slope in the fault). The lower wall of an inclined fault is called the footwall. Lying over the footwall is the hanging wall. When rock masses slip past each other parallel to the strike, the movement is known as strike-slip faulting. Movement parallel to the dip is called dip-slip faulting. In dip-slip faults, if the hanging-wall block moves downward relative to the footwall block, it is called "normal" faulting; the opposite motion, with the hanging wall moving upward relative to the footwall, produces reverse or thrust faulting. (*Id.*)

As a fault rupture progresses along or up the fault, rock masses are flung in opposite directions and thus spring back to a position with less strain. (*Id.*)

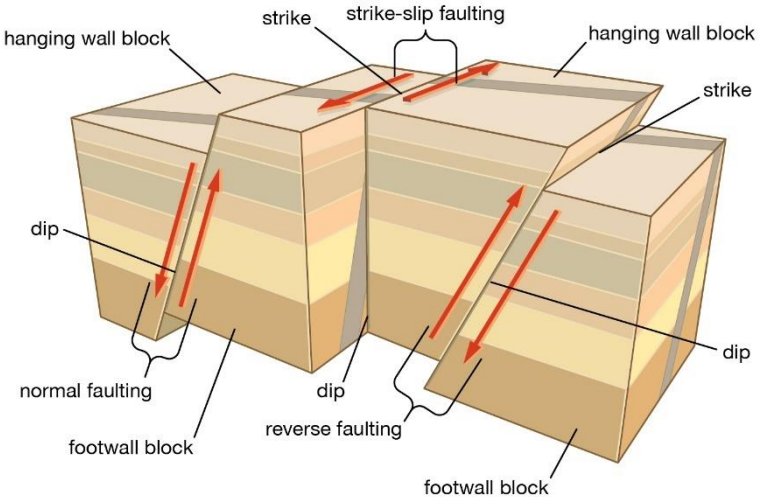


Figure 4-6: Earthquake Faulting

Soil Liquefaction

Soil liquefaction is a phenomenon in which the strength and stiffness of soil are reduced by earthquake shaking or other rapid loading. Soil liquefaction and related phenomena have been responsible for tremendous amounts of damage in historical earthquakes worldwide. Soil liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure and causing some of the pore spaces between granules to collapse. Pore-water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Saturated or partially saturated soil substantially loses strength and stiffness in response to applied stress, such as shaking during an earthquake or other sudden changes in stress conditions. The phenomenon is most often observed in saturated, loose, low-density, or uncompacted sandy soils. Loose sand tends to compress when a load is applied. Dense sands, by contrast,

tend to expand in volume or "dilate." If the soil is saturated by water, which often occurs when soil is below the water table or sea level, then water fills the pore spaces between soil grains. (USGS, n.d.)

Earthquake Classifications

Earthquakes are typically classified either 1) by the amount of energy released, measured as *magnitude*, or 2) by the impact on people and structures, measured as *intensity*. (USGS, n.d.)

Magnitude

The most common method for measuring earthquakes is magnitude, which measures the strength of earthquakes. While the majority of scientists generally use the **Moment Magnitude (Mw) Scale** to measure earthquake magnitude, the **Richter (M) Scale** is the most universally known measurement. The magnitude of an earthquake is related to the total area of the fault that ruptured and the amount of offset (displacement) across the fault. As shown in **Table 4-3**, there are seven earthquake magnitude classes on the Mw scale, ranging from great to micro. A magnitude class of great can cause tremendous damage to infrastructure, compared to a micro class, which results in minor damage to infrastructure. (*Id.*)

Earthquake Magnitude Classes (Mw)		
Magnitude Class	**Magnitude Range (Mw = Moment Magnitude)**	**Description**
Great	Mw > 8	Tremendous damage
Major	7 <= Mw < 7.9	Widespread heavy damage
Strong	6 <= Mw < 6.9	Severe damage
Moderate	5 <= Mw < 5.9	Considerable damage
Light	4 <= Mw < 4.9	Moderate damage
Minor	3 <= Mw < 3.9	Rarely causes damage.
Micro	Mw < 3	Minor damage

Table 4-3: Moment Magnitude Scale

Intensity

The effects of an earthquake in a particular location are measured by intensity. Earthquake intensity decreases with increasing distance from the epicenter of the earthquake. The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects experienced at that place. (United States Geological Survey)

The **lower** numbers of the intensity scale generally deal with how people feel the earthquake. The **higher** numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII-X. **Table 4-4** is an abbreviated description of the levels of Modified Mercalli Intensity. (*Id.*)

Table 4-4: Modified Mercalli Intensity Level Descriptions

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Similar to a heavy truck striking a building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone, many awakened. Some dishes and/or windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster—slight damage.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X +	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS, Abridged from The Severity of an Earthquake, USGS General Interest Publication 1989-288-913

Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity. (Pacific Northwest Seismic Network)

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values

are directly related to these lateral forces that could damage "short period structures" such as single-family dwellings. Longer-period response components determine the lateral forces that damage larger structures with longer natural periods such as apartment buildings, factories, high-rises, bridges. **Table 4-5** lists the damage potential and perceived shaking by PGA factors, compared to the Mercalli scale. (USGS)

Table 4-5: Modified Mercalli Scale and Peak Ground Acceleration

		Potential Structure Damage		Estimated PGA
Modified Mercalli Scale	Perceived Shaking	Resistant Buildings	Vulnerable Buildings	(%g)
I	Not Felt	None	None	<0.17%
II	Weak	None	None	0.17% - 1.4%
III	Light	None	None	1.4% - 3.9%
IV	Moderate	Very Light	Light	3.9% - 9.2%
V	Strong	Light	Moderate	9.2% - 18%
VI	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VII	Severe	Moderate/Heavy	Heavy	34% - 65%
VIII	Violent	Heavy	Very Heavy	65% - 124%
IX +	Extreme	Very Heavy	Very Heavy	>124%

Note: PGA measured in percent of g, where g is the acceleration of gravity

Sources: USGS, 2008; USGS, 2010

4.2.2.1 Plans Policies, and Regulatory Environment

Alquist-Priolo Earthquake Fault Zoning Act and Seismic Hazards Mapping Act (1972)

The 1971 San Fernando Earthquake resulted in the destruction of numerous structures built across its path. This led to the passage of the **Alquist-Priolo Earthquake Fault Zoning Act** in 1972. This Act prohibits the construction of buildings for human occupancy across active faults in the State of California. Similarly, extensive damage caused by ground failures during the 1989 Loma Prieta Earthquake focused attention on decreasing the impacts of landslides and liquefaction. This led to the creation of the **Seismic Hazards Mapping Act**, which increases construction standards at locations where ground failure is probable during earthquakes. This mapping identifies zones of required investigation for possible earthquake faulting, landslides, and liquefaction. These zones are delineated and distributed to cities, counties, and state construction agencies to help identify where higher building standards may be necessary for safe development. (Cal. Dep't of Conservation, 2019) **Figure 4-7** illustrates the zones of required investigation in Loma Linda.

2019 California Building Standards Code

The Loma Linda Municipal Code adopts the 2019 California Building Code, which includes materials requirements, construction methods, and maintenance standards for earthquake protection and resiliency.

City of Loma Linda General Plan

The 2009 City of Loma Linda General Plan includes several policies in the Public Health and Safety Element to mitigate the effects of earthquakes. The Guiding Policy directs the City to minimize the risks of property damage and personal injury caused by seismic and geologic hazards. The Plan's implementing policies direct the City to limit development, enforce the Alquist-Priolo Earthquake Fault Zoning Act, rehabilitate existing buildings, prepare soils and geologic reports, and safe slope engineering.

4.2.2.2 Past Occurrences

The last significant earthquake along the Southern California stretch of the San Andreas Fault occurred in 1857. Since 1690 the southern end of the fault from San Bernardino to the Salton Sea has not experienced fault rupture. Stress along this portion of the fault has continued to store energy that will be released in a future earthquake. Southern California has thousands of smaller earthquakes every year**. Table 4-6** shows the earthquakes greater than magnitude 5 in or near the San Bernardino County area from 1990 through 2020.

Table 4-6: Earthquakes M5.0 in or near San Bernardino County 1990-2020

Date	Location	Magnitude (M)
2019-07-05	10 km Northwest of Ridgecrest	7.1
2008-07-29	5 km South of Chino Hills	5.4
1999-10-16	7 km Northeast of Running Springs	5.6
1992-12-04	10 km Southeast of Lucerne Valley	5.3
1992-11-27	10 km Northwest of Big Bear City	5.3
1992-08-17	7 km Southeast of Big Bear Lake	5.2
1992-07-01	24 km North of Yucca Valley	5.3
1992-06-28	1 km North of Big Bear Lake	5.3
1992-06-28	7 km Southeast of Big Bear City	6.3
1992-06-28	11 km Southeast of Big Bear Lake	5.5
1992-06-28	26 km Northeast of Yucca Valley	5.4
1992-06-28	7 km Southwest of Yucca Valley	5.0
1990-02-28	6 km Northeast Claremont	5.5

Source: USGS Earthquake database

4.2.2.3 Location/ Geographic Extent

Earthquakes may occur anywhere in the region, at any time, and Loma Linda is exposed to earthquake impacts throughout the City. Earthquakes in California are caused by the movement of huge blocks of the

earth's crust known as the Pacific and North American plates. The Pacific plate is moving northwest, scraping horizontally past North America at a rate of about 50 millimeters (2 inches) per year. About two-thirds of this movement occurs on the San Andreas Fault and three major parallel faults: the San Jacinto, Elsinore, and Imperial. Over time, these faults produce about half of the region's significant earthquakes and many minor earthquakes.

There are also more than 300 additional major faults and countless smaller ones throughout the region. This is primarily due to the "big bend" of the San Andreas fault, from the southern end of the San Joaquin Valley to the eastern end of the San Bernardino mountains. Where the fault bends, the Pacific and North American plates push into each other, compressing the earth's crust into the mountains of Southern California and creating hundreds of additional faults. These faults produce thousands of small earthquakes each year and the other half of our significant earthquakes. Examples include the 1994 Northridge and 1987 Whittier Narrows earthquakes.

Several faults run through the boundaries of Loma Linda, as **Figure 4-7** illustrates. The most active of those is the San Jacinto Fault, which has been the most historically active fault zone in Southern California. This fault is located within a zone of required investigation as designated by the California Geological Survey. Southwest of the San Jacinto Fault is the Reche Canyon Fault, which is potentially active. Other faults in the City are classified as inactive, including the Loma Linda, Banning, and Live Oak Canyon Faults. (City of Loma Linda General Plan, 2009, p. 10.2)

The San Andreas Fault does not directly run through Loma Linda but poses a higher probability of both occurrence and severe shaking in the City, as discussed in the Frequency and Probability Section of this HMP (4.2.2.4). **Figure 4-8** illustrates the sheer number of faults surrounding Loma Linda. While this HMP focuses on a single scenario to illustrate the City's earthquake vulnerability, the reality is that any of the illustrated faults pose a risk to the City.

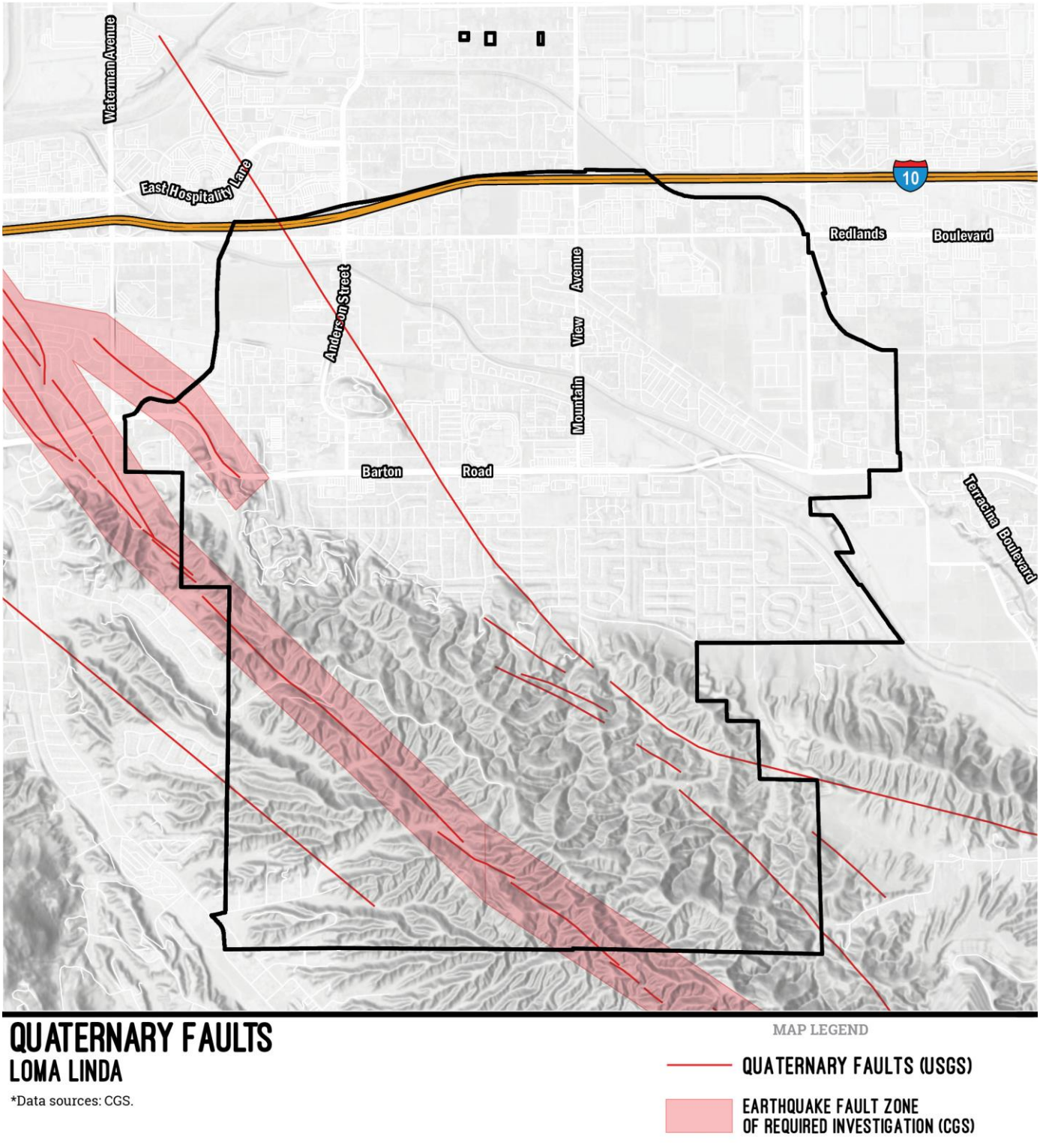


Figure 4-7: USGS Quaternary Faults

4.2.2.4 Frequency/ Probability of Future Events

In general, many faults around Loma Linda have more than a 1% chance of creating a 6.7M earthquake in the next 30 years, with the possibility of violent to severe shaking occurring in the City. See **Figure 4-8.** In California, earthquakes large enough to cause moderate damage to structures—those of 5.5 M or larger—occur three to four times a year statewide. Strong earthquakes of 6 to 6.9 M strike on average once every two to three years. Major earthquakes of 7 to 7.9 M occur in California about once every 10 years. (Cal OES, 2018)

This plan utilizes two mapping tools to estimate the frequency and probability of an earthquake occurrence that impacts the City of Loma Linda: 1) the Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3)(see **Figure 4-8)** and 2) the Earthquake Shaking Potential based on the USGS National Seismic Hazard Model (see **Figure 4-9**). Both mapping tools are described in more detail below.

Importantly, these probabilistic maps were used to determine the earthquake scenario used for the vulnerability analysis. This plan focuses on the **Shakeout2 Scenario** along the San Andreas Fault **(Figure 4-10)** because it is the scenario with the highest likelihood of severe shaking and producing an M 7.8 earthquake within the next 30 years.

4.2.2.4.1 30-Year Earthquake Probability (UCERF3)

One method for evaluating earthquake probability is to examine the probability of a fault producing an earthquake of a certain magnitude within a time frame. **Figure 4-8** presents the probabilities that various depicted faults will produce a 6.7M earthquake within the next 30 years.

The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3),[1] is a comprehensive model of earthquake occurrence for California. It represents the best available science for authoritative estimates of California's magnitude, location, and likelihood of potentially damaging earthquakes. According to UCERF3 and as shown in **Figure 4-8**, the Shakeout2 Scenario, resulting from a San Andreas fault rupture, has a 10% to 100% probability of occurrence within 30 years, the highest probability affecting the City.

[1] Quaternary faults are those active faults that have been recognized at the surface and which have evidence of movement in the past 1.6 million years - the duration of the Quaternary Period.

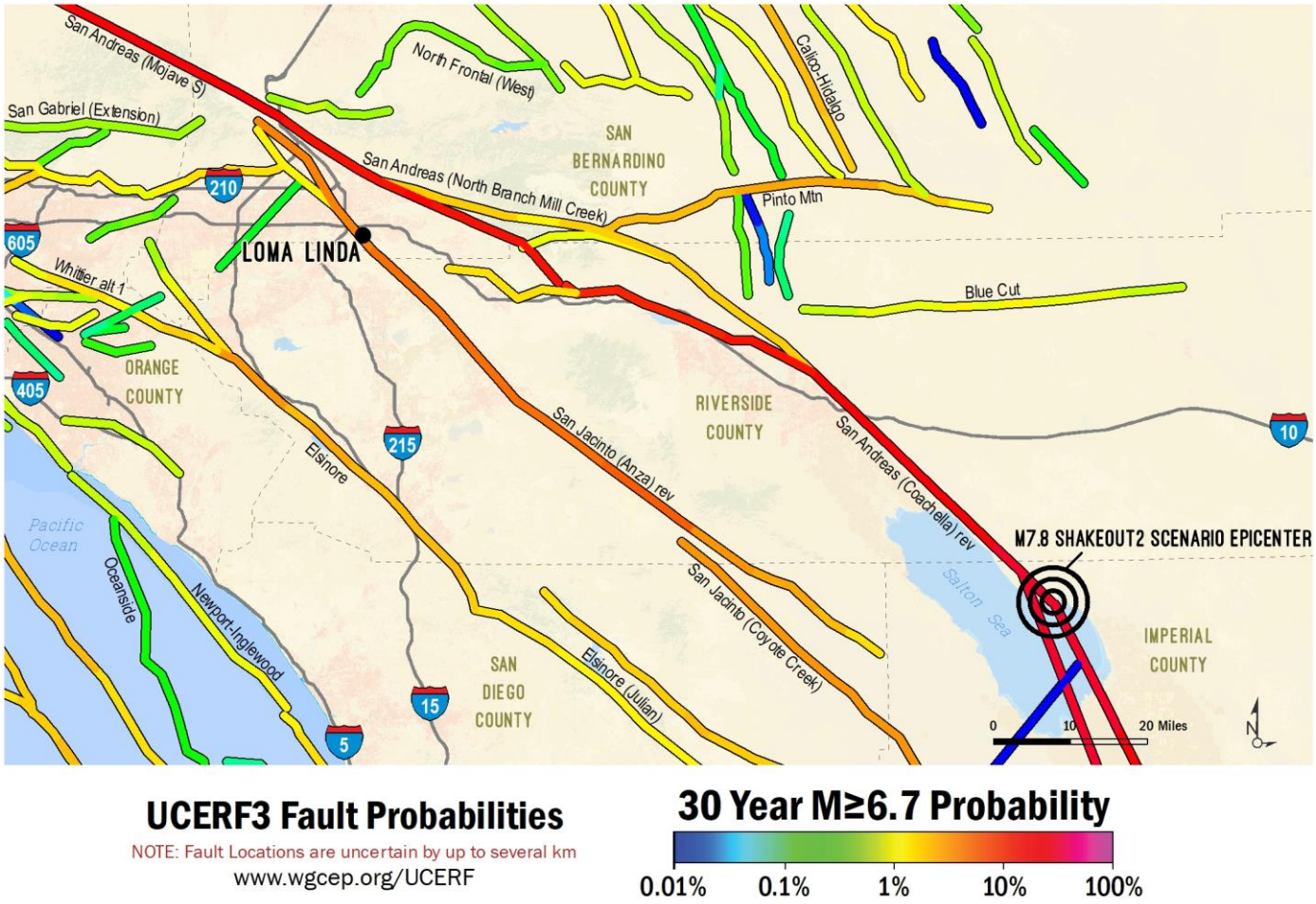


Figure 4-8: San Bernardino County Region Earthquake Probability

4.2.2.4.2 Earthquake Shaking Potential

Another method for understanding the probability and frequency of a future earthquake is to examine the "shaking potential" of an area. The Earthquake Shaking Potential Map, **Figure 4-9**, shows this potential seismic shaking from anticipated future earthquakes. It is probabilistic in the sense that the analysis considers the uncertainties in the size and location of earthquakes and the resulting ground motions that can affect a particular site. (CGS, 2020) It is also useful in understanding the severity of shaking in different locations throughout the City, as discussed in Section 4.2.2.5.

The map is expressed in terms of shaking potential or the probability of exceeding a certain ground motion. The map shows a 2% probability of exceeding one second of ground motion in 50 years. Earthquake shaking potential in California is calculated based on the USGS National Seismic Hazard Model and in partnership with California Geological Survey (CGS). Earthquake shaking potential also considers historical earthquakes, slip rates on major faults, deformation throughout the region, and the potential for amplifying seismic waves by near-surface geologic materials. (CGS, 2020)

The map depicts a range of lower hazard to higher hazard probability. Higher hazard areas are those near major, active faults that will, on average, experience stronger earthquake shaking more frequently. This intense shaking can damage even strong, modern buildings. Lower hazard areas are those regions that are distant from known, active faults that will experience lower levels of shaking less frequently. In most earthquakes, only weaker masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking in those locations. (D. Branum, 2016)

Ground shaking potential estimates the severity of shaking that has a 2% chance of occurrence (or exceedance) in 50 years. In other words, the ground shaking probability illustrates the severity of shaking that has a 2,500-year average repeat time. Relatively long-period (1.0 second) earthquake shaking is shown. Long-period shaking affects tall, relatively flexible buildings but also correlates well with overall earthquake damage. Although the greatest hazard is in areas of highest intensity, as shown in **Figure 4-9**, no region is immune from potential earthquake damage. (*Id.*)

The potential for earthquake ground shaking, as defined by the U.S. National Seismic Hazard Model, is used by engineers to design buildings for larger ground motions than what we think will occur during a 50-year interval. This will make buildings safer than if they were only designed for the ground motions that we expect to occur in the next 50 years. (USGS, 2020)

4.2.2.4.1 Shakeout2 Scenario

This HMP uses the "Shakeout2 Scenario," named by the USGS, to evaluate earthquake vulnerability because it's both the highest probability of occurrence from the UCERF mapping and the highest shake potential from a range of regional, scenario-based shake maps available from USGS for the vulnerability analysis.

Figure 4-10 illustrates the violent to extreme intensity predicted for Loma Linda under the Shakeout2 Scenario. Section 4.3.2.4 details the City's vulnerability to the impacts from the Shakehout2 scenario.

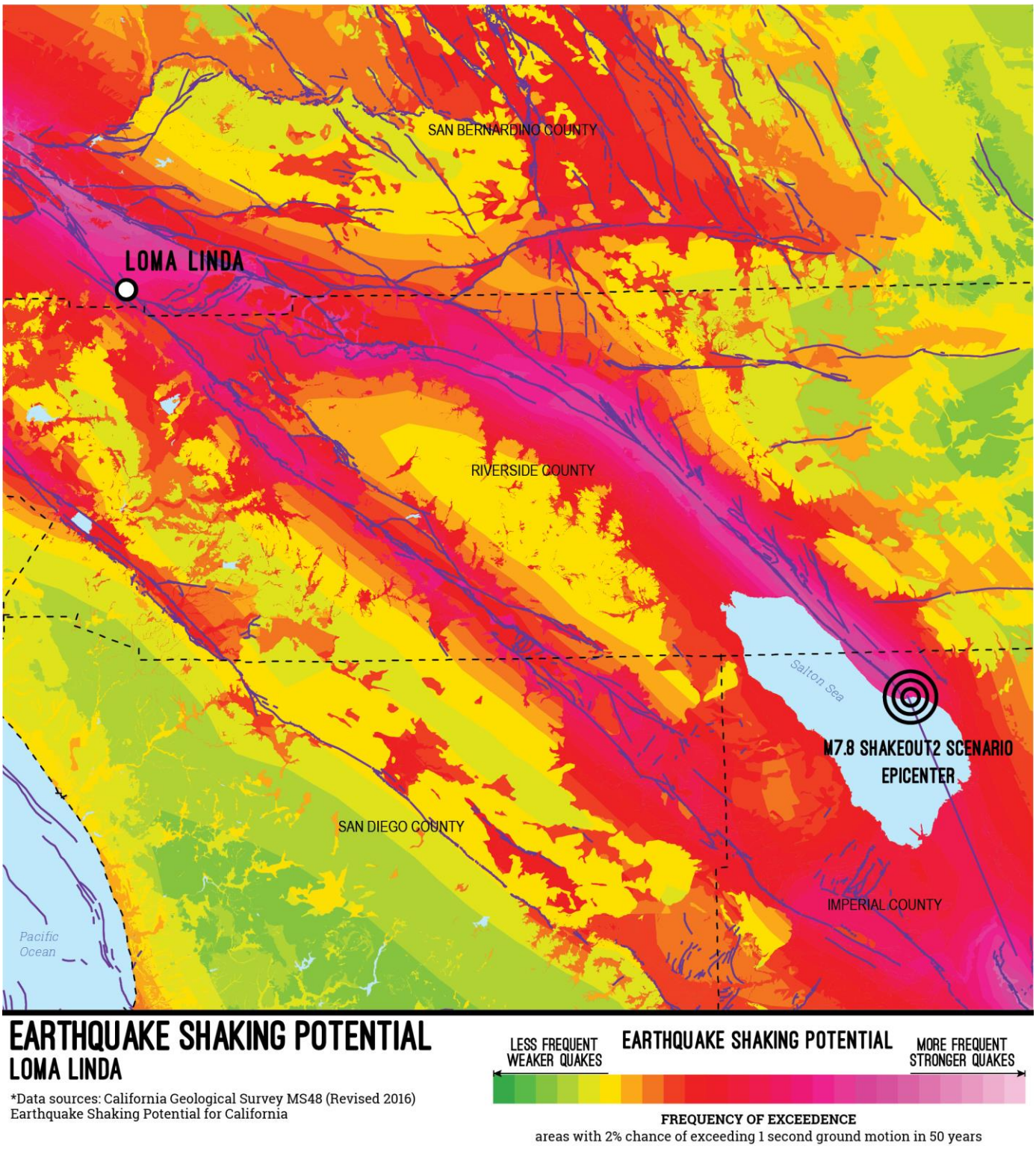
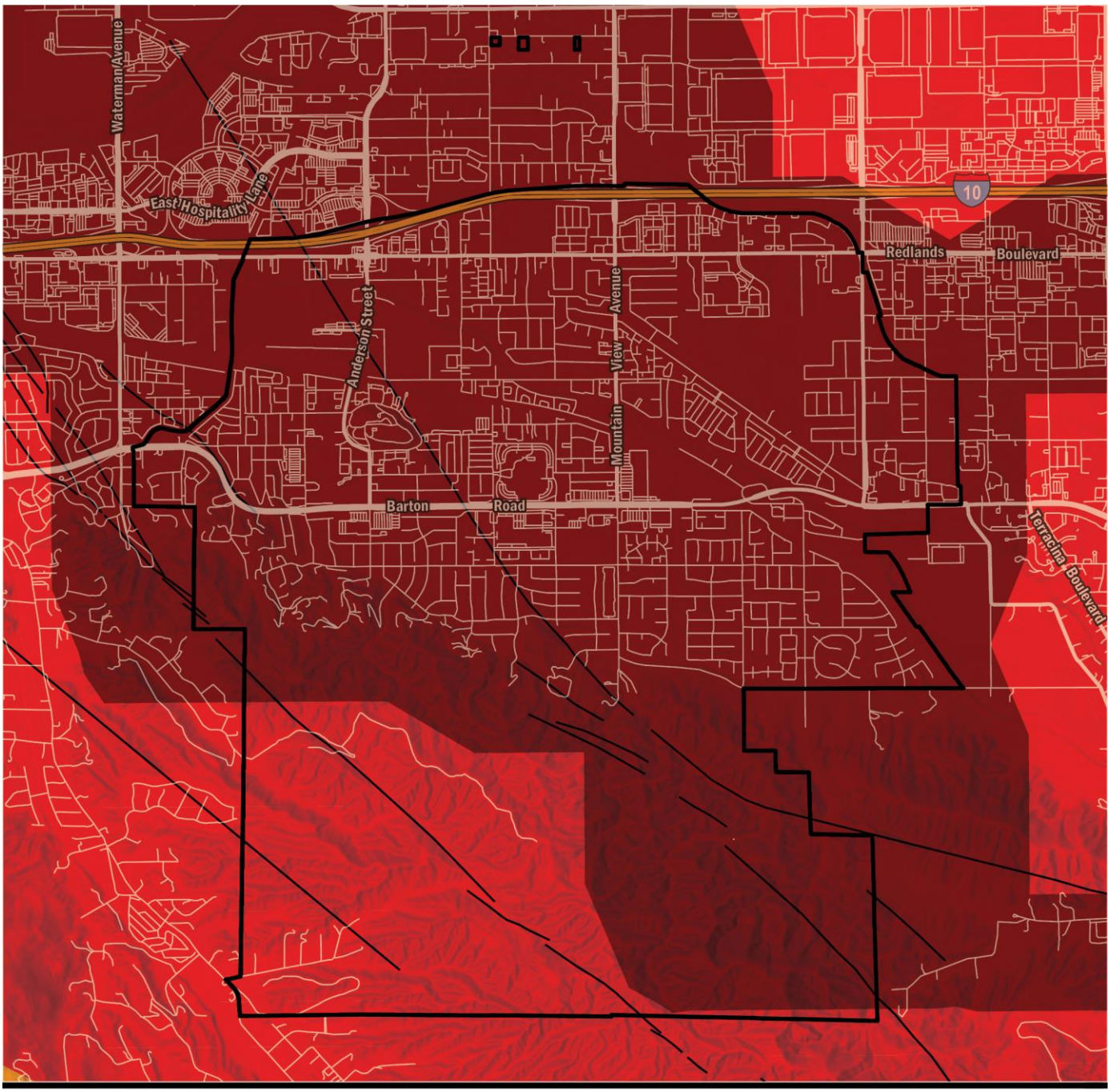


Figure 4-9: Loma Linda EQ Shake Potential



SHAKEOUT2 (M7.8)
LOMA LINDA
*Data sources: USGS.

MAP LEGEND
III IV V VI VII VIII IX X
WEAK LIGHT MODERATE STRONG VERY STRONG SEVERE VIOLENT EXTREME
MMI

Figure 4-10: Loma Linda Shakeout2 (M7.8)

4.2.2.5 Severity and Extent

As we know from past events, even a moderate earthquake occurring in or near Loma Linda could result in deaths, casualties, property and environmental damage, and disruption of everyday services and activities. The event's severity could be aggravated by collateral emergencies such as fires, hazardous material spills, utility disruptions, landslides, and transportation emergencies.

The severity and extent of earthquakes depend on the origin and severity of the specific earthquake, therefore ranging significantly. The tools for understanding probability, discussed in the Frequency and Probability Section of this hazard profile (4.2.2.4), also serve as the basis for understanding the severity and extent of potential earthquakes in Loma Linda.

The Fault Probability Map, **Figure 4-8**, illustrates the probability of a relatively severe M 6.7 earthquake occurrence; many faults around Loma Linda have a more than 1% chance of creating that M 6.7 in the next 30 years. The Earthquake Shake Potential Map, **Figure 4-9**, demonstrates Loma Linda's susceptibility to more frequent and more severe earthquake shaking potential.

These two maps, taken together, show that Loma Linda is susceptible to severe earthquakes in the future. Moreover, the earthquake scenario with the highest probability of occurrence and producing severe shaking, the M 7.8 Shakeout2 Scenario earthquake, produces extreme and violent intensity in Loma Linda.

4.2.2.6 Warning Time

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being conducted with warning systems that use the low energy waves that precede major earthquakes. Seconds and minutes of advanced warning can allow people and systems to take actions to protect life and property from destructive shaking. Even a few seconds of warning can enable protective actions specific to various sectors of the population, such as:

- **Public:** Citizens, including school children, drop, cover, and hold on, turn off stoves, or safely stop vehicles.
- **Businesses:** Personnel move to safe locations, automated systems ensure elevator doors open, production lines are shut down, and sensitive equipment is placed in a safe mode.
- **Medical services:** Surgeons, dentists, and others stop delicate procedures.
- **Emergency responders:** Responders can open firehouse doors; personnel prepare and prioritize response decisions.
- **Power infrastructure:** Personnel can protect power stations and grid facilities from strong shaking.

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4.2.3 Drought Hazard Profile

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. Drought severity depends on numerous factors, including duration, intensity, geographic extent, and regional water supply demands by humans and vegetation. Other climatic factors can aggravate the severity of drought, such as prolonged high winds and low relative humidity.

California's water resources have been stressed by periodic drought cycles and, in some places, overuse, creating the need for unprecedented state and local restrictions in water use. Climate change is expected to increase drought and extreme weather. While the duration and severity of drought are always in question, it is certain that California and the City of Loma Linda will continue to be impacted by drought. (California Drought Contingency Plan, 2010)

Drought originates from a deficiency of precipitation over an extended period, usually one or more seasons. Drought can result in a water shortage for some activity, group, or environmental sector. Drought is a complex natural hazard, which is reflected in the following four types of drought:

- Agricultural drought is defined principally in terms of naturally occurring soil moisture deficiencies relative to water demands of plant life, usually arid crops.
- Hydrological drought is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- Meteorological drought is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Socioeconomic drought associates the supply and demand of economic goods or services with meteorological, hydrologic, and agricultural drought elements. Socioeconomic drought occurs when the water demand exceeds the supply due to a weather-related supply shortfall. It may also be called a water management drought.

Although climate is a primary contributor to hydrological drought, other factors such as changes in land use (e.g., deforestation), land degradation, and the construction of dams all affect the hydrological characteristics of the watershed. Since regions are interconnected by hydrologic systems, the impact of meteorological drought may extend well beyond the borders of the precipitation-deficient area. Similarly, changes in land use upstream may alter hydrologic characteristics such as infiltration and runoff rates, resulting in more variable streamflow and a higher incidence of hydrologic drought downstream. Land use change is one way human actions alter the frequency of water shortage even when no change in the frequency of meteorological drought has been observed.

4.2.3.1 Plans Policies, and Regulatory Environment

California Sustainable Groundwater Management Act

On September 16, 2014, Governor Brown signed a package of bills (SB1168, AB1739, and SB1319) collectively called the Sustainable Groundwater Management Act (SGMA). SGMA requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. Under SGMA, these basins should reach sustainability within 20 years of implementing their sustainability plans. For critically over-drafted basins, that date will be 2040. For the remaining high and medium priority basins, 2042 is the deadline.

Statewide Emergency Water Conservation Regulations

In 2016, the State Water Resources Control Board (Water Board) adjusted emergency water conservation regulations to recognize the differing water supply conditions and ongoing drought across the state to comply with an Executive Order from the California Governor declaring a drought emergency. Executive Order B-37-16 Making Water Conservation a California Way of Life updates temporary emergency water restrictions and transitions to permanent, long-term improvements in water use by:

- providing for wiser water use
- eliminating water waste
- strengthening local drought resilience
- improving agricultural water use efficiency and drought planning

In April of 2017, a new Executive Order lifted the drought emergency but retained many conservation requirements. Most regulations are still in effect with the exception of water supply "stress test" requirements and conservation standards for urban water suppliers. The temporary restrictions established a baseline of the types of benefits that are possible from water conservation requirements. The Executive Orders are available at:
https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/executive_orders.html

California Water Plan

The California Water Plan presents strategic plan elements, including a vision, mission, goals, guiding principles, and recommendations for current water conditions, challenges, and activities. The plan includes future uncertainties and climate change impacts, scenarios for 2050, and a roadmap for improving data and analytical tools needed for integrated water management and sustainability. The California Water Plan was updated most recently in 2018. See: https://water.ca.gov/Programs/California-Water-Plan.

2015 San Bernardino Valley Regional Urban Water Management Plan

This Urban Water Management Plan summarizes anticipated supplies and demands for the years 2015-2040 for the agencies participating in the plan, including Riverside Highland Water Company who services the City of Loma Linda. The Urban Water Management Plan Act requires evaluation of the following:

- Whether supplies will be sufficient to meet demands during the following hydrologic year types normal/average year, single dry year, multiple dry year sequence;
- Existing baseline water use in terms of gallons per capita per day (GPCD) (applies only to retail water suppliers);
- Targets for future water use consistent with the Water Conservation Act of 2009 (SB X7-7), which seeks a 20 percent reduction in per capita water use by 2020;
- Demand Management Measures (DMMs) implemented or planned for implementation as well as the methods proposed for achieving future water use targets;
- Water shortage contingency planning; and
- Notification and coordination with other water agencies, land use entities, and the community.

One Water One Watershed Plan for Santa Ana River Integrated Watershed (2018 Update)

This integrated water management plan addresses the Santa Ana River Watershed resources, including hydrogeology, land use, biological resources, water supply, water quality, flood control, and demographics. The plan also presents regional watershed management practices, including water storage, water quality improvements, water recycling, flood control, wetlands and sensitive habitat protection, recreational opportunities, and water conservation. (One Water One Watershed Plan, 2018)

4.2.3.2 Past Occurrences

California experienced massive changes over the course of the twentieth century, as evidenced by dramatic population increases and land use conversion. (Cal. Dep't of Water Resources, 2015) The single driest year in California's measured hydrologic history is 1977. This drought period began in November 1975. It first drained the State's reservoirs, which then lead to widespread water shortages in 1977. Additionally, 1976 is on record as the fourth driest year for California. During this period, 47 of the 58 California counties declared emergencies. (USGS)

San Bernardino County has experienced the following drought events since 1896. These past occurrences are described as follows:

- 1975 to 1977: California experienced the two driest years (1976 and 1977) in the State's history. The drought was declared an Emergency (FEMA-EM-3023) on January 20, 1977. Total crop damages statewide totaled $2.67 billion for both years ($888.5 million in 1976 and $1.8 billion in 1977). (Cal OES, 2018, pp. 597-600)

- 2007 to 2009: A California State-declared three-year drought of below-average rainfall, low snowmelt runoff, and the largest court-ordered water restricting in the state's history. The dry conditions damaged crops, deteriorated water quality, and caused extreme wildfire danger. The water year of 2007, in particular, was the single driest year of that drought and was also in the top 20 percent of dry years based on computed statewide runoff. (*Id.*)

- 2012 to 2017: This drought impacted all counties throughout California. It notably affected the agricultural sector in the San Joaquin Valley and Southern California during the 2012-2013

timespan. San Bernardino County first declared a local drought emergency in 2014. As of May 23rd, 2016, San Bernardino County had submitted a local Emergency Proclamation. This was the most severe drought in over 100 years. (*Id.*)

The winter of 2016-2017 formally ended California's most recent significant drought; however, the State is still recovering from five dry years. The 2017-2018 winter also experienced less precipitation than normal across the state. Drought conditions have returned because of this, although less intense than in recent years. As of March 11th, 2021, approximately 99.3 percent of California was at minimum abnormally dry, and approximately 90.9 percent of the state was characterized by at least moderate drought. Approximately 58.6 percent of California experienced at least severe drought conditions, and a smaller part of the state (approximately 29.5 percent, in far southeastern California) experienced extreme drought conditions. In San Bernardino County, these conditions are worse. As of March 11th, 2021, the entire County has experienced a moderate drought, and more than 90 percent of the County has experienced severe drought. (NOAA & NIDIS, 2021) **Figure 4-11** depicts a drought severity timeline from 2000 through 2021 in the Santa Ana region.

4.2.3.3 Location/Geographic Extent

Drought is one of the few hazards with the potential to impact the entire population of the City of Loma Linda directly or indirectly through water restrictions, higher water and food prices, reduced air or water quality, or restricted access to recreational areas. No portion of the City is immune from drought conditions.

Lack of winter snowfall in the mountains can eventually lead to agricultural impacts due to decreased stream flows. Reduced base flows may introduce additional challenges for communities that depend on direct drinking water supplies from rivers and tributaries. Droughts of just a few weeks during critical periods of plant development can have disastrous effects on agriculture production. Reduced reservoir storage from decreased runoff in the mountains can lead to water shortages. Droughts that occur in populated areas may not directly affect the residents but may increase the threat of wildfire in the wildland-urban interface areas.

4.2.3.4 Severity and Extent

The severity and extent of a drought depend on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly.

Unlike most disasters, droughts normally occur slowly but last a long time. On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture,

transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

Drought eventually affects groundwater sources but generally not as quickly as surface water supplies. In contrast, groundwater supplies generally take longer to recover from a drought event. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can reduce groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

A drought directly or indirectly impacts all people in the affected areas. Drought can result in farmers not being able to plant crops or the failure of planted crops. This results in loss of work for farm workers and those in food processing and winemaking jobs. Other water-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) and landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

4.2.3.5 Frequency/Probability of Future Occurrences

Predicting the precise probability of future drought depends on comprehensive and reliable data. Cal-Adapt, an authority on climate variance in California, projects an extended period of drought over a 20-year period statewide. (Cal-Adapt, 2020) Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air, resulting in less precipitation.

According to the results of the risk factor exercises for the City, the probability of drought occurring in Loma Linda is highly likely (100% annual probability). **Figure 4-11** provides a time series from the National Drought Monitor that shows that the City of Loma Linda has been in some form of drought for much of the period from 2000 to 2020. **Table 4-7** describes the possible impacts of each level of drought classification in California from the US Drought Monitor.

Table 4-7: Drought Classifications and Impacts

Category	Description	Possible Impacts
D0	Abnormally Dry	▪ Active fire season begins ▪ Going into drought, short-term dryness, slowing planting, growth of crops or pastures. ▪ Coming out of drought, some lingering water deficits, and pasture or crops not fully recovered,

D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed
D3	Extreme Drought	▪ Major crop/ pasture losses ▪ Widespread water shortages or restrictions
D4	Exceptional Drought	▪ Exceptional and widespread crop/ pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water

Adapted from U.S. Drought Monitor Drought Classifications and Impacts

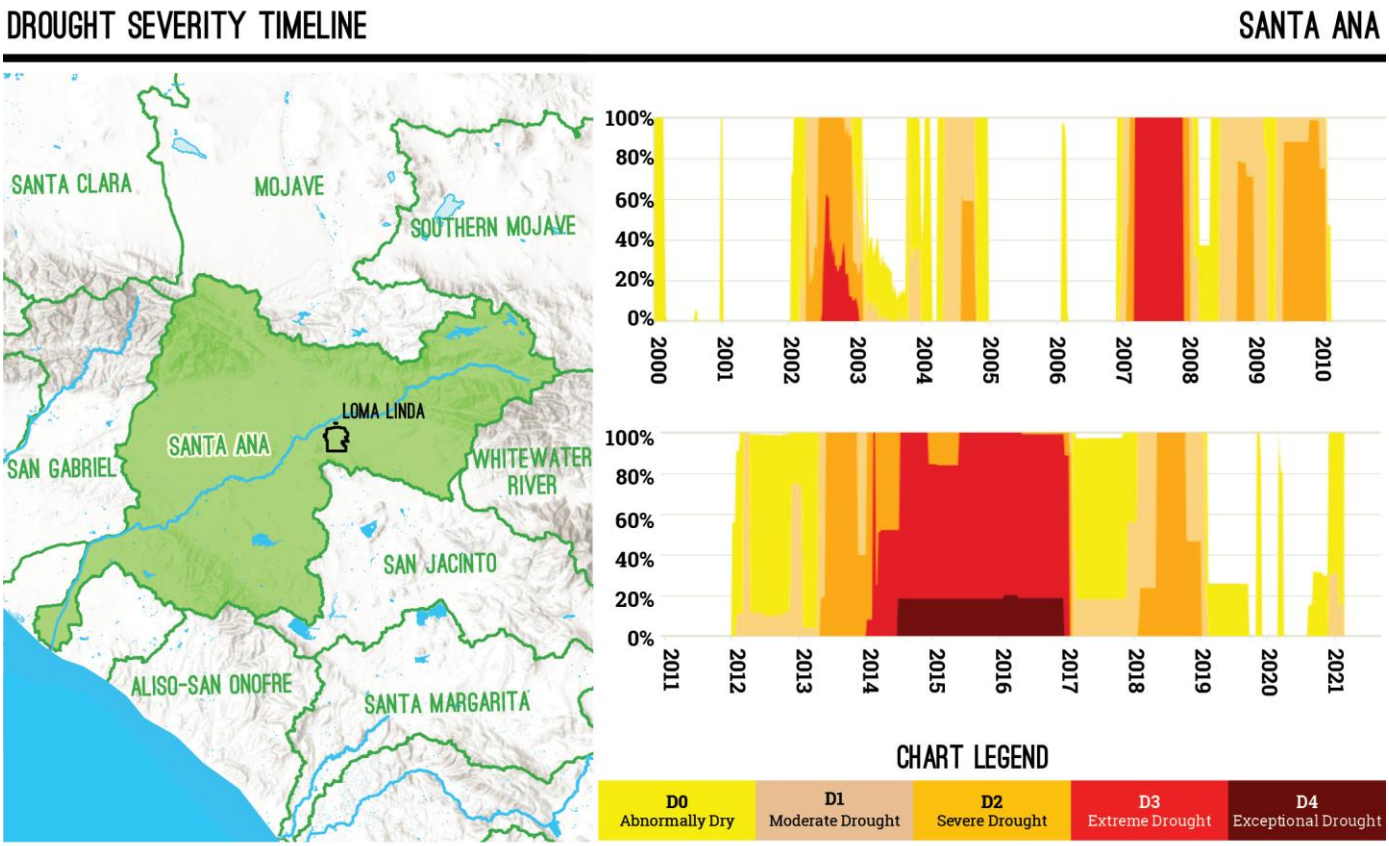

Figure 4-11: Loma Linda – Santa Ana Drought Monitor

4.2.4 Climate Change Hazard Profile

Climate change refers to any distinct change in measures of climate lasting for a long period of time, more specifically, major changes in temperature, rainfall, snow, or wind patterns. Climate change may be limited to a specific region or may occur across the planet. Climate change may result from:

- Natural factors (e.g., changes in the Sun's energy or slow changes in the Earth's orbit around the Sun);
- Natural processes within the climate system (e.g., changes in ocean circulation); and
- Human activities that change the atmosphere's make-up (e.g., burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.).

Changes in extreme weather and climate events, such as heatwaves and drought, are the primary way that most people experience climate change. Human-induced climate change has already increased the number and strength of these extreme events. Over the last 50 years, much of the U.S. has seen increases in prolonged periods of excessively high temperatures, heavy downpours, and severe floods and droughts in some regions. (Wuebbles Et al., 2017)

The effects of climate change are varied and include extremes in precipitation and temperature. Increases in long-term average temperature, precipitation, and sea-level rise can result in compounding impacts such as ocean acidification, increasing insect outbreaks, and shifts in biological phenomena, to name a few. (Food and Agriculture Organization of the United Nations, 2014).

California is already experiencing the impacts of climate change, including prolonged drought, increased coastal flooding and erosion, and tree mortality. The state has also seen increased average temperatures, more extreme heat days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, a decreased summertime fog of 33%, and both snowmelt and rainwater running off sooner in the year. (Cal OES, 2018) The intensity of extreme weather events is also increasing. The state has also seen increased extreme weather events and related hazards, such as heatwaves, wildfires, droughts, and floods. (USGS, n.d.)

4.2.4.1 Policies, Plans, and Regulatory Environment

California Assembly Bill (AB) 2516: Database for Sea-level Rise Planning

AB 2516 directed the Natural Resources Agency in collaboration with the Ocean Protection Council to conduct biannual surveys of sea-level rise planning information to catalog California's efforts to prepare for rising sea levels. Numerous studies, vulnerability assessments, and local coastal programs have been developed under this directive. AB 2516 resources are stored in the Adaption Clearinghouse, resilientca.org.

2019 California Green Building Standards

The City has adopted the 2019 California Green Building Standards, also known as CALGreen Code. CALGreen Code establishes regulations for green building, non-residential and residential buildings. The

regulations cover planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality. The code also includes voluntary measures for residential, nonresidential, and health facilities.

California Sustainable Communities and Climate Protection Act of 2008

The Sustainable Communities and Climate Protection Act of 2008 (Sustainable Communities Act, SB 375, Chapter 728, Statutes of 2008) looks to reduce GHG emissions through coordinated transportation and land use planning with the goal of more sustainable communities. Regional targets are established for GHG emissions reductions from passenger vehicle use by the Sustainable Communities Strategy (SCS) established by each metropolitan planning organization (MPO). The SCS is an integral part of regional transportation plans (RTP) and contains land use, housing, and transportation strategies to meet GHG reduction targets.

2018 California's Fourth Climate Change Assessment

California's Fourth Climate Change Assessment promotes actionable science that serves the growing needs of state and local-level decision-makers from a diverse number of sectors. The Fourth Assessment provides information in a number of ways. Regional reports summarize climate impacts and adaptation needs around the state, at a resolution useful for local decision-makers. Statewide impacts are summarized in the Statewide Summary Report, as well as reports on Tribal and Indigenous Communities, Climate Justice, and California's Ocean and Coast. The Technical Reports are the foundation of the Fourth Assessment and include climate projections and analyses of expected impacts in various sectors across the state.

2020 California Adaptation Planning Guide (APG)

California has been addressing climate change for over 20 years, focusing on both greenhouse gas emissions reduction and adaptation. Cal OES's Adaptation Planning Guide (APG) provides guidance and support for communities addressing the unavoidable consequences of climate change. The 2020 APG presents an updated, step-by-step process that communities can use to plan for climate change.

California Senate Bill 379: General Plan Safety Element and Climate Adaption

California SB 379 requires cities and counties to include climate adaptation and resiliency strategies in the Safety Elements of their General Plans upon the next revision beginning January 1, 2017. The bill requires the climate adaptation update to include goals, policies, objectives, and implementation measures for their communities based on a climate vulnerability assessment, including a discussion of conserving and protecting the natural infrastructure that serves an adaptation function.

California Senate Bill 1000: General Plan Safety and Environmental Justice Elements

Senate Bill 1000 requires local governments to include climate adaptation and resilience strategies when updating the safety element of their general plan. It also includes provision for an Environmental Justice

element in General Plans. SB 1000 has four basic requirements, whether those requirements are combined into a single environmental justice element or distributed throughout other existing elements, including:

- identifying disadvantaged communities,
- incorporating policies to reduce the environmental health impacts that adversely affect residents in disadvantaged communities,
- incorporating policies to include residents of disadvantaged communities in decision-making processes, and
- incorporating policies that prioritize improvements and projects in disadvantaged communities.

4.2.4.2 Past Occurrences

Climate change has never been directly responsible for any declared disasters. Past flooding, wildfire, levee failure, and drought disasters may have been exacerbated by climate change, but it is impossible to make direct connections to individual disasters. In addition, unlike earthquakes and floods that occur over a finite time period, climate change is an ongoing hazard, the effects of which some are already experiencing. Other effects may not be seriously experienced for decades or may be avoided altogether by mitigation actions taken today.

4.2.4.3 Location/Geographic Extent

Geographical borders do not limit the effects of climate change. Loma Linda, San Bernardino County, the State of California, the United States, and the rest of the world are all at risk of climate change. As such, the entire City is at risk of the effects of climate change.

The City of Loma Linda lies in a region defined largely by the San Gabriel Mountains, San Bernardino Mountains, San Jacinto Mountains, and smaller inland mountains reaching through the desert to the Colorado River, which borders the region on the east.

4.2.4.4 Severity and Extent

Climate Change can potentially affect the City of Loma Linda in a variety of ways.

- **Heatwaves:** Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heatwaves in the City of Loma Linda and the rest of California, which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions. Those most at risk and vulnerable to climate-related illness are the elderly, individuals with chronic conditions such as heart and lung disease, diabetes, and mental illnesses, infants, the socially or economically disadvantaged, and those who work outdoors. Heat can stress infrastructure, altering maintenance needs, particularly for roadways.

- **Precipitation, intense rainstorms, and landslide:** Increased frequency of landslides could be seen throughout the City, especially in areas already identified as high risk. Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and/or more extensive flooding.
- **Wildfire:** Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations, affecting forest health and reducing forest resilience to wildfires. Increased wildfire intensity and extent will increase public safety risks, property damage, fire suppression, and emergency response costs to government, watershed and water quality impacts, vegetation conversions, and habitat fragmentation.
- **Droughts:** Droughts are likely to become more frequent and persistent in the 21st century. (Bedsworth, 2018)

Average Maximum Temperature Increases

Temperatures are predicted to rise due to climate change in the region that includes Loma Linda and the southwestern portion of San Bernardino County more broadly. While the historical annual average maximum temperature in the region was 72.5°F, that average is projected to increase to 74.8°F by the early-21st century, 76.7°F by the mid-21st century, and 77.8°F by the late-21st century under a more moderate climate emissions scenario. Under an extreme scenario, interior regions in Southern California are projected to experience up to a 10°F increase in temperature in the late-21st century. (Hall, 2018). See also **Figure 4-12,** which compares historically observed temperatures with annual average maximum temperature projections for the State of California. Temperatures are predicted to continue increasing under various emission scenarios. See **Figure 4-13** and **Figure 4-14**.

There are six representative scenarios for projecting temperature increases and other climate change impacts, influenced by Representative Concentration Pathways (RCPs). These six scenarios range from a low of .3-meter global mean sea level rise to the highest 2.5-meter global mean sea level rise. NOAA utilizes three RCPs, each representing potential underlying socioeconomic conditions and technological considerations influencing the six scenarios. These include a low-end range (RCP 2.6), which projects strong measures, a moderate (RCP 4.5) range, which requires stabilizing mitigation measures through 2050, and a high-end (RCP 8.5), which maintains a fossil fuel-intensive, business as usual emission scenario. This LHMP focuses on RCP 4.5 and RCP 8.5 to understand the range of possible impacts by the end of the century.

Figure 4-12 depicts historic temperatures and projected annual average maximum temperatures throughout the State of California through 2100 for the RCP 4.5 and 8.5 scenarios.

Figure 4-13 and **Figure 4-14** show annual averages of observed and projected Maximum Temperature values for the City of Loma Linda Climate Region under the RCP 4.5 and 8.5 emissions scenarios. These

projections differ depending on the time of year and the type of measurement (highs vs. lows), all of which have different potential effects on the City's ecosystem health, agricultural production, water use and availability, and energy demand.

4.2.4.5 Frequency/Probability of Future Occurrences

Climate change is one of the few natural hazards where the probability of occurrence is influenced by human action. The Representative Concentration Pathways (RCPs) 4.5 and 8.5 take into consideration various emissions scenarios moving forward (both business-as-usual, RCP 8.5, and moderately reduced emissions, RCP 4.5).

In addition, unlike other hazards like earthquakes and floods that occur over a finite period of time, climate change is an ongoing hazard. Climate change is predicted to increase the frequency of other hazard events. Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. Climate change is expected to increase extreme heat events and heat waves' frequency, intensity, and duration.

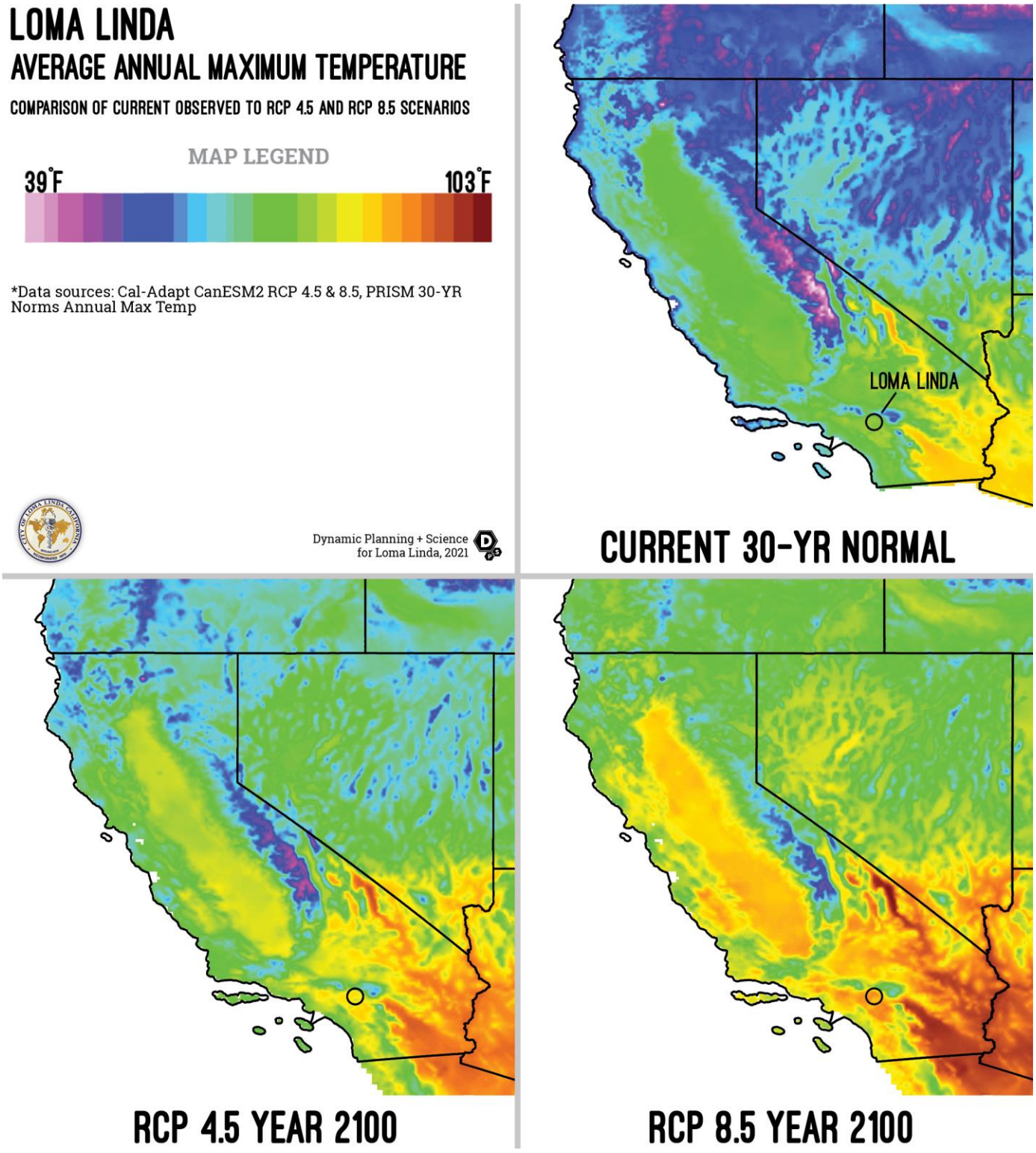

Figure 4-12: Annual Average Max Temperature Future Scenario Comparison.

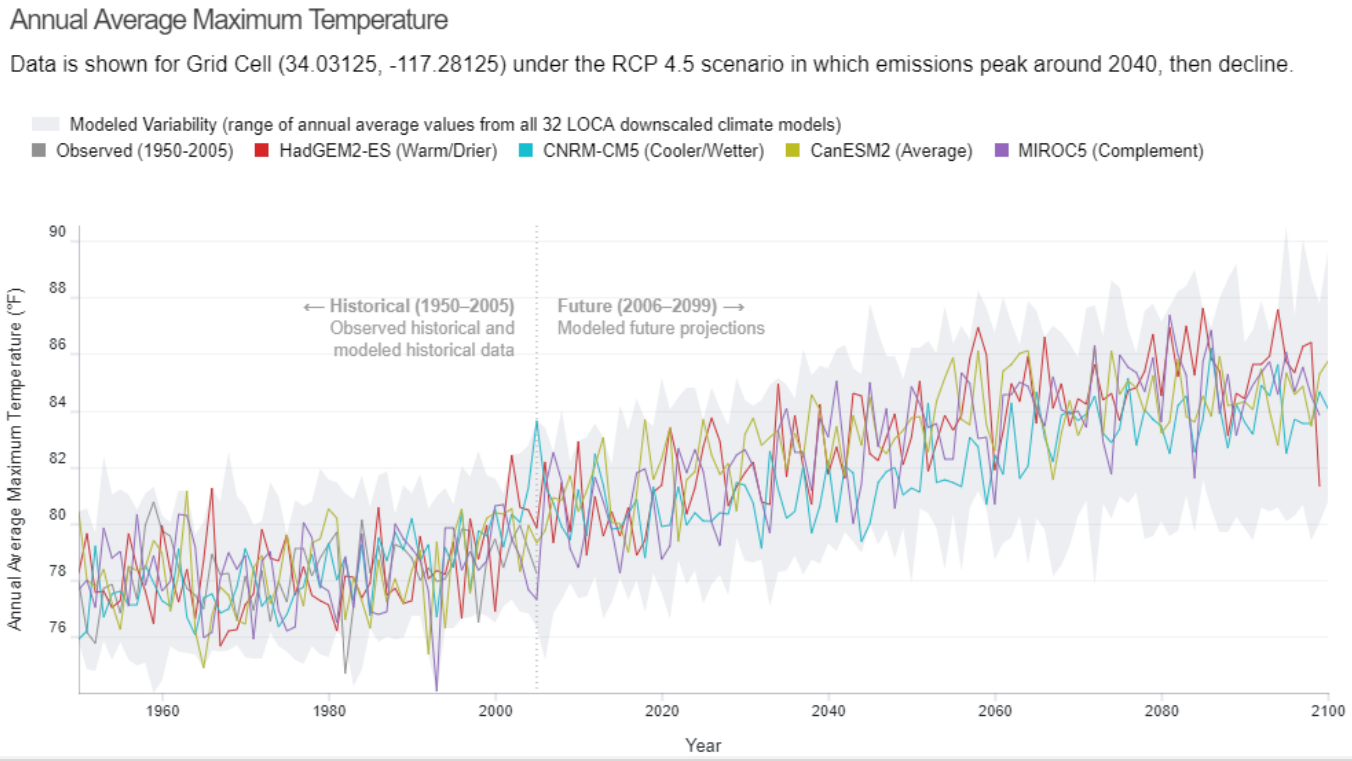

Figure 4-13: Maximum Temperatures in the City of Loma Linda Climate Region (RCP 4.5)

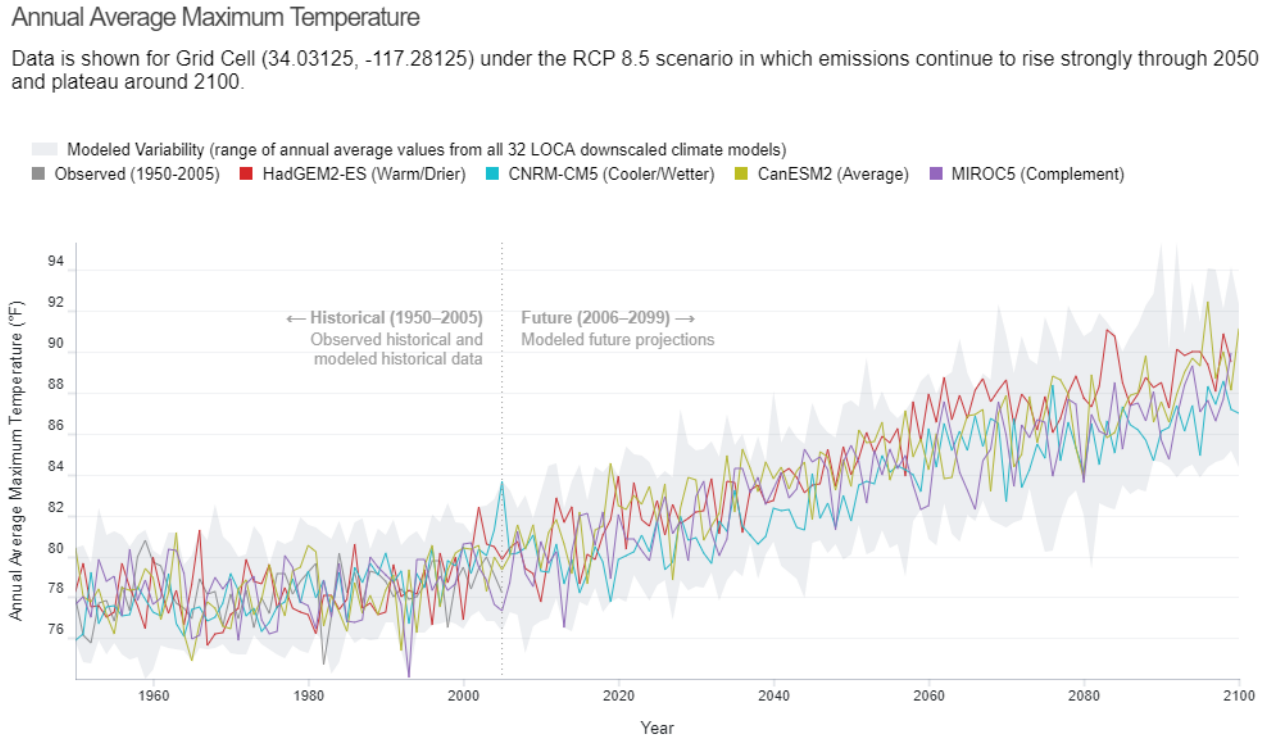

Figure 4-14: Maximum Temperatures in the City of Loma Linda Climate Region (RCP 8.5)

Source: cal-adapt.org

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4.2.5 Hazardous Waste & Materials

Hazardous materials release is a hazard event whereby harmful concentrations of hazardous or toxic substances are released into the environment. A release occurs when storage containers of hazardous materials leak or fail. This can happen due to industrial accidents, vehicle crashes, as a direct result of other disasters (e.g., a flood or earthquake), or as a deliberate act.

As part of this analysis, the City also identified the potential environmental justice issues associated with hazardous materials. The mapping prepared uses the CalEnviroScreen data set from the California Environmental Protection Agency (Cal EPA). This dataset helps identify California communities most affected by various sources of pollution and where people are often especially vulnerable to pollution's effects. The dataset uses environmental, health, and socioeconomic information to produce scores for every census tract in the state that is mapped using a scale based on the pollution burden of the location. The higher the percentage, the greater the burden, and the higher likelihood of environmental justice concerns.

4.2.5.1 Policies, Plans, and Regulatory Environment

United States Environmental Protection Agency

The United States Environmental Protection Agency (USEPA) is the primary federal agency that regulates hazardous materials and waste. In general, the USEPA works to develop and enforce regulations that implement environmental laws enacted by Congress. The agency is responsible for researching and setting national standards for various environmental programs, delegating the responsibility for issuing permits, and monitoring and enforcing compliance to states and Native American tribes. USEPA programs promote handling hazardous wastes safely, cleaning up contaminated land, and reducing waste volumes through such strategies as recycling. California falls under the jurisdiction of USEPA Region 9.

United States Department of Transportation

The United States Department of Transportation (USDOT) has the regulatory responsibility for the safe transportation of hazardous materials between states and internationally. The USDOT regulations govern all means of transportation, except for those packages shipped by mail, which are covered by United States Postal Service regulations.

Hazardous Materials Transportation Act

The USDOT regulates hazardous materials transportation under Title 49 of the Code of Federal Regulations. State agencies that have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans). The California State Fire Marshal's Office has oversight authority for hazardous materials liquid pipelines. The California Public Utilities Commission has oversight authority for natural gas pipelines in California. These agencies also govern permitting for hazardous materials transportation.

Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984

Federal hazardous waste laws are generally promulgated under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984. These laws provide for the "cradle to grave" regulation of hazardous wastes. Any business, institution, or other entity that generates hazardous waste is required to identify and track its hazardous waste from the point of generation until it is recycled, reused, or disposed. The Department of Toxic Substance Control (DTSC) is responsible for implementing the RCRA program as well as California's own hazardous waste laws, which are collectively known as the Hazardous Waste Control Law.

Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) requires specific training for hazardous materials handlers, provision of information to employees who may be exposed to hazardous materials, and acquisition of material safety data sheets from materials manufacturers. The material safety data sheets describe the risks and proper handling and procedures related to specific hazardous materials. Employee training must include response and remediation procedures for hazardous materials releases and exposures.

Comprehensive Environmental Response, Compensation, and Liability Act and the Superfund Amendments and Reauthorization Act of 1986

Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as "Superfund," on December 11, 1980. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, established a trust fund to provide for cleanup when no responsible party could be identified. The Superfund Amendments and Reauthorization Act (SARA) amended the CERCLA on October 17, 1986. SARA stressed the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites.

Emergency Planning Community Right-to-Know Act

Also known as SARA Title III, it was enacted in October 1986. This law requires state and local governments to plan for chemical emergencies. Reported information is then made publicly available so that interested parties may become informed about potentially dangerous chemicals in their community. In California, SARA Title III is implemented through California Accidental Release Prevention (CalARP) program.

California Environmental Protection Agency

One of the primary State agencies that regulates hazardous materials is the CalEPA, authorized by the USEPA to enforce and implement certain federal hazardous materials laws and regulations. The California DTSC, a department of the CalEPA, protects California and Californians from exposure to hazardous waste, primarily under the authority of the RCRA and the California Health and Safety Code. The DTSC requirements include the need for written programs and response plans, such as Hazardous Materials Management Plans. The DTSC programs include dealing with aftermath clean-ups of improper hazardous

waste management, evaluation of samples taken from sites, enforcement of regulations regarding the use, storage, and disposal of hazardous materials, and encouragement of pollution prevention.

California Division of Occupational Safety and Health

Like OSHA at the federal level, the California Division of Occupational Safety and Health (CalOSHA) is the responsible State-level agency for ensuring workplace safety. If a work site is contaminated, a Site Safety Plan must be crafted and implemented. Site Safety Plans establish policies, practices, and procedures to prevent the exposure of workers and members of the public to hazardous materials originating from the contaminated site or building.

California Department of Transportation and California Highway Patrol

Caltrans and the CHP are the two State agencies that have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies. Caltrans is the first responder for hazardous material spills and releases that occur on highways, freeways, and intercity rail lines. The CHP enforces hazardous materials and hazardous waste labeling and packing regulations designed to prevent leakage and spills of materials in transit and to provide detailed information to cleanup crews in the event of an accident.

California Health and Safety Code

California Health and Safety Code Chapter 6.95 and California Code of Regulations Title 19, Section 2729 set out the minimum requirements for business emergency plans and chemical inventory reporting. These regulations require businesses to provide emergency response plans and procedures, training program information, and a hazardous material chemical inventory disclosing hazardous materials stored, used, or handled on-site. A business that uses hazardous materials or a mixture containing hazardous materials must establish and implement a management plan if the hazardous material is handled in certain quantities.

Title 2. Public Morals, Safety, and Welfare, Division 3. Fire Protection and Explosives and Hazardous Materials, Chapters 4-7 in San Bernardino County Code § 23.0401-§ 23.0762-69

County Fire is an all-risk department that provides oversight and regulation of all commercial hazardous materials and wastes within the County. The County Hazardous Materials (HazMat) Division protects the health and safety of the public and the environment of the County of San Bernardino by assuring that hazardous materials are properly handled and stored. The following three HazMat programs provide services to all businesses in all cities within the County through inspection, emergency response, site remediation, and hazardous waste management:

- Certified Unified Program Agency (CUPA) that inspects approximately 7,500 facilities annually to ensure the proper management of hazardous materials and wastes in six areas of State regulatory concern.

- Underground Storage Tank (UST) that involves the construction, removal, and monitoring of about 800 underground storage tanks, which has led to the investigation of leaks at hundreds of facilities. Staff in this program ensures mediation efforts to remove the contamination and protect groundwater.
- Hazardous Materials Response Team provides emergency response to, and investigation of, all releases of hazardous materials. This 24/7 team responds to all types of hazardous material releases from businesses, pipelines, tanker trucks, and rail cars. The team develops Hazardous Materials Release Response Plans and Inventory (Business Plans). The team can mitigate the release and ensure that any contamination resulting from the spill or release is remediated below any level of health risk concern. If there is any sign of misconduct, the program contacts the County Environmental Crimes Task Force that coordinates all investigatory activity with the District Attorney's office. (San Bernardino County, 2016-2017)

4.2.5.2 Past Occurrences

Loma Linda has experienced an average of 5.3 hazardous materials spills per year from 2010-2020, reported to the Cal OES Spill Release Reporting database. The vast majority of these incidents involve transporting various materials via railroad and petroleum products such as diesel or gasoline. **Table 4-8** identifies the yearly releases reported to Cal OES. Loma Linda has been fortunate to experience such a low number of hazardous materials spills compared to other cities within San Bernardino County.

Table 4-8: Loma Linda Hazardous Materials Spills Cal OES Reporting

Year	Reported Releases
2010	**3**
2011	**1**
2012	**5**
2013	**8**
2014	**9**
2015	**9**
2016	**3**
2017	**6**
2018	**7**
2019	**4**
2020	**3**

Source: Cal OES Database (https://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/spill-release-reporting)

4.2.5.3 Location/Geographic Extent

Hazardous materials and chemicals are used daily in households and businesses throughout Loma Linda. Sources of hazardous materials can originate from seemingly harmless places such as service stations, dry cleaners, medical centers, and most industrial businesses. Hazardous waste can take the form of liquids, solids, contained gases, or sludge and can be the by-products of manufacturing processes or simply discarded commercial products, such as cleaning fluids and pesticides.

In severe situations, Loma Linda may also be at risk of hazardous materials release events on a regional level. With the right prevailing wind conditions, airborne toxic material could spread to and impact various parts of the air basin, including areas of Loma Linda.

4.2.5.4 Severity and Extent

The threat that hazardous materials pose to human health depends on the type of material, frequency, and duration of exposure, and whether chemicals are inhaled, penetrate the skin, or are ingested, among other factors. Exposure to hazardous materials can result in short- or long-term effects, including major damage to organs and systems in the body or death. Hazardous waste is any material with properties that make it dangerous or potentially harmful to human health or the environment. Hazardous materials can also cause health risks if they contaminate soil, groundwater, and air, potentially posing a threat long after the initial release.

4.2.5.5 Frequency/Probability of Future Occurrences

Figure 4-15 identifies stationary hazardous materials locations within Loma Linda that store, use, or produce hazardous materials regulated by the state. While these locations are fixed, roadways throughout the community are commonly used for the transport of hazardous materials and waste. These facilities are common locations for spills and releases. While there is no extent scale for hazardous materials release, the probability of an incident is anticipated to be occasional (less than 10% chance of occurrence) each year.

Most of the release events within Loma Linda have occurred due to human error, malfunctioning equipment, or accidents. Given this, it is anticipated that future events within Loma Linda will include minor incidents similar to past occurrences identified above. A key element identified in **Figure 4-15** is the density of hazardous material sites that may contribute to future accidents and hazardous material release events within the community. Activities to prevent future releases, as well as response strategies, should take this into consideration.

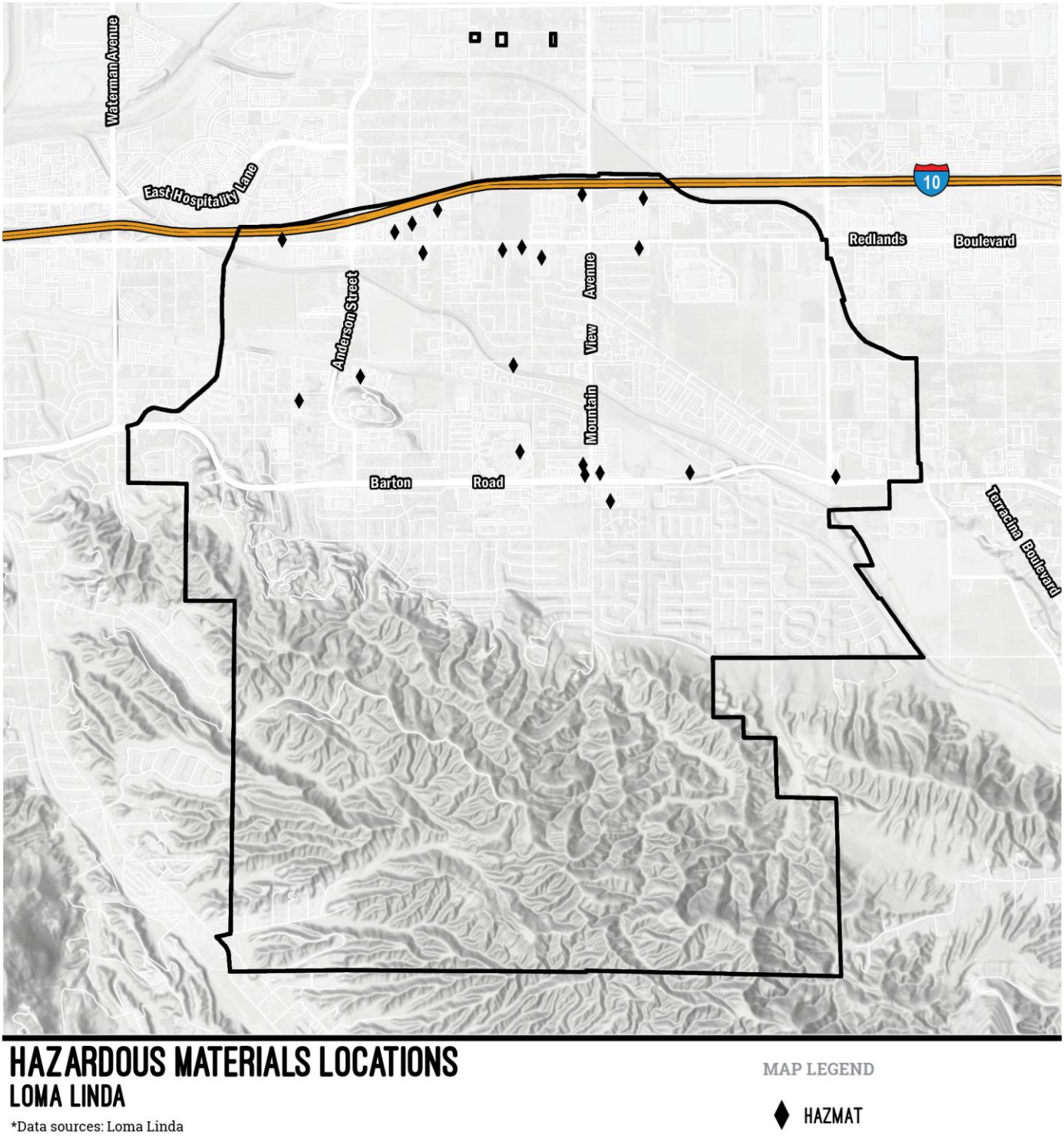


Figure 4-15: Hazardous Materials Locations

4.2.6 Human-Caused Hazards

Human-caused hazards include both terrorism and airplane hazards.

Terrorism

There is no single, universally accepted definition of terrorism; however, FEMA defines "terrorism" as intentional, criminal, malicious acts. FEMA document 386-7 refers to terrorism specifically as the use of Weapons of Mass Destruction (WMD), including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous materials releases; and "cyberterrorism."

FEMA developed the Integrated Emergency Management System (IEMS) using an all-hazards approach. While the IEMS was established as an "all-hazard" approach, responding to the threat of terrorism (referred to as counterterrorism) came to be viewed as the responsibility of law enforcement, defense, and intelligence agencies. Furthermore, defensive efforts to protect people and facilities from terrorism (referred to as anti-terrorism) were generally limited to the government sector, the military, and some industrial interests.

While the term "mitigation" generally refers to activities that reduce the loss of life and property by eliminating or reducing the effects of disasters, in the terrorism context, it is often interpreted to include a wide variety of preparedness and response actions. For this document's purposes, the traditional meaning will be assumed; that mitigation refers to specific actions that can be taken to reduce loss of life and property from human-caused hazards by "modifying the built environment" or anti-terrorism to reduce the risk and potential consequences of these hazards.

Aircraft Hazards

An aircraft incident refers to when an airborne vehicle, such as an airplane, helicopter, or airship, experiences failure to the degree that people on the ground are endangered by the aircraft. This could be the result of human error, inclement weather, deferred maintenance, design flaw, equipment failure, or, in a worst-case scenario, a collision. An aircraft accident is generally an incident that involves injury, fatality, or major damage to the aircraft.

4.2.6.1 Policies, Plans, and Regulatory Environment

United Facilities Criteria (UFC) 4-010-01

Adopted on February 9, 2012, and updated on October 1, 2013, United Facilities Criteria (UFC) 4-010-01 defines the United States Department of Defense's (DoD) minimum anti-terrorism standards for both new and existing buildings. The document applies to DoD buildings, National Guard buildings, visitor centers and museums, visitor control facilities, and expeditionary structures. Historic preservation compliance for implementing anti-terrorism standards, philosophy, design strategies, and assumptions is all considered. Site planning, structural design, architectural design, and electrical and mechanical design are discussed in Appendix B. The document is available to the public and can be found online.

Full-time Task Force Officer (TFO) Positions

After the Waterman Terrorism Incident on December 2, 2015, two full-time Task Force Officer (TFO) positions with the FBI's Joint Terrorism Task Force (JTTF) were created. These TFOs have the clearance to conduct terrorism investigations within the County. The JTTF includes partners from Homeland Security Investigations (HSI), the San Bernardino Police Department, the San Bernardino County Sheriff's Department, the Riverside County Sheriff's Department, the Ontario Police Department, the Riverside Police Department, the Corona Police Department, and the Chino Police Department. For more information regarding the positions, contact the San Bernardino Police Department at (909) 384-5742.

According to the State of California Department of Justice's Anti-terrorism program website, the Anti-terrorism program works with federal, state, and local law enforcement agencies to detect, investigate, prosecute, dismantle, prevent, and respond to domestic and international terrorist activities.

The State of California Bureau of Security and Investigative Services' Power to Arrest Course includes a Weapons of Mass Destruction (WMD) & Terrorism Awareness section. More information regarding the course can be found in the Bureau of Security and Investigative Services California Code of Regulations.

Police protection for the city of Loma Linda is provided by and contracted through the San Bernardino County Sheriff's Department. According to the Sheriff's Department website, advanced officer training courses available include:

- Bombs and Terrorism for Patrol
- Chemical Agents Instructor
- Dispatch Terrorism Awareness
- Dispatch Active Shooter Situations
- Dispatchers Role in Mass Casualty Incidents (San Bernardino County Sheriff's Department, 2021)

Loma Linda General Plan

Maintain Disaster Preparedness: The City will maintain and update on a five-year basis, a Multi-Hazard Functional Plan to coordinate disaster recovery activities within the City of Loma Linda. As a part of this effort, the City will actively solicit the input of local disaster preparedness agencies, including, but not limited to, fire, Sheriff and Highway Patrol, American Red Cross, and Emergency Health providers. The City's existing plan will be expanded to address issues of domestic terrorism, including incident prevention and response.

Federal Aviation Administration

The Federal Aviation Administration is the federal agency that oversees aviation safety across the United States. The major roles and responsibilities of this organization include:

- Regulating civil aviation to promote safety
- Encouraging and developing civil aeronautics, including new aviation technology

- Developing and operating a system of air traffic control and navigation for both civil and military aircraft
- Researching and developing the National Airspace System and civil aeronautics
- Developing and carrying out programs to control aircraft noise and other environmental effects of civil aviation
- Regulating U.S. commercial space transportation

County of San Bernardino Department of Airports

The County of San Bernardino Department of Airports provides for the management, maintenance, and operation of six county-owned airports. They also assist San Bernardino County private and municipal airport operators with planning, interpreting, and implementing FAA general aviation requirements.

Loma Linda General Plan

After the adoption of the San Bernardino Airport Land Use Plan, adopt an airport overlay zone which specifies the criteria included in the Plan for the airport influence area.

4.2.6.2 Past Occurrences

Terrorism

There have been four terrorist attacks recorded in San Bernardino County since 1970. Two attacks resulted in fatalities and/or injuries; the other two attacks were carried out against a church and university and resulted in property damage; however, no loss of life was reported. **Table 4-9** describes these attacks.

Table 4-9: Loma Linda Terrorist Attacks

Date	Perpetrator Group	Fatalities	Injured	Target Type
3/16/1970	White Extremists	0	1	Government (General)
4/22/1970	Left-Wing Militants	0	0	Educational Institution
12/2/2015	Jihadi-inspired extremists	16	17	Government (General)
12/7/2016	Unknown	0	0	Religious Figure/Institution (Church)

Source: Global Terrorism Database (http://www.start.umd.edu/gtd)

The state of California has experienced 620 terrorist attacks from 1970-2018 (Integrated United States Security Database (IUSSD): Data on the Terrorist Attacks in the United States Homeland, 1970-2018 2020); although included in the database, two of these attacks did not happen in California. One was an attack on an American military base in Baghdad. The other attack was United Airlines Flight 93, bound for CA during the 9/11 hijackings.

Aircraft Hazards

Loma Linda is centrally located among multiple airports within a 25-mile radius. Loma Linda, along with the neighboring cities of Colton and Redlands, have all experienced aircraft accidents. According to the National Transportation Safety Board (NTSB) website (a database which houses all of the reported aircraft accidents/incidents), from 1960-2007 (current data set available from NTSB site), 32 accidents and 43 incidents have occurred in or near the City. Loma Linda has only had one non-fatal incident reported within the City limits, while the remainder is divided among Redlands and Colton, with the majority occurring in Redlands (Redlands Municipal Airport is less than seven miles away). **Table 4-10** provides an overview of the past events that have occurred in or near the City. Over the time period on record, there has been an average of 1.5 accidents/incidents annually.

Table 4-10: Aircraft Accidents/Incidents in or near Loma Linda (Loma Linda, Colton, and Redlands) 1960-2007

Accident/Incident Type	Number	Percentage
Accident	32	43.0%
Incident	43	57.0%
Fatal Accidents	15	46.9%
Fatality Range	1-4	N/A
Aircraft Destroyed	12	N/A
Total Fatal Injuries	26	25.2%
Total Serious Injuries	4	3.9%
Total Minor Injuries	8	7.8%
Total Uninjured	65	63.1%

Source: NTSB database

Notable recent aircraft accidents/incidents near Loma Linda include the following:

- May 6th, 2016 - Single-engine plane crashes into a vacant field in Highland on approach to San Bernardino International Airport. Both the pilot and passenger walked away with no injuries.
- June 5th, 2020 - Small single-engine plane crashes into a hillside in Mentone, killing all three occupants, including the pilot.

4.2.6.3 Location/Geographic Extent

Terrorism

Terrorism can occur anywhere, although public spaces and locations where a lot of people congregate. For Loma Linda, these may include parks, schools, places of worship, government facilities, medical facilities, shopping centers, and public gathering areas.

Acts of terrorism may be located at the locations listed above; however, the perpetrators may also choose high-value targets such as electric-generating facilities, water treatment plants, dams or reservoirs, railroads, highways, and critical facilities that could impact governmental services.

Aircraft Hazards

Loma Linda has no airports within its boundaries; however, numerous regional, municipal, and international airports are in the City's surroundings, and the airways above the City are highly trafficked. The following are airports within a 25-mile radius of Loma Linda:

- Banning Municipal Airport: (BNG) 24.48 miles away, located in Banning, CA.
- Ontario International Airport: (ONT) 20.28 miles away, located in Ontario, CA.
- Riverside Municipal Airport: (RAL) 13.8 miles away, located in Riverside, CA.
- Redlands Municipal Airport: (REI) 6.4 miles away, located in Redlands, CA.
- San Bernardino International Airport: (SBD) 3.3 miles away, located in San Bernardino, CA.

In addition to the public airports that operate in the region, March Air Reserve Base is also located within 12 miles of the City. This facility is actively used for military logistics, as well as contracting the use of their tarmac/runways for use by private companies such as Amazon, which maintains large distribution centers in the area.

- March Air Reserve Base: (RIV) 11.7 miles away, located in Perris, CA.

Air traffic from these facilities and many others within the region fly over the City regularly and could cause any sort of aircraft hazard.

4.2.6.4 Severity and Extent

Terrorism

Acts of terrorism are typically measured by the fatalities, injuries, and destruction they cause, but there is no universally used scale for measuring terrorist events. Terrorism can occur anywhere and at any time, varying in severity and extent. **Figure 4-16** shows the different methods of terrorist attacks in the state of California from 1970 to the present. **Figure 4-17** shows the various intended targets of those same terrorist attacks.

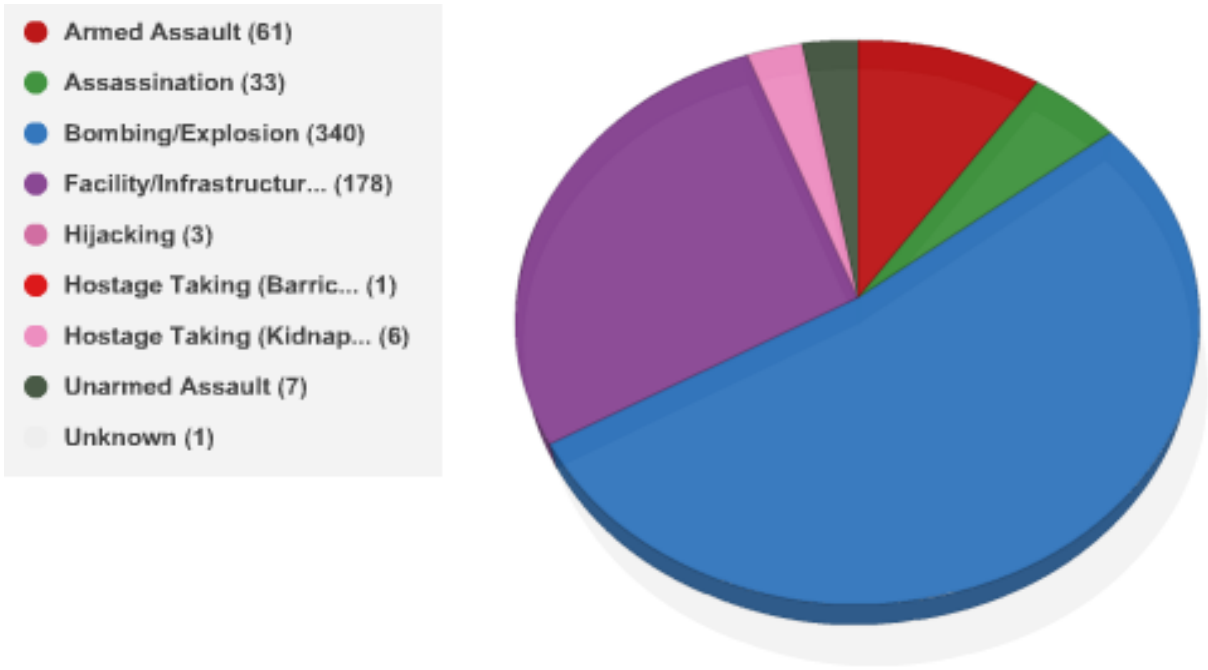


Figure 4-16: Methods of Terrorist Attacks
Source: Global Terrorism Database (https://www.start.umd.edu/gtd/search/Results.aspx?chart=overtime&search=california&count=100)

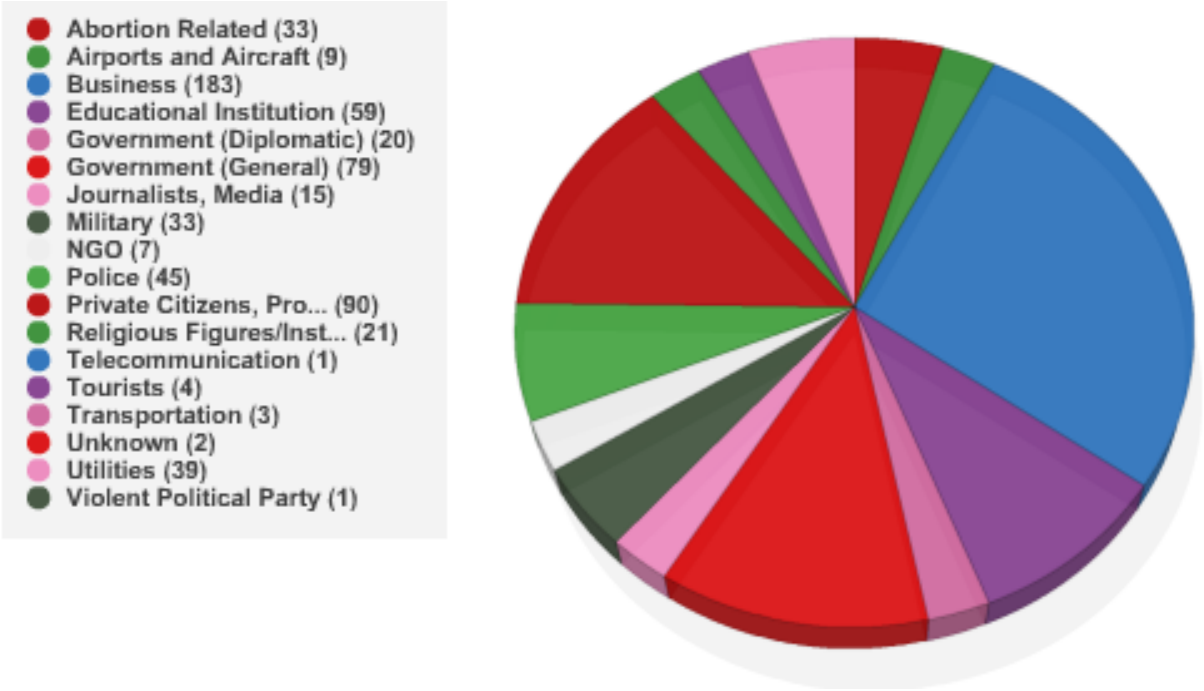


Figure 4-17: Intended Targets of Terrorist Attacks
Source: Global Terrorism Database (https://www.start.umd.edu/gtd/search/Results.aspx?chart=overtime&search=california&count=100)

According to the Global Terrorism Database, the number of terrorist attacks in the United States has steadily decreased since 1970. Additionally, **Figure 4-18** shows the number of fatalities associated with each attack. The significant increase in 2001 is attributed to the 9/11 terrorist attacks.

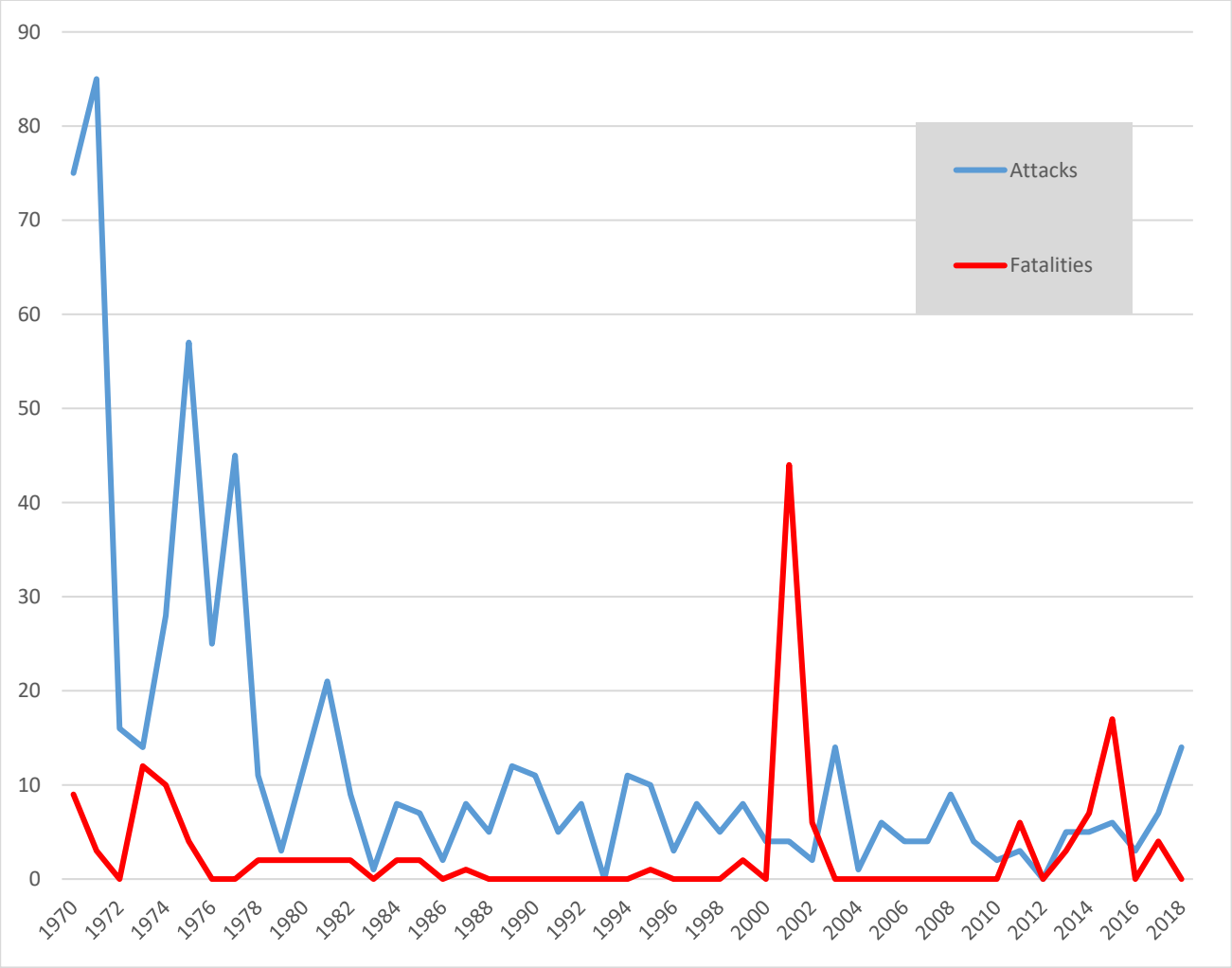
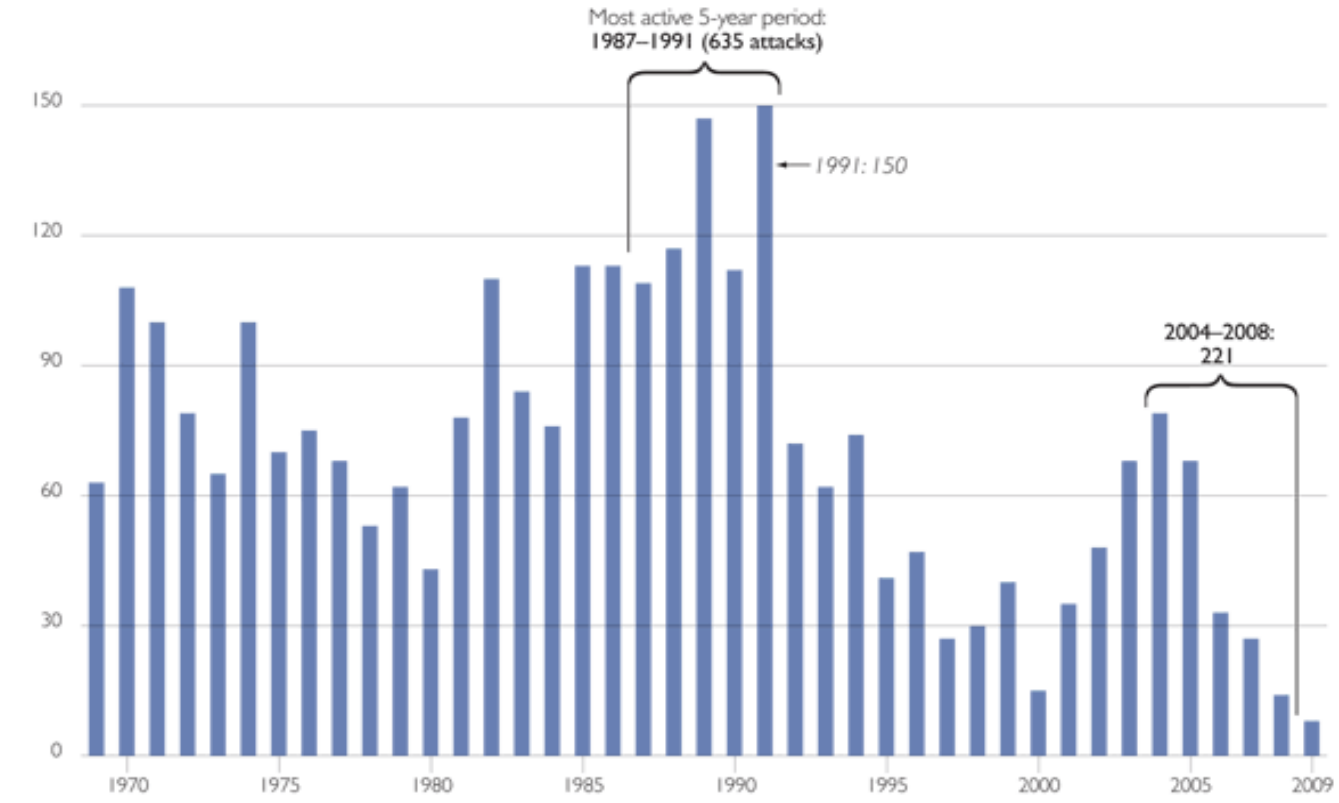


Figure 4-18: Total and Fatal Terrorist Attacks in the United States by Year
Source: Global Terrorism Database (https://www.start.umd.edu/gtd/search/Results.aspx?chart=overtime&search=california&count=100)

Figure 4-19 shows the number of international terrorist attacks against the United States from 1970-201. The graphic indicates that most attacks on American assets happen outside of the nation's borders.



Note: The number of terrorist attacks in 2009 should be interpreted with caution because the reporting of terrorist incidents is incomplete. While the recording of terrorist incidents in the RAND data for 2009 was completed for North America, Latin America and the Caribbean, and Europe, data collection for Africa, the Middle East, South Asia, Southeast Asia, East Asia, Oceana, and Central Asia (including the former Soviet Union states in Central Asia) stopped in January 2009.

Source: Calculations by the Heritage Foundation's Center for Data Analysis based on data from the RAND Database of Worldwide Terrorism Incidents, at *http://www.rand.org/nsrd/projects/terrorism-incidents.html* (April 18, 2011).

Figure 4-19: International Terrorist Attacks on the United States

Aircraft Hazards

Title 49 of the Code of Federal Regulations Part 830, §830.2 provides the following definitions for aircraft accident and aircraft incident:

An **Accident** is an occurrence associated with the operation of an aircraft that:

- Occurs in the time between when the first boarding person enters the aircraft – with the intention of flight –and the last person disembarks.
- Results in death or serious injury, or
- Causes substantial damage to the aircraft.

An **Incident** is an occurrence – other than an accident (no intention of flight) – associated with the operation of an aircraft that affects or could affect the safety of operations.

4.2.6.5 Frequency/Probability of Future Occurrences

Terrorism

We can usually forecast the type, frequency, and location of a natural hazard thanks to the laws of physics and nature. However, when dealing with human-caused hazards such as terrorism, we are often dealing with functions of the human mind - malice, incompetence, carelessness, and other behaviors. These actions cannot be predicted with any accuracy; therefore, there is the potential for an act of terrorism to occur anywhere, at any time. Acts of terrorism stem from a variety of factors: economics, societal pressures, mental health, global geopolitics, warfare, and religion, etc., making it impossible to predict when an incident will occur. Since Loma Linda does not feature facilities of critical national or state importance, it is likely that future incidents would originate domestically and are less likely to attract the attention of international terrorist groups. Incidents of these types are more likely to be conducted by smaller organizations or individuals aligned with greater-known organizations, although the effects may be no less significant.

Aircraft Hazards

Given the high volume of air traffic in the area, the possibility of an aircraft accident occurring in Loma Linda will continue to exist. Based on historical events, it is anticipated that future impacts will be similar in nature. A key component to aircraft incident safety is administering the Airport Environs Land Use Plans for the airports closest to Loma Linda, including Redlands Municipal Airport and San Bernardino International Airport. These plans identify the height restrictions and safety zones that require land-use restrictions to minimize potential impacts. Future land-use decisions that adhere to these restrictions and plan accordingly will help reduce future impacts associated with aircraft incidents. While these efforts can assist in reducing impacts on the ground, there is little that can be done to reduce the impacts associated with aircraft flying overhead under normal flight conditions. The risk associated with these types of incidents is comparable to other parts of San Bernardino County and southern California.

4.2.7 Flood Hazard Profile

Flooding is one of the three primary hazards in California, along with earthquake and wildfire, and represents the second most destructive source of hazard, vulnerability, and risk statewide. (Cal OES, 2018). Most communities in the United States have experienced some kind of flooding during or after spring rains, heavy thunderstorms, winter snow thaws, or summer thunderstorms. Floods can be slow- or fast-rising but generally develop over a period of hours or days.

A flood, as defined by FEMA's National Flood Insurance Program (NFIP), is "[a] general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from:

- Overflow of inland or tidal waters, or
- Unusual and rapid accumulation or runoff of surface waters from any source, or
- 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." (FEMA, 2011, p. 3)

The standard for flooding is the 1% annual chance flood, commonly called the 100-year flood, the benchmark used by FEMA to establish a flood control standard in communities throughout the country. The 1% annual chance flood is also referred to as the base flood.

The 1% annual chance flood is the flood that has a 1% chance of being equaled or exceeded in any given year, and it could occur more than once in a relatively short period of time. By comparison, the 10% flood (10-year flood) means that there is a 10% chance for a flood of its size to occur in any given year.

The portions of the City of Loma Linda that have been vulnerable to historical flooding are associated with Mission Channel, the Santa Ana River, and small-scale floods originating on hillsides in the southern portion of the City. (City of Loma Linda General Plan, 2009)

4.2.7.1 Plans, Policies, and Regulatory Environment

National Flood Insurance Program (NFIP)

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. The City of Loma Linda participates in NFIP.

For most communities participating in the NFIP, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the 1% annual chance flood (the 100-year flood) and the 0.2% annual chance flood (the 500-year flood).

Base-flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tool for identifying the extent and location of the

flood hazard. FIRMs also designate and display the floodway, which is the river or stream channel, and adjacent land that must remain free from obstruction so that the 100-year flood can be conveyed downstream. FIRMs are the most detailed and consistent data source available, and for many communities, they represent the minimum area of oversight under their floodplain management program. The most recent city FIRM was completed on August 8th, 2008.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, the City must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-YR flood;
- New floodplain development must not aggravate existing flood problems or increase damage to other properties; and
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Structures permitted or built in the City before December 31, 1974, are called "pre-FIRM" structures, and structures built afterward are called "post-FIRM." Post-FIRM properties are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Pre-FIRM properties are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The insurance rate is different for the two types of structures.

Compliance is monitored by FEMA regional staff and by the California Department of Water Resources under a contract with FEMA. Maintaining compliance under the NFIP is an important component of flood risk reduction. As discussed herein, the City of Loma Linda greatly reduced populations reliant on the NFIP through the San Timoteo Creek Project that eliminated thousands of residents living in the flood zone.

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property.

Cobey-Alquist Floodplain Management Act

The Cobey-Alquist Floodplain Management Act of 1965 provided state-level guidance and review of floodplain management, including the review of floodplain management plans, establishment of floodplain management regulations, and the use of designated floodways. The California Department of Water Resources (DWR) adopts regulations, maintains a statewide flood management data collection and planning program, manages a statewide grant program, and helps coordinate emergency flood response operations.

City of Loma Linda General Plan

The 2009 City of Loma Linda General Plan includes several policies in the Public Health and Safety Element to mitigate the effects of flood hazards. The Plan's Guiding Policy directs the City to protect the community from any risks relating to lives and property which might be impacted by flooding and stormwater runoff. The Plan also includes several Implementing Policies aimed at maintaining City flood control and storm drainage infrastructure, require new development to utilize studies and drainage plans to prepare for flooding, and to

One Water One Watershed Plan for Santa Ana River Integrated Watershed (2018 Update)

This integrated water management plan addresses the Santa Ana River Watershed resources, including hydrogeology, land use, biological resources, water supply, water quality, flood control, and demographics. The plan also presents regional watershed management practices, including water storage, water quality improvements, water recycling, flood control, wetlands, sensitive habitat protection, recreational opportunities, and water conservation. (One Water One Watershed Plan, 2018)

California Building Code Chapter 18 Section 1804.5

In flood hazard areas established in § 1804.5, grading, fill, or both shall not be approved unless certain criteria are met. These criteria include the placement of fill to minimize shifting and erosion, construction that will not increase flood levels and will not increase the design flood elevation by more than a foot in some instances.

4.2.7.2 Past Occurrences

Table 4-11 shows the flood events that took place in San Bernardino County since the year 2000 that caused either property or crop damage. (NOAA, 2020)

Table 4-11 San Bernardino County Flood Events Since 2000

Date	Flood Type	Property Damage Value ($)
2/25/2001	Flood	30,000
7/6/2001	Flood	45,000
11/24/2001	Flood	70,000
4/26/2002	Flood	25,000
11/8/2002	Flood	200,000
12/16/2002	Flood	500,000
2/11/2003	Flood	300,000
1/9/2005	Flood	3,000,000
1/11/2005	Flood	2,000,000
1/14/2005	Flood	10,000,000
10/19/2010	Flood	5,000
12/19/2010	Flood	97,000,000
12/21/2010	Flood	5,000,000
3/17/2012	Flood	1,000

Date	Flood Type	Property Damage Value ($)
9/15/2015	Flood	65,000
12/22/2016	Flood	5,000
2/17/2017	Flood	15,000
8/3/2017	Flood	1,000
1/9/2018	Flood	2,000
8/2/2018	Flood	1,000
11/19/2019	Flood	1,000
11/20/2019	Flood	2,000

Source: NOAA Storm Events Database

4.2.7.3 Location/ Geographic Extent

The City is primarily vulnerable to flooding associated with San Timoteo Creek, Mission Channel (Redlands Boulevard), and the Santa Ana River, as illustrated in **Figure 4-20.** It is also vulnerable to small-scale floods that originate on hillsides in the southern portion of the City. Roadways are vulnerable to flooding where they intersect with waterways. The major roadways that cross over watercourses/channels in the City include Anderson Street and Barton Road (San Timoteo Creek), and Redlands Boulevard (Mission Channel), and Beaumont Avenue (San Timoteo Creek). Improvements to San Timoteo Creek have minimized the risk of flooding hazards in most areas of the City. The areas adjacent to the Mission Channel are characterized by business park areas and a medium high-density residential area that is already completely developed. The areas in the City's southern portion are also at lower risk because they have been designated at a very low density. This allows developers to avoid hazards such as flooding. (City of Loma Linda Local Hazard Mitigation Plan, 2011)

Flooding may be caused by dam inundation or an earthquake. The northern portion of the City lies within the inundation zone of the Seven Oaks Dam. The failure of this dam would not likely impact the City. The Seven Oaks Dam is a dry dam that decreases peak water flows during spring runoff and rainstorm events. When it is full, the dam water is released by "metering out" water through a culvert located at the foot of the dam. There is also a risk of flooding caused by earthquakes. Canals, levees, and flood control channels may be vulnerable to earthquake-induced effects, including liquefaction, lateral spreading, and primary fault rupture. In Loma Linda, an earthquake could cause local flooding by creating seiches (reverberating waves) by damaging water storage facilities or detention basins that are generally located in the southern foothills. (*Id.*)

4.2.7.4 Measuring Frequency and Severity

The frequency and severity of flooding are measured using a discharge probability. This statistical tool defines the probability that a certain river discharge or flow level will be equaled or exceeded within a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-YR discharge has a 1% chance of being equaled or exceeded in any given year. The "annual flood" is the

greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-YR or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

Many agencies use the extent of flooding associated with a 1% annual probability of occurrence (the base flood or 100-YR flood) as the regulatory boundary. Also referred to as the special flood hazard area (SFHA), this boundary is convenient for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

4.2.7.5 Severity and Extent

Generally, in urban areas like Loma Linda, flood problems are sometimes intensified because new homes and other structures, and new streets, driveways, parking lots, and other paved areas decrease the amount of open land available to absorb rainfall and runoff, thus increasing the volume of water that must be carried away by waterways.

The average amount of precipitation in Loma Linda is not expected to change under climate change models. However, rain events are predicted to come as more extreme events, which could create additional flooding concerns. (Cal-Adapt, 2021)

Loma Linda has greatly decreased the historical severity and extent of flooding with the San Timoteo Creek Project, a combination of channelization, stormwater capture basins, and other flood resiliency efforts. As a result, thousands of people are no longer in the floodplain, and the severity and extent of flooding in Loma Linda are significantly reduced.

4.2.7.6 Frequency/ Probability of Future Occurrences

Flood Insurance Rate Maps identify the flood hazard zones for insurance and floodplain management purposes, and they also provide a statement of probability of future occurrence. As illustrated in **Figure 4-20**, the portion of the City bisected by San Timoteo creek is located in the 100-Year flood zone, which means there is a 1% annual chance of flooding. Portions of Mission Channel are also in a 100-Year flood zone. Although the recurrence interval represents the long-term average period between floods of specific magnitude, significant floods could occur at shorter intervals or even within the same year.

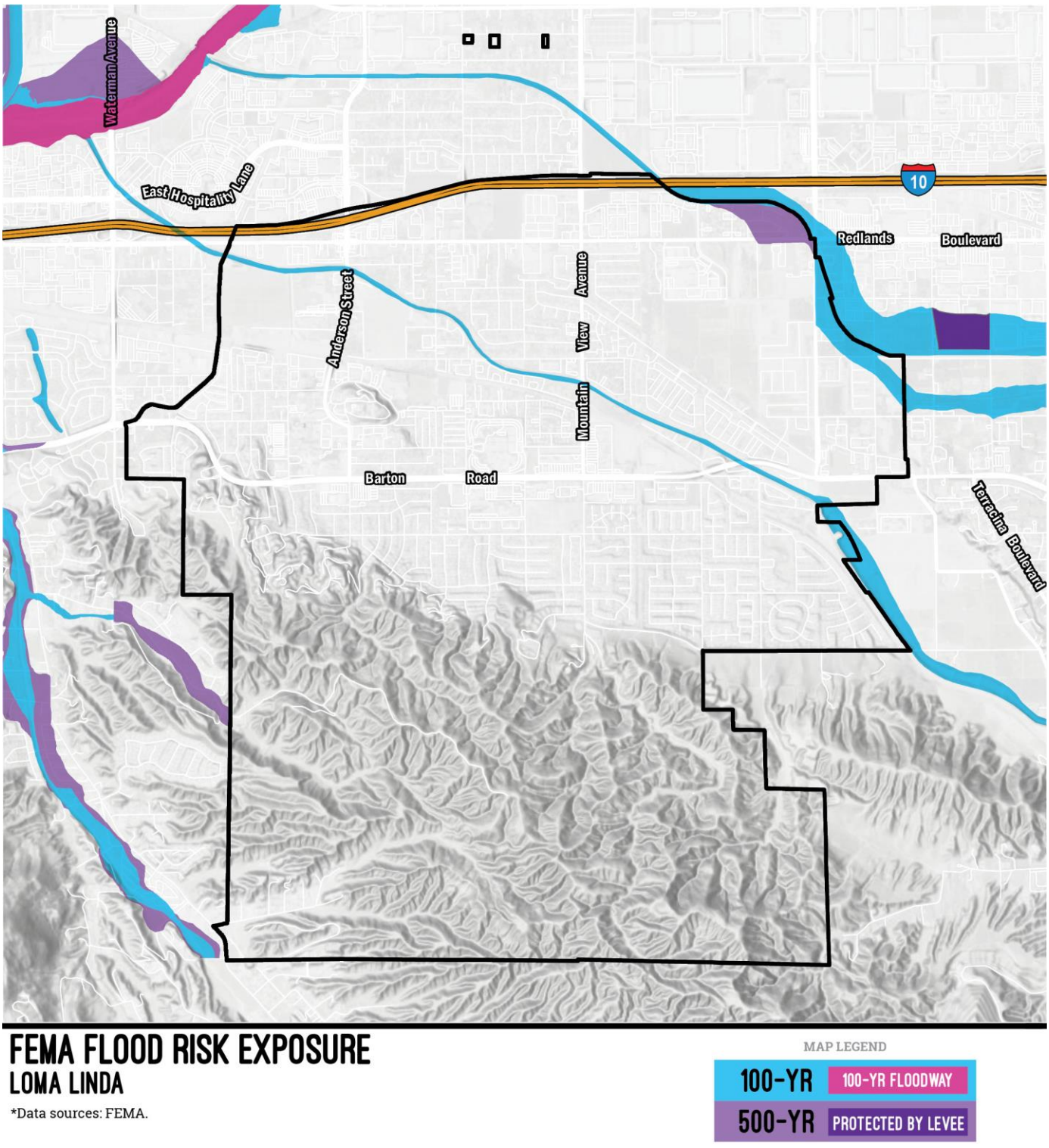
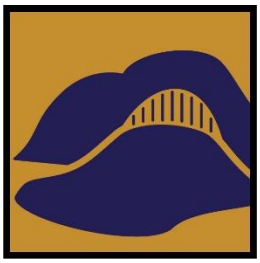


Figure 4-20: 100 and 500- Year Flood Zones in Loma Linda

4.2.8 Slope Failure Hazard Profile



Landslides occur when the force pulling the material on the slope in a downward direction under gravitational influence exceeds the strength of the earth materials that compose the slope (USGS, 2004). These materials may move by falling, toppling, sliding, spreading, or flowing. The strength of rock and soil, steepness of the slope, and weight of the hillside material all play an important role in the stability of hillside areas. Weathering and water absorption can weaken slopes, while the added weight of saturated materials or overlying construction can increase the chances of slope failure. Sudden failure can be triggered by earthquake shaking, excavation of weak slopes, and heavy rainfall.

Landslides are primarily associated with mountainous regions or areas with steeper grades. Landslides can occur due to geological, morphological, or human causes. Because portions of southern Loma Linda, notably the South Hills and Badlands areas, include elevated terrain, there is a potential for landslides throughout this area. Landslides often accompany other natural hazard events, such as earthquakes, flooding, and wildfire.

4.2.8.1 Plans, Policies, and Regulatory Environment

The City of Loma Linda has adopted the California Building Code (2019) which establishes the minimum requirements to safeguard the public health, safety, and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, safety to life and property from fire and other hazards attributed to the built environment, and to provide safety to firefighters and emergency responders during emergency operations.

The Loma Linda Municipal Code further restricts development on hillsides with steep gradients through its Residential and Hillside Development Control Regulation (§ 19.16), including establishing density limitations and ridgeline setbacks.

City of Loma Linda General Plan

The 2009 City of Loma Linda General Plan includes several policies in the Public Health and Safety Element to mitigate the effects of slope failure. The Plan's guiding policy directs the City to reduce the potential for property damage and human injury from slope failure, hazards, and erosion. Its implementing policies direct the City to limit cut and fill slopes to 3:1 (33% slope) throughout the City, provide erosion control mechanisms, and utilize soil and geologic reports as part of development review processes.

4.2.8.2 Past Occurrences

Table 4-12 lists the slope failure events that took place in the County since the year 2005. The only type of slope failure event in the NOAA Storm Database in San Bernardino County is debris flow, which typically occurs during the winter months.

Table 4-12: Slope Failure Events Near the City of Loma Linda Since 2005

Date	Type of Event	Property Damage Value ($)
12/17/2010	Debris Flow	$1,090,000
8/17/2012	Debris Flow	0
11/9/2012	Debris Flow	0
2/28/2014	Debris Flow	0
7/6/2015	Debris Flow	0
7/18/2015	Debris Flow	1,000
7/19/2015	Debris Flow	0
7/19/2015	Debris Flow	0
9/15/2015	Debris Flow	0
2/17/2017	Debris Flow	500,000
7/7/2018	Debris Flow	0
7/11/2018	Debris Flow	50,000
7/12/2018	Debris Flow	1,000
8/16/2018	Debris Flow	0
8/16/2018	Debris Flow	0
8/17/2018	Debris Flow	0
11/29/2018	Debris Flow	0
1/17/2019	Debris Flow	0
3/6/2019	Debris Flow	0
5/11/2019	Debris Flow	0
7/24/2019	Debris Flow	0
4/6/2020	Debris Flow	0
4/6/2020	Debris Flow	0
Total:		**552,000**

Source: NOAA Storm Events Database

4.2.8.3 Location/ Geographic Extent

The best available predictor of where slope failure might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years—most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges.

It is important to recognize ancient dormant mass movement sites to identify current areas susceptible to flows and slides because they can be reactivated by earthquakes or exceptionally wet weather. Those ancient scars also consist of broken materials, frequently involve disruption of groundwater flow, and are vulnerable to construction-triggered sliding.

The southern end of the City, which is most susceptible to slope failure, abuts what are known as the Badlands and South Hills, which have steep natural slopes that are vulnerable to instability. The type of instability could include deep-seated landslides, surficial soil slips, wet debris flows, and surficial creep. The majority of these mapped landslides appear to be relatively recent (less than 11,000 years).

New expansion will likely occur in the southern portion of the City as potential development will seek to locate in the lower hillsides of the City. As these hillsides are vulnerable to instability, the City's hillside development regulations will continue to be important and require revisiting to ensure adequacy. (*Id.*)

4.2.8.4 Severity and Extent

As shown in **Figure 4-21**, nearly a third of the City has been identified as having medium to high susceptibility to landslides. These areas are generally located along the southern borders of the City, where the land is steep and unstable.

4.2.8.5 Frequency/ Probability of Future Events

As future development occurs near steep slopes, the probability of washouts, sloughing, erosion, rockslides, and landslide events occurring in the City becomes more likely. To prevent current problem areas (highlighted in Section 5.2) from getting worse, the mitigation actions presented in Section 5.4.4 should be completed.

Mismanaged intense residential and recreational development in sloped areas such as the Badlands and South Hills could increase the frequency of damaging landslides occurring in the City. Avoiding development in the medium to high landslide susceptibility areas as well as adequately regulating development occurring in those areas will be critical to reducing the frequency and probability of future landslide events.

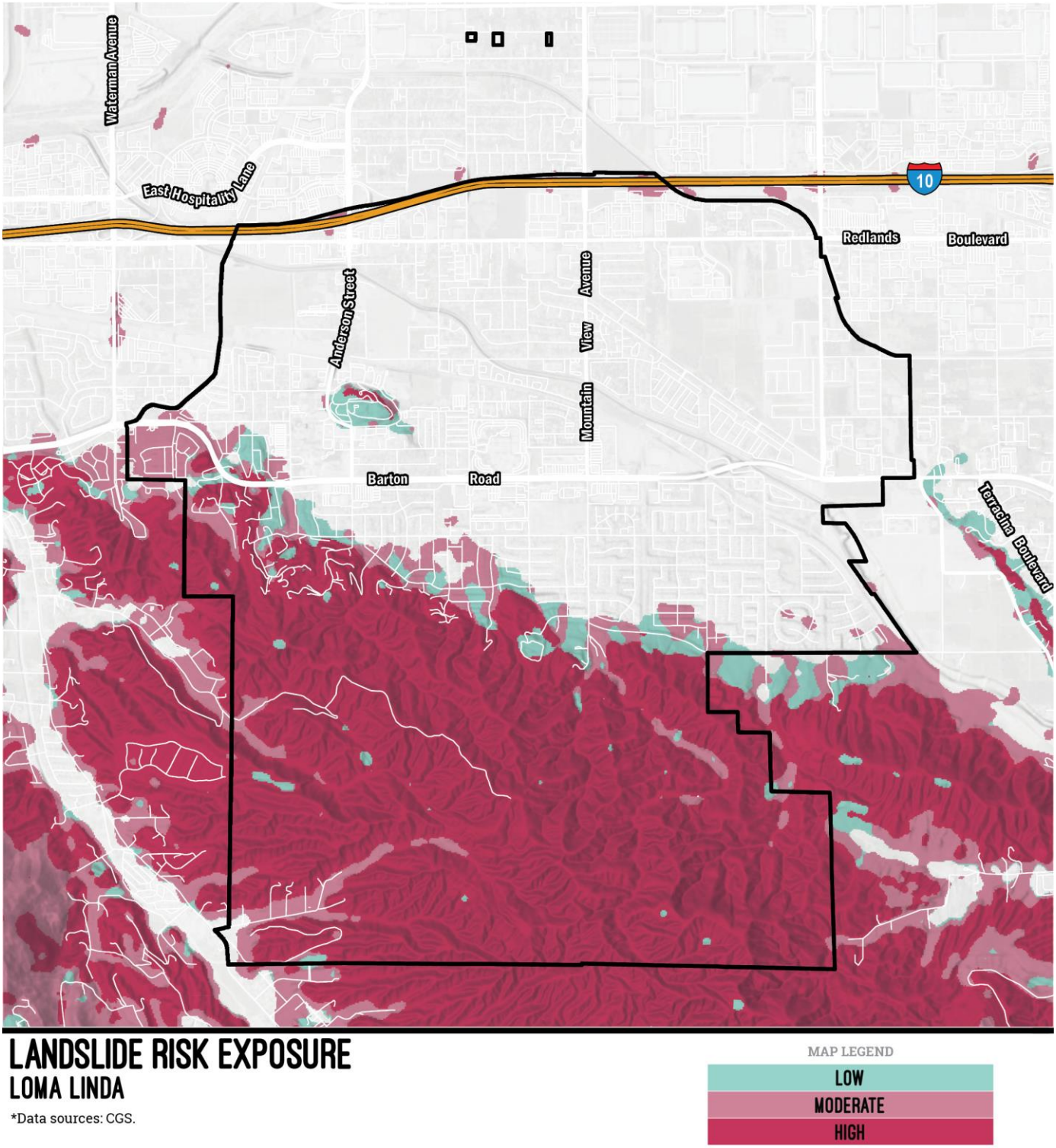


Figure 4-21: Landslide Susceptibility in the City of Loma Linda

4.3 Vulnerability Assessment Methods

This section provides an overview of the methods used in the vulnerability assessments in Section 0. Vulnerabilities to each hazard are assessed in a two-step process, as outlined in this section. First, population, critical facilities, and parcels are inventoried to develop a "lay of the land." Second, the inventories are used to calculate estimated exposure and damage from hazards at various levels of severity. A more detailed explanation of the methodology is included in Appendix A.

Figure 4-22 illustrates the data inputs and outputs used to create the vulnerability analyses for each hazard in Section 0.

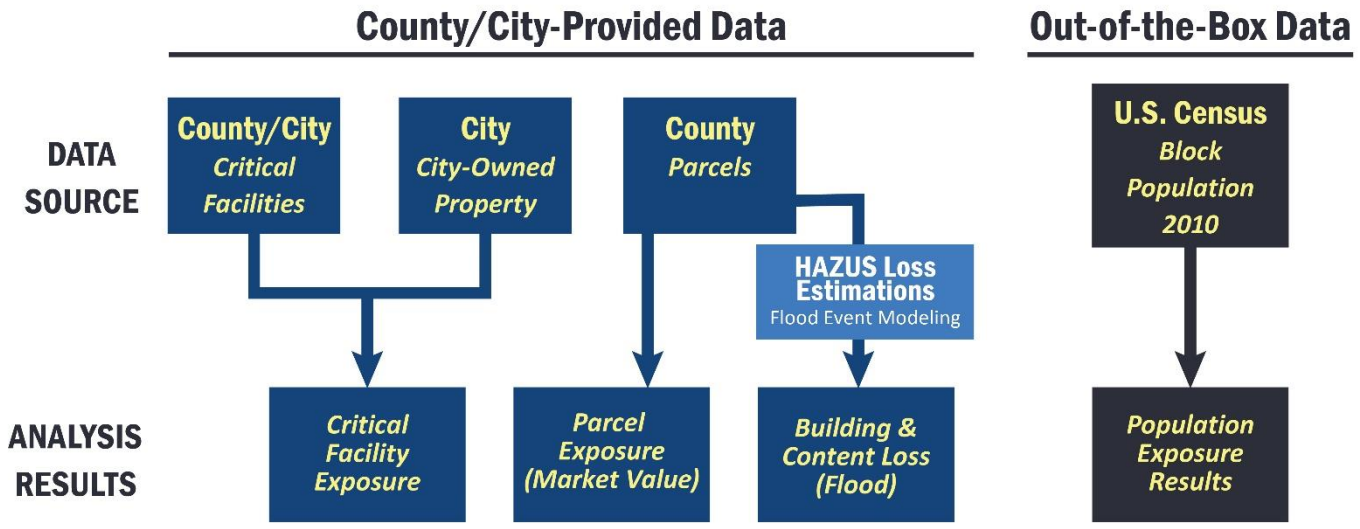


Figure 4-22: Data Source and Method

4.3.1.1 Population and Asset Inventory

To describe vulnerability for each hazard, it is important to first understand the total population and total assets at risk. Population and asset inventories provide a baseline to measure the vulnerability to people and assets for natural hazard events. Asset inventories can also be used to estimate damages and losses expected during a "worst-case scenario" event for each hazard. The following describes the total population, critical facilities, and parcel inventory inputs.

Population

An initial step in producing the hazard-specific vulnerability assessments is to determine the population near each natural hazard. Each natural hazard scenario affects the City residents differently depending on the location of the hazard and the population density of where the hazard event could occur. For hazards that potentially affect the whole city, such as earthquake or drought, the vulnerability assessment

assumes 24,482 persons or 100% of the city's population is exposed.[2] Vulnerability assessments presented in Section 0 summarize the population exposure for each natural hazard, if available.

Parcel Value Inventory

The County of San Bernardino Assessor's data is essential to developing parcel values exposed to each hazard and includes the current fair market value of at-risk assets. Loma Linda Parcel Value Inventory is summarized in Section 0. The Parcel Value Inventory includes the market value,[3] content replacement value, and total assessed value ("total value"). Each hazard profile outlines predicted impacts to this inventory for each hazard's geographic extent. These elements are called out in the table because, in the event of a disaster, the value of the infrastructure or improvements to the land is usually the focus of concern. Generally, the land is not a total loss, and structures can be rebuilt or contents replaced.

"Total market value" as presented in this plan reflects Loma Linda Assessor data, including fair market value where available. If no fair market value was available for a given property, the value reflects the assessed improvement value.

"Total content value" was calculated based on the assessor's use codes, translated to occupancy-based multipliers. Each occupancy class prescribes a specific content cost multiplier used to calculate the content cost values shown in the summary and the hazard profiles in Section 0. Occupancy-based content cost multipliers used in this plan reflect those found in the FEMA Hazus-MH 4.2 technical manuals.

Table 4-13: Loma Linda Parcel Counts and Value

	Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Loma Linda	5,661	$ 2,377,019,848	$ 2,264,947,136	$ 4,641,966,984

Total market value as provided by County Assessor's Office. Content value calculated using content multipliers per Hazus occupancy classes per county land use designation. Total value is the sum of total market value and total content value. Improved Parcels Only

[2] Population estimates were derived from 2013-2017 Census American Community Survey 5-Year (ACS) information.
[3] Market Value includes a long-term asset which indicates the cost of the constructed improvements to land, such as buildings, driveways, walkways, lighting, and parking lots.

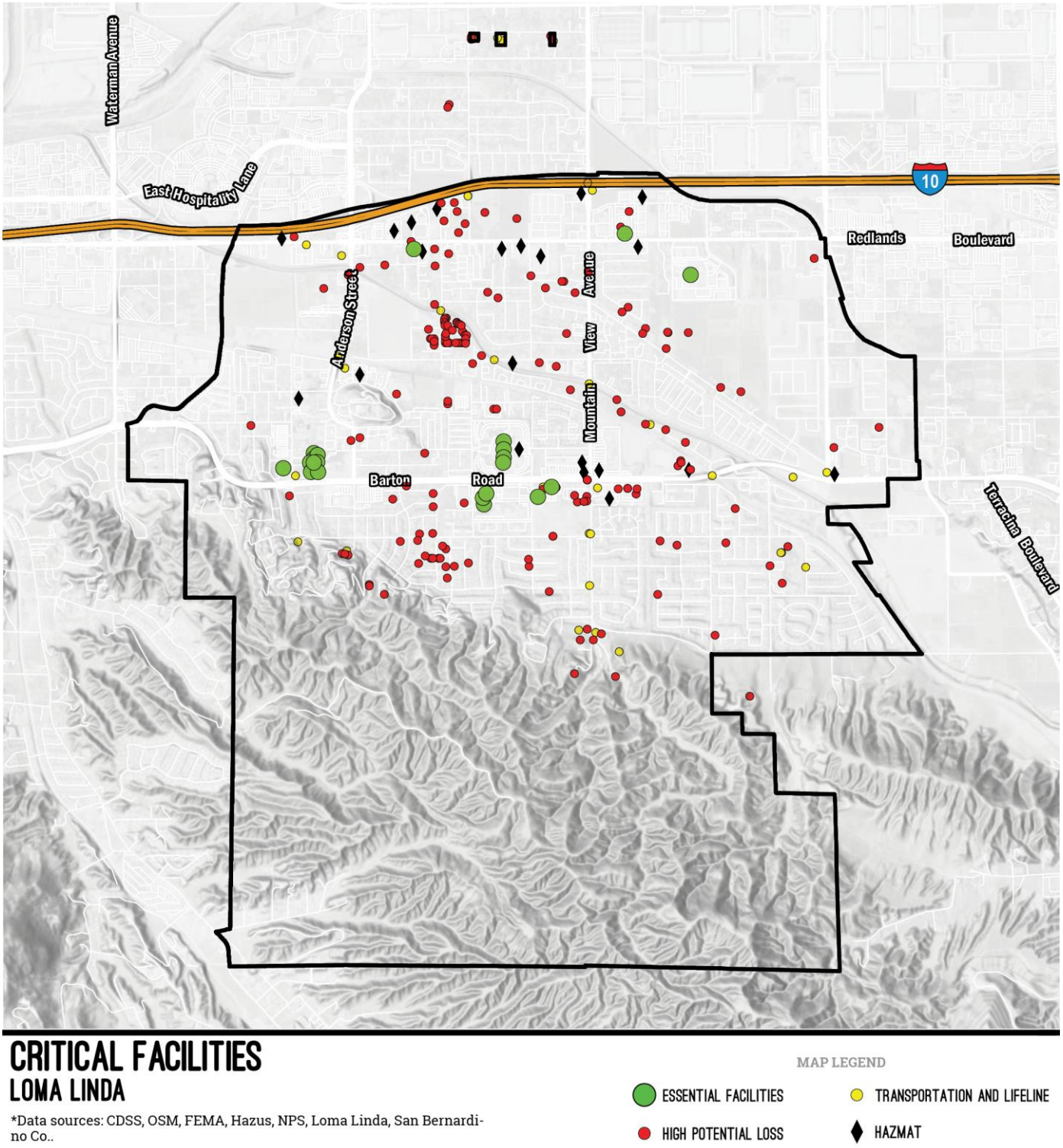


Figure 4-23: Loma Linda Critical Facilities

Critical Facilities Inventory

Critical facilities are of particular concern when planning to mitigate hazards. A critical facility is a structure or other improvement that, because of its function, size, service area, or uniqueness, has the potential to disrupt vital socioeconomic activities if it is destroyed, damaged, or functionally impaired.

Critical facilities inventory data was developed from a combination of datasets, including county, city, special purpose district, state, federal, and private industry. A critical infrastructure spatial database was developed to translate critical facilities information into georeferenced[4] points and lifelines.

Critical facility points include facilities such as police stations, fire stations, hospitals, elder care facilities, daycare facilities, schools, transportation infrastructure, utilities, and government buildings. **Lifelines** include facilities related to communication, electric power, liquid fuel, natural gas, and transportation routes. A current representation of the critical facility points and lifelines is provided in **Figure 4-23**. Some critical facility information may have been omitted from this document due to national security purposes. For additional information on included critical facilities as well as transportation and lifeline data, see Appendix A.

Critical facilities and transportation and lifeline data came from various sources, including local jurisdictions and a variety of statewide and national datasets. See Appendix A for more detailed sourcing information. All data sources have a level of accuracy acceptable for planning purposes. Due to the sensitivity of this information, a detailed list of facilities is not provided. The list is on file with the City. The risk assessment for each hazard qualitatively discusses critical facilities with regard to that hazard.

4.3.1.2 Hazard Exposure and Damage Estimation

The population and inventory information are used to generate specific exposure and damage estimations based on the severity of specific hazard events. The hazards in Loma Linda, which have known geographic extents and corresponding spatial information and thus have exposure and damage estimations, are:

- wildfire,
- earthquake,
- flooding, and
- slope failure.

Population and Asset Exposure

"Exposure" of assets and population refers to the total counts of parcels, people, facilities, and assets within the planning area where a hazard event may occur. A natural hazards overlay was developed to reflect the combination of many known natural hazard spatial footprints. The spatial overlay method summarizes building values, parcel counts, population exposure, and critical facility exposure within a hazard's

[4] To georeference something means to define its existence in physical space. That is, establishing its location in terms of map projections or coordinate systems. The term is used both when establishing the relation between raster or vector images and coordinates, and when determining the spatial location of other geographical features.

geographic extents. **Figure 4-24** illustrates hypothetical flooding exposure. Exposure numbers were generated using City of Loma Linda Assessor data, address point, and parcel data for replacement and content cost estimates.

Figure 4-24: Hazard Exposure Explanation Graphic

Damage Estimation

For flood and earthquake, detailed damage estimations were conducted through FEMA's Hazus software. Hazus is a nationally applicable, standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus uses Geographic Information Systems (GIS) technology to estimate the physical, economic, and social impacts of disasters. The estimated damage and losses provided by the Hazus Software are based upon chosen severity of events and provides the ability to understand possible widescale damage to buildings and facilities.

In the hypothetical geography shown in **Figure 4-25**, even though both structures are exposed to flooding, it is expected that the structure with a first-floor height below the depth of flooding will receive significantly more damage than the structure with a first-floor height above the expected water depth. For a more detailed explanation of risk assessment methods, see Appendix A.

At-risk populations, critical infrastructure, improved parcels, and loss results for each hazard category are provided in bar chart summary tables in Section 0 to evaluate the percentage of assets exposed to different types of hazards. The side-by-side comparison allows the City to evaluate the impacts of potential hazards to prioritize hazard mitigation energy and resources.

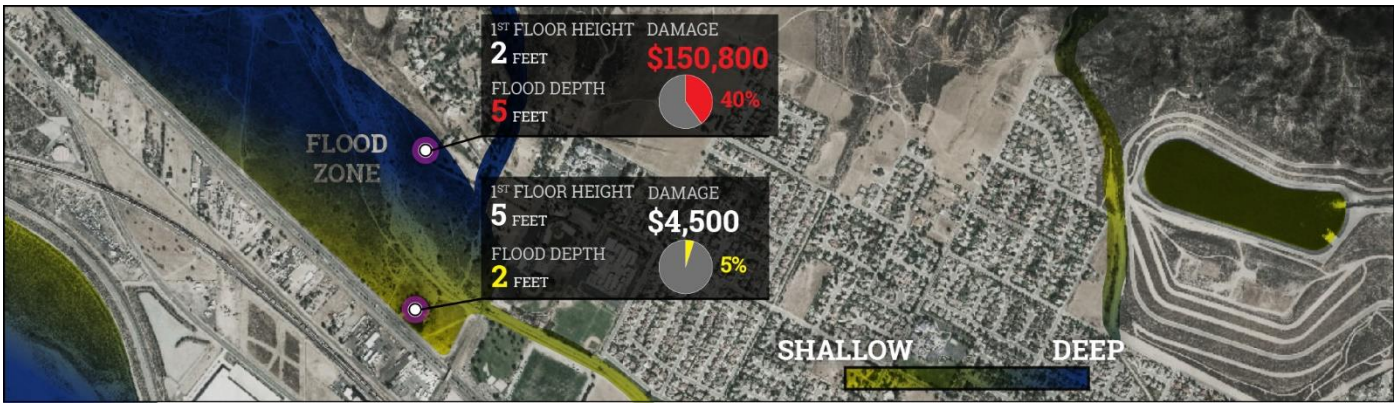


Figure 4-25: Hazus Damage Estimation Example

Vulnerability Assessment

The Disaster Mitigation Act regulations require that the City of Loma Linda evaluate the risks associated with each hazard identified in the planning process. The vulnerability assessment utilizes geospatial data along with local knowledge of past events.

Geospatial data is essential in determining the population and assets exposed to hazards identified in this plan. Geospatial analysis can be conducted if a natural hazard has a spatial footprint that can be analyzed against the locations of people and assets. Geospatial analysis provides for a quantifiable vulnerability analysis. In the City of Loma Linda, wildfire, earthquake, flooding, and slope failure have identifiable geographic extents and corresponding spatial information about each hazard.

Other information can be collected regarding the hazard area, such as the location of critical community facilities, historic structures, and valued natural resources. Together, this information conveys the vulnerability of that area to a hazard.

This section summarizes the possible impacts and quantifies, where data permits, the City's vulnerability to each of the priority hazards identified in the hazard profiles. The hazards evaluated as part of this vulnerability assessment include:

Wildfire
SECTION 4.3.2

Earthquake
SECTION 4.3.3

Drought
SECTION 4.3.4

Climate Change
SECTION 4.3.5

Hazardous Waste & Materials
SECTION 4.3.6

Human-Caused Hazards
SECTION 4.3.7

Flood
SECTION 4.3.8

Slope Failure
SECTION 4.3.9

4.3.2 Wildfire

Risk to the City of Loma Linda from wildfire is a significant concern. Steep hills and clusters of vegetation bordered by residential zones create the potential for both natural and human-caused fires that can result in loss of life and property. In addition, high temperatures, low humidity, and clear sunny days characterize the summer months. Thunderstorms from July through September can create lightning strikes and erratic high winds that contribute to wildfire ignition.

Potential losses from wildfire include human life, structures and other improvements, natural and cultural resources, quality and quantity of water supplies, cropland, timber, and recreational opportunities. Short and long-term economic losses could also result due to loss of business and other economic drivers. Smoke and air pollution from wildfires can be a severe health hazard. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Generally, three major factors sustain wildfires and predict a given area's potential vulnerability to burning. These factors are fuel, topography, and weather.

- **Fuel** – Fuel is the material that feeds fire and is a key factor in wildfire behavior. Fuel is generally classified by type and volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches, to dead standing trees, live trees, brush, and cured grasses. Human-made structures are also considered a fuel source, such as homes and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that is under human control. Residential developments in the east, northeast, and a small part of the western region (in the mountains and foothills) currently possess the highest vulnerability to wildfire. Significant measures have been taken to mitigate wildfire when new development has been constructed. Fire prevention strategies also focus on educating the public and enforcement of fire codes. Nevertheless, these high fuel hazards, coupled with a greater potential for ignitions, increase the City's susceptibility to a catastrophic wildfire.
- **Topography** – An area's terrain and slope affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.
- **Weather** – Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most treacherous weather factor. The greater the wind, the faster a fire can spread and the more intense it can be. Wind shifts, in addition to wind speed, can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. As part of a weather system, lightning also ignites wildfires, often in difficult-to-reach terrain for firefighters.

Factors contributing to the high, widespread wildfire risk in Loma Linda include:

- Residential landscaping, fencing, and outbuildings increase fuel loading, spotting, and fire intensity,
- Nature and frequency of ignitions; and increasing population density leading to more ignitions,
- Slope of the foothills, and
- Residential development along the foothills.

For more general information on wildfire in Loma Linda, see the hazard profile in Section 0.

4.3.2.1 Population at Risk

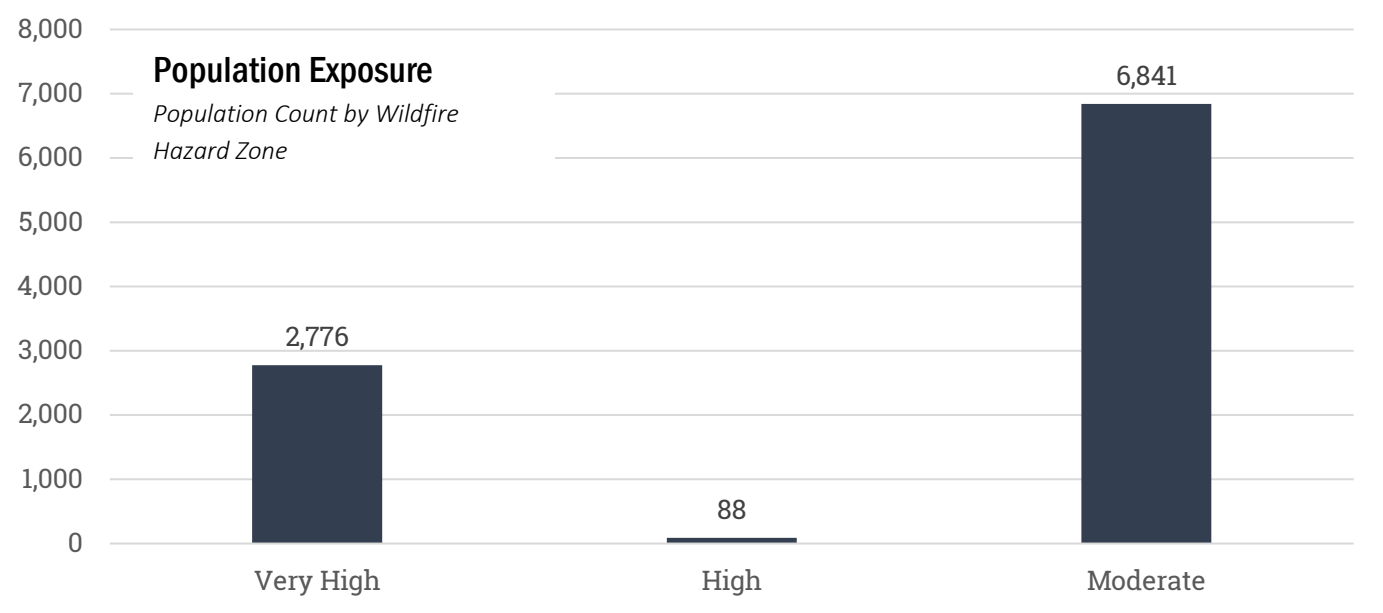
Wildfire is of greatest concern to populations residing in the moderate, high, and very high fire hazard severity zones. U.S. Census Bureau block data was used to estimate populations within the Cal Fire identified hazard zones. As seen in **Figure 4-26,** approximately 2,776 residents live in areas considered very high risk to wildfires, 88 reside in high-risk areas, and 6,841 reside in moderate-risk areas.

Table 4-14: Population at risk from wildfire hazards

	Total Population
Loma Linda	23,961

Wildfire Severity Zone	Population Count	% of Total
Very High	2,776	*11.59%*
High	88	*0.37%*
Moderate	6,841	*28.55%*
Total	**9,705**	**40.50%**

Figure 4-26: Population at risk from wildfire hazards



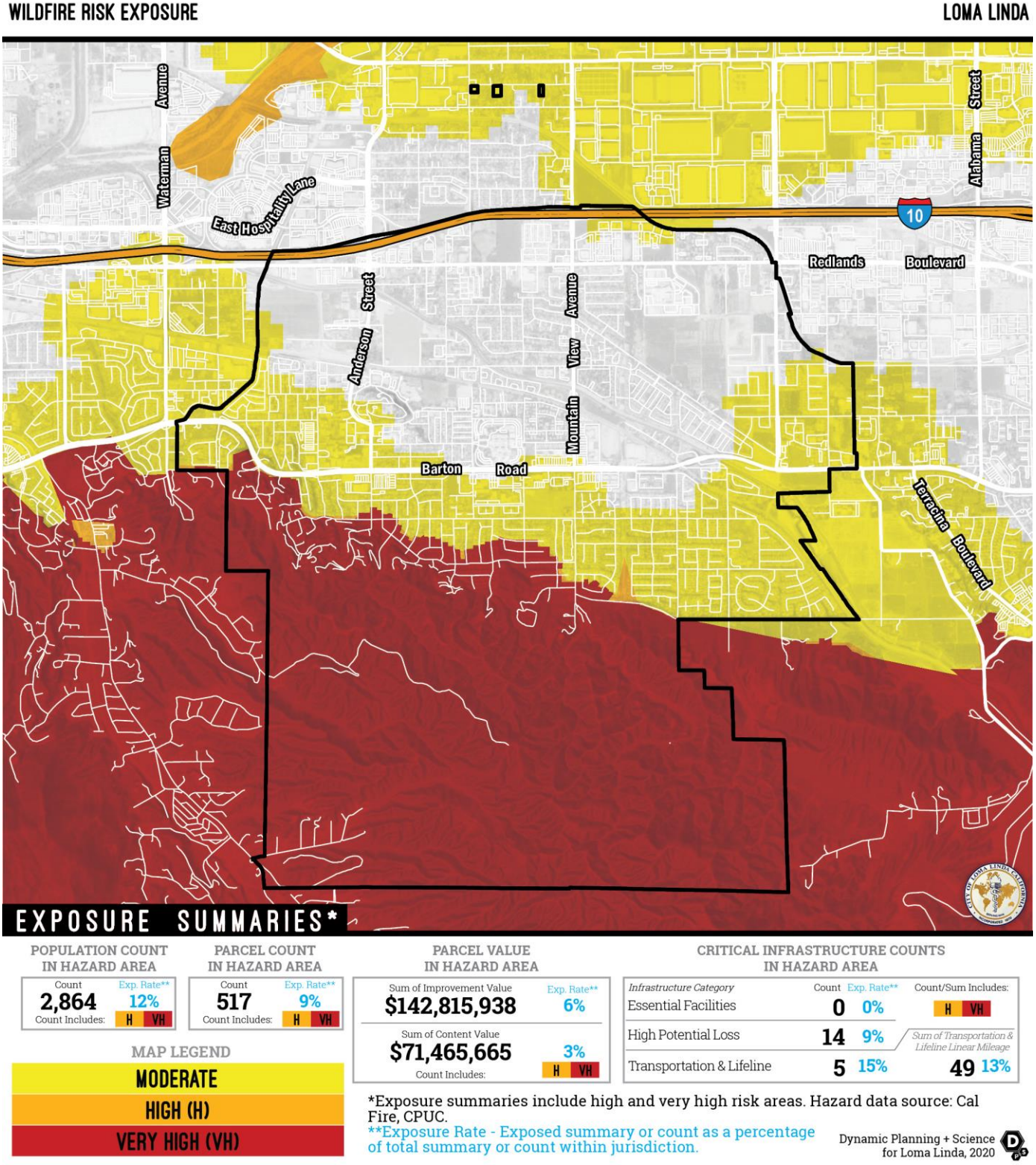


Figure 4-27: City of Loma Linda Exposure Wildfire Vulnerability and Snapshot Map

4.3.2.2 Residential Parcel Value at Risk

The City's parcel layer was used as the basis for the inventory of improved residential parcels. In some cases, a parcel will be within multiple fire threat zones. GIS was used to create centroids, or points, to represent the center of each parcel polygon – this is assumed to be the structure's location for analysis purposes. The centroids were then overlaid with the fire threat layer to determine the risk for each structure. The fire threat zone in which the centroid was located was assigned to the entire parcel. This methodology assumed that every parcel with a square footage value greater than zero is considered an improved parcel and analyzed using this methodology. **Table 4-15** depicts the portions of Loma Linda that have significant assets at risk to wildfire in the moderate, high, and very high fire severity zones.

Table 4-15: Residential Buildings and Content within Cal Fire Wildfire Severity Zones

	Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Loma Linda	5,661	$ 2,377,019,848	$ 2,264,947,136	$ 4,641,966,984

Fire Hazard Severity Zone	Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Very High	484	*8.5%*	$ 134,714,104	$ 67,414,747	$ 202,128,851	*4.4%*
High	33	*0.6%*	$ 8,101,834	$ 4,050,919	$ 12,152,753	*0.3%*
Moderate	2,609	*46.1%*	$ 1,245,688,275	$ 1,203,870,114	$ 2,449,558,389	*52.8%*
Total	**3,126**	**55%**	**$ 1,388,504,213**	**$ 1,275,335,779**	**$ 2,663,839,992**	**57.4%**

4.3.2.3 Critical Facilities and Infrastructure

Critical facilities data were overlaid with fire hazard severity zone data to determine the type and number of facilities within each risk classification. **Table 4-16** and **Table 4-17** list the critical facilities and lifelines in the moderate, high, and very high wildfire hazard zones for Loma Linda.

Table 4-16: Critical Facility Exposure to Wildfire Severity Zones

Critical Infrastructure - Wildfire Severity Zone			
Infrastructure Type	Very High	High	Moderate
Essential Facility	-	-	15
EOC	-	-	1
Hospital	-	-	13
Fire Station	-	-	-
High Potential Loss	14	-	44
Child Care Center	-	-	1
School	-	-	1
Medical Facility	-	-	10
Reservoir	7	-	-
Elder Residential Care	3	-	23
Adult Residential Care	1	-	3

Critical Infrastructure - Wildfire Severity Zone			
Infrastructure Type	Very High	High	Moderate
Low Income Housing	-	-	-
Lodging	-	-	-
Veterinary Care	-	-	-
Water Treatment Facility	-	-	2
Park	1	-	1
Real Property Asset	2	-	2
Recreation	-	-	-
Library	-	-	1
Corp Yard	-	-	-
Transportation and Lifeline	5	-	17
Communications Tower	1	-	3
Water Booster	3	-	2
Water PRV	-	-	7
Highway Bridge	-	-	1
Lift Station	-	-	-
Water Well	1	-	4
Hazmat	-	-	6
Hazardous Materials Site	-	-	6
Grand Total	**19**	**-**	**82**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership.*

Table 4-17: Lifelines in Wildfire Severity Zones

Lifelines (miles) - Wildfire Severity Zone			
Infrastructure Type (Linear)	Very High	High	Moderate
Fiber Optics	1.49	0.35	41.54
Sewer Main	0.01	0.01	0.29
Storm Drain Main	0.69	0.02	7.06
Street	34.18	0.66	60.88
Interstate	-	-	1.39
Major Road	-	-	5.95
Local Road	9.53	0.34	31.23
Service Road	6.08	0.03	18.08
Bike Path	0.01	0.29	0.86
Walking Path	18.56	-	3.37
Water Main	10.68	0.55	52.74
Grand Total	**47.05**	**1.58**	**162.51**

4.3.2.4 Past and Future Development

Some past development in Loma Linda occurred within the high wildfire severity zone in the southern portion of Loma Linda, increasing overall vulnerability to wildfire in the City. However, the vast majority of that growth occurred more than two decades ago. Currently, the City has severely limited growth in the high wildfire severity zone on the southern hillside. First, in 2006 voters passed a slow-growth initiative that included hillside development limitations that made hillside development in high wildfire severity zones near impossible. The City also owns significant amounts of that same hillside area of concern.

Future development in Loma Linda is not likely to contribute to wildfire vulnerability. As a result, much of the focus is on protecting existing populations, structures, and critical facilities from wildfire. Fuel reduction projects are ongoing on state and private lands surrounding Loma Linda. Such projects include vegetation management, broadcast burning, pre-commercial thinning, and the removal of dead, dying, and diseased trees, and are often completed in coordination with San Bernardino County.

4.3.3 Earthquake

Major impacts from earthquakes are primarily the probable number of casualties and damage to infrastructure occurring from ground movement along a particular fault (USGS, 2009). The degree of infrastructure damage depends on the magnitude, focal depth, distance from the fault, duration of shaking, type of surface deposits, presence of high groundwater, topography, and the design, type, and quality of infrastructure construction.

To analyze the risk to Loma Linda residents, the Shakeout2 Scenario was performed at a magnitude of 7.8, and the San Jacinto Scenario was performed at a magnitude of 7.0. The hazard footprints for these scenarios were used to develop exposure results for population, critical facilities, and single-family residential parcel values. FEMA Hazus analyses were used to conduct loss estimation and included building and content loss estimation results based on peak ground acceleration, peak ground velocity, and peak spectral acceleration.

Building codes provide one of the best methods of addressing natural hazards. When properly designed and constructed according to code, the average building can withstand many of the impacts of natural hazards. To reduce future flood losses, hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. It is important to note that the City of Loma Linda has adopted California's 2019 Building Code standards (Volumes 1, 2).

Manufactured or mobile homes are often not regulated by local building codes. They do have to meet construction standards set by the U.S. Department of Housing and Urban Development that apply uniformly across the country. However, local jurisdictions may regulate the location of these structures and their on-site installation.

For more general information on earthquakes in Loma Linda, see the hazard profile in Section 4.2.2.

4.3.3.1 Earthquake Exposure Methods

The exposure analysis for the City of Loma Linda centers on an earthquake scenario produced from the Shakeout2 fault line. As discussed in Section 4.2.2.4, this scenario presents the highest probability for a severe earthquake and severe shaking in the City of Loma Linda.

An exposure analysis was conducted to develop earthquake vulnerability data throughout the City of Loma Linda using the methods outlined in Section 4.3.1.2. To develop earthquake exposure data for the City, asset inventories for people, property, and critical facilities were superimposed with earthquake shaking intensity data from the USGS. **Figure 4-28** depicts the exposure summary for the Shakeout2 scenario. The summary predicts a 100% exposure for the City's population.

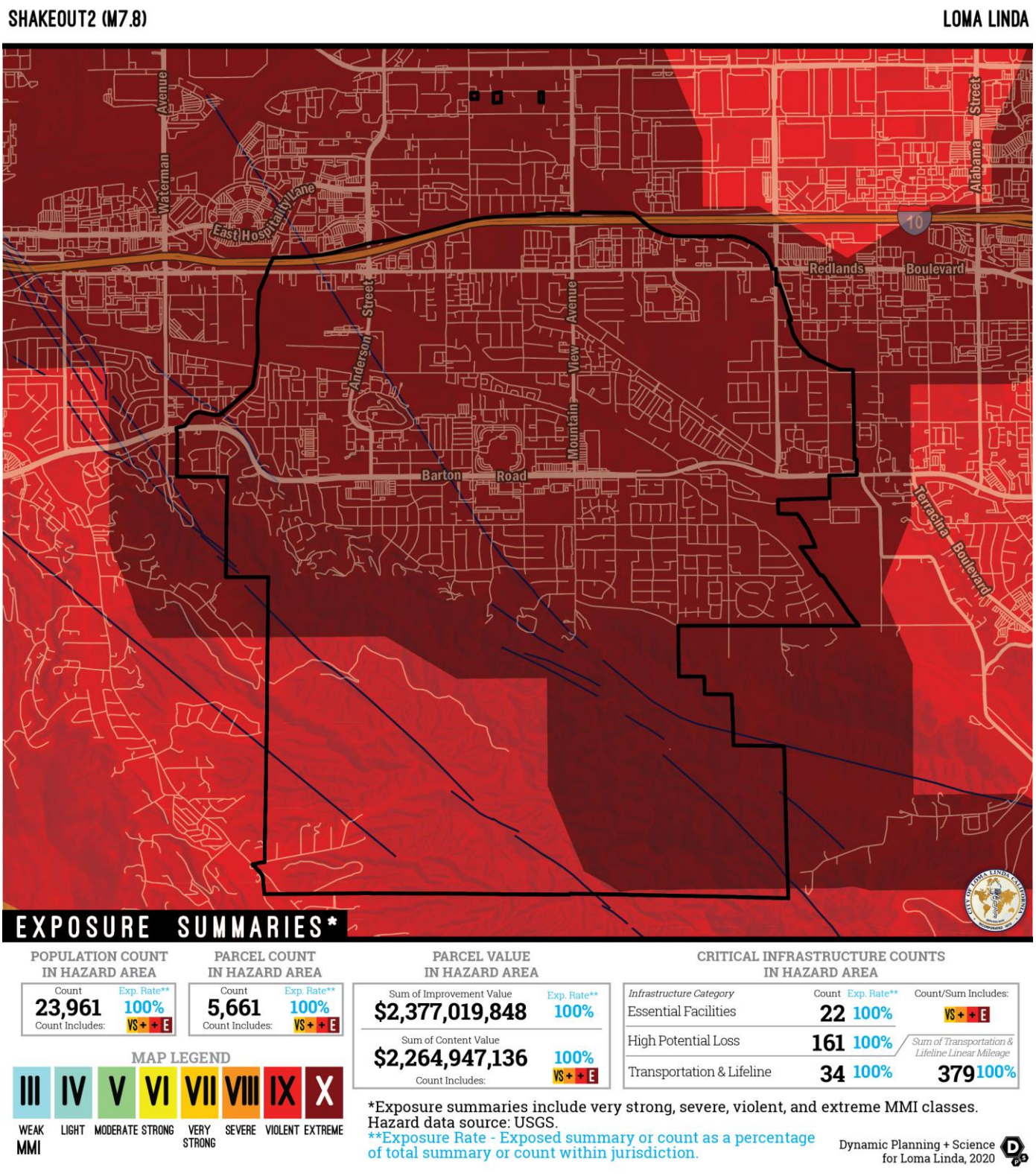


Figure 4-28: Loma Linda Shakeout2 (M7.8) Exposure and Snapshot Map

4.3.3.2 Population at Risk

Table 4-18 and **Figure 4-29** summarize population exposure results for the M7.8 Shakeout2. The entire population of the City of Loma Linda is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure depends on many factors, including the age and construction type of dwellings, the soil types on which their homes are constructed, and proximity to the fault location. Whether directly or indirectly impacted, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

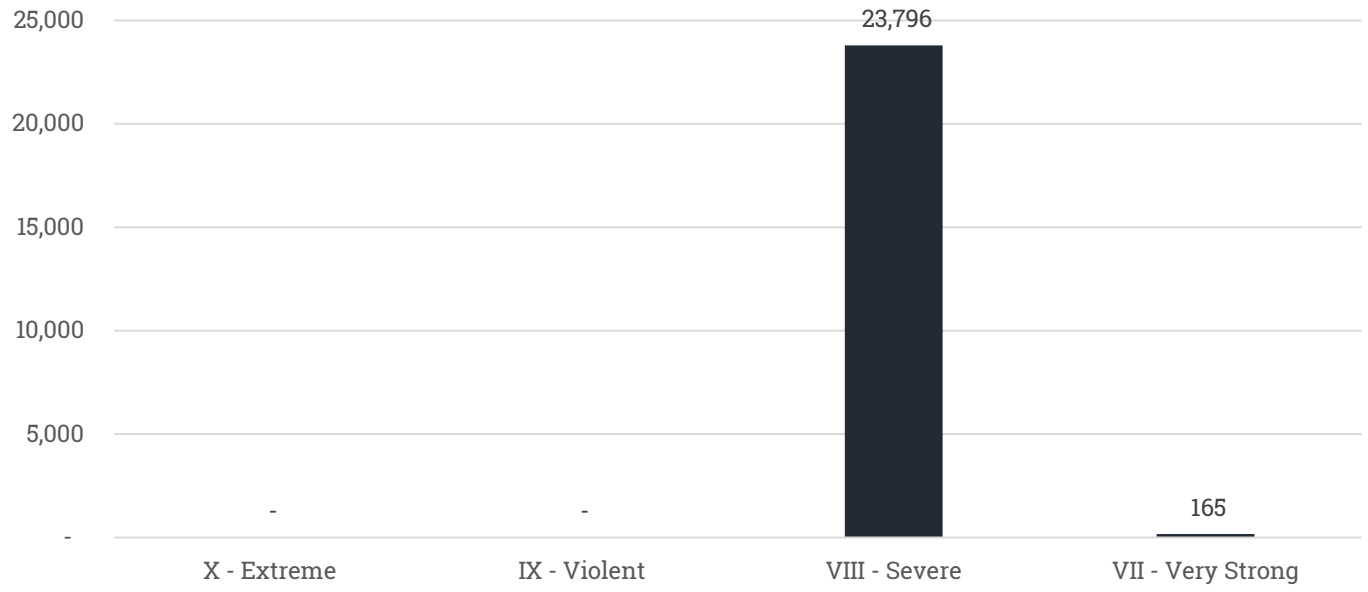


Figure 4-29: Population Exposure to M7.8 Shakeout2

Table 4-18: Population Exposure to M7.8 Shakeout2

	Total Population
Loma Linda	23,961

Shake Severity Zone	Population Count	% of Total
X - Extreme	-	0.00%
IX - Violent	-	0.00%
VIII - Severe	23,796	99.31%
VII - Very Strong	165	0.69%
Total	**23,961**	**100.00%**

4.3.3.3 General Building Vulnerability

One of the key issues that must be addressed in an earthquake vulnerability assessment is the determination of (1) the year in which seismic codes were initially adopted and enforced by the jurisdiction having authority and (2) the year in which significantly improved seismic codes were adopted and enforced, otherwise known as the benchmark year. **Table 4-19** provides a listing of code improvements for the City of Loma Linda. Benchmark years are indicated in bold. For reference, **Table 4-20** provides the definitions of the building types listed in **Table 4-19**.

Generally, structures constructed before the 1976 Uniform Building Code are considerably more vulnerable to earthquake damage without retrofitting.

Table 4-19: Seismic Benchmark Years

Code Edition	Effective Date	Building Type
(2019 CBC)	January 1, 2019	
(2016 CBC)	January 1, 2016	
(2013 CBC)	January 1, 2014	N/A
(2012 IBC)		
(2010 CBC)	January 1, 2011	N/A
(2009 IBC)		
(2007 CBC)	January 1, 2008	N/A
(2006 IBC)		
(2001 CBC)	November 1, 2002	N/A
(1997 UBC)		
(1998 CBC)	**July 1, 1999**	**W1a, S2, S2a, RM1, PC1, PC1a**
(1997 UBC)		
(1994 UBC)	**January 7, 1996**	**S1, S1a, C1, C2, C2a, RM2**
(1991 UBC)	**November 29, 1992**	**URM**
(1988 UBC)	**April 29, 1990**	**S2 & S2a**
(1985 UBC)	November 8, 1987	N/A
(1982 UBC)	December 9, 1984	N/A
(1979 UBC)	June 21, 1981	N/A
(1976 UBC)	**November 1, 1977**	**W1 and W2**
(1973 UBC)	April 13, 1975	N/A
(1970 UBC)	August 29, 1971	N/A
(1967 UBC)	July 12, 1968	N/A
(1964 UBC)	July 1, 1965	N/A
(1961 UBC)	August 17, 1962	N/A
(1958 UBC)	October 1, 1958	N/A
(1955 UBC)	January 1, 1956	N/A
(1955 UBC)	January 1, 1956	N/A
(1946 UBC)	June 18, 1948	N/A

Code Edition	Effective Date	Building Type
(1943 UBC)	July 13, 1944	N/A
(1940 UBC)	April 4, 1941	N/A
(1937 UBC)	September 10, 1937	N/A
(1930 UBC)	March 20, 1933	N/A

Source: ASCE 41-13

Table 4-20: Definitions of FEMA Building Types

FEMA Building Type	Definition
W1	Wood Light Frame
W1A	Wood Light Frame (multi-unit residence)
W2	Wood Frame (commercial and industrial)
S1	Steel Moment Frames
S2	Steel-braced Frames
S3	Steel Light Frames
S4	Steel Frames with concrete shear walls
S5	Steel Frames with infill masonry walls
C1	Concrete Moment Frames
C3	Concrete Frames with infill masonry shear walls
C2	Concrete Shear Walls
PC1	Tilt-Up Concrete shear walls
PC2	Precast Concrete Frames with shear walls
RM1	Reinforced Masonry Walls with flexible diaphragms
RM2	Reinforced Masonry Walls with stiff diaphragms
URM	Unreinforced Masonry Bearing Walls

4.3.3.4 Residential Parcel Value at Risk

The City's parcel layer was used as the basis for the inventory of improved residential parcels. GIS was used to create centroids, or points, to represent the center of each parcel polygon – this is assumed to be the structure's location for analysis purposes. The centroids were then overlaid with the shake severity zones to determine the at-risk structures. Only improved parcels greater than $20,000 were analyzed. The type and year of construction will greatly influence damage for structures subject to similar shaking. **Table 4-21** shows the count of at-risk structures and their associated improvement and land exposure values.

Table 4-21: Residential Parcel Value Exposure from Shakeout2 Scenario

	Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Loma Linda	5,661	$ 2,377,019,848	$ 2,264,947,136	$ 4,641,966,984

Shake Severity Zone	Improved Res. Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
X - Extreme	5,632	99.5%	$ 2,372,535,982	$ 2,262,700,832	$ 4,635,236,814	99.9%
IX - Violent	29	0.5%	$ 4,483,866	$ 2,246,304	$ 6,730,170	0.1%
VIII - Severe	-	-	-	-	-	-
VII - Very Strong	-	-	-	-	-	-
Total	**29**	**0.5%**	**$ 4,483,866**	**$ 2,246,304**	**$ 6,730,170**	**0.1%**

4.3.3.5 Critical Facilities with Damage Potential

Earthquakes pose numerous risks to critical facilities and infrastructure. Seismic risks or losses that are likely to result from exposure to seismic hazards include:

- Casualties (fatalities and injuries).
- Utility outages.
- Economic losses for repair and replacement of critical facilities, roads, buildings, etc.
- Indirect economic losses such as income lost during downtime resulting from damage to private property or public infrastructure.

Roads or bridges that are blocked or damaged can prevent access throughout the area and isolate residents and emergency service providers needing to reach vulnerable populations or make repairs.

Linear utilities and transportation routes are vulnerable to rupture and damage during and after a significant earthquake event. The cascading impact of a single failure can have effects across multiple systems and utility sectors. Degrading infrastructure systems and future large earthquakes with epicenters near-critical regional infrastructure could result in system outages that last weeks for the most reliable systems and multiple months for others.

Table 4-22 provides an inventory of critical facility locations (points only) with earthquake exposure for the Shakeout2 Scenario, respectively. Depending on the "year built," each critical facility presented in the tables may have varying damage potential.

Table 4-22: Shakeout2 Critical Infrastructure with EQ Risk

Critical Infrastructure - M7.8 Shakeout2				
Infrastructure Type	X - Extreme	VIII - Severe	VII - Very Strong	VII - Very Strong
Essential Facility	22	-	-	-
EOC	1	-	-	-
Hospital	19	-	-	-
Fire Station	1	-	-	-
High Potential Loss	161	-	-	-
Child Care Center	4	-	-	-
School	4	-	-	-
Medical Facility	16	-	-	-
Reservoir	7	-	-	-
Elder Residential Care	37	-	-	-
Adult Residential Care	12	-	-	-
Low Income Housing	42	-	-	-
Lodging	2	-	-	-
Veterinary Care	1	-	-	-
Water Treatment Facility	3	-	-	-
Park	8	-	-	-
Real Property Asset	21	-	-	-
Recreation	2	-	-	-
Library	1	-	-	-
Corp Yard	1	-	-	-
Transportation and Lifeline	34	-	-	-
Communications Tower	7	-	-	-
Water Booster	6	-	-	-
Water PRV	7	-	-	-
Highway Bridge	6	-	-	-
Lift Station	1	-	-	-
Water Well	7	-	-	-
Hazmat	21	-	-	-
Hazardous Materials Site	21	-	-	-
Grand Total	**238**	-	-	-

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership.*

4.3.3.5.1 HazMat Fixed Facilities

Although earthquakes are low probability events, they produce hazardous materials (HazMat) threats at very high levels when they do occur. Depending on the year built and construction of each facility containing HazMat, earthquake-initiated hazardous material releases (EIHR) potential will vary. HazMat contained within masonry or concrete structures built before certain benchmark years reflecting code improvements may be of particular vulnerability.

4.3.3.5.2 Transportation

Earthquake events can significantly impact bridges and overpasses, which often provide the only access to some neighborhoods. Since soft soil regions generally follow floodplain boundaries, bridges that cross

watercourses are considered vulnerable. Bridges and roadways which intersect waterways are thus at least somewhat vulnerable to earthquakes.

Interstate 215 is a 54.5 mile-long north-south Interstate highway in the Inland Empire region of Southern California. It is an auxiliary route of Interstate 15, running from Murrieta to northern San Bernardino. While I-215 connects the city centers of both Riverside and San Bernardino, its parent I-15 runs to the west through Corona and Ontario. Freeway overpasses provide throughways to significant regional corridors in San Bernardino County. A single overpass failure can severely disrupt travel, emergency access, public safety, and mutual aid from neighboring public safety districts. The Newport Avenue overpass has undergone seismic safety upgrades, but the Barton Road Overpass has not.

4.3.3.5.3 Public Schools

The Field Act was enacted on April 10, 1933, one month after the Long Beach Earthquake, in which many schools were destroyed or suffered major damage. Public school construction has been governed by the Field Act since 1933 and enforced by the Division of the State Architect. In any community, public schools constructed under the Field Act after 1978 are likely to be among the safest buildings to experience a major earthquake. The Field Act requires:

- School building construction plans be prepared by qualified California licensed structural engineers and architects;
- Designs and plans are checked by the Division of the State Architect (DSA) for compliance with the Field Act before a contract for construction can be awarded;
- Qualified inspectors, independent of the contractors and hired by the school districts, continuously inspect construction and verify full compliance with plans;
- The responsible architects and/or structural engineers observe the construction periodically and prepare changes to plans (if needed) subject to approval by DSA;
- Architects, engineers, inspectors, and contractors file reports under penalty of perjury to verify compliance of the construction with the approved plans emphasizing the importance of testing and inspections to achieve seismically safe construction. Any person who violates the provisions or makes any false statement in any verification report or affidavit required pursuant to the Act is guilty of a felony.

Private schools are not subject to the Field Act and fall solely under the jurisdiction of the local building departments and their requirements. Private schools are covered under the Private Schools Building Act of 1986. The legislative intent is that children attending private schools are afforded life safety protection similar to that of children attending public schools.

In the late 1960s, regulations were put in place to have pre-Field Act (1933) buildings retrofitted, removed from school use, or demolished. (Cal. Edu. Code § 15516, Appendix X (1968)) The Field Act also prohibits the use of unreinforced masonry buildings as school buildings. In general, seismic building standards were greatly strengthened after significant damage to buildings was observed, especially in the 1971 San

Fernando earthquake. The Field Act regulations in place since 1978 are considered adequate for most public school buildings in most cases.

4.3.3.5.4 Utilities

Linear utilities and transportation infrastructure would likely suffer considerable damage in the event of an earthquake. Due to the amount of infrastructure and sensitivity of utility data, linear utilities are difficult to analyze without further investigation of individual system components. **Table 4-23** provides the best available linear utility data, and it should be assumed that these systems are exposed to breakage and failure.

Table 4-23: Lifeline Exposure Shakedown2 Scenario

Lifelines (miles) - M7.8 N. San Andreas - N. Coast - Peninsula - SC Mtn.				
Infrastructure Type (Linear)	X - Extreme	IX - Violent	VIII - Severe	VII - Very Strong
Fiber Optics	68.2	-	-	-
Sewer Main	1.1	-	-	-
Storm Drain Main	19.6	-	-	-
Street	161.4	14.5	-	-
Interstate	*6.4*	-	-	-
Major Road	*12.9*	-	-	-
Local Road	*67.7*	*2.1*	-	-
Service Road	*55.2*	*2.1*	-	-
Bike Path	*4.5*	-	-	-
Walking Path	*14.8*	*10.3*	-	-
Water Main	114.6	-	-	-
Grand Total	**364.9**	**14.5**	**-**	**-**

4.3.3.5.5 Water Supply Utilities

The City of Loma Linda provides water within the City boundaries. The municipally owned retail water utility services approximately 6,784 acres, or 10.6 square miles in size. This area is part of the greater San Bernardino-Ontario metropolitan area and also within the boundaries of the Valley District service area. (San Bernardino Valley Regional Urban Water Management Plan, 2015)

The supply for the City comes from primarily three local groundwater basins. The Bunker Hill Water Basin lies under the northern area of the City. This water basin underlies most of the San Bernardino Valley, which extends from the San Bernardino Mountain range to the south hills of Loma Linda. This aquifer supplies the majority of water to the City of Loma Linda. The groundwater basin underlying the southwest portion of the City is the Reche Canyon Basin. The San Timoteo Basin is under the southeast portion of the City. The City of Loma Linda's groundwater is supplied from five wells. They include the Richardson Wells

#1, #3, and #4, and Mountain View Wells #3, #4, and #5. All of the City's wells are located in the Bunker Hill Basin. (City of Loma Linda General Plan, 2009)

The California Aqueduct carries water from the Sacramento-San Joaquin Delta to the San Joaquin Valley and Southern California. The Aqueduct has been designed to "break" at the Devil Canyon Powerplant (approx. 13 miles north of Loma Linda) in the event of a large earthquake. (Upper Santa Ana Integrated Resources Water Management Plan, 2015).

Natural Gas Utilities

The U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) defines natural gas pipelines under two categories, "Transmission" and "Distribution." Transmission pipelines are primarily used to receive gas from suppliers and move it to distribution load centers or storage facilities.

High-Pressure Distribution lines are used to deliver gas to Loma Linda customers. These pipelines operate at pressures above 60 psi and deliver gas to the lower pressure distribution system in smaller volumes. (SoCal Gas Transmission and High Pressure Distribution Pipeline Interactive Map, n.d.)

Several common characteristics of earthquakes and their impacts on natural gas safety are:

1. Earthquake ground shaking will generally lead to substantially more instances of building damage than fire ignitions.
2. Ground motions that are sufficient enough to damage buildings are the most likely to impact utility and customer gas systems and create a potential for gas-related fire ignitions.
3. The number of post-earthquake fire ignitions related to natural gas can be expected to be 20% to 50% of the total post-earthquake fire ignitions.
4. The consequences of post-earthquake fire ignitions for residential gas customers are largely financial. A fire ignition only becomes a life safety concern when inhabitants cannot exit the building following earthquakes. Experience in past earthquakes indicates that egress from earthquake-damaged single-family homes is generally possible because of the limited structure height, low numbers of occupants, and multiple direct escape paths through doors and windows.
5. The potential life safety dangers from post-earthquake fires are considerably more serious in seismically vulnerable apartment or condominium buildings since they provide a greater chance for damaging the structure and trapping the occupants.

Southern California Gas Company (SoCal Gas), Loma Linda's natural gas utility, is responsible for designing, constructing, maintaining, and operating the natural gas system safely and efficiently. This includes all the facilities used in the delivery of gas to any customer up to and including the point of delivery to the customers' gas piping system. SoCal Gas provides seismic safety through compliance with existing regulations, coordinating their emergency planning with local governments, and incorporating earthquake-resistant design considerations into their maintenance activities and new construction.

Gas customers and Loma Linda residents are responsible for using gas safely on their property and within their buildings and other facilities. Customers meet this responsibility by maintaining their gas appliances in good working condition, assuring that only qualified individuals are engaged to modify or maintain their gas service and facility piping, and knowing what to do before and after earthquakes to maintain the safe operation of their natural gas service.

The following conditions, when combined, pose the greatest risk for severe post-earthquake fire damage:

1. Buildings are unoccupied, and individuals are not present to mitigate damage to gas systems or control small fires.
2. High building density or dense, fire-prone vegetation.
3. High wind and low humidity weather conditions.
4. Damage to water systems that severely limits firefighting capabilities.
5. Reduced responsiveness of firefighting resulting from impaired communications, numerous requests for assistance, direct damage to fire stations, restricted access because of traffic congestion and damaged roadways, and delays in mutual aid from neighboring fire districts.

4.3.3.6 Loss Estimation Results

Hazus 4.2 was used to estimate the loss potential to residential properties and Government service facilities exposed to the Shakeout2 earthquake scenario Hazus reports the damage potential and loss potential from a given earthquake scenario in four categories: slight damage, moderate damage, extensive damage, and economic loss. Economic loss consists of estimations on repair and replacement costs to damaged or destroyed buildings and contents, relocation expenses, capital-related income, wage losses, and rental income losses. The results shown in **Table 4-24** summarize improved parcels and government property loss.

Table 4-24: Shakeout2 Earthquake Building and Content Loss Estimation

Building Type	Average of Potential Damage to Exceed "Slight"	Average of Potential Damage to Exceed "Moderate"	Average of Potential Damage to Exceed "Extensive"	Average Economic Loss for Each Building Category	Sum of Economic Loss	Proportion of Loss (%)
Agriculture	99%	95%	72%	$773	$15,465	0%
Commercial	83%	63%	39%	$1,662,197	$267,613,730	30%
Education	100%	98%	84%	$5,678,040	$141,951,010	16%
Emergency	83%	62%	35%	$268,656	$805,968	0%
Government	77%	41%	11%	$175,103	$16,809,864	2%
Industrial	99%	95%	74%	$177,249	$238,223,124	26%
Religion	84%	53%	17%	$637,184	$7,009,020	1%
Residential	63%	27%	5%	$57,261	$234,197,855	26%
Total					**$906,626,037**	

Note: Total Inventory Values
1 - Building Replacement Costs = $2,400,466,573
2 - Content Replacement Costs = $2,280,402,222
3 - Total Value = $4,680,868,795

Table 4-25: Detailed Insurance Roll of Real Property Asset Exposure to M7.8 Shakeout2

Building/ Site Name	# Bldg.	Site Value			Probability Damage Exceeds			Economic Loss	Loss Pct.
		Structure	Content	Total	Slight	Moderate	Extensive		
Corp Yard	2	$502,028	$165,905	$667,933	79%	49%	11%	$135,412	20%
Corporation Yard	1	$256,526	$52,534	$309,060	79%	49%	11%	$69,193	22%
Public Works	1	$245,502	$113,371	$358,873	79%	49%	11%	$66,219	18%
Dwelling	2	$504,996	$2	$504,998	57%	15%	1%	$51,076	10%
Dwelling	2	$504,996	$2	$504,998	57%	15%	1%	$51,076	10%
Equipment	2	$2	$124,595	$124,597	79%	49%	11%	$1	0%
Cable Television Equipment	1	$1	$124,594	$124,595	79%	49%	11%	$0	0%
City Equipment Storage	1	$1	$1	$2	79%	49%	11%	$0	13%
Fire	2	$3,070,302	$436,052	$3,506,354	75%	43%	9%	$805,967	23%
Fire Department	1	$2,682,853	$436,051	$3,118,904	79%	49%	11%	$723,646	23%
Fire Station #2	1	$387,449	$1	$387,450	71%	38%	7%	$82,321	21%
Library	1	$4,881,016	$1	$4,881,017	79%	49%	11%	$1,316,557	27%
Civic Center Library	1	$4,881,016	$1	$4,881,017	79%	49%	11%	$1,316,557	27%
Misc.	33	$5,201,804	$257,802	$5,459,606	75%	35%	5%	$1,403,080	26%
Vacant Land	9	$9	$9	$18	70%	30%	4%	$2	9%
Civic Center Complex	1	$5,201,772	$218,025	$5,419,797	79%	49%	11%	$1,403,074	26%
Hulda Crooks Sculpture	1	$1	$39,746	$39,747	56%	18%	2%	$0	0%
Purchased By Redevelopment Agency	21	$21	$21	$42	79%	39%	6%	$5	11%
Park Land	1	$1	$1	$2	55%	11%	0%	$0	4%
Open Space	5	$5	$5	$10	73%	30%	4%	$1	9%
Debris Basin	1	$1	$1	$2	79%	39%	6%	$0	11%
Vacant Land	1	$1	$1	$2	79%	39%	6%	$0	11%
Parkland	2	$2	$2	$4	63%	16%	1%	$0	6%
Vacant Lot	1	$1	$1	$2	79%	39%	6%	$0	11%
Poplar Commons	18	$18	$18	$36	80%	40%	7%	$4	12%
Purchased By Redevelopment Agency	18	$18	$18	$36	80%	40%	7%	$4	12%
Recreation	7	$1,171,880	$78,782	$1,250,662	68%	33%	13%	$877,863	70%
Senior Center	1	$1,171,874	$1	$1,171,875	99%	96%	74%	$877,863	75%
Hulda Crooks Park	1	$1	$1	$2	53%	10%	0%	$0	4%
Leonard Bailey Park	1	$1	$1	$2	47%	7%	0%	$0	3%
Community Garden	1	$1	$1	$2	79%	39%	6%	$0	11%

Building/ Site Name	# Bldg.	Site Value			Probability Damage Exceeds			Economic Loss	Loss Pct.
		Structure	Content	Total	Slight	Moderate	Extensive		
Dawson Park	1	$1	$1	$2	79%	39%	6%	$0	11%
Ball Park	1	$1	$1	$2	58%	20%	2%	$0	6%
Heritage Park	1	$1	$78,776	$78,777	58%	20%	2%	$0	0%
Storage	1	$29,675	$1	$29,676	79%	49%	11%	$8,004	27%
40' X 60' Metal Storage Building	1	$29,675	$1	$29,676	79%	49%	11%	$8,004	27%
Water	12	$8,084,995	$14,391,919	$22,476,914	77%	49%	28%	$4,023,982	18%
Richardson #3 Water Treatment	1	$1	$1	$2	79%	39%	6%	$0	11%
Water Treatment Plant	1	$1	$1	$2	66%	26%	3%	$0	8%
Richardson#4 Water Treatment	1	$1	$1	$2	66%	26%	3%	$0	8%
Mountain View #5 Water Treatment	1	$1	$1	$2	66%	26%	3%	$0	8%
Mountain View #3 Water Treatment	1	$1	$1	$2	82%	44%	8%	$0	12%
Reservoir	5	$8,084,988	$7,536,895	$15,621,883	92%	79%	61%	$4,023,981	26%
Reservoir & Pump Station	1	$1	$6,855,018	$6,855,019	53%	10%	0%	$0	0%
Golconda Well Site	1	$1	$1	$2	56%	18%	2%	$0	6%
Grand Total	**85**	**$23,446,721**	**$15,455,082**	**$38,901,803**	**75%**	**38%**	**10%**	**$8,621,948**	**22%**

**Single dollar values represent locations with no insured valuation.*

4.3.3.6.1 Past and Future Development

Loma Linda has some concerning pre-1970s development in the older parts of town, particularly near the University, that is more susceptible to earthquakes. Much of that older construction is from the 1930s and 1940s and may not have adequate retrofitting.

Current and future development in the planning area is regulated through building standards and performance measures so that the degree of risk to buildings and infrastructure is greatly reduced. The California Building Code establishes requirements to greatly reduce seismic risk.

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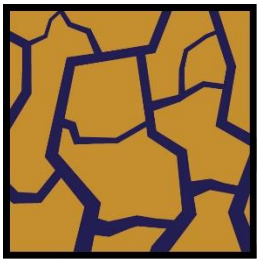
4.3.4 Drought



Drought has impacted almost every area of California at one time or another, causing more than $2 billion in total costs for some periods. (UC Davis, 2014) Droughts exceeding three years are relatively rare in northern California, the source of much of the state's water supply. The 1929-1934 drought established the criteria commonly used in designing storage capacity and yield for large northern California reservoirs. The driest single year in California's measured hydrologic history was 1977. (California Department of Water Resources, 2015)

Drought impacts in California are felt first by those most dependent on annual rainfall, including agencies fighting wildfires, ranchers engaged in dryland grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable water source. (*Id.*)

For more general information on drought in Loma Linda, see the hazard profile in Section 4.2.3.

4.3.4.1 Population at Risk

The residents of the City rely on healthy watersheds to provide adequate water for domestic and agricultural purposes. The City of Loma Linda has experienced population growth and is projected to continue growing. No significant life or health impacts are anticipated as a result of drought within the planning area.

4.3.4.2 Property

During drought years, property owners with shallow wells can be impacted by drought with increased demand for groundwater resources. Surface water supplies are often lower, which can reduce available supplies and increase cost. This sometimes encourages growers who historically use surface water to switch to groundwater, which permanently impacts those reliant on groundwater.

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

The agricultural sector is particularly susceptible to drought impacts. Impacts on irrigated agriculture depend on the source and nature of the irrigation water supply, whether it be local groundwater, local surface water, or imported surface water, and any water rights or contractual provisions associated with the source. The extent to which producers may mitigate water shortage impacts depends on multiple factors but is heavily influenced by economic considerations. Factors involved in making decisions about mitigating irrigation water shortages include availability and costs of pumping groundwater, price of alternative surface water sources, capital investments associated with maintaining permanent plantings, and status of international crop markets. (California Drought Contingency Plan, 2010)

4.3.4.3 Critical Facilities and Infrastructure

Critical facilities, as defined for this plan, will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, landscaped areas will not be watered and may die when water conservation measures are in place. These aesthetic impacts are not considered significant.

4.3.4.4 Past and Future Development

Like many municipalities in California, Loma Linda is working to conserve water and reduce outdoor landscaping water consumption in current and future development. Past development contributed to some drought impacts by requiring significant outdoor water usage, especially through turfgrass. Loma Linda has long had a water-efficient landscape requirement in Municipal Code § 13.32. The statewide conservation regulations instituted following the 2015-2017 drought aim to further reduce water use in the City.

The City also developed the Richardson Treatment Plant in 2010, which increases water supply options for the City, increasing sustainable water supplies. Since that time, the City has coordinated groundwater production with the San Bernardino Water Conservation District, which oversees groundwater recharges and water quality monitoring of the Bunker Hill Basin, where the City gets its water. On a semi-annual basis the City pays an assessment to ensure groundwater quality and quantity is maintained within the basin, especially during drought conditions. The capabilities assessment offers some additional insight into future opportunities for sustainability measures in the face of drought, such as a comprehensive drought management plan or revisiting the City's water-efficient landscaping regulations.

4.3.5 Climate Change

4.3.5.1 Population at Risk

The effects of climate change are not limited or defined by geographical borders. Every resident of Loma Linda is at risk to the impacts of climate change.

Vulnerable populations should receive special attention when assessing the community's vulnerability to climate change. For example, care and sheltering during extreme heat conditions must be provided for vulnerable populations such as the elderly. According to FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. According to the National Weather Service (NWS), among natural hazards, only the cold of winter—not lightning, hurricanes, tornados, floods, or earthquakes—takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heatwave of 1980, more than 1,250 people died. (PubMed.gov)

Since climate change can exacerbate other hazards, consideration should also be given to populations living in high hazard wildfire and flood zones. Drought caused by climate change will also affect the entire population. Agricultural yields will suffer, and drier vegetation creates more fuel for wildfires.

For more general information on climate change in Loma Linda, see the hazard profile in Section 4.2.4.

4.3.5.2 Property

Climate change may exacerbate impacts to property through increased severity and frequency of hazard occurrences such as severe weather, slope failure, wildfire, and flooding. These potential impacts are described in more detail in the hazard-specific vulnerability for each section.

4.3.5.3 Critical Facilities and Infrastructure

The location of infrastructure, its current condition, and its susceptibility to climate impacts are important factors to consider when accessing the vulnerability of critical facilities to climate change.

Infrastructure provides the resources and services critical to community function. Roads, rail, water (pipes, canals, and dams), waste (sewer, storm, and solid waste), electricity, gas, and communication systems are all needed for community function. Climate change increases the likelihood of both delays and failures of infrastructure. Delays and failures can result from climate-exacerbated hazards such as flooding, fire, or landslide, as well as increased demand, load, or stress on infrastructure systems that can result from climate change (e.g., heat impacts on roadway durability). Temporary delays or outages can result in inconvenience and economic loss, while larger failures can have disastrous economic and social effects. (California Adaptation Planning Guide)

Three to five more heatwaves will be experienced by 2050, increasing to 12 to 16 in the western parts of the region and more than 18 to 20 in the eastern parts. The age and construction method of essential facilities, transportation systems, lifeline utility systems, high potential loss facilities, and hazardous material facilities will determine how they stand up to the effects of climate change, such as extreme heat days.

4.3.5.4 Past and Future Development

Loma Linda is committed to continued efforts to address and reduce climate-related risks and future impacts on a holistic and programmatic level. Many of its current regulations aim to ensure future development is prepared to adapt to a changing climate, such as its' water-efficient landscaping regulations.

The City is currently focusing its efforts on this HMP Update and a concurrent update of the City's General Plan Safety Element to include policies and implementation actions that consider and mitigate future climate change to the extent possible. These efforts are intended to reduce vulnerability to climate change within the City.

4.3.6 Hazardous Waste & Materials

For more general information on hazardous materials in Loma Linda, see the hazard profile at 4.2.5.

4.3.6.1 Population at Risk

Loma Linda residents and businesses are at risk of hazardous materials release from a variety of sources. While 21 locations within the City store, use, or produce hazardous materials, these locations are regulated by federal, state, and local regulations. No significant life or health impacts are anticipated as a result of hazardous materials within the planning area.

4.3.6.2 Property

Some properties within Loma Linda are located in close proximity to existing hazardous materials locations or transportation routes (roads/rails) used for the movement of materials. These properties are at greater risk to exposure from a hazardous materials release. While this risk exists, the storage, movement, and use of hazardous materials is regulated by federal, state, and local agencies, which ensure exposure is minimized to the greatest extent possible. As a result, significant life or health impacts are not anticipated as a result of hazardous materials within the planning area.

4.3.6.3 Critical Facilities and Infrastructure

As defined for this plan, critical facilities are not anticipated to be significantly impacted by hazardous materials releases. Key facilities that are located in close proximity to hazardous materials locations include Fire Station 2, and several of the medical facilities within the City that store, use, and dispose of hazardous materials (medical waste). Releases associated with the transport of materials through the City could affect critical facilities located along Barton Road or Redlands Blvd, where most of the City's facilities are located.

4.3.6.4 Past and Future Development

While most development in the City was constructed many years ago, residents and businesses continue to invest in rehabilitation and retrofit of existing structures. This development activity continues to increase the City's resilience and reduce the potential threat of exposure to hazardous materials release. In addition, new developments adhere to the latest standards and requirements, ensuring future releases are reduced or minimized to the greatest extent possible.

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4.3.7 Human-Caused Hazards

Human-caused hazards include both terrorism and airplane hazards.

For more general information on terrorism in Loma Linda, see the hazard profile at 4.2.6.

4.3.7.1 Population at Risk

Terrorism

All residents and businesses are at risk of terrorism to some degree within Loma Linda. Certain populations at greater risk may be those who frequent locations within the City that may be considered targets for terrorism incidents; however, these locations and impacts are hard to predict.

Airplane Hazards

All residents and businesses are at risk of airplane hazards primarily from overflight, given the amount of air traffic flying over the City. No specific populations are at significant risk, given airport operations occur several miles outside of the City.

4.3.7.2 Property

Terrorism

Given the unknown nature of terrorism-related incidents, it is assumed that some properties within the City may be at greater risk given the nature of the activities that occur within (medical, religious, civic).

Airplane Hazards

Properties within the City are at risk from airplane hazards; however, it is assumed that taller buildings within the City are at greater risk due to their relative height above the majority of other buildings within the City.

4.3.7.3 Critical Facilities and Infrastructure

Terrorism

Critical facilities and infrastructure may be at heightened risk to terrorism incidents due to their role in City operations.

Airplane Hazards

While critical facilities and infrastructure play a key role in City operations, they may not be any more vulnerable than other properties; however, these locations could become targets as part of a malicious act by an aircraft.

4.3.7.4 Past and Future Development

Terrorism

A majority of past development in the City has not taken terrorism into account during the planning and design process. However, for certain critical locations, the City and property owners of these facilities have taken steps to increase security measures and retrofit buildings to reduce the consequences of malicious acts. For future developments within the City, security-related improvements are promoted to increase the safety of residents and businesses to the greatest extent possible.

Airplane Hazards

Most of the development within the City occurred at times when airplane operations in and around the City were significantly less than current activity. As a result, future developments take greater care in understanding and complying with relevant regulations and requirements associated with airport operations. Future developments will continue to adhere to applicable regulations to reduce vulnerability to airplane hazards.

4.3.8 Flood

Flooding is a significant problem in Loma Linda, as described in the flood hazard profile. The portions of the City of Loma Linda that have been vulnerable to historical flooding are associated with Mission Channel, the Santa Ana River, and small-scale floods originating on hillsides in the southern portion of the City. (City of Loma Linda General Plan, 2009) Localized flooding often occurs throughout the City due to drainage issues. In urban areas, the increase in paved areas associated with new development decreases the amount of open land available to absorb rainfall and runoff, thus increasing the volume of water that must be carried away from by waterways.

For more general information on flooding in Loma Linda, see the hazard profile in Section 4.2.7.

4.3.8.1 Population at Risk

Population counts of those living in the floodplain were generated by analyzing County assessor and parcel data that intersect with the 100-YR and 500-year floodplains identified on FIRMs. Using GIS, U.S. Census Bureau information was used to intersect the floodplain, and an estimate of population was calculated by weighting the population within each census block and track with the percentage of the flood risk area. Using this approach, **Figure 4-30** and **Table 4-26** display the results of this analysis showing how much of the population of Loma Linda is exposed to flood hazard zones. **Figure 4-31** displays a visual of the FEMA flood exposure risk for both 100- and 500-year floodplains.

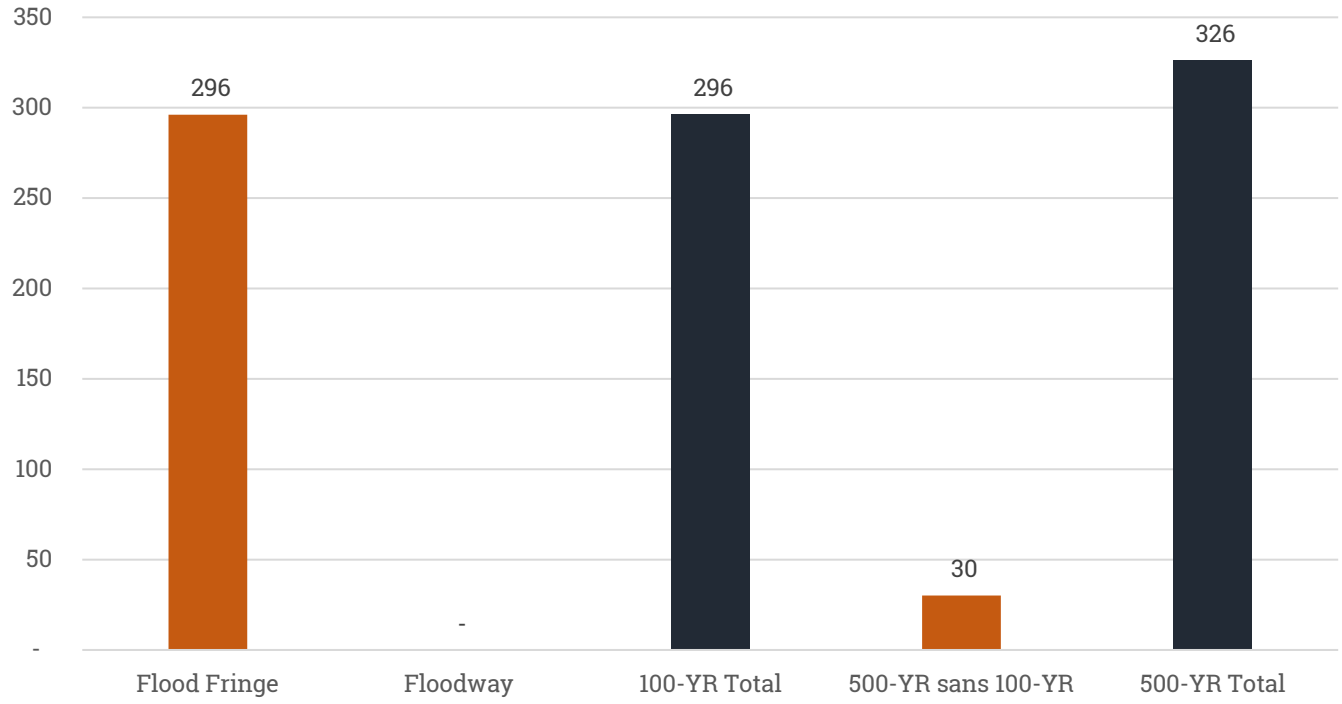

Figure 4-30: Population Exposure to Flood

Table 4-26: Summary Population Exposure to Flood

	Total Population
Loma Linda	23,961

Flood Hazard Zone	Population Count	% of Total
Flood Fringe	296	*1.24%*
Floodway	-	*0.00%*
100-YR Total	296	*1.24%*
500-YR sans 100-YR	30	*0.13%*
500-YR Total	326	*1.36%*

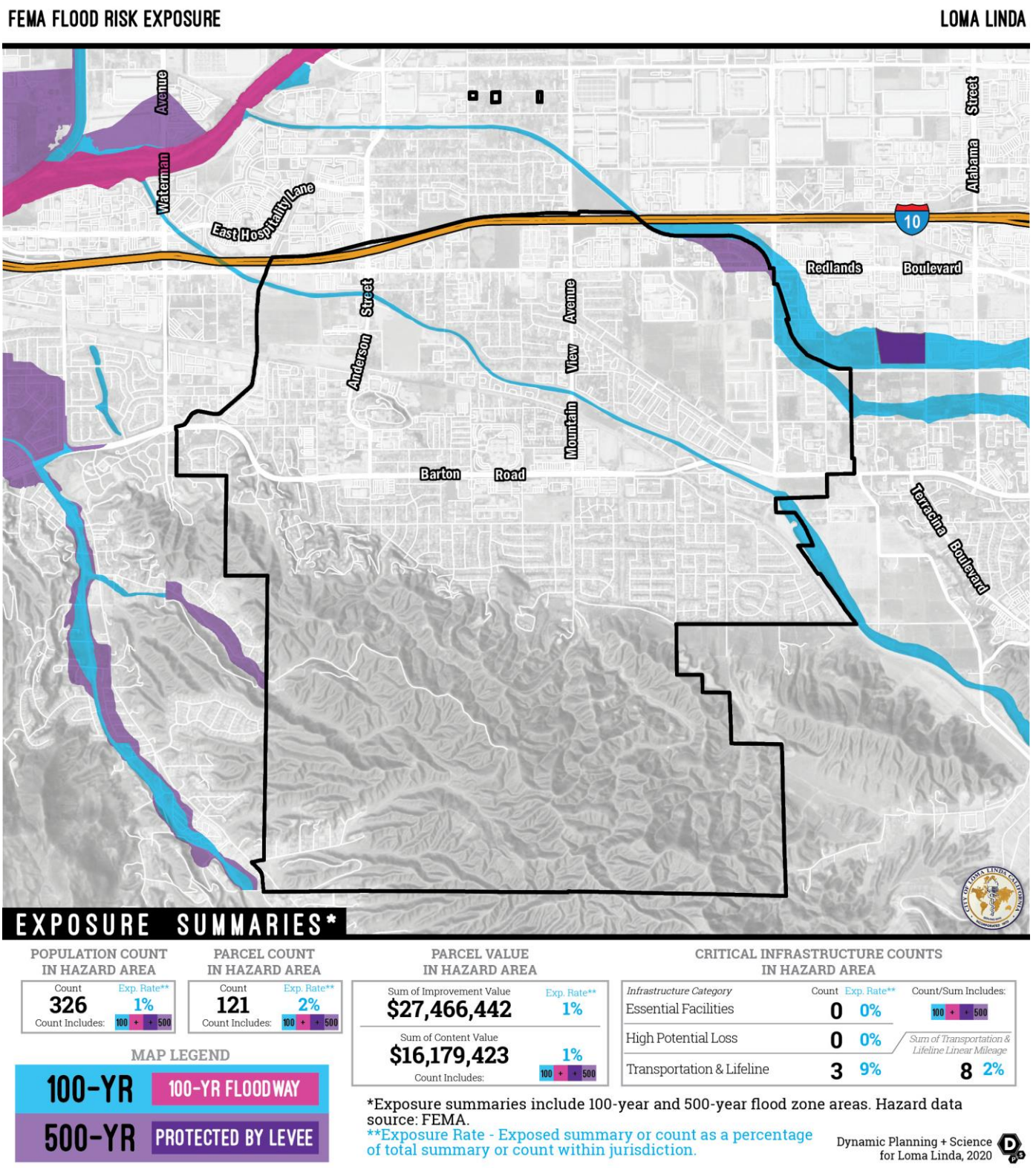

Figure 4-31: Loma Linda - FEMA Flood Risk Exposure

4.3.8.2 Residential Parcel Value at Risk

The City's parcel layer was used as the basis for the inventory of improved residential parcels within the FEMA NFIP flood zones. In some cases, a parcel will be within multiple flood zones. GIS was used to create centroids, or points, to represent the center of each parcel polygon – this is assumed to be the structure's location for analysis purposes. The centroids were then overlaid with the floodplain layer to determine the flood risk for each structure. The flood zone in which the centroid was located was assigned to the entire parcel. This methodology assumed that every parcel with a square footage value greater than zero was developed in some way. Only improved parcels greater than $20,000 were analyzed. **Table 4-27** shows the count of at-risk parcels and their improvement and land exposure values.

Table 4-27: Parcels Exposed to NFIP Flood Zones

	Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Loma Linda	5,661	$ 2,377,019,848	$ 2,264,947,136	$ 4,641,966,984

Flood Hazard Zone	Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Flood Fringe	18	*0.3%*	$ 6,883,327	$ 5,887,861	$ 12,771,188	*0.3%*
Floodway	-	*0.0%*	$ -	$ -	$ -	*0.0%*
100-YR Total	**18**	**0.3%**	**$ 6,883,327**	**$5,887,861**	**$ 12,771,188**	**0.3%**
500-YR sans 100-YR	103	*1.8%*	$20,583,115	$10,291,563	$ 30,874,678	*0.7%*
500-YR Total	**121**	**2.1%**	**$ 27,466,442**	**$ 16,179,423**	**$ 43,645,865**	**0.9%**

Note: The table above does not display loss estimation results; the table exhibits total value at risk based upon the hazard overlay and San Bernardino County Assessor data.

While there are several limitations to this methodology, it does allow for potential loss estimation. It should be noted that the analysis may include structures in the floodplain that are elevated at or above the level of the base flood elevation, which will likely decrease potential flood damage to these particular structures. Also, it is important to remember that the replacement costs are well below actual market values; thus, the actual value of assets at risk may be significantly higher than those included herein.

4.3.8.3 Critical Facilities and Infrastructure

Critical facilities data were overlaid with flood hazard data to determine the type and number of facilities within the 100- and 500-year floodplain. Flooding poses numerous risks to critical facilities and infrastructure:

- Roads or bridges that are blocked or damaged can prevent access throughout the area and isolate residents and emergency service providers needing to reach vulnerable populations or make repairs.
- Creek or river floodwaters can back up drainage systems causing localized flooding.
- Floodwaters can get into drinking water supplies causing contamination.

- Sewer systems can be backed up, causing waste to spill into homes, neighborhoods, rivers, and streams.
- Underground utilities can also be damaged.

Table 4-28 summarizes the critical facilities and infrastructure located in the flood fringe, floodway, and 100-year and 500-year floodplains of Loma Linda.

Table 4-28: Critical Facility Points in the Floodplain

Infrastructure Type	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
Essential Facility	-	-	-	-	-
High Potential Loss	-	-	-	-	-
Transportation and Lifeline	3	-	3	-	3
Communications Tower	-	-	-	-	-
Water Booster	-	-	-	-	-
Water PRV	-	-	-	-	-
Highway Bridge	3	-	3	-	3
Lift Station	-	-	-	-	-
Water Well	-	-	-	-	-
Hazmat	-	-	-	-	-
Grand Total	**3**	**-**	**3**	**-**	**3**

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership.*

4.3.8.3.1 Utilities

It is important to determine who may be at risk if the infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the City, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect**. Table 4-29** shows critical facilities (linear) in the floodplain.

Table 4-29: Lifelines in the Floodplain

Lifelines (miles) - Flood Risk Exposure					
Infrastructure Type (linear)	Flood Fringe	Floodway	100-YR Total	500-YR sans 100-YR	500-YR Total
Fiber Optics	0.1	-	0.1	0.3	0.4
Sewer Main	0.0	-	0.0	0.0	0.0
Storm Drain Main	0.1	-	0.1	0.1	0.2
Street	3.5	-	3.5	1.3	4.7
Interstate	-	-	-	-	-
Major Road	0.1	-	0.1	0.3	0.4
Local Road	0.4	-	0.4	0.8	1.1
Service Road	0.7	-	0.7	0.2	1.0
Bike Path	2.3	-	2.3	-	2.3
Walking Path	-	-	-	0.0	0.0
Water Main	0.7	-	0.7	1.7	2.4
Grand Total	**4.4**	**-**	**4.4**	**3.4**	**7.8**

4.3.8.4 Loss Estimation Results

Hazus calculates losses to structures from flooding by analyzing the depth of flooding and type of structure. Using historical flood insurance claim data, Hazus estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, all non-vacant parcels with current market values were used instead of the default inventory data provided with Hazus. **Table 4-30** and **Figure 4-32** show the 100-year flood loss estimation (based on depth) in NFIP flood zones by occupancy type. **Table 4-31** and **Figure 4-33** show the 500-year flood loss estimation (based on depth) in NFIP flood zones by occupancy type.

The City's insurance data was obtained and formatted for use in Hazus for a detailed damage estimation of City-owned facilities. This combined government dataset has additional information, including the number of floors, building value, content value, and construction type, that significantly enhances Hazus results. **Table 4-30** displays damage estimation for City facilities located in the 100-year flood zone.

Damage Estimation for 100 yr. Floodplain

Table 4-30 and **Figure 4-32** display damage estimation summaries for the 100-year floodplain in Loma Linda occupancy type.

Table 4-30: 100-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Damage ($)	Building Damage (% of total loss)	Content Damage ($)	Content Damage (% of total loss)	Total Damage ($)	Proportion of Loss (%)
Agriculture	$0	0%	$0	0%	$0	0%
Commercial	$0	0%	$0	0%	$0	0%
Education	$0	0%	$0	0%	$0	0%
Emergency	$0	0%	$0	0%	$0	0%
Government	$0	0%	$0	0%	$0	0%
Industrial	$0	0%	$0	0%	$0	0%
Religion	$0	0%	$0	0%	$0	0%
Residential	$784,967	75%	$255,516	25%	$1,040,483	100%
Total	**$784,967**	**75%**	**$255,516**	**25%**	**$1,040,483**	

Note: Total Inventory Values
1 - Building Replacement Costs = $2,400,466,573
2 - Content Replacement Costs = $2,280,402,222
3 - Total Value = $4,680,868,795

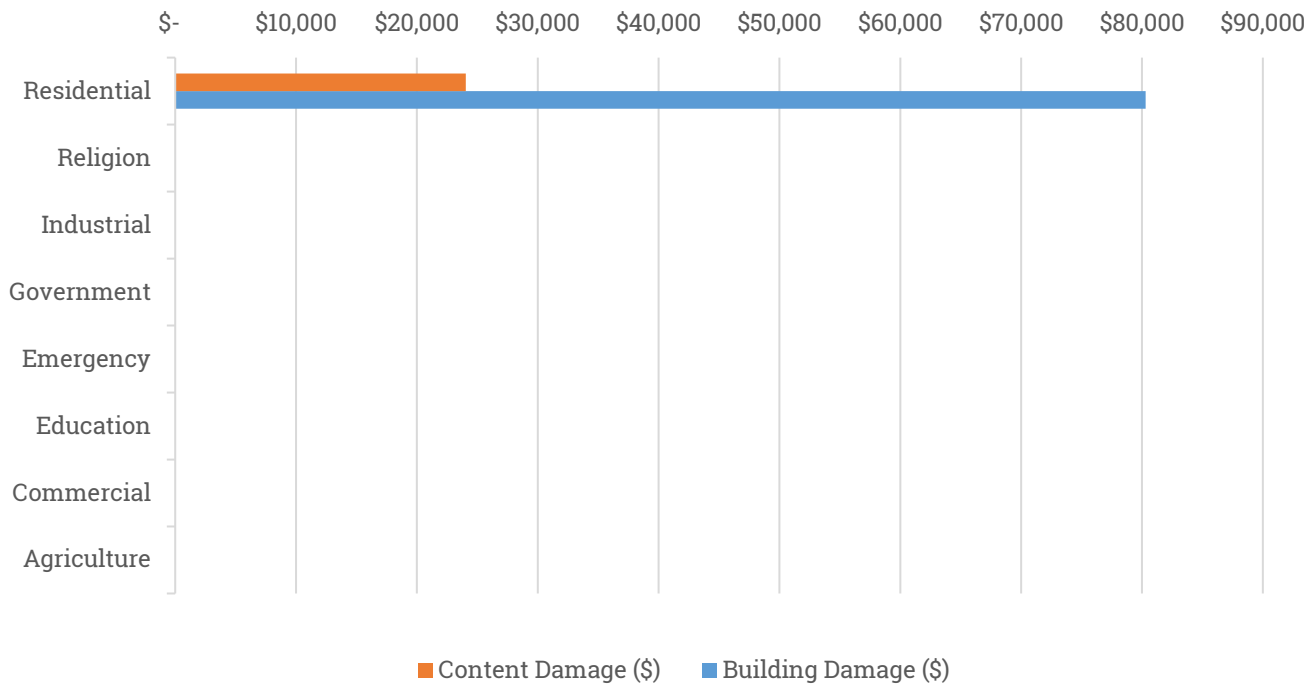

Figure 4-32: 100-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Damage Estimation for 500 yr. Floodplain

Table 4-31 displays the damage estimation for the 500 yr. floodplain in Loma Linda by occupancy type.

Table 4-31. 500-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Damage ($)	Building Damage (% of total loss)	Content Damage ($)	Content Damage (% of total loss)	Total Damage ($)	Proportion of Loss (%)
Agriculture	$0	0%	$1	0%	$1	0%
Commercial	$0	0%	$0	0%	$0	0%
Education	$0	0%	$0	0%	$0	0%
Emergency	$0	0%	$0	0%	$0	0%
Government	$0	0%	$0	0%	$0	0%
Industrial	$0	0%	$0	0%	$0	0%
Religion	$0	0%	$0	0%	$0	0%
Residential	$80,302	77%	$24,050	23%	$104,352	100%
Total	**$80,303**	**77%**	**$24,051**	**23%**	**$104,353**	

Note: Total Inventory Values
1 - Building Replacement Costs = $2,400,466,573
2 - Content Replacement Costs = $2,280,402,222
3 - Total Value = $4,680,868,795

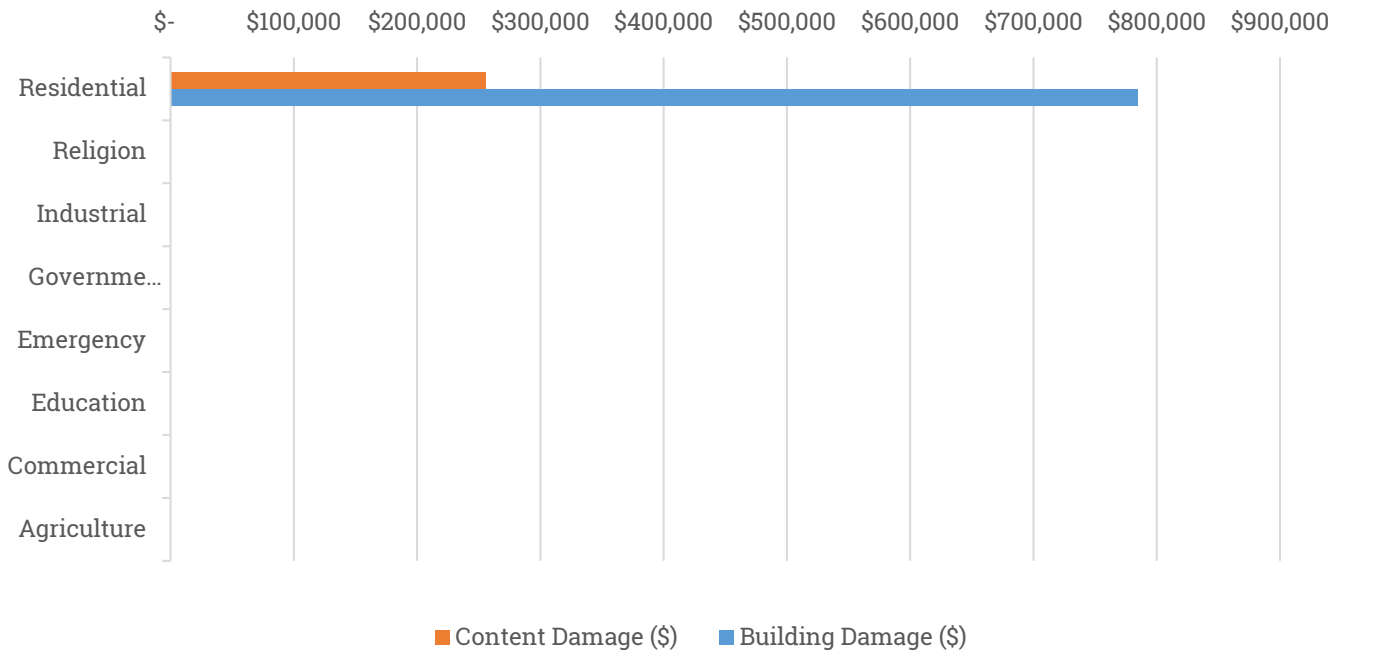

Figure 4-33: 500-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

4.3.8.5 Past and Future Development

The City of Loma Linda has greatly reduced its vulnerability to flooding in the past several decades. The most significant project to date was the San Timoteo Creek Project, conducted by the Army Corps of Engineers and the San Bernardino County Flood Control District. The project consisted of channelization and various other improvements to San Timoteo Creek. The project includes 3.6 miles of concrete (trapezoidal or rectangular) channel, 2.2 miles of flow-through, 18 sediment control basins, and 1.4 miles of earthen low-flow channels on the upstream end. Thousands of residences were removed from the floodplain as a result of the project. In 2007, FEMA issued a Letter of Map Revision (LOMR) showing the significantly reduced flood hazard area. (FEMA, 2019)

The City does currently have some parcels that could be developed in the future in the 100-year floodplain. However, the City's review is strict for those parcels and requires a flood hazard area permit before any development can occur in the floodplain (§ 19.12.070) and has instituted standards for flood reduction in §§ 19-12-120 through 140. The City does not anticipate any further vulnerability to flooding in the future.

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4.3.9 Slope Failure

Landslides, mudflow, debris flow, and rockfall, collectively known as slope failure, may cause damage across the City. They rarely present a threat to human life but often disrupt everyday services, including emergency response capabilities. Landslides can block transportation routes, dam creeks, and drainages and contaminate water supplies. When these hazards affect transportation routes, they are frequently expensive to clean up and can have significant economic impacts on the City. (United States Geological Survey, 2004)

Landslide

The many types of landslides are categorized based on form and type of movement. They range from slow-moving rotational slumps and earth flows, which can slowly distress structures but are less threatening to personal safety, to fast-moving rock avalanches and debris flows that are a serious threat to structures and have been responsible for most fatalities during landslide events. Many large landslides are complex and a combination of more than one landslide type. (United States Geological Survey, n.d.)

Mudflow/Debris Flow

When slope material becomes saturated with water, a debris flow may develop. Debris flows can also occur from horizontal seismic inertia forces induced in a slope from ground shaking. There are generally two types of debris flows from a geologic perspective: debris flows related to shallow landslides and post-wildfire debris flows. (United States Geological Survey, 2005)

Debris flows related to shallow landslides occur on hillslope due to soil failure, which liquefies and runs downhill. This type of debris flow generally results from a shallow landslide (less than 10 to 15 feet deep) and has a discrete initiation zone depositional area. Shallow landslides tend to occur in winter but are most likely after prolonged periods of heavy rainfall when soil materials are saturated. Debris flows are typically more dangerous because they are fast-moving, causing property damage and life loss. (*Id.*)

Post-wildfire debris flows result from post-fire conditions, where burned soil surfaces enhance rainfall runoff that concentrates in a channel and picks up debris as it moves. The post-fire debris flow has a less discrete initiation zone but is similar to a debris flow derived from hillslopes in that it may result in inundation and a detrimental impact on lives and property within its zone of runout and deposition. It can result in downstream flooding. (*Id.*)

For more general information on slope failure in Loma Linda, see the hazard profile in Section 4.2.8.

4.3.9.1 Population at Risk

An estimated 3,697 persons, or 15.43% of the City's population, are exposed to slope failure areas, as shown in **Table 4-26** below. Population estimates within slope failure areas were generated by analyzing City assessor and parcel data that intersect with landslide hazard areas identified by California Geological Survey. Using GIS, U.S. Census Bureau information was used to intersect slope failure hazards; a population estimate was calculated by weighting the population within each census block and track with the percentage of slope hazard areas.

Table 4-32: Summary Population Exposure to Landslide

	Total Population
Loma Linda	23,961

Landslide Susceptibility	Population Count	% of Total
High	1,935	*8.07%*
Moderate	1,034	*4.31%*
Low	729	*3.04%*
Total	**3,697**	**15.43%**

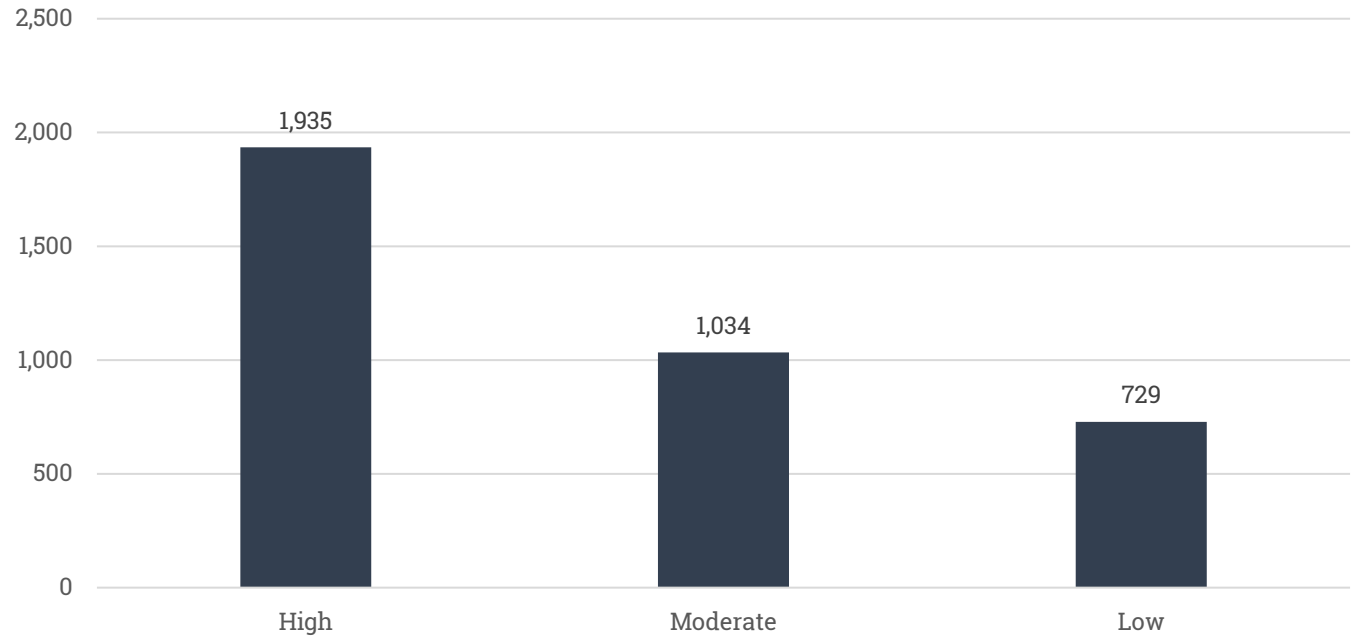

Figure 4-34: Population Exposure to Landslide

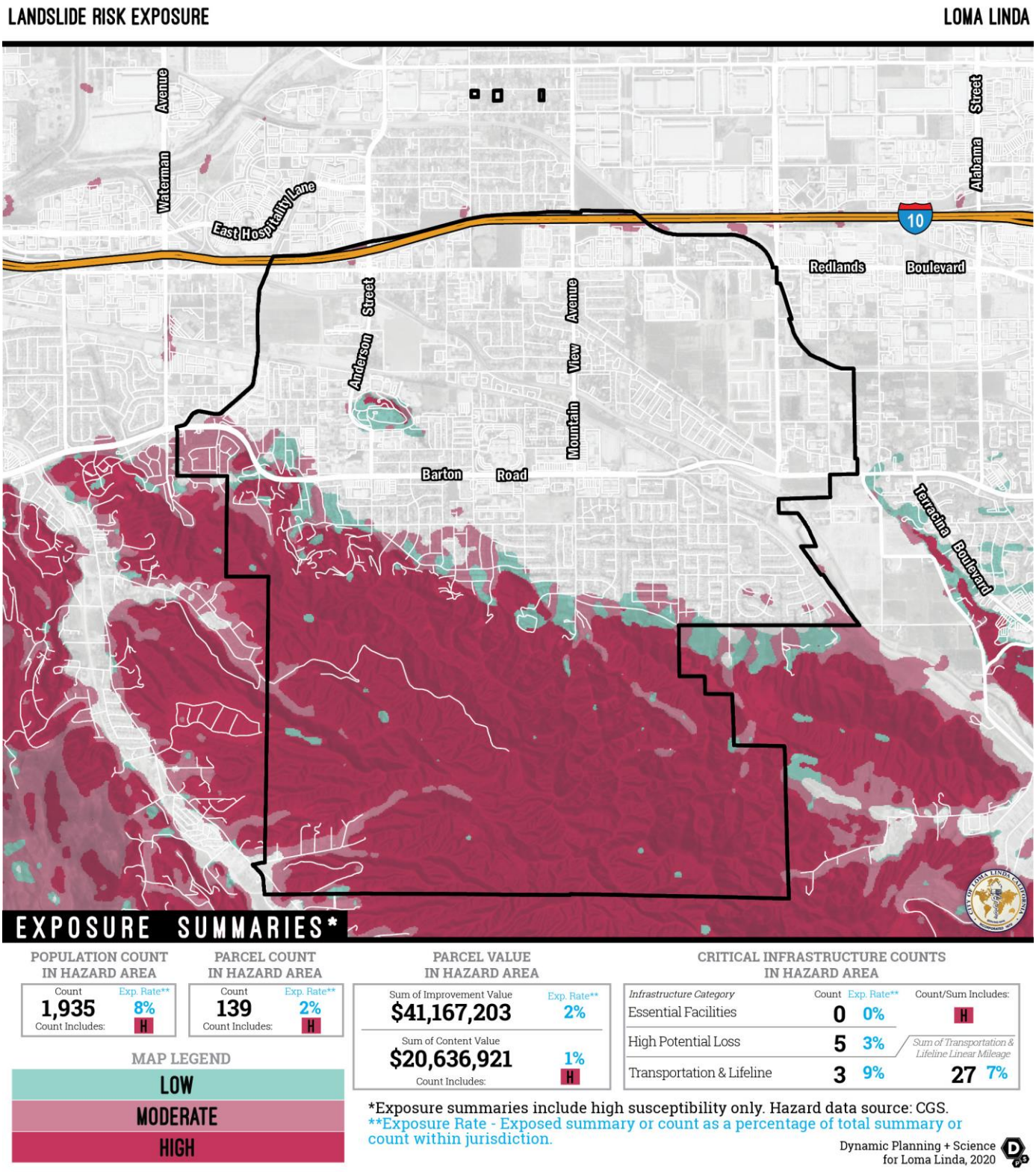

Figure 4-35: Loma Linda -Snapshot Layout-Landslide Risk Exposure

4.3.9.2 Property

Table 4-33 shows the number of parcels, market value exposure, and content value exposure in the steep-slope risk areas. The predominant zoning classes in cities are single-family, vacant, and manufactured homes.

Table 4-33: Property Value Exposed to Landslides.

	Total Parcels	Total Market Value ($)	Total Content Value ($)	Total Value ($)
Loma Linda	5,661	$ 2,377,019,848	$ 2,264,947,136	$ 4,641,966,984

Landslide Susceptibility	Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Low	238	*4.2%*	$ 78,749,697	$ 56,506,377	$ 135,256,074	*2.9%*
Moderate	418	*7.4%*	$ 144,182,864	$ 79,391,828	$ 223,574,692	*4.8%*
High	139	*2.5%*	$ 41,167,203	$ 20,636,921	$ 61,804,124	*1.3%*
Total	**795**	**14%**	**$ 264,099,764**	**$ 156,535,125**	**$ 420,634,889**	**9.1%**

4.3.9.3 Critical Facilities and Infrastructure

Several types of infrastructure are exposed to mass movements, including transportation, water, sewer, and power infrastructure. At this time, all infrastructure and transportation corridors identified as exposed to the landslide hazard are considered vulnerable until more information becomes available. **Table 4-34** and **Table 4-35** summarize the critical facilities exposed to the slope failure hazard.

Table 4-34: Critical Facility Points with Slope Failure Hazard Risk

Critical Infrastructure - Landslide Susceptibility			
Infrastructure Type	High	Moderate	Low
Essential Facility	-	1	-
EOC	-	-	-
Hospital	-	1	-
Fire Station	-	-	-
High Potential Loss	5	12	2
Child Care Center	-	1	-
School	-	-	-
Medical Facility	-	-	-
Reservoir	5	1	1
Elder Residential Care	-	5	-
Adult Residential Care	-	3	-
Low Income Housing	-	-	-
Lodging	-	-	-
Veterinary Care	-	-	-

Critical Infrastructure - Landslide Susceptibility			
Infrastructure Type	High	Moderate	Low
Water Treatment Facility	-	-	-
Park	-	-	1
Real Property Asset	-	2	-
Recreation	-	-	-
Library	-	-	-
Corp Yard	-	-	-
Transportation and Lifeline	3	1	1
Communications Tower	1	-	-
Water Booster	2	1	-
Water PRV	-	-	-
Highway Bridge	-	-	-
Lift Station	-	-	-
Water Well	-	-	1
Hazmat	-	-	-
Hazardous Materials Site	-	-	-
Grand Total	8	14	3

**Real Property Assets are digitized insurance rolls for demonstrating value and ownership.*

Table 4-35: Critical Facilities (Linear) with Slope Failure Hazard Risk

Lifelines (miles) - Landslide Susceptibility			
Infrastructure Type (Linear)	High	Moderate	Low
Fiber Optics	0.2	3.8	1.4
Sewer Main	-	0.1	0.0
Storm Drain Main	0.1	1.3	0.4
Street	23.9	12.8	6.6
Interstate	-	0.9	-
Major Road	0.2	0.9	0.4
Local Road	2.6	8.1	3.9
Service Road	4.8	1.2	1.4
Bike Path	-	-	0.1
Walking Path	16.3	1.7	0.7
Water Main	2.7	9.2	5.3
Grand Total	**26.9**	**27.3**	**13.6**

4.3.9.4 Past and Future Development

The City's primary vulnerability to slope failure is from the hillside area in the southern part of the City. Some past development in Loma Linda occurred within those moderate and high landslide risk areas, increasing overall vulnerability to slope failure in the City. However, the vast majority of that growth occurred more than two decades ago. Currently, the City has severely limited growth in the high landslide risk areas on the southern hillside. First, in 2006 voters passed a slow-growth initiative that included hillside development limitations that made hillside development nearly impossible. The City also owns significant amounts of that same hillside area of concern. In January of 2016, the city installed a series of gabion walls to reduce the damage potential of debris flows in the south hills. A rain gauge was also installed in the south hills to measure rainfall intensity as a way of preliminary identification of potentially hazardous levels of rainfall.

Future development in Loma Linda is not likely to contribute to landslide risk. As a result, much of the focus is on protecting existing populations, structures, and critical facilities from landslides.

Section 5. Mitigation Strategy

The intent of the mitigation strategy is to provide the City of Loma Linda with a guidebook to implementing future hazard mitigation. The mitigation strategy is intended to reduce vulnerabilities outlined in the previous section with a prescription of policies and physical projects. This will help City staff achieve compatibility with existing planning mechanisms and ensure that mitigation activities provide specific roles and resources for implementation success.

5.1 Planning Process for Setting Hazard Mitigation Goals and Objectives

The mitigation strategy represents the key outcomes of the Loma Linda HMP planning process. The hazard mitigation planning process conducted by the Planning Committee is a typical problem-solving methodology:

- Estimate the impacts the problem could cause (*See Section 4.2, Vulnerability Assessment*);
- Describe the problem (*See Section 5.2, Identifying the Problem*);
- Assess what safeguards and resources exist that could potentially lessen those impacts (See Section, 5.3 *Capabilities Assessment*);
- Develop Goals and Objectives with current capabilities to address the problems (*See Section 5.4.1 Goals and Objectives*)
- Using this information, determine what can be done and select appropriate actions for the community (*See Section 5.5, Goal, Objective, and Mitigation Action Matrix*).

5.2 Identifying the Problem

As part of the mitigation actions identification process, the HMP Planning Committee identified issues and/or weaknesses as a result of the risk assessment and vulnerability analysis. By combining common issues and weaknesses developed by the Planning Committee, the realm of resources needed for mitigating each can be understood.

For Loma Linda, key issues that the City faces deal with development pressures encroaching in areas of heightened risk. Much of the open space within the City is vulnerable to seismic, geologic, and slope failure risk.

5.3 Capabilities Assessment

The mitigation strategy includes an assessment of the City's planning and regulatory, administrative/technical, fiscal, and political capabilities to augment known issues and weaknesses from identified natural hazards.

The information in **Table 5-1** is used to construct mitigation actions aligned with the City's existing planning and regulatory capabilities. Planning and regulatory tools typically used by local jurisdictions to

implement hazard mitigation activities are building codes, zoning regulations, floodplain management policies, and other municipal planning documents.

Table 5-1. Loma Linda Capabilities Assessment

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		City of Loma Linda	
City Manager's Office	Personnel Resource	The City Manager is the Chief Executive Officer of the City; he provides and coordinates the overall operation of the City under the policy mandates of the City Council, oversees the annual operating budget, and supervises all departments within the organization. Mitigation activities implemented by this office may include direction setting with the City Council and City Departments and prioritization of new initiatives that support mitigation activities within the City	City of Loma Linda
City Clerk	Personnel Resource	The City Clerk is responsible for the related agendas, meetings, correspondence, and public hearing notices. Other duties include retaining legal documents, microfilming, administering the State Political Reform Act and the city's Conflict of Interest Code, coordinating city elections, legal advertising, opening competitive bids, and the overall coordination of the Redevelopment Agency Affordable Housing Programs. The city clerk also serves as the clerk of the council, administering municipal elections. Mitigation activities implemented by this department may include record-keeping and document coordination. Updates to City codes that mitigate future hazards would be administered through the office of the City Clerk.	City Of Loma Linda
Finance Department	Personnel Resource	The Finance Department is responsible for managing the financial operation of the city, the Loma Linda Housing Authority, and the Loma Linda Redevelopment Successor Agency in accordance with generally accepted accounting principles, federal and state statutes, the city's municipal code, and administrative policies. Mitigation actions include recommending fiscal policies to city management	City of Loma Linda

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		and implements such policies. The department provides fiscal support to all city departments and programs to ensure that the city's fiscal affairs are effectively managed and projects receive the proper funding. Financial management (and personnel) within the City can assist with mitigation activities by tracking costs associated with hazard events and disasters, identifying grant funding opportunities, and establishing financial risk calculations that can help departments with budgeting operations, maintenance, and capital improvements.	
Human Resources	Personnel Resource	The department focuses on recruitment, classification, compensation, benefits administration, performance management, training, development, succession planning, safety, and labor/employee relations. The Human Resources Department to implement and support processes that add value to the City of Loma Linda and its employees, leading to improved employee recruitment, development, retention, and morale while aligned with the City of Loma Linda vision and objectives for its employees, stakeholders, and citizens. This department can support mitigation activities by identifying staffing needs and shortfalls and developing plans and agreements with other jurisdictions/agencies to meet future needs.	City of Loma Linda
Planning Division **(Community Development)**	Personnel Resource	The Planning Division provides various services to the public, including zoning information, land use information, assistance with permits, current planning, and long-range planning. Provides support to the City Council, Planning Commission, Water District, School District, and several City Commissions, Committees, and Boards. The Planning Division also anticipates and acts on the need for new plans, policies, and Zoning Code changes. Mitigation support can identify large systemic issues within the community and incorporate mitigation strategies or policies into existing and new projects.	City of Loma Linda
Building and Safety Division	Personnel Resource	Building staff implements the Building Code and other applicable rules and guidelines. This ensures the proper construction of buildings within Loma Linda, protects the public's health and safety, and protects and improves	City of Loma Linda

Resource Name	Type of Resource	Ability to Support Mitigation	Website
(Community Development)		property values by enforcing standards for high-quality construction. Mitigation activities for this department come in the form of inspections on new and established constructions, identifying potential hazards, and implementing the necessary retrofits to comply with established policies. Provide emergency response and damage assessment during and after disaster events.	
Economic Development	Personnel Resource	It primarily focuses on attracting new retail and high-tech industrial development to increase the City's sales tax and property tax revenues and provide new employment opportunities for local residents. The Department is also responsible for negotiating and developing Agency owned-real estate within designated Redevelopment Project Areas. The economic development effort of the City of Loma Linda is a vital element to the city's overall goal of continuing to provide quality services in a family-oriented community. Mitigation actions include the integration of mitigation action and strategies into the economic development of the city. Increasing revenue of the City to aid in funding of mitigation strategies.	City of Loma Linda
Information System Department	Personnel Resource	The Information System Department reports directly to the City Manager. The department's primary duty is to provide centralized information technology for all city departments. The City has four primary areas of technology: LAN/WAN Network – Servers/Clients, VoIP Telephone System, Channel 3 (Cable TV channel), and Fiber to the Home/Business Network (LLCCP). They also provide the City with all Arc GIS (Geographical Information System) data input and mapping, which aids in hazard mitigation analysis issues and projects. It can help utilize new technologies to improve City planning, research, data collection, mapping, and develop new ways to aid in mitigation strategies and their creation.	City of Loma Linda
Engineering Division (Public Works Dpt.)	Personnel Resource	This division is responsible for the sections relative to plan check, construction inspection, consultant-contract administration, contract project administration, and various regional programs that involve transportation, solid waste, stormwater management, and public utilities.	City of Loma Linda

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		This also includes capital improvement project management and development review. The department's duty is to implement and cooperate in those programs established and/or mandated by federal, state, county, and special districts. Mitigation actions include the planning, designing, and managing of mitigation projects for the City. This department aids the City in the identification of potential violations and creating the projects to address them.	
Operations Division (Public Works)	Personnel Resource	This division conducts all of the department's maintenance activities, including landscape parks, streets, traffic safety, sewer collection, water production and distribution, meters, storm drainages, fleet and equipment, public building and various contract services such as mechanics and landscapers. Mitigation actions include the maintenance and managing of mitigation infrastructure and assets for the City. This department aids the City in the identification of potential mitigation shortfalls and creating the projects to address them.	City of Loma Linda
Loma Linda Fire Department	Personnel Resource	The Fire Department is responsible for fire hydrant testing (for fire suppression purposes), disaster preparedness (earthquakes, flooding), fire investigation (arson), fire inspections (schools, commercial buildings), CPR/First aid courses, and fire safety programs (Learn not to burn). Department personnel are certified in heavy rescue, hazardous materials response, vehicle extrication, emergency medical services, and fire suppression in structural, high-rise, wildland, and vehicle firefighting. Firefighters deliver an efficient and effective emergency response through structural and wildland fire suppression, emergency medical services, hazardous materials response, technical rescue, and tactical response. The Emergency Preparedness program reduces vulnerability to hazards, increases community disaster resiliency, and provides timely economic recovery utilizing comprehensive mitigation, preparedness, and response programs.	City of Loma Linda

Resource Name	Type of Resource	Ability to Support Mitigation	Website
Police Department	Personnel Resource	The city of Loma Linda contracts with the San Bernardino Sheriff's Department for police services throughout the city. Mitigation actions related to the safe movement of traffic (e.g., during evacuations), residents' public safety during emergency events, and terrorism-related activities may be implemented through Sheriff Department staff. As emergency preparedness is part of the department's responsibilities, the Sheriff Department can also widely implement other mitigation actions through coordination with other departments and agencies.	City of Loma Linda
Public Safety	Personnel Resource	Provides fire protection/suppression, emergency medical services, and other programs to reduce the risk of fire and other hazards. In addition, the department conducts inspections to help prevent potential fire hazards. This department is responsible for fire prevention education and disaster preparedness planning. The Department also provides for animal control, code enforcement, and parking control.	City of Loma Linda
Adopted FY Budget	Financial Resource	The City adopts its budget, which identifies the funding available for each fiscal year that can be used to support governmental operations. This budget is a key location where future mitigation projects can be identified from a funding perspective.	FY Budget 2019-2020
Capital Improvement Program	Financial Resource		
Financial Resources for Hazard Mitigation Funding	Financial Resource	The City has many different avenues for raising money to aid in mitigation project funding. Different types of fees and levies (Ex: Sewer Service Fees, Sales Tax, Water Fund, Storm Drain Fees), the sale of bonds, and Capital Project Funds. Mitigation activity is funded by many of these programs and further subsidized by FEMA.	Loma Linda Budget FY 2019-2020
General Plan	Plan Resource	The General Plan is the long-term, comprehensive blueprint for development and changes in the community. The general plan's policies address land uses, public safety, environmental protection, transportation, etc. The general plan serves as a framework for mitigation actions,	Loma Linda General Plan

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		establishing the overarching policies for mitigation activities. Mitigation actions may be directly incorporated into the general plan as policies and/or implementation actions to provide a stronger enforcement mechanism	
Building Code	Plan Resource	The Building Code is part of the City's Municipal Code (Title 15, Buildings and Construction), which includes the building code and other associated standards (Residential Code, Mechanical Code, Electrical Code, etc.) govern how new buildings are constructed. They are published by the state and are adopted by local communities, sometimes with amendments to make the codes more locally applicable. Mitigation actions to construct buildings to a safer standard, allowing them to better resist damage during a hazard event, could be part of future building code updates.	Loma Linda Municipal Code
Zoning Ordinance	Plan Resource	The Loma Linda Zoning Ordinance (Title 17, Zoning, Loma Linda Municipal Code) implements the City's general plan. It establishes regulations for land uses throughout the community, including where other development and land use activity can occur, how these developments can look, and how they may be operated. Mitigation actions related to the siting, construction, and operation of new developments in Loma Linda may be implemented through the Zoning Code to ensure these locations address risks identified in the plan.	Loma Linda Municipal Code
City of Loma Linda Water Production Division	Technical Resource	The City of Loma Linda's water production division provides water from the cities own six production wells. Loma Linda's main water source is groundwater within the vast Bunker Hill Basin. Nearly all of the snowmelt running down from the San Bernardino Mountains replenishes this basin. Loma Linda's water supply meets the City's current needs, and Loma Linda is not reliant on State Water Project aqueducts and surface channels or rivers, as is the case with many areas of California. Keeping track of the cities production system is a complex computer system called S.C.A.D.A. (Supervisory Control and Data Acquisition). This S.C.A.D.A. system can monitor the twenty-three remote sites ranging from reservoir	Water Production Division

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		levels, pressures in the different zones, chlorine residuals, operation of boosters and wells, and automatically make system adjustments to predetermined set points.	
		San Bernardino County	
San Bernardino County Sheriff Department	Personnel Resource	Loma Linda contracts through the County of San Bernardino Sheriff's Department. "The City of Loma Linda is a small university town that maintains a large presence in the Inland Empire and throughout the world. Long noted for its leading role in medical science and higher education, Loma Linda University Medical Center has been a national center for health, wellness, and research for decades. The Jerry L. Pettis Veterans Memorial Medical Center also joined the community, and in conjunction with the Loma Linda Medical Center, became the major employers of the city. Loma Linda orange groves, once the predominant land use, are giving way to residential developments as the city, with 22,000 residents continues to grow." - San Bernardino County Sheriff's Web Site	SBC Sheriff Department
		Regional, State, and Federal Agencies	
California State Hazard Mitigation Plan	Plan Resource	The California State Hazard Mitigation Plan assesses the types of hazards that may be present in California. It includes descriptions of these hazards, summaries of past hazard events, descriptions of how these hazards may occur in the future, and how these hazards may harm California's people and assets. Like a local hazard mitigation plan, the State Hazard Mitigation Plan is updated every five years. The Committee can use the State Hazard Mitigation Plan as a source of information to refine the hazard profiles and vulnerability assessments in future Loma Linda LHMPs.	CA State Hazard Mitigation Plan
Federal Emergency Management Agency	Technical Resource	The Federal Emergency Management Agency (FEMA) is the federal agency responsible for hazard mitigation, emergency preparedness, and emergency response and recovery activities. It guides state and local governments	FEMA

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		on hazard mitigation activities, including best practices and compliance with federal requirements. FEMA also provides funding for hazard mitigation actions through grant programs.	
Cal-Adapt	Technical Resource	Cal-Adapt is an online tool that provides detailed projections for future climate-related conditions in California, including factors such as temperature, precipitation, and sea-level rise. These projections can help inform future hazard events and explain how hazard conditions are expected to change. The Committee can use Cal-Adapt to monitor anticipated changes in future climate conditions and adjust mitigation actions accordingly.	Cal-Adapt
California Department of Transportation	Technical Resource	The California Department of Transportation (Caltrans) is the state agency with jurisdiction over designated highways, including State Route 210 and Interstate Routes 10 and 15. Mitigation measures related to ensuring the resiliency of state-designated routes will be implemented through coordination with Caltrans.	Caltrans
California Governor's Office of Emergency Services	Technical Resource	The California Governor's Office of Emergency Services (Cal OES) is the state agency responsible for reducing hazards through mitigation activities, conducting emergency planning, supporting emergency response and recovery activities, and acting as a liaison between local and federal agencies on emergency-related issues. Cal OES guides hazard mitigation planning activities, shares best practices, and distributes funding opportunities. The Committee can work with Cal OES to obtain funding to implement LHMP mitigation strategies and receive future updates.	Cal OES
		Private Organizations	
Southern California Gas Company	Technical Resource	The Southern California Gas Company (SoCalGas) is the natural gas provider for Loma Linda and owns the community's natural gas infrastructure. Mitigation actions that address the resiliency of natural gas	SoCalGas

Resource Name	Type of Resource	Ability to Support Mitigation	Website
		infrastructure and services in Loma Linda will be implemented through coordination with SoCalGas.	
Southern California Edison	Technical Resource	Southern California Edison (SCE) is the electrical service provider for Loma Linda. SCE also owns the electrical distribution grid in the community. Mitigation actions relating to Loma Linda's electrical grid's resiliency will be implemented through coordination with SCE.	Southern CA Edison
CR&R Incorporated Environmental Services	Technical Resource	In business since 1963, CR&R's mission has been to provide our customers with consistent, safe, worry-free, and sustainable waste and recycling services. CR&R also has an extensive network of processing facilities that can manage every facet of your waste stream, including solid waste, recyclables, green waste, food waste, construction and demolition waste, electronic waste, and a number of other materials. Through our extensive collection and processing systems, we strive to reduce the negative impact that solid waste can potentially have on our environment for generations to come. We welcome you to the CR&R family of companies.	Waste Services

5.4 Mitigation Development

Goals and objectives discussed in this section help describe what actions should occur, using increasingly narrow descriptors. Long-term goals are developed, which can be accomplished by objectives. To achieve the stated objectives, "mitigation actions" provide specific, measurable descriptors on accomplishing the objective. The goals, objectives, and actions form the basis for developing a Mitigation Action Strategy and specific mitigation projects to be considered for implementation.

The process consists of 1) setting goals and objectives, 2) considering mitigation alternatives, 3) identifying strategies or "actions," and 4) developing a prioritized action plan resulting in a mitigation strategy.

5.4.1 Goals

The HMP Planning Committee discussed goals for this plan update at distinct points in the planning process. At the beginning of the planning process, the Planning Committee discussed overall project goals and based on the results of the risk assessment and the identified issues/weaknesses to be addressed by Mitigation Actions. During that time, the HMP Planning Committee opted to develop a new set of goals as

a result of the risk analysis and community priorities. More details of this particular meeting are provided in Appendix B. The following goals have been developed as part of this planning effort:

- Save lives and reduce injuries among Loma Linda community members and visitors.
- Avoid damage to public and private property and environmental systems.
- Preserve key government functions and other critical services.
- Integrate hazard mitigation activities into City policies.
- Maintain the City's eligibility for increased hazard mitigation and disaster recovery funding.
- Support compliance with state laws addressing hazards, including the effects of climate change.

5.4.2 Considering Mitigation Alternatives

In February 2021, the HMP Planning Committee participated in developing and reviewing mitigation actions with a wide range of alternatives. To narrow mitigation alternatives for inclusion, FEMA's six broad categories of mitigation alternatives were used: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. The HMP Planning Committee developed several mitigation alternatives for implementation under each mitigation category.

5.4.3 Mitigation Costs

The cost-effectiveness of each measure was a primary consideration when developing mitigation actions. Because mitigation is an investment to reduce future damages, it is important to select measures for which the reduced damages over the life of the measure are likely to be greater than the project cost. For structural projects, the level of cost-effectiveness is primarily based on the likelihood of damages occurring in the future, the severity of the damages when they occur, and the level of effectiveness of the selected measure.

While a detailed analysis was not conducted during the mitigation action development process, these factors were of primary concern when selecting measures. For measures that do not result in a quantifiable reduction of damages, such as public education and outreach, the relationship between probable future benefits and the cost of each measure was considered when developing the mitigation actions. Costs are made available in individual Implementation Plans described in Appendix C.

5.4.4 Prioritization of Mitigation Actions

Common failures of a mitigation plan involve the prioritization of mitigation actions for future implementation. Implementing the identified mitigation actions in **Table 5-2** can be overwhelming for any community, especially with limited staffing and fiscal resources. To ensure that the City of Loma Linda's HMP reflects a reality of what the City can do with its available resources, mitigation actions are prioritized with public input, risk factor scores, and HMP Planning Committee agreement. This method assists the City to direct resources appropriately during particular planning windows.

5.4.4.1 Public Input

The results of the survey indicated the following:

- 18 respondents have been affected by a disaster
- Approximately 65% of respondents are somewhat concerned or very concerned about climate change
- A majority of respondents identified trainings, education, and effective emergency communications/notifications as the best way to assist residents and businesses
- The top three hazards of concern based on responses include Sesimic Hazards, Wildfire, and Flooding (see word cloud. Below)

The complete survey results can be found in Appendix B.

5.4.4.2 Planning Committee Prioritization Process

Using risk factor scores and their historical knowledge and local expertise, the Planning Committee prioritized the mitigation actions. These mitigation actions were compared to the results of the Community Survey to validate the Priority Mitigation Actions. This process is documented in Appendix B.

The benefits of proposed projects were also weighed against estimated costs as part of the project prioritization process. A review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the benefits of these projects.

Benefit ratings were defined as follows:

- High—Project will provide an immediate reduction of risk exposure for life and property.
- Medium—Project will have a long-term impact on reducing risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
- Low—Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios are considered cost-beneficial and are prioritized accordingly.

5.5 Mitigation Action Strategy

Based upon the City's capabilities, Table 5-2 lists each priority mitigation action (listed in order of priority by hazard) and identifies the responsible party, time frame, potential funding source, and an implementation plan for each action.

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Table 5-2: Mitigation Action Tracker

Action No.	Year	Hazard Type	Department	Specific Mitigation Action	Mitigation Type	Priority Rating	Estimated Cost	Estimated Benefit	Potential Funding Source(s)	Expected Time Frames for Completion
1	2021	All hazard	Information Systems	Install or upgrade backup power systems (generator or battery) for IT server farms, IDF, and/or LLCCP MDF locations, including but not limited to City Hall, Corporate Yard, Fire Station 252, Shady Lane, Monarch Cove, Mission Trails, Mission Creek, and Barton Vineyards.	Structural Projects	Medium	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.	Medium - The project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	3-5 Years
2	2021	All hazard	Information Systems	Replace antiquated battery backup systems for Server Farms and install a backup internet circuit for IT redundancy.	Structural Projects	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	High - Project will provide an immediate reduction of risk exposure for life and property.	HMGP / BRIC	3-5 Years
3	2021	All hazard	Public Works, Water	Install emergency generators at city wells.	Emergency Services	High	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years
4	2021	All hazard	Public Works, Water	Install or upgrade emergency generators for water reservoirs.	Emergency Services	High	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years
5	2021	All hazard	Public Works, Water	Install a parallel water main distribution line to create redundancy in the City's water system.	Structural Projects	Low	High - Existing funding will not cover the project's cost; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	Internal Funding	5-10 Years
6	2021	Drought/Climate Change	Public Works, Water	Construct 3 new, 2-million-gallon water reservoirs.	Structural Projects	Medium	High - Existing funding will not cover the project's cost; implementation would require new revenue through an	High - Project will provide an immediate reduction of risk exposure for life and property.	HMGP / BRIC	5-10 Years

Action No.	Year	Hazard Type	Department	Specific Mitigation Action	Mitigation Type	Priority Rating	Estimated Cost	Estimated Benefit	Potential Funding Source(s)	Expected Time Frames for Completion
							alternative source (for example, bonds, grants, and fee increases).			
7	2021	All hazard	Public Works, Water	Install a looped fiber-optic communications network to groundwater well sites.	Structural Projects	Medium	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years (Under Construction)
8	2021	All hazard	Public Works, Water	Install redundant waterlines across railroad rights of way and drainage channel located on Beaumont Avenue.	Structural Projects	Low	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years
9	2021	Earthquake	Public Works, Water	Conduct seismic retrofit analysis and improvements at existing water reservoirs.	Structural Projects	Medium	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	3-5 Years
10	2021	All hazard	Public Works, Sewer	Install a new sewer trunk line crossing railroad rights of way to increase redundancy in sewer treatment.	Structural Projects	Medium	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-5 Years
11	2021	All hazard	Public Works, Sewer	Install backup emergency generators at sewer pumping stations.	Emergency Services	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	HMGP / BRIC	1-3 Years

Action No.	Year	Hazard Type	Department	Specific Mitigation Action	Mitigation Type	Priority Rating	Estimated Cost	Estimated Benefit	Potential Funding Source(s)	Expected Time Frames for Completion
12	2021	All hazard	Public Works, General	Install a 2000-gallon fuel tank at Fire Station 252 on the north side of town.	Emergency Services	Medium	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years
13	2021	All hazard	Public Works, General	Construct a new Public Works Building at the Corporate Yard that meets or exceeds current code requirements.	Structural Projects	High	High - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years. The project is estimated to cost four million dollars.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	3-5 Years
14	2021	All hazard	Public Works, General	Construct an at grade crossing at the railroad tracks at Parkland St., parallel to the Anderson Bridge.	Structural Projects	Low	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	HMGP / BRIC	3-5 Years
15	2021	All hazard	Public Works, General	Install generators for the Senior Center and Library to be used as Cooling Centers.	Emergency Services	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	HMGP / BRIC	1-3 Years
16	2021	All hazard	Public Works, General	Install backup communications system and Mass Notification/Emergency Alert Messaging System for City Hall, EOC, City yard, City residents, and businesses.	Emergency Services	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years
17	2016	Flood	Public Works, General (San Bernardino County Flood Control)	Upgrade the Mission Zanja Flood Control Channel.	Structural Projects	Medium	Medium - The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the project's cost would have to be spread over multiple years.	High - Project will provide an immediate reduction of risk exposure for life and property.	HMGP / BRIC	5-10 Years

Action No.	Year	Hazard Type	Department	Specific Mitigation Action	Mitigation Type	Priority Rating	Estimated Cost	Estimated Benefit	Potential Funding Source(s)	Expected Time Frames for Completion
18	2021	Flood	Public Works, General	Storm Drain at Benton St from Barton Rd to Lawton Ave.	Structural Projects	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	3-5 Years
19	2021	Flood	Public Works, General	Construct a detention basin at the end of Almond Court.	Structural Projects	Low	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	HMGP / BRIC	5-10 Years
20	2021	Earthquake	Public Works, General	Conduct a seismic retrofit on the bridge at New Jersey St. and Citrus St. Bridge is owned and managed by San Bernardino Flood Control.	Structural Projects	Low	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	3-5 Years
21	2021	Wildfire	Fire Department	Conduct brush clearance and vegetation management activities in areas of elevated fire risk.	Structural Projects	High	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	Annually
22	2021	All hazard	Fire Department	Prepare a Communication Plan for Mass Evacuation Notification and Emergency Alerting.	Structural Projects	High	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years
23	2021	Wildfire	Fire Department	Prepare a Community Wildfire Protection Plan identifying areas of potential access for the WUI.	Prevention	High	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Medium - Project will have a long-term impact on reducing risk exposure for life and property, or the project will not provide an immediate reduction in the risk exposure for property.	HMGP / BRIC	1-3 Years

Action No.	Year	Hazard Type	Department	Specific Mitigation Action	Mitigation Type	Priority Rating	Estimated Cost	Estimated Benefit	Potential Funding Source(s)	Expected Time Frames for Completion
24	2021	All hazard	Fire Department	Conduct public education and outreach to reduce cardiac events, wildfire risks, slip and fall hazards, cooking fires, and increase social media presence.	Public Education & Outreach	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	HMGP / BRIC	Annually
25	2021	All hazard	Fire Department	Perform a Community Risk Assessment (CRA).	Prevention	High	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	HMGP / BRIC	1-3 Years
26	2021	All hazard	Community Development	Conduct Development Code and General Plan Amendments to streamline zoning and land use designations to reduce hazard vulnerability.	Prevention	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	Internal Funding	1-3 Years
27	2021	All hazard	Community Development	Update the development application to streamline future reviews and address hazard vulnerabilities.	Prevention	Medium	Low- the project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.	Low - Long-term benefits of the project are difficult to quantify in the short term.	Internal Funding	1-3 Years
28	2021	Earthquake	Loma Linda Hospital	The installation of a Vertical Isolation System (VIS) as a seismic enhancement to the new Hospital.	Structural Project	High	High - Existing funding will not cover the project's cost; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).	High - Project will provide an immediate reduction of risk exposure for life and property.	HMGP / BRIC	3-5 Years

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Section 6. Plan Implementation and Maintenance

As a living document, it is important that this plan becomes a tool in the City's resources to ensure reductions in possible damage from a natural hazard event. This section discusses plan adoption, implementation, monitoring, evaluating, and updating the HMP. Plan implementation and maintenance procedures will ensure that the HMP remains relevant and continues to address the changing environment in the City. This section describes the incorporation of the HMP into existing City planning mechanisms and how the city staff will continue to engage the public.

6.1 Plan Adoption

To comply with DMA 2000, the City Council has officially adopted the 2021 City of Loma Linda HMP. The adoption of the 2021 HMP recognizes the City's commitment to reducing the impacts of natural hazards within the city limits. A copy of the 2021 HMP adoption resolution is included in Appendix A.

6.2 Implementation

Over time, Implementation Strategies will become more detailed, and the City's mitigation planners will work to provide more detail for priority mitigation actions. In conjunction with the progress report processes outlined in Section 6.4.2, implementation strategy worksheets provided in Appendix C will be extremely useful as a plan of record tool for updates. Each implementation strategy worksheet provides individual steps and resources need to complete each mitigation action. The following provides several options to consider when developing implementation strategies in the future:

- **Use processes that already exist:** initial strategy is to take advantage of tools and procedures identified in the capability assessment in Section 5. Using planning mechanisms already in use and familiar to City departments and organizations will give the planning implementation phase a strong initial boost, especially if a mitigation strategy calls for expanding existing programs or creating new programs or processes at a later date.
- **Updated work plans, policies, or procedures**: hazard mitigation concepts and activities can help integrate the 2021 LHMP into daily operations. These changes can include how major development projects and subdivision reviews are addressed in hazard-prone areas or ensure that hazard mitigation concerns are considered in the approval of major capital improvement projects.
- **Job descriptions:** working with department or agency heads to revise job descriptions of government staff to include mitigation-related duties could further institutionalize hazard mitigation. This change would not necessarily result in great financial expenditures or programmatic changes.

6.3 Future Participation

The City of Loma Linda HMP Planning Committee has become a permanent advisory body to administer and coordinate the implementation and maintenance of the 2021 HMP. The Fire Department will lead the 2021 HMP plan development and updates and all associated HMP maintenance requirements. On an annual basis, the HMP Planning Committee will report to the City Council and the public on the status of plan implementation and mitigation opportunities in the City. Other duties include reviewing and promoting mitigation opportunities, informing and soliciting input from the public, and developing grant applications for hazard mitigation assistance.

6.4 Monitoring, Evaluating, and Updating the HMP

This section describes the schedule and process for monitoring, evaluating, and updating the 2021 LHMP.

6.4.1 Schedule

Monitoring the progress of the mitigation actions will be ongoing throughout the five-year period between the adoption of the 2021 LHMP and the next update effort. The HMP Planning Committee will meet on an annual basis to monitor the status of the implementation of mitigation actions and develop updates as necessary.

The HMP Planning Committee should meet two months prior to the City budget process to prepare an evaluation report on the success and failures of the 2021 LHMP and provide a formal budget request for approval by the City at a later date.

The HMP will be updated every five years, as required by DMA 2000. The update process will begin at least one year prior to the expiration of the 2021 LHMP. However, should a significant disaster occur within the City, the HMP Planning Committee will reconvene within 30 days of the disaster to review and update the HMP as appropriate. The City Council will adopt written updates to the HMP as a DMA 2000 requirement.

6.4.2 Process

The HMP Planning Committee will coordinate with responsible agencies/organizations identified for each mitigation action. These responsible agencies/organizations will monitor and evaluate the progress made on implementing mitigation actions and report to the HMP Planning Committee on an annual basis. Working with the HMP Planning Committee, these responsible agencies/organizations will be asked to assess the effectiveness of the mitigation actions and modify the mitigation actions as appropriate. An HMP Mitigation Action Progress Report worksheet, provided in Appendix D, was developed as part of this HMP to assist mitigation project managers in reporting on the status and assessing the effectiveness of the mitigation actions.

Information culled from the mitigation leads or "champions" will be used to monitor mitigation actions and annual evaluation of the HMP. The following questions will be considered as criteria for evaluating the effectiveness of the HMP:

- Has the nature or magnitude of hazards affecting the City changed?
- Are there new hazards that have the potential to impact the City?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the HMP?
- Should additional local resources be committed to addressing identified hazards?

Future updates to the HMP will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. Issues that arise during monitoring and evaluating the HMP, which require changes to the risk assessment, mitigation strategy, and other components of the HMP, will be incorporated into the next update of the 2021 LHMP in 2026. The questions identified above would remain valid during the preparation of the 2026 update.

6.5 Incorporation into Existing Planning Mechanisms

An important implementation mechanism is to incorporate the recommendations and underlying principles of the HMP into community planning and development, such as capital improvement budgeting, building and zoning codes, general plans, and regional plans. Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of the jurisdiction attempting to implement risk-reducing actions. The integration of a variety of City departments on the HMP Planning Committee provides an opportunity for constant and pervasive efforts to network, identify, and highlight mitigation activities and opportunities at all levels of government. This collaborative effort is also important to monitor funding opportunities that can be leveraged to implement mitigation actions. Information from this 2021 HMP can be incorporated into:

- **City of Loma Linda General Plan:** The 2021 HMP will provide information that can be incorporated into the Land Use, Public Health and Safety, and Sustainable Development Elements during the next general plan update. Specific risk and vulnerability information from the City of Loma Linda HMP will assist in identifying areas where development may be at risk to potential hazards.
- **City Building / Development Codes and Zoning Ordinances:** The 2021 HMP will provide information to enable the City to make decisions on appropriate building/development codes and ordinances. Appropriate building codes and ordinances can increase the City's resilience against natural disasters.
- **San Bernardino Valley Regional Urban Water Management Plan (UWMP):** The 2021 HMP highlights areas of concern regarding climate change and the added pressure it will place on the City's water supply. Suitable mitigation actions from the HMP can be included in the UWMP.

6.6 Continued Public Involvement

During the five-year update cycle (2021-2026), City staff will involve the public using public workshops and meetings. Information on upcoming public events related to the HMP or solicitation for comments will be announced via newspapers, mailings, and the City website (https://www.lomalinda-ca.gov/our_city/departments/community_development/hazard_mitigation_plan). An electronic copy of the current HMP document will be accessible through the City website, with hard copies available for review at the City of Loma Linda Planning & Development Services office and Public Works Department. The HMP Planning Committee will, as much as practicable, incorporate the following concepts into its public outreach strategy to ensure continued public involvement in the HMP planning process:

- Collaborate with San Bernardino County on hazard mitigation efforts
- Work with public service clubs, i.e., The Lions Club, Loma Linda University Foundation, Loma Linda Senior Center
- Collaborate with faith-based organizations, i.e., Loma Linda University Church of the Seventh-day Adventists, Redeemer Fellowship, St. Joseph the Worker Church
- Create story ideas for media outlets, such as newspapers, local radio, and TV
- Distribute emails and postcards/mailers to City residents about hazard mitigation updates
- Post-meeting announcements at coffee houses, grocery stores, libraries, etc.
- Educate and collaborate with insurance companies.
  - Piggyback on other existing local community meetings
  - Distribute information through K-12 schools
  - Continue to use the City website as a distribution point of hazard mitigation information

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Appendix A. Analysis Methodology

CITY OF LOMA LINDA

LOCAL HAZARD MITIGATION PLAN

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A GIS-based vulnerability assessment was conducted for each of the priority hazards identified by the Planning Committee. Several sources of data are necessary to conduct a vulnerability analysis. This appendix presents an outline of the data inputs, processing steps, and outputs used to create the vulnerability analysis results presented in the Hazard Mitigation Plan. The analysis methodology is presented first, followed by an overview of the analysis data.

A.1. Natural Hazard Exposure

The natural hazard exposure analysis (see C. Natural Hazard Exposure in Figure 7-4) is an inventory of population, parcels, critical facilities, and other assets within each natural hazard area. As shown in Figure 7-1, the presence of a structure inside a natural hazard area (the flood zone in this example) qualifies that structure as exposed to the natural hazard.

Figure 7-1: Hazard Exposure

The total counts of parcels, people, facilities, assets and the sum of values within the planning area which could be exposed to a hazard event is referred to as the "exposure" in this plan. A natural hazards overlay was developed to reflect the combination of many known natural hazard spatial footprints. The spatial overlay method enables summarization of building values, parcel counts, population exposure, and critical facility exposure within a hazard's geographic extents (see C. Natural Hazard Exposure in Figure 7-4). The input data is used to evaluate exposure for earthquakes, landslides, flooding, dam inundation, and wildfire.

A.1.1. Damage Estimation with Hazus

FEMA's Hazus software was implemented to conduct a detailed loss estimation for flood, earthquake, and dam inundation. Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. For purposes of this planning effort, Hazus was used to generate damage estimations due to possible earthquakes, flooding, and dam inundation depths. The estimated damage and losses provided by the Hazus Software provide the ability to understand possible widescale damage to buildings and facilities (see D. Hazus Damage Estimations in Figure 7-4).

In the hypothetical geography shown in Figure 7-3, even though both structures are exposed to flooding, it is expected that the structure with a first floor height below the depth of flooding will receive significantly more damage than the structure with a first floor height above the expected water depth. Note that not all building data contains first floor height and first floor height is an example of the type of field utilized by Hazus in calculating damage estimates.

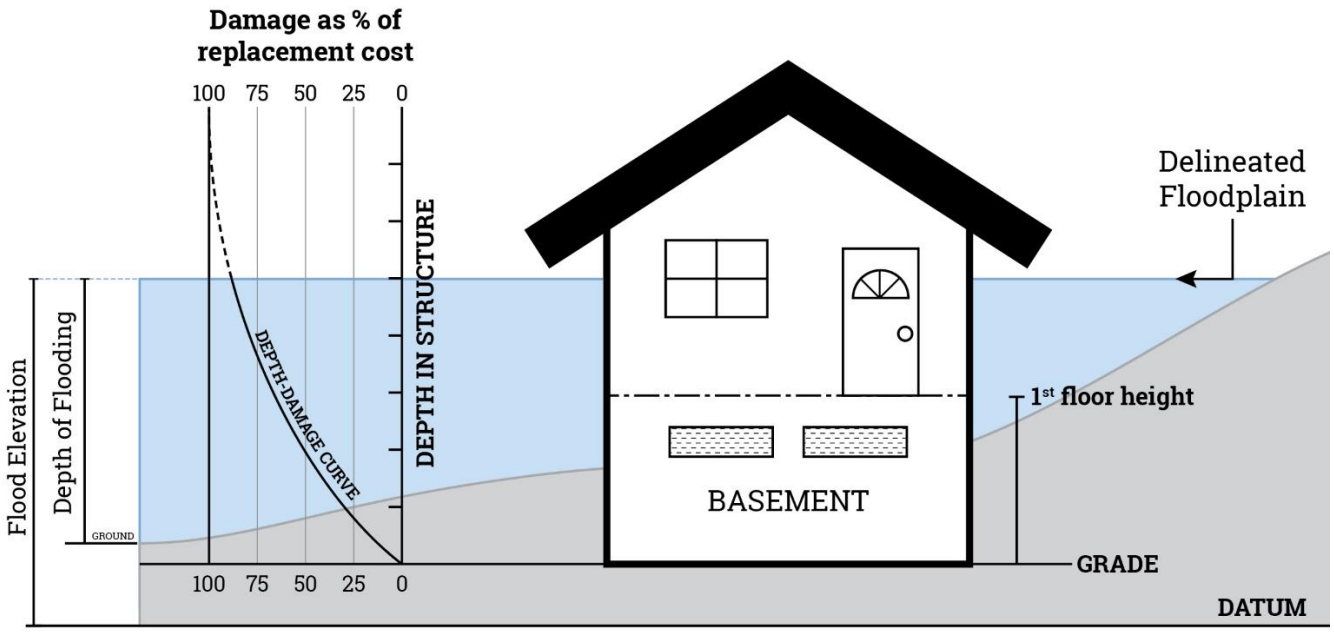

Figure 7-2: Flood Depth and Damage Curves

Figure 7-3: Hazus Damage Estimations

Hazus is a FEMA product with highly detailed documentation provided on the analysis steps and algorithms performed against the input data and associated scenarios in the process of obtaining loss estimates. The explanation in this appendix section is simplified. Refer to the full documentation and technical manuals from FEMA for greater explanation on Hazus specifics.

A.1.2. Distinguishing Results – Natural Hazard Exposure Analysis vs Hazus Results

Table and chart references throughout the hazard mitigation plan are explicitly called out for Hazus results as "Damage Estimates". There are expected differences in the results between estimations of Natural Hazard overlays and detailed Hazus results. Snapshot tables and Natural Hazard Exposure sections do not contain Hazus estimates.

A.2. Analysis Data

A.2.1. Assets, Value, and Population

A.2.1.1. Parcels

County provided parcel geometry was joined with county assessor data. Centroids were created to represent parcels at a single location. Fields required by Hazus that were not present in the parcel data provided were given default values based on the mapped use-codes of each parcel. Earthquake building design level attribution was based on year built (where the default was 1972) and building code adaptation chronology. Improved parcels were chosen for the parcels dataset by a query of improvement value presence and use-code descriptors.

A.2.1.2. Asset Insurance Schedules

Loma Linda's insurance schedule was used in developing Real Property Asset data with valuations and structural data for analyses. The city owned assets were utilized in damage estimations and exposure analysis. City owned real property assets and individual participating jurisdiction asset data were used in exposure analysis. The tabular data were geocoded and quality checked for building placement. These data are presented in the exposure analysis as "Real Property Assets" and in Hazus results as appropriate general use code type or specific building location description.

A.2.1.3. Population

Population estimates were derived from 2013-2017 5-year Census American Community Survey (ACS) numbers as applied to Census block groups and Census Place geographies, then processed through GIS modeling in order to break down the proportional population for smaller units of area in relation to natural hazards.

A.2.1.4. Critical Infrastructure

Critical facilities and transportation/lifeline typically include hospitals, fire stations, police stations, storage of critical records, and similar facilities. These data came from a collection of sources including but not limited to: City GIS, city insurance data, CDSS, CEC, FCC, Hazus, USACE, FEMA, and NPS. All data sources have a level of accuracy acceptable for planning purposes. See Table 7-1 for a list of Critical Infrastructure data used in the analysis.

A.2.1.5. Hazus Inputs

Hazus data inputs include hazard scenario data and detailed building data. The GIS team conducted a Level 2 analysis utilizing user-defined buildings with refined building characteristic parameters as inputs for the damage estimation calculations (See A.2.1.1 and A.2.1.2). Both city building data and assets were used as inputs in this level 2 analysis. The customized user defined building dataset allows for more accurate results for damage estimation based upon detailed building characteristics.

Note: FEMA's Hazus software utilizes different user defined building information inputs to develop loss estimates depending on the hazard module. The Hazus flood and earthquake modules use fragility curves based upon the user's definition of building characteristics including but not limited to:

- *Area*
- *Year Built*
- *Construction Type*
- *Number of Stories*
- *EQ Design Level*
- *Occupancy Type (Residential, Government, etc)*
- *Building Values*

Defaults were used for missing fields and values based on use-code and other available information for that input.

A.2.2. Natural Hazard Data

A.2.2.1. Dam Inundation Zones

Dam inundation zone GIS data were provided by Cal OES and DWR. These represent the estimated flood extent in the event of dam failure for individual dams. **No Dam Inundation Zones are found within the municipal city limits of Loma Linda.**

A.2.2.2. Earthquake Shaking

The CGS 2 percent chance – 50-yr probability map was used as a qualitative guide in selecting an earthquake epicenter based shakemap scenario for analyses. The M7.8 Shakeout1 and M7.0 San Andreas - N. Coast – Peninsula – SC MTN Scenarios were chosen for use in analyses.

Intensity	MMI	Description/Damage
I-Not felt	0-1	Not felt except by a very few under especially favorable conditions.
II-Weak	1-2	Felt only by a few persons at rest, especially on upper floors of buildings.
III-Weak	2-3	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV-Light	3-4	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

Intensity	MMI	Description/Damage
V-Moderate	4-5	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI-Strong	5-6	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII-Very strong	6-7	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII-Severe	7-8	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX-Violent	8-9	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X-Extreme	9-10	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS Scenario MMI Grid

A.2.2.3. Flood Zones

The input parameters for Hazus analysis of Flood exposure included depth grids created with the FEMA Flood Zone data mentioned in section A.2.2.3. 100-YR and 500-YR were scenarios that were used to analyze the exposure to inputs as depicted in Figure 7-4.

Hazard	Flood Zone	Description
100-YR Flood [SFHA]	Subtype: Floodway	A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations.
	SFHA outside Floodway	The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on NFIP maps. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.
500-YR Flood [non-SFHA]	Subtypes: 0.2% Annual Chance, Protected by Levee	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones.

Source: FEMA MSC DFIRM

A.2.2.4. Landslide Susceptibility

GIS layer with geographic boundaries defining the likelihood of deep-seated landslides. Underlying geology and slope angle are used in the creation of this layer by the California Geological Society. Low, Medium, and High landslide classes were chosen as summary classes for this plan.

Hazard	Description	
Low	1-5	These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks.
Medium	6-7	Very high landslide susceptibility, classes VIII, IX, and X, includes moderate and steep slopes in hard rocks and weak rocks.
High	8-10	Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks.

Source: CGS Susceptibility to Deep-Seated Landslides in California

A.2.2.5. Wildfire Hazard Severity

A proprietary DP+S composite GIS layer derived from Wildland-urban interfaces, California Public Utilities Commission fire threat areas and Fire Hazard Severity Zones.

Hazard	Native Class	Description
Moderate	Tier 1	HHZs are zones in direct proximity to communities, roads, and utility lines, and are a direct threat to public safety.
	1	WUI is the potential treatment zone in which projects could be conducted to reduce wildland fire threats to people.
	1 / Moderate	See Cal Fire FHSZ (State Responsibility Area [SRA] & Local Responsibility Area [LRA])
High	Tier 2	Tier 2 fire-threat areas depict areas where there is an elevated risk (including likelihood and potential impacts on people and property) from utility associated wildfires.
	High	See Cal Fire FHSZ (State Responsibility Area [SRA] & Local Responsibility Area [LRA])
Very High	Tier 3	Tier 3 fire-threat areas depict areas where there is an extreme risk (including likelihood and potential impacts on people and property) from utility associated wildfires.
	Very High	Classification of a zone as moderate, high or very high fire hazard is based on a combination of how a fire will behave and the probability of flames and embers threatening buildings. Each area of the map gets a score for flame length, embers, and the likelihood of the area burning. Scores are then averaged over the zone areas. Final zone class (moderate, high and very high) is based on the averaged scores for the zone.

Source: Moderate - Cal Fire Tree Mortality, WUI, FHSZ; High - CPUC Utility Threat, Cal Fire FHSZ; Very High - High - CPUC Utility Threat, Cal Fire FHSZ (SRA & LRA)

A.2.3. Methodology Overview

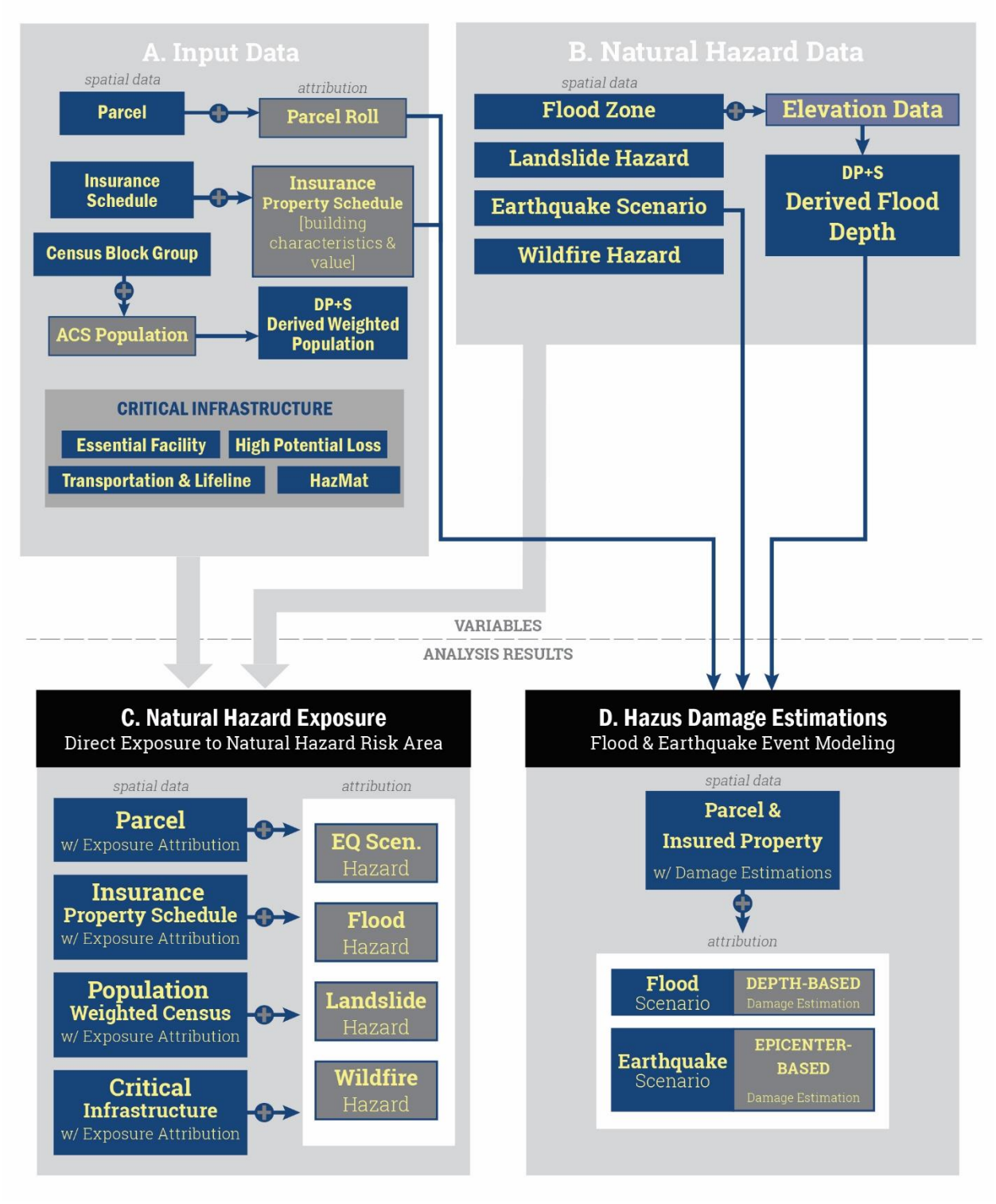

Figure 7-4: Data Analysis Methodology

A.2.4. Data Dictionary

Table 7-1: Data Dictionary

Dataset	Data Steward	Notes
Municipal Boundaries	Local Jurisdiction	Have from local jurisdiction data request
DEM	NOAA	NOAA Digital Coast
GNIS	USGS	Census
Stream	Esri, NHD	Rivers and Streams
Water	Esri, NHD	Bodies of water
Parcel Geometry	County	From county
Parcel Roll	County	From county, lacks some contributing fields to Hazus CDMS analysis but has required
Emergency Operations Center	Local Jurisdiction	From geocoded CI table at Barton Road
Fire Station	Local Jurisdiction	From geocoded CI table and insurance roll
Hospital	Local Jurisdiction	From geocoded CI table
Police	Local Jurisdiction	All police departments are outside of municipal bounds
Hazardous Materials Site	Local Jurisdiction	From geocoded CI table
Adult Residential Care	Local Jurisdiction	From geocoded CI table
Child Care Center	Local Jurisdiction	From geocoded CI table
Corp Yard	Local Jurisdiction	From local insurance roll
Dam	USACE NID	None in NID
Elder Residential Care	Local Jurisdiction	From geocoded CI table
Library	Local Jurisdiction	From local insurance roll
Lodging	Local Jurisdiction	From geocoded CI table
Low Income Housing	Local Jurisdiction	From geocoded CI table and insurance roll
Medical Facility	Local Jurisdiction	From geocoded CI table
Park	Local Jurisdiction	Insurance roll from local jurisdiction
Real Property Asset	Insurance Provider	Insurance roll from local jurisdiction
Recreation	Local Jurisdiction	From local insurance roll
Reservoir	Local Jurisdiction	From geocoded CI table and insurance roll
School	Local Jurisdiction	From geocoded CI table
Veterinary Care	Local Jurisdiction	From Geocoded CI table
Water Treatment Facility	Local Jurisdiction	From geocoded CI table and insurance roll
Communications Tower	Local Jurisdiction	From geocoded CI table
Fiber Optics	Local Jurisdiction	From data request

Dataset	Data Steward	Notes
Highway Bridge	Local Jurisdiction	From geocoded CI table
Levee	FEMA	None within municipal bounds
Levee Flood Wall	USACE NLD	None within municipal bounds
Lift Station	Local Jurisdiction	From geocoded CI table
Sewer Main	Local Jurisdiction	From data request
Storm Drain Main	Local Jurisdiction	From data request
Street	OSM	OSM
Water Booster	Local Jurisdiction	From geocoded CI table
Water Main	Local Jurisdiction	From data request
Water PRV	Local Jurisdiction	From geocoded CI table
Water Well	Local Jurisdiction	From data request and insurance roll
Census Block	US Census Bureau	Census Tiger
Census Block Group	US Census Bureau	Census Tiger
ACS_2017	US Census Bureau ACS	ACS 2017 data calculated to adjust for demographics report, used in RA
Census Tract	US Census Bureau	Census Tiger
Awareness Zones	DWR	Not utilized in previous plans
Dam Inundation	Cal OES	Cal OES Dam inundation, DWR was referenced, little exposure
EQ Probabilistic MI	USGS, CISN	Used for defining EQ1
EQ Scenarios 1-X	USGS, CISN	EQ1 is from closest most probabilistic San Jacinto SJ Valley EQ2 is from Shakeout2 utilized in County Plan
Flood Hazard	FEMA	Regional study from FEMA
Landslide Susceptibility	CGS	CGS Landslide classes
Wildfire Hazard Severity Zone	Cal Fire / CPUC	Utilize new composite fire layer: Fire Threat CPUC, Tree Mortality, WUI, FHSZ
EQ Fault Zones	CGS	Processed from CGS landslide susceptibility
Fire Perimeter Calfire	Cal Fire	Statewide for burn perimeters 2019, in cartography dataset
Fire Regime MFRI	USGS	https://www.landfire.gov/NationalProductDescriptions13.php
Qfaults	USGS	Obtained from USGS

A.2.5. Insured Assets Roll

Building/ Site Name	# Bldg.	Site Value		
		Structure	Contents	Total
Corp Yard	2	$502,028	$165,905	$667,933
Corporation Yard	1	$256,526	$52,534	$309,060
Public Works	1	$245,502	$113,371	$358,873
Dwelling	2	$504,996	$ -	$504,996
Dwelling	2	$504,996	$ -	$504,996
Equipment	2	$ -	$124,594	$124,594
Cable Television Equipment	1	$ -	$124,594	$124,594
City Equipment Storage	1	$ -	$ -	$ -
Fire	2	$3,070,302	$436,051	$3,506,353
Fire Department	1	$2,682,853	$436,051	$3,118,904
Fire Station #2	1	$387,449	$ -	$387,449
Library	1	$4,881,016	$ -	$4,881,016
Civic Center Library	1	$4,881,016	$ -	$4,881,016
Misc	35	$5,201,772	$269,354	$5,471,126
Vacant Land	10	$ -	$ -	$ -
Civic Center Complex	1	$5,201,772	$218,025	$5,419,797
Piano	1	$ -	$11,583	$11,583
Hulda Crooks Sculpture	1	$ -	$39,746	$39,746
Purchased By Redevelopment Agency	21	$ -	$ -	$ -
Park Land	1	$ -	$ -	$ -
Open Space	7	$ -	$ -	$ -
Debris Basin	2	$ -	$ -	$ -
Vacant Land	1	$ -	$ -	$ -
Parkland	2	$ -	$ -	$ -
Vacant Lot	1	$ -	$ -	$ -
Park Land	1	$ -	$ -	$ -
Poplar Commons	18	$ -	$ -	$ -
Purchased By Redevelopment Agency	18	$ -	$ -	$ -
Recreation	7	$1,171,874	$78,776	$1,250,650
Senior Center	1	$1,171,874	$ -	$1,171,874
Hulda Crooks Park	1	$ -	$ -	$ -
Leonard Bailey Park	1	$ -	$ -	$ -
Community Garden	1	$ -	$ -	$ -
Dawson Park	1	$ -	$ -	$ -
Ball Park	1	$ -	$ -	$ -
Heritage Park	1	$ -	$78,776	$78,776

Building/ Site Name	# Bldg.	Site Value		
		Structure	Contents	Total
Storage	1	$29,675	$ -	$29,675
40' X 60' Metal Storage Building	1	$29,675	$ -	$29,675
Water	12	$8,084,988	$14,391,913	$22,476,901
Richardson #3 Water Treatment	1	$ -	$ -	$ -
Water Treatment Plant	1	$ -	$ -	$ -
Richardson#4 Water Treatment	1	$ -	$ -	$ -
Mountain View #5 Water Treatment	1	$ -	$ -	$ -
Mountain View #3 Water Treatment	1	$ -	$ -	$ -
Reservoir	4	$6,701,905	$6,805,158	$13,507,063
Reservoir	1	$1,383,083	$731,737	$2,114,820
Reservoir & Pump Station	1	$ -	$6,855,018	$6,855,018
Golconda Well Site	1	$ -	$ -	$ -
Grand Total	**89**	**$23,446,651**	**$15,466,593**	**$38,913,244**

Appendix B. Process Documentation

CITY OF LOMA LINDA

LOCAL HAZARD MITIGATION PLAN

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Date:	July 29, 2020
Time:	10:00 AM -12:00 AM
Location:	Virtual (ZOOM)

City of Loma Linda

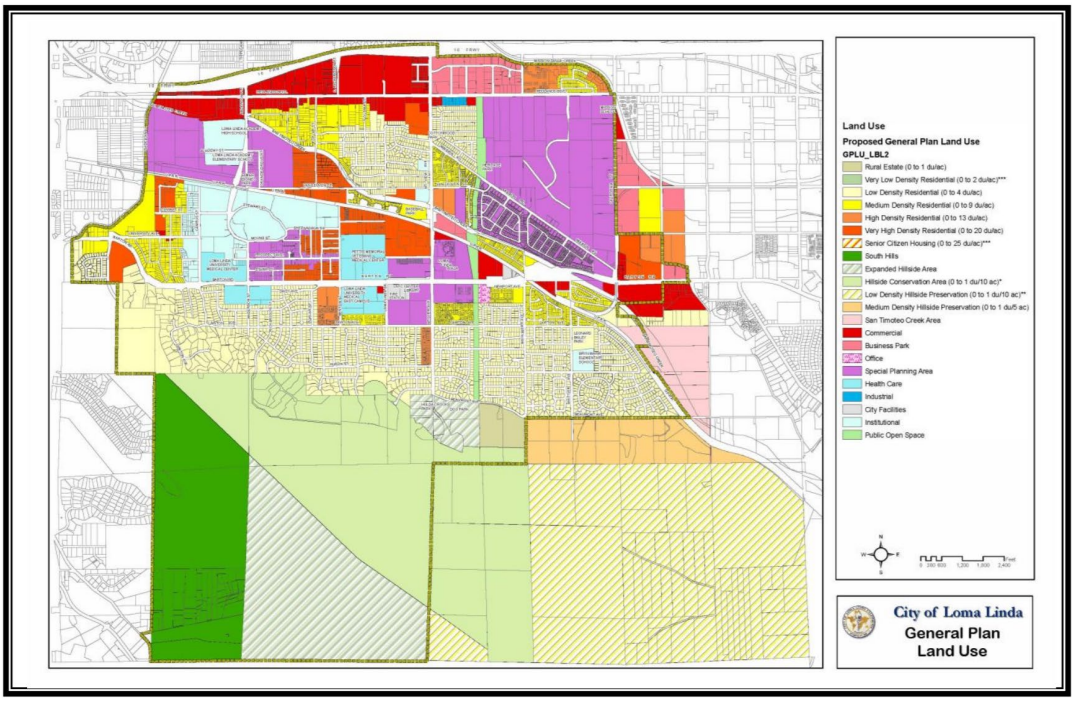
Hazard Mitigation Planning Meeting #1

Agenda:

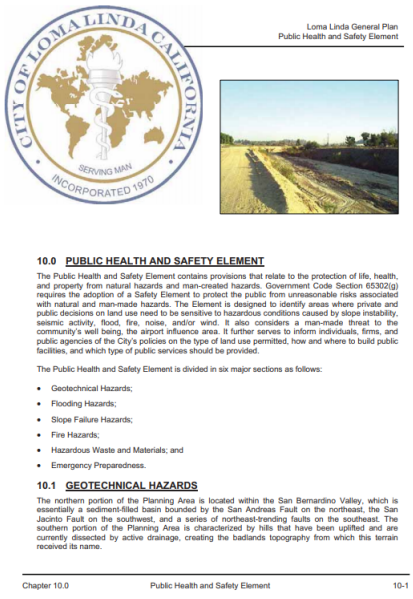
1. Team Introductions (10 minutes)
2. City of Loma Linda Project Overview (10 minutes)
3. Local Hazard Mitigation Plan Overview (10 minutes)
4. Project Goals and Expectations (10 minutes)
5. Hazard Mitigation Planning Team Roster (10 minutes)
6. Communication Protocols (5 minutes)
7. Break (5 minutes)
8. 2011 City of Loma Linda LHMP (15 minutes)
9. Data Needs (Critical Facilities List, vulnerable populations, recent/past hazards, GIS) (10 minutes)
10. Community Engagement and Outreach Strategy (10 minutes)
11. Hazard Identification/Prioritization (20 minutes)
12. Next Steps and To Do List (5 minutes)

City of Loma Linda Project Overview

The City of Loma Linda has initiated an update to their Local Hazard Mitigation Plan and General Plan Safety Element. The General Plan was originally adopted in 2009.



Two components of this General Plan Update that address natural hazards and resilience:


Loma Linda General Plan
Public Health and Safety Element

10.0 PUBLIC HEALTH AND SAFETY ELEMENT

The Public Health and Safety Element contains provisions that relate to the protection of life, health, and property from natural hazards and man-created hazards. Government Code Section 65302(g) requires the adoption of a Safety Element to protect the public from unreasonable risks associated with natural and man-made hazards. The Element is designed to identify areas where private and public decisions on land use need to be sensitive to hazardous conditions caused by slope instability, seismic activity, flood, fire, noise, and/or wind. It also considers a man-made threat to the community's well being, the airport influence area. It further serves to inform individuals, firms, and public agencies of the City's policies on the type of land use permitted, how and where to build public facilities, and which type of public services should be provided.

The Public Health and Safety Element is divided in six major sections as follows:

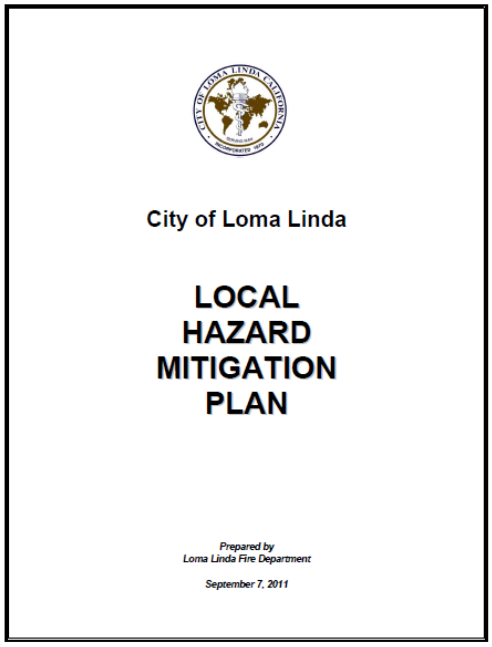
- Geotechnical Hazards;
- Flooding Hazards;
- Slope Failure Hazards;
- Fire Hazards;
- Hazardous Waste and Materials; and
- Emergency Preparedness.

10.1 GEOTECHNICAL HAZARDS

The northern portion of the Planning Area is located within the San Bernardino Valley, which is essentially a sediment-filled basin bounded by the San Andreas Fault on the northeast, the San Jacinto Fault on the southwest, and a series of northeast-trending faults on the southeast. The southern portion of the Planning Area is characterized by hills that have been uplifted and are currently dissected by active drainage, creating the badlands topography from which this terrain received its name.

Chapter 10.0 Public Health and Safety Element 10-1

1 - General Plan Safety Element


City of Loma Linda

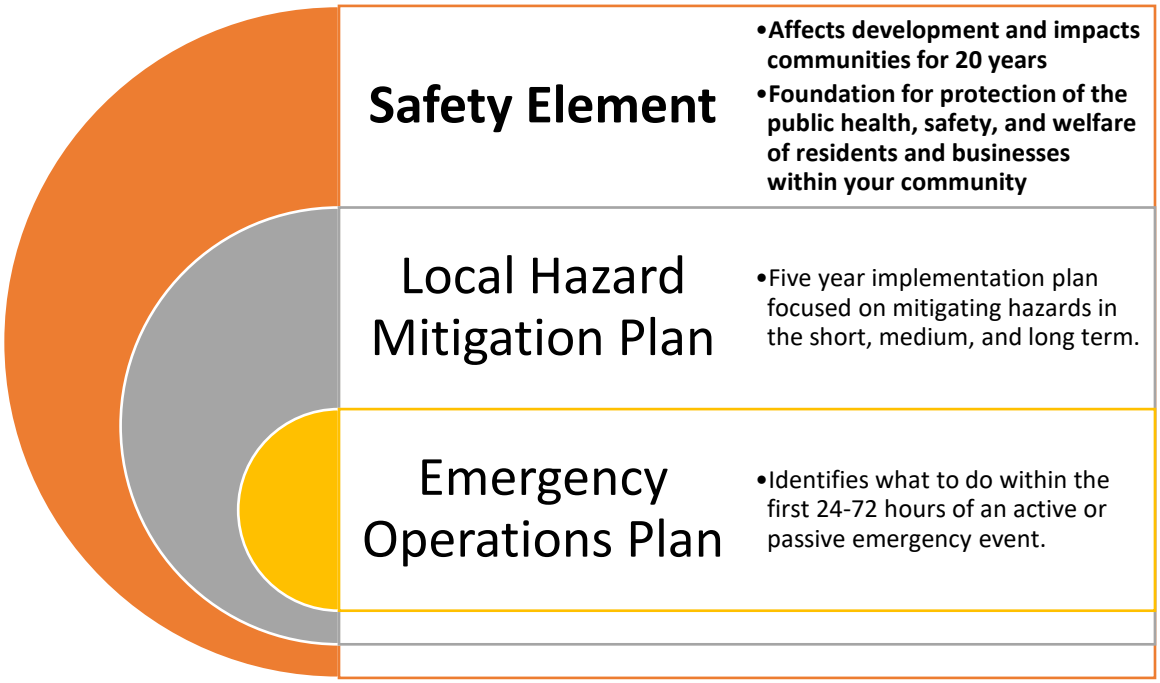
LOCAL HAZARD MITIGATION PLAN

Prepared by
Loma Linda Fire Department

September 7, 2011

2 - 2011 Local Hazard Mitigation Plan

Why Update these Documents Together?



General Plan Safety Element Goals

The following guiding policies (goals) are included in the 2009 General Plan Safety Element:

GOAL PS-1: Minimize the risks of property damage and personal injury resulting from seismic and geologic hazards.

GOAL PS-2: Protect the community from risks to lives and property created by flooding and stormwater runoff

GOAL PS-3: Reduce the potential for property damage and personal injury from slope failure hazards and erosion.

GOAL PS-4: Minimize the threat to persons, property, and the environment resulting from wildfires.

GOAL PS-5: Minimize the negative impacts associated with the storage, use, generation, transport, and disposal of hazardous materials.

GOAL PS-6: Maintain a level of preparedness to adequately respond to emergency situations and disasters

GOAL PS-7: Support the San Bernardino Airport Land Use Commission.

GOAL PS-8: Minimize the threats to drivers and pedestrians at rail-highway crossings.

Local Hazard Mitigation Plan Overview

The Local Hazard Mitigation Plan (LHMP) is Loma Linda's strategic plan to assess and reduce the threat from natural hazard conditions. The LHMP will also help identify future impacts from climate change, allowing the City to prepare for these future conditions and mitigate their effects before they become a substantial problem. Under California law, cities must assess their vulnerability to climate change when preparing or updating an LHMP.

While not a requirement, having an LHMP creates a unified and deliberate approach to improving community resilience. **A valid LHMP makes communities eligible for grant funding and additional post-disaster relief funds from FEMA and Cal OES**. LHMPs remain valid for five years following approval and adoption by City Council.

The LHMP is part of a larger cycle of emergency management:

- **The event** (the disaster)
- **Response**: Taking action to save lives, minimize injuries, and reduce future damage immediately after an emergency occurs.
- **Recovery**: Restoring normal conditions and "life as usual" after an emergency.
- **Mitigation**: Planning to reduce the threat to life, health, and property from future emergencies. The LHMP primarily applied to this part of the cycle.
- **Preparedness:** Planning the response activities in anticipation of future emergencies.

Figure 3 - Four Phases of Emergency Management

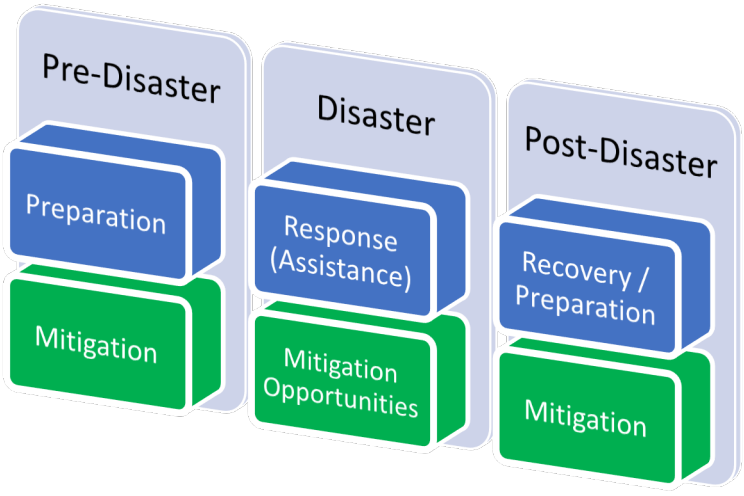


Figure 4 - Mitigation Linkages

Project Goals and Expectations

A key component of the LHMP is the identification of Plan Goals. These goals should cover the overall intent of the LHMP and be tailored to match Loma Linda's characteristics and values. Often, we look to existing plans for goals that can be incorporated into the LHMP. The General Plan goals listed earlier can become a foundation for this plan. In addition, the following are goals from the 2011 LHMP:

- Reduction of damage caused by a significant earthquake in or near Loma Linda
- Prevention or mitigation of damage caused to structures and infrastructure by uncontrolled wildfire.
- Reduction or elimination of potential damage to structures and infrastructure caused by flooding from the San Timoteo Creek and tributaries.
- Reduce risk of wildfires through fuel reduction, by developing weed abatement protocol and distribute educational materials to residents.
- To improve channel flow in conjunction with the realignment of Redlands Blvd. and California Street project. Include channel improvements during phase 1 of the realignment project.

LHMP Best Practices:

- Should consider the broader goals of Loma Linda
- Should be flexible and adaptable to changing conditions
- Help define future mitigation efforts and actions

Goal Setting Process:

- The goals will be discussed/ re-visited at each meeting
- Goals will be finalized prior to release of public draft LHMP

Hazard Mitigation Planning Team Roster

The Hazard Mitigation Planning Team (HMPT) actively guides the development of the LHMP and provides feedback during the process. The Planning Team predominantly consists of representatives from City departments. Representatives from stakeholder agencies and community partners are also invited to participate in different ways. The Planning Team has invited the following individuals:

- Shannon Kendall **(City of Loma Linda/ LHMP POC)**
- Barbara Erwin (Omnitrans)
- Barbara Nicholson (City of Loma Linda)
- Brett McPherson (LLUH)
- Carrie Cruz (County OES)
- Dan Harker (City of Loma Linda)
- Diana DeAnda (City of Loma Linda)
- Ehren Ngo (LLUH)
- Eleazar Rubalcava (City of Loma Linda)
- Ellie Bergthold (VA Hospital)
- Esther Martinez (City of Redlands)
- Eric Schilt (LLUH)
- Frank Sirna(Community Rep/ CERT)
- Geoffry Danker (So Cal Gas)
- Haide Aguirre (City of Grand Terrace)
- James Farner (BNSF RR)
- Jarb Thaipejr (City of Loma Linda)
- Jeff Peterson (City of Loma Linda)
- John Toon (Cal FIRE)
- John Trujillo (City of Loma Linda)
- Ken Morse (Redlands USD)
- Kristine Scott (Sempra)
- Konrad Bolowich (City of Loma Linda)
- Lorena A Matarrita **(City of Loma Linda/ Safety Element POC)**
- Mark Cloud (SC Edison)
- Melissa Curtis (Cal FIRE)
- Mark Brettnacher (LL Academy)
- Nick Oldendorf (City of San Bernardino)
- Raymond Martinez (Cal FIRE)
- Robert Anderson (Red Cross)
- Robert McCray (VA Hospital)
- Russ Handy (City of Loma Linda)
- Robert Bavier (Union Pacific RR)
- Sonia Brown (Cal OES)
- Tom Ingalls (City of Loma Linda)

Question: Who is missing from this list?

The HMPT can invite key stakeholders/participants to this process; the following is a list of potential invitees:

- American Red Cross
- Cal FIRE
- Loma Linda University Health
- University of Redlands
- City of Redlands
- City of Colton
- City of San Bernardino
- County of San Bernardino
- Colton Joint Unified School District
- Redlands Unified School District
- Southern CA Gas Company
- Southern California Edison
- Frontier Communications

Question: Who is missing from this list?

Communication Protocols

The primary contacts for the City of Loma Linda and Atlas Planning will be responsible for most of the communication. These primary contacts are:

City of Loma Linda
Shannon Kendall
Emergency Services Coordinator
Phone: (909) 799-2860
Email: skendall@lomalinda-ca.gov

Atlas Planning Solutions
Aaron Pfannenstiel, AICP, LEED AP
LHMP Project Manager
Phone: (909) 374-4848
Email: aaron@atlasplanning.org

At times, it may be more efficient to have communication between persons other than the primary contacts. In these instances, please make sure the primary contacts are CC'd on any transmittals.

2011 LHMP Hazards of Concern

Hazard Assessment Matrix

		Impact		
		High	**Medium**	**Low**
Probability	**High**	• Earthquake	• Wildfires	
	Medium	• Flooding	• Hazardous Waste and Materials	• Slope Failure • Airplane Crash • Railroad Accidents
	Low	• Terrorism		

Figure 4.3

Probability
High = Highly Likely
Med. = Possible
Low = Unlikely

Impact
High = Catastrophic/Critical
Med. = Limited
Low = Negligible

What Additional Hazards Should Be Added?

- Drought
- Climate Change

2011 Critical Facilities

Type of Facility	Names of Facility	Number of Facilities
Medical Facilities	• Jerry L. Pettis VA Medical Center • Loma Linda University Medical Center (LLUMC) • LLUMC Children's Hospital • LLUMC Behavioral Medicine Center • LLUMC East Campus Hospital • LLUMC Heart and Surgical Hospital	7
City Services	• City Hall	1
Emergency Services	• Fire Station 251 • Fire Station 252 • Police Department	3

What additional facilities should be added to this list?

- Water Infrastructure?
- Bridges?
- Parks?
- Community Centers?

2011 Mitigation Actions

Implementation Strategy Mitigation Project	Lead Agency	Hazard	Funding Source	Cost	Timeframe
Anderson Bridge Seismic Retrofit	City Public Works	Earthquake	Federal Transportation Grant (CalTrans)	$259,000	Short-term
Zanja Channel Improvement	City Public Works	Flood	TBD	$6,000,000	Short-term
Urban-Wildland Interface Hillside Weed Abatement	City Fire Department	Fire	Fire Department Annual Budget	TBD	Long-term
Loma Linda University Medical Center: Seismic Retrofit Project	Loma Linda University Medical Center	Earthquake	TBD	TBD	Long-term

Did you progress on any of these actions since the last plan?

Data Needs

Various types of data are necessary to complete the LHMP. This includes information on hazard types present in Loma Linda and the areas of elevated hazards, recent hazard events, past hazard mitigation actions, critical facilities, and persons and community assets who face heightened vulnerability to hazards. The following categories of data are crucial to LHMP development.

- **Critical Facilities List (to be created by the team)**
- **Vulnerable Populations or Assets**
- **Past Disasters**
- **Recent Hazard Events**
- **GIS Data Sets (State and Federal sources)**

Vulnerable Populations and Assets

Past Disasters

- Landers Earthquake 06/28/1992, San Jacinto 1968 04/09/1968,
- "South Hills" wildfires:
    - 2001-one wildfire
    - 1999-two wildfires
    - 1998-seven wildfires
- December 2010 Winter Storms, Flood of 1969 01/18/1969, Flood of 1938 (Worst flood in Loma Linda history)

Past Hazard Events

Since 1980 there have been 45 Disaster Declaration/Proclamations for the state of California from the Federal, State, and County Governments:

- 27 Wildfires
- 1 Earthquake
- 7 Floods
- 11 Severe Storms/Weather Events
- 1 Terrorist Attack

LHMP Community Engagement and Outreach

In accordance with FEMA guidance, communities should use an open public involvement process with developing hazard mitigation plans. Typical engagement for an LHMP includes these components:

Online Engagement –

- Online Survey to Loma Linda community members
- Social Media Posts:
    - Facebook
    - Twitter: Police Department
    - NextDoor
    - Nixle
    - City Newsletters
- Project Website

The overall City of Loma Linda Engagement Strategy is still under review and should be completed shortly. Upon completion, specific activities for the LHMP process will be finalized.

What Community Engagement is occurring within the City today?

Hazard Identification / Prioritization

As part of the data collection process, the Planning Team will identify the hazards to be addressed in the LHMP. The table provided identifies hazards typically covered in an LHMP and some preliminary recommendations.

Hazard	Natural Hazard	Other Hazards	Technological Hazard	Threat and Disturbance Hazard	SHMP	Included in this LHMP
Agricultural pests/diseases		X			X	
Air pollution		X			X	
Aircraft incident		X				
Aquatic Invasive Species		X			X	N/A
Avalanche	X				X	N/A
Civil disturbance and riot				X	X	
Climate change	X				X	All Profiles
Coastal flooding and storms	X				X	N/A
Cyber Threats				X	X	
Dam failure	X				X	
Drought	X				X	
Energy shortage		X			X	
Epidemic/ Pandemic/Vector Borne Disease		X			X	
Erosion	X				X	
Expansive soil	X					N/A
Extreme cold	X				X	
Extreme heat	X				X	
Flooding	X				X	
Fracking			X		X	N/A
Hail	X					N/A
Hazardous materials release			X		X	
Hurricane	X					N/A
Landslide	X				X	
Levee failure	X				X	
Lightning	X					
Methane-containing soils	X					N/A
Natural Gas Pipeline Hazards			X		X	
Oil Spills			X		X	N/A

Hazard	Natural Hazard	Other Hazards	Technological Hazard	Threat and Disturbance Hazard	SHMP	Included in this LHMP
Radiological Accidents			X		X	N/A
Sea level rise	X				X	N/A
Seiche	X				X	N/A
Seismic Hazards	X				X	
Fault rupture	X				X	
Seismic Shaking	X				X	
Liquefaction	X				X	
Severe wind	X					
Severe weather and Storms	X				X	
Storm surge	X					N/A
Subsidence	X					
Terrorism				X	X	
Thunderstorm	X					
Tornadoes	X					N/A
Transportation Accidents				X	X	
Tree Mortality		X			X	
Tsunami	X				X	N/A
Urban Fire		X			X	
Volcano	X				X	N/A
Wildfire	X				X	

Climate Change: Under state law, cities must assess their vulnerability to climate change when preparing or updating an LHMP. Our recommendation is to treat climate change a factor that can influence the frequency, intensity, and/or locations of other hazards and used to determine future risk for relevant hazards.

After identifying the hazards, these hazards will be prioritized using a method recommended by the Federal Emergency Management Agency (FEMA). Each hazard is graded on four criteria, using a scale of 1 to 4. Each criterion is assigned a weighting value, and all scores are aggregated to determine a final priority for each hazard.

The four criteria for each hazard are:

Criteria	***1***	***2***	***3***	***4***
Probability: *Estimated Likelihood that the hazard will occur in the future.*	**Unlikely**	**Occasionally**	**Likely**	**Highly Likely**
Location: *The size of the affected area from a typical future occurrence.*	**Negligible**	**Limited**	**Significant**	**Extensive**
Maximum Probable Extent: *The estimated damage to facilities from a typical failure.*	**Weak –** little to no damage	**Moderate –** some damage, loss of service for days	**Severe –** devastating damage, loss of service for months	**Extreme –** catastrophic damage, uninhabitable conditions
Secondary Impacts: *The effects to the community beyond physical damage*	**Negligible –** no loss of function, downtime, and/or evacuations	**Limited –** minimal loss of function, downtime, and/or evacuations	**Moderate –** some loss of function, downtime, and/or evacuations	**High –** major loss of function, downtime, and/or evacuations

Next Steps

» Hazard Mitigation Planning Process	July 2020 - December 2020
» Community Outreach	October 2020 - February 2021
» Administrative Draft LHMP	January 2021
» Public Review Draft LHMP Document	February 2021 – March 2021
» Cal OES/FEMA Review Draft Document	March 2021

First Name	Last Name	Email	Registratio	Approval Status
Robert	McCray	robert.mcc	########	approved
Mark	Cloud	Mark.cloud	########	approved
Thomas	Ingalls	tingalls@lc	########	approved
City of Loma	Linda	jthaipejr@	########	approved
Eric	Schilt	eschilt@llu	########	approved
Frank	Sirna	fscert2014	########	approved
Elfega "Elli	Bergthold	elfega.berg	########	approved
Eleazar	Rubalcava	Erubalcava	########	approved
Melissa	Curtis	melissa.cu	########	approved
Esther	Martinez	emartinez(	########	approved
John	Trujillo	Jtrujillo@lc	########	approved
Lorena	Matarrita	lmatarrita(	########	approved
Ehren	Ngo	engo@llu.e	########	approved
Kristine	Scott	Kscott@so	########	approved
Ken	Morse	ken_morse	########	approved
Shannon	Kendall	skendall@l	########	approved

Loma Linda Hazard Mitigation Plan 2021 Update

Planning Committee Meeting #2
Wed. Nov 18, 2020

PLEASE NAVIGATE TO: pollev.com/dynamicplanning

Important Links and Project Info

Project Website: mitigatehazards.com

http://mitigatehazards.com/loma-linda/

Password: LomaLinda2020

Polling Website for Smartphone: pollev.com/dynamicplanning

Agenda

- Welcome and Introductions
- Meeting #1 Recap
- Risk Assessment Data Review
- RAMP (Risk Assessment Mapping Platform) Tool Review
  - RAMP Poll EV Exercises
- Discussion of hazard-specific areas of concern
- Outreach update
- Next Steps

Welcome and Introductions

Meet the Team

Introductions

POLL-EV

PLEASE NAVIGATE TO:
pollev.com/dynamicplanning

How excited are you about mitigation planning?

What word or phrase would you use to describe Loma Linda?

Choose your favorite COVID19 face covering:

Bandana/TShirt

Surgical Mask

Handmade mask with pattern

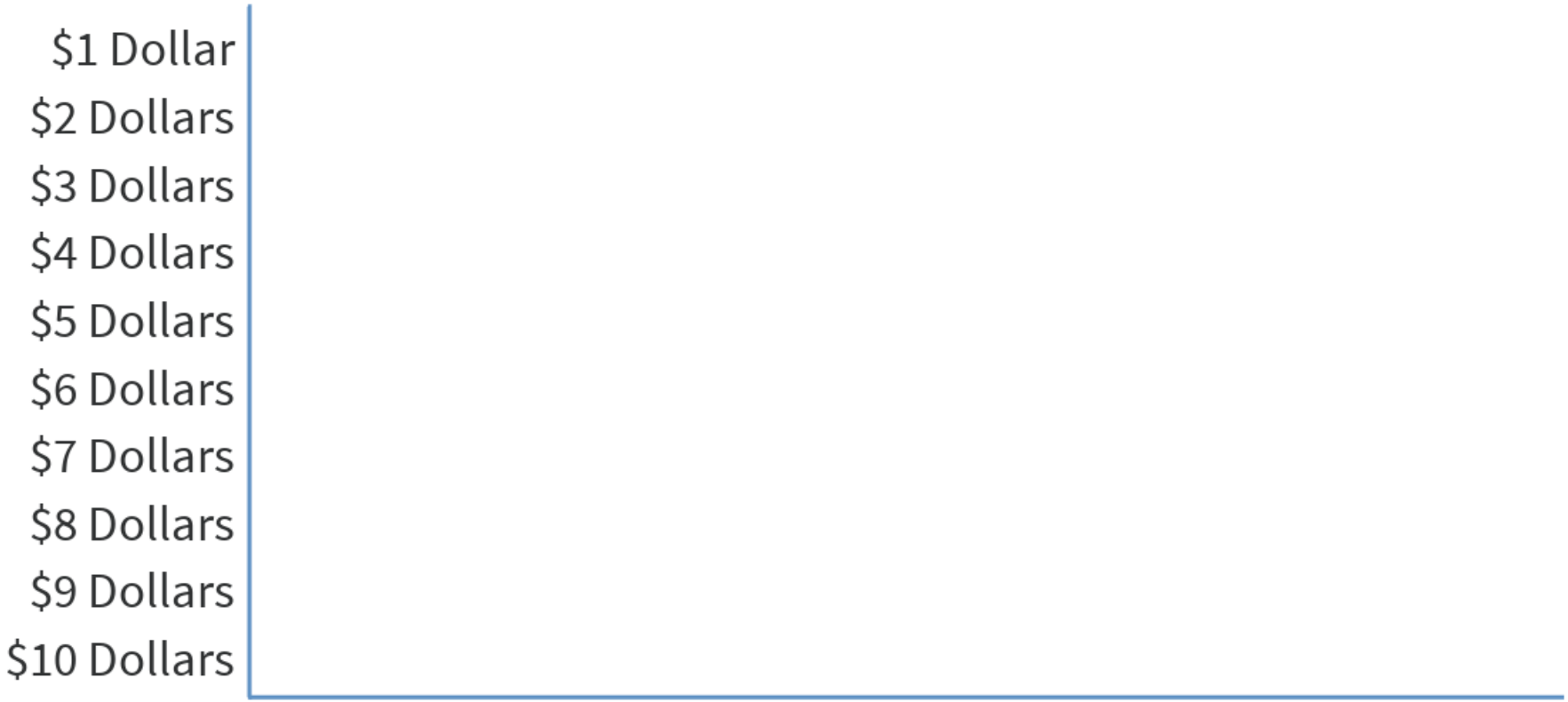
N95 Mask

I can't pick, I now have more than 10 masks

Other

Whichever mask I happen to have with me

For every mitigation dollar spent how much is commonly saved in disaster damage avoidance?



Meeting #1 Recap

Hazard Mitigation Planning & More

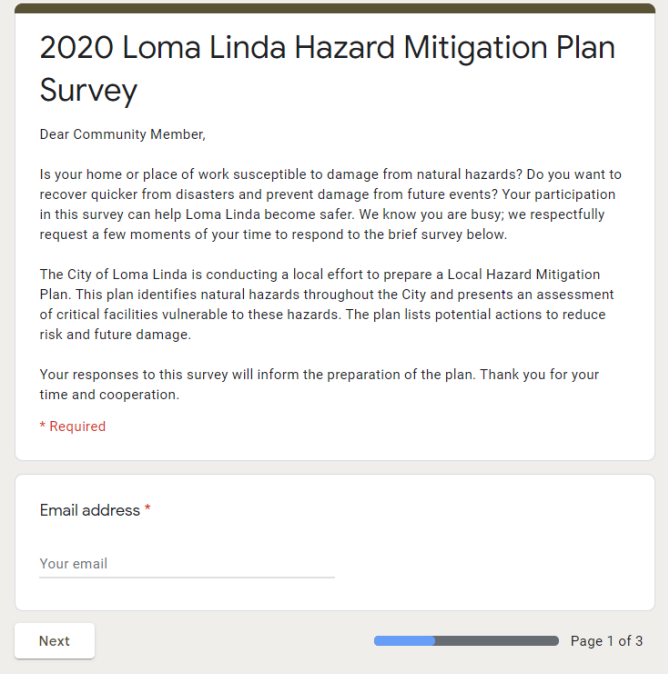
Meeting #1 Recap

Project Goals and Expectations (2011 LHMP)

- Reduction of damage caused by a significant earthquake in or near Loma Linda
- Prevention or mitigation of damage caused to structures and infrastructure by uncontrolled wildfire.
- Reduction or elimination of potential damage to structures and infrastructure caused by flooding from the San Timoteo Creek and tributaries.
- Reduce risk of wildfires through fuel reduction, by developing weed abatement protocol and distribute educational materials to residents.
- To improve channel flow in conjunction with the realignment of Redlands Blvd. and California Street project. Include channel improvements during phase 1 of the realignment project.

Meeting #1 Recap

Community Engagement and Outreach



2020 Loma Linda Hazard Mitigation Plan Survey

Dear Community Member,

Is your home or place of work susceptible to damage from natural hazards? Do you want to recover quicker from disasters and prevent damage from future events? Your participation in this survey can help Loma Linda become safer. We know you are busy; we respectfully request a few moments of your time to respond to the brief survey below.

The City of Loma Linda is conducting a local effort to prepare a Local Hazard Mitigation Plan. This plan identifies natural hazards throughout the City and presents an assessment of critical facilities vulnerable to these hazards. The plan lists potential actions to reduce risk and future damage.

Your responses to this survey will inform the preparation of the plan. Thank you for your time and cooperation.

* Required

Email address *

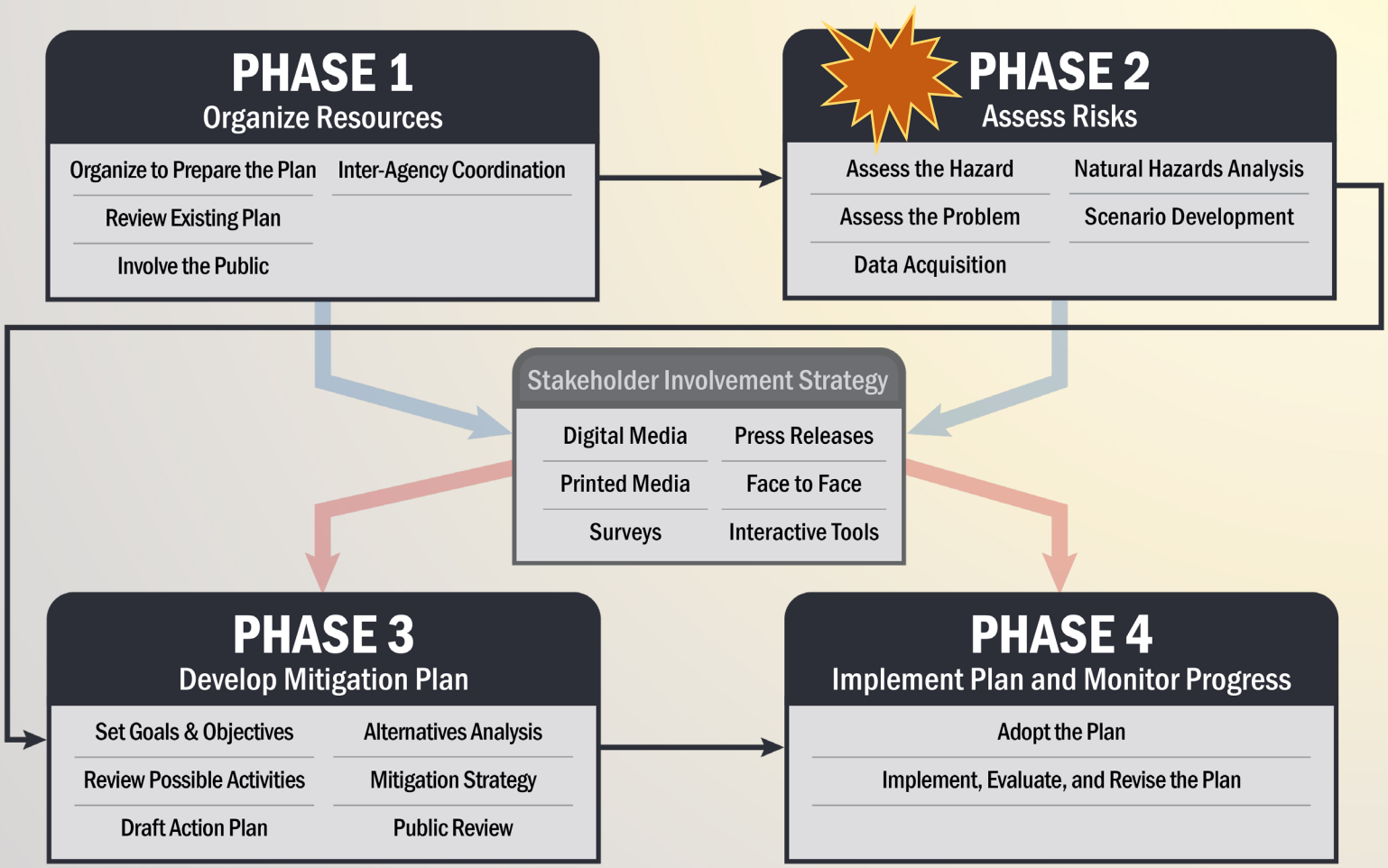
Your email

Next

Page 1 of 3

Water Bill Insert
Channel 3 Advertisement

Planning Process



Risk Assessment Review

Current methods and data

Risk Assessment Process

- Inventory hazards in document.
- Inventory historic plans and identify hazards.
- Develop Universe of Hazards.
- Understand Hazard Perceptions.
- Understand Frequency of Occurrences.
- Understand Severity (geographic extent, possible impacts).

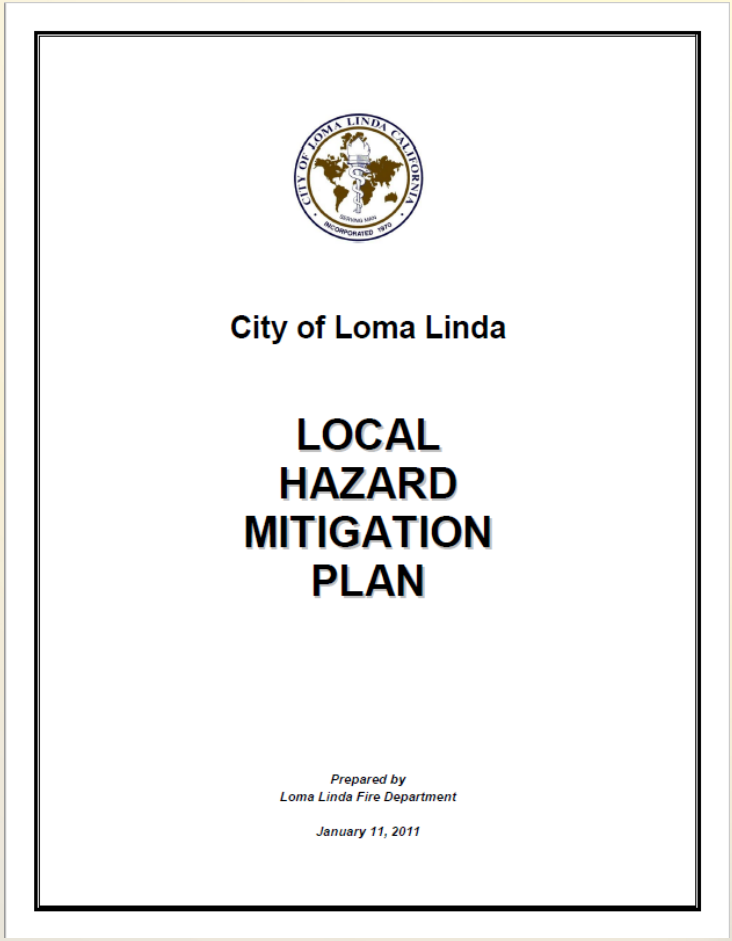
2011 HMP Profiled:

Natural Hazards:

- Earthquakes
- Floods
- Slope Failure
- Wildfires

Non-natural Hazards:

- Airplane Crash
- Hazardous Waste & Materials
- Railroad crash
- Terrorism


City of Loma Linda

LOCAL HAZARD MITIGATION PLAN

Prepared by
Loma Linda Fire Department

January 11, 2011

Potential Hazards

Hazards	2011 Loma Linda HMP	2009 Loma Linda General Plan	2016 San Bernardino County MJHMP	2018 California State HMP
Climate Change		■	■	■
Dam Failure				■
Drought		■	■	■
Earthquake	■	■	■	■
Flood	■	■	■	■
Landslide			■	■
Levee Failure			■	■
Human-caused	■*	■	■	■
Pandemic				■
Severe Weather			■	■
Soil Hazards		■	■	■
Terrorism & Tech	■*		■	■
Volcano				■
Wildfire	■	■	■	■

** Medium priority, not profiled in 2011 HMP*

Hazard Ranking from Meeting #1

	Impact					
	High		Medium		Low	
High		Wildfire Seismic	Drought			
Medium		Haz Mat	Climate Change Flood Terrorism Slope Failure Airplane Crash			
Low						

- **Slope Failure**
- **Slope Failure**

2021 updates to 2011 HMP:

Natural Hazards:
- Earthquakes
- Floods
- Slope Failure
- Wildfires

Hazards with Known Spatial Footprints

Additional natural hazards:
- Climate Change
- Drought

Non-natural Hazards:
- Airplane Crash
- Terrorism
- Hazardous Waste & Materials
- Railroad crash

"Human-caused Hazards"

"Haz. Waste & Materials"

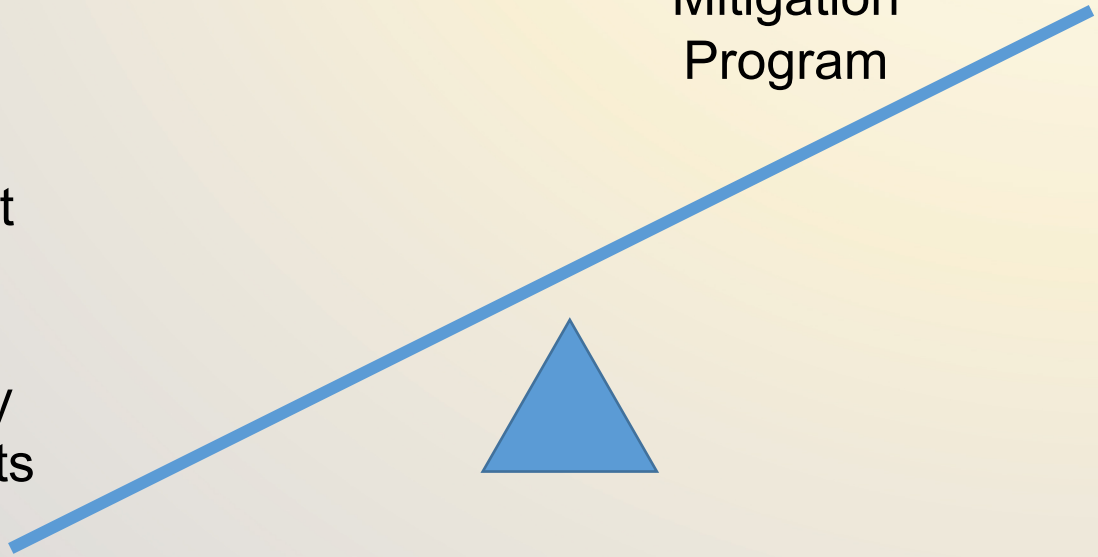
2021 HMP
Risk Assessment Data

Developing Data and Hazard Profiles

Hazard Mitigation Risk Assessment Data Paradigm:

Meaningful and Detailed Mitigation Program

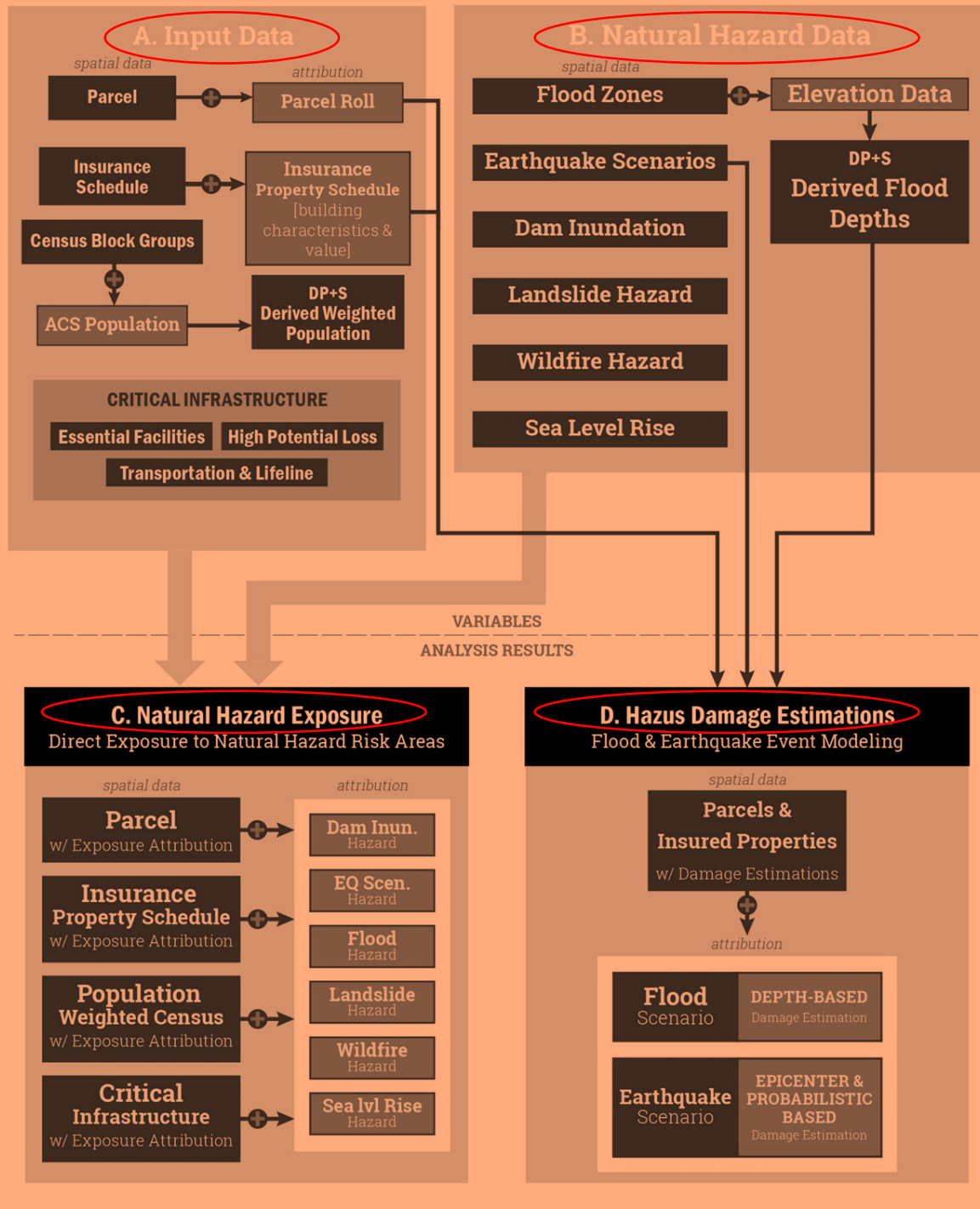
Risk Assessment Data / FEMA Vulnerability Requirements



Risk Assessment Data

Inputs:
Population
Parcels
Critical Infrastructure

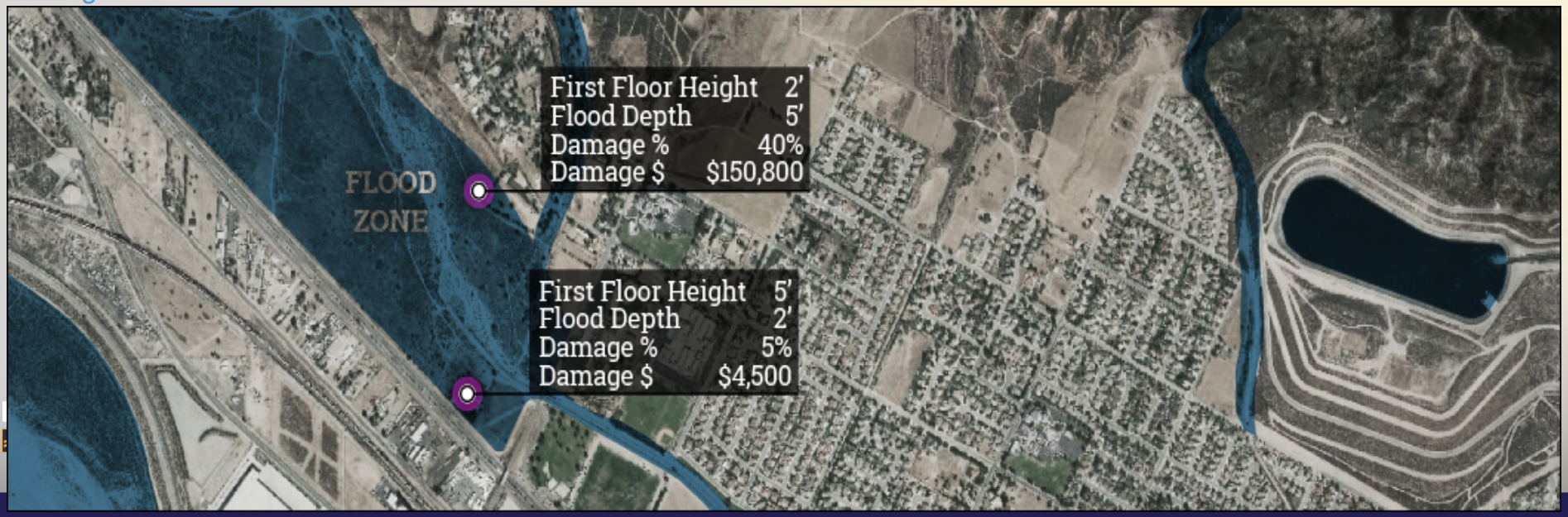
Outputs:
Hazard Exposure
Damage Estimations



Risk Assessment Data Mapping

Hazard Exposure

Damage Estimation



M7.4 MAACAMA GARBERVILLE SNAPSHOT

LANDSLIDE RISK EXPOSURE SNAPSHOT

FEMA FLOOD RISK EXPOSURE SNAPSHOT

WILDFIRE RISK EXPOSURE SNAPSHOT

STANDARD LAYOUT - CRITICAL FACILITIES

STANDARD LAYOUT - 65 AND OVER

NATURALLY OCCURRING ASBESTOS SNAPSHOT

M7.8 N. SAN ANDREAS - N. COAST - PENINSULA - SC MTN SNAPSHOT

DAM INUNDATION EXPOSURE SNAPSHOT

STANDARD LAYOUT - JANMINTEMP

STANDARD LAYOUT - MFRI

STANDARD LAYOUT - JULYMAXTEMP

New Risk Assessment Maps

- Custom Maps for City
- Demographics Data
- Hazard Overview Maps
- Hazard Exposure Snapshots w/ Maps

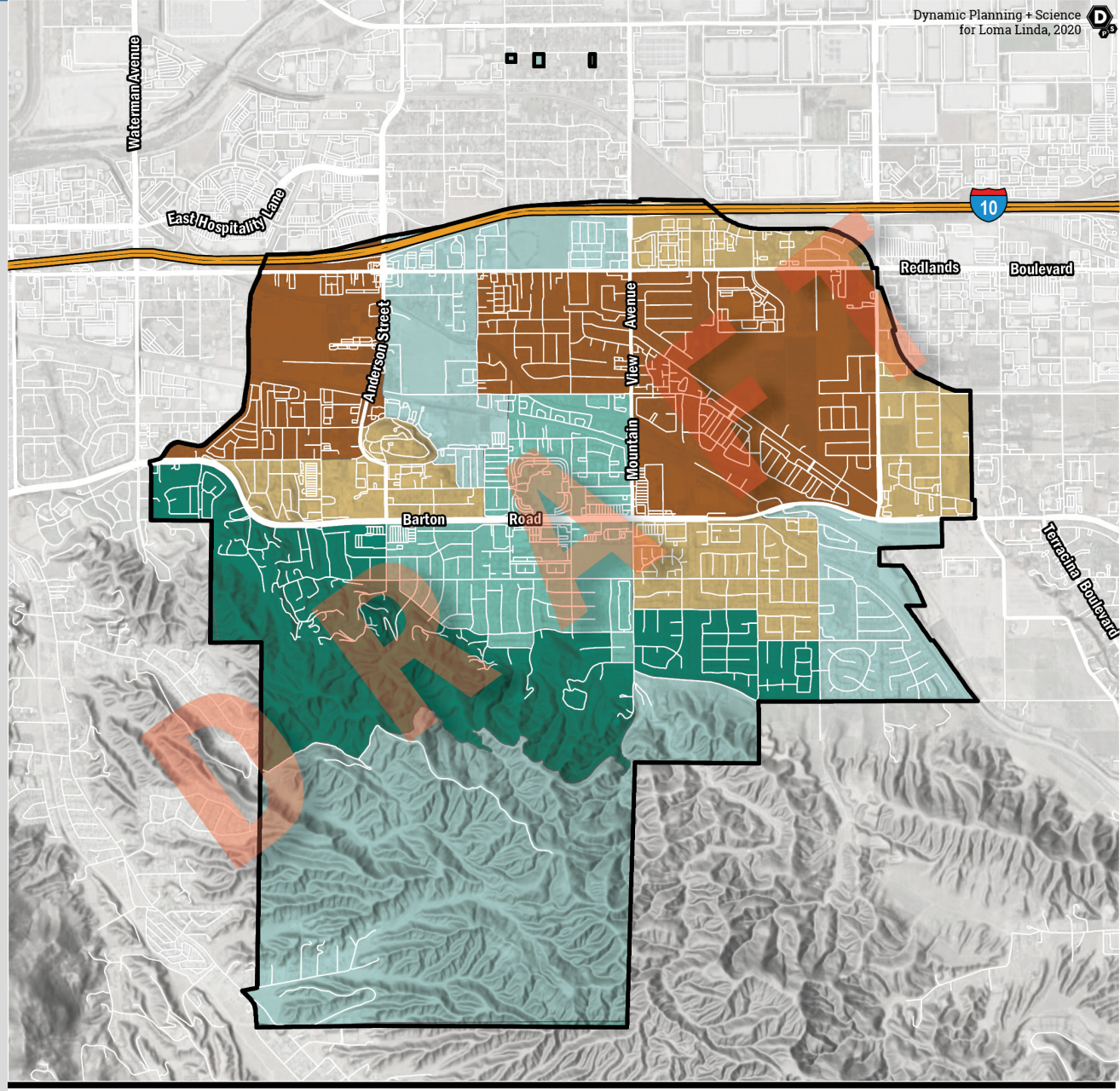
STANDARD LAYOUT - UNDER 18

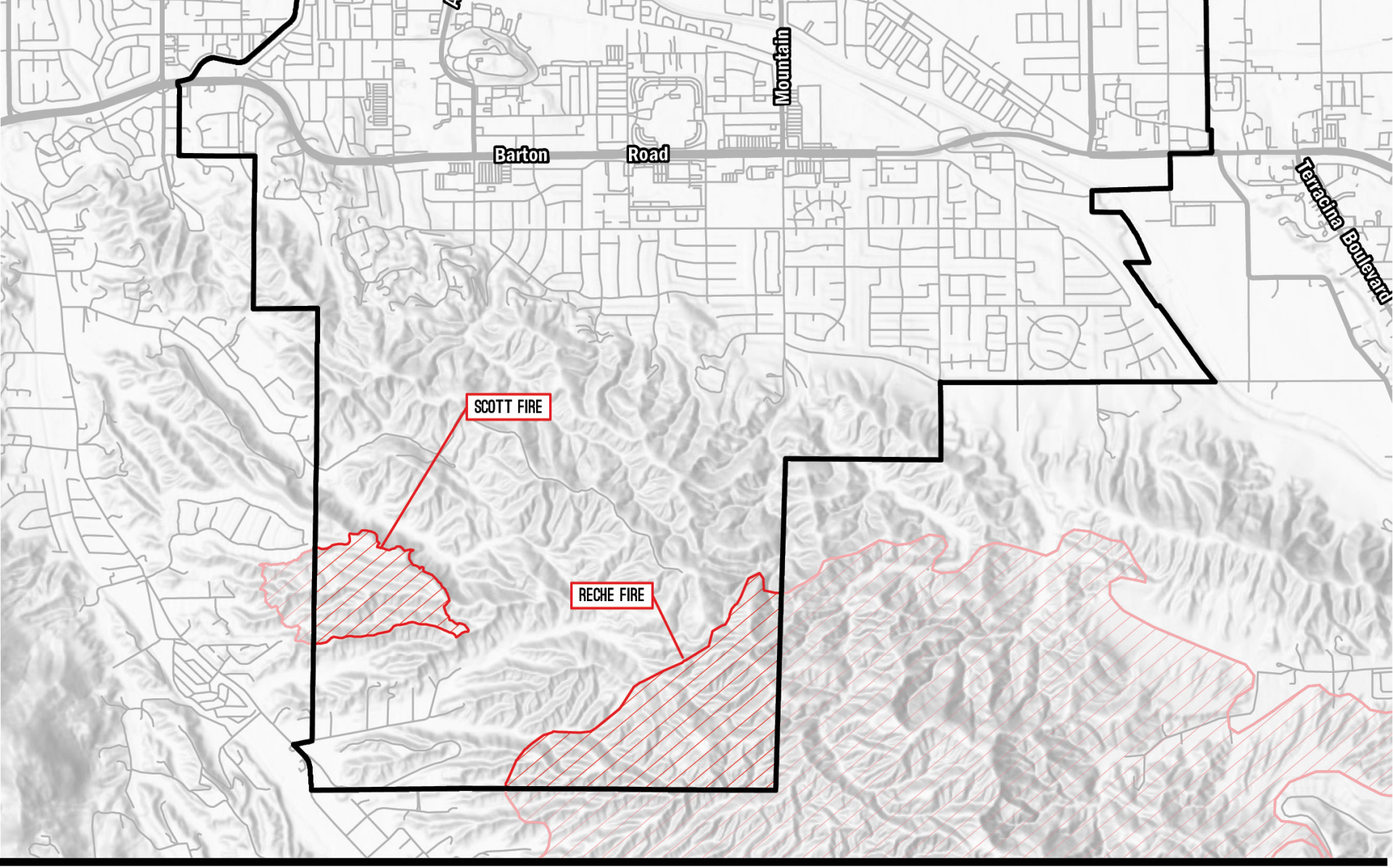
STANDARD LAYOUT - WIND

TSUNAMI RUN-UP AREA SNAPSHOT

Demographic Data

- 2017 5-year estimates, Census American Community Survey (ACS)
- Understanding population demographics is import for communication and outreach
- Provides “general” understanding of vulnerable populations





HISTORIC LARGE FIRES

LOMA LINDA

*Data sources: CalFire (2000-2019).

MAP LEGEND

JURISDICTION

FIRE PERIMETER

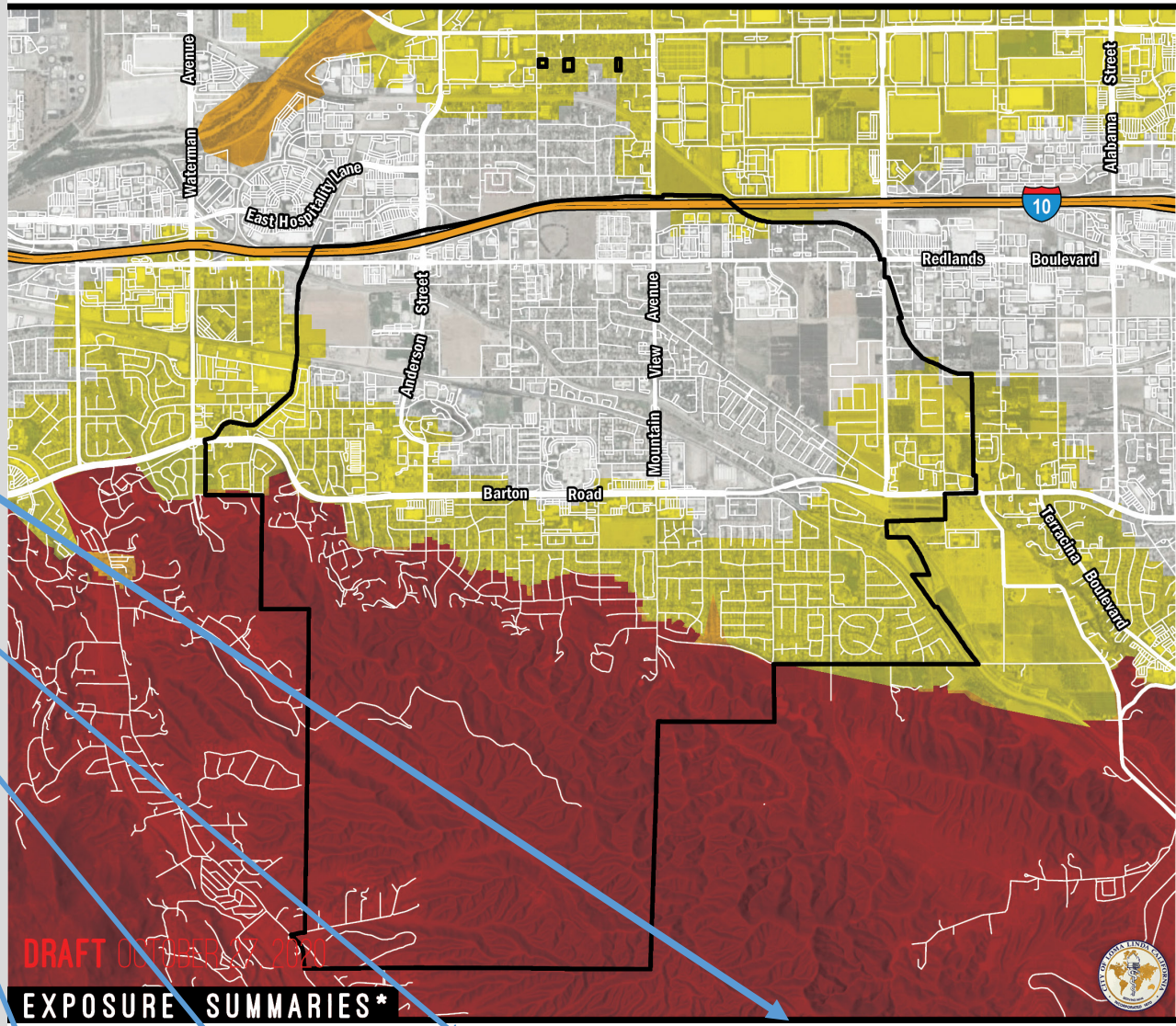
Exposure Snap Shots

Critical Infrastructure

Parcel Value

Parcel Count

Population



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
2,864	12%
Count Includes:	H VH

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
517	9%
Count Includes:	H VH

PARCEL VALUE IN HAZARD AREA

Sum of Improvement Value	Exp. Rate**
$142,815,938	6%
Sum of Content Value	
$71,465,665	3%
Count Includes:	H VH

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	0	0%	H VH
High Potential Loss	16	8%	*Sum of Transportation & Lifeline Linear Mileage*
Transportation & Lifeline	5	15%	49 13%

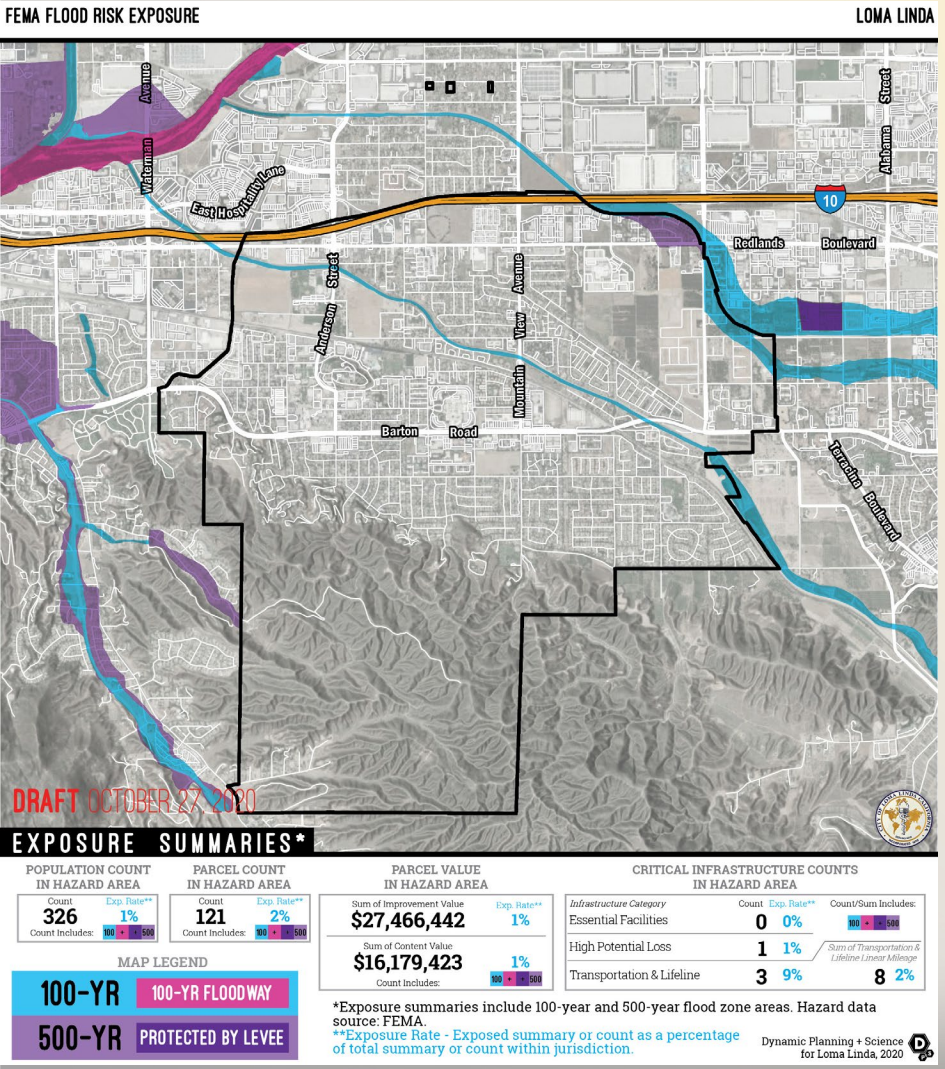
MAP LEGEND

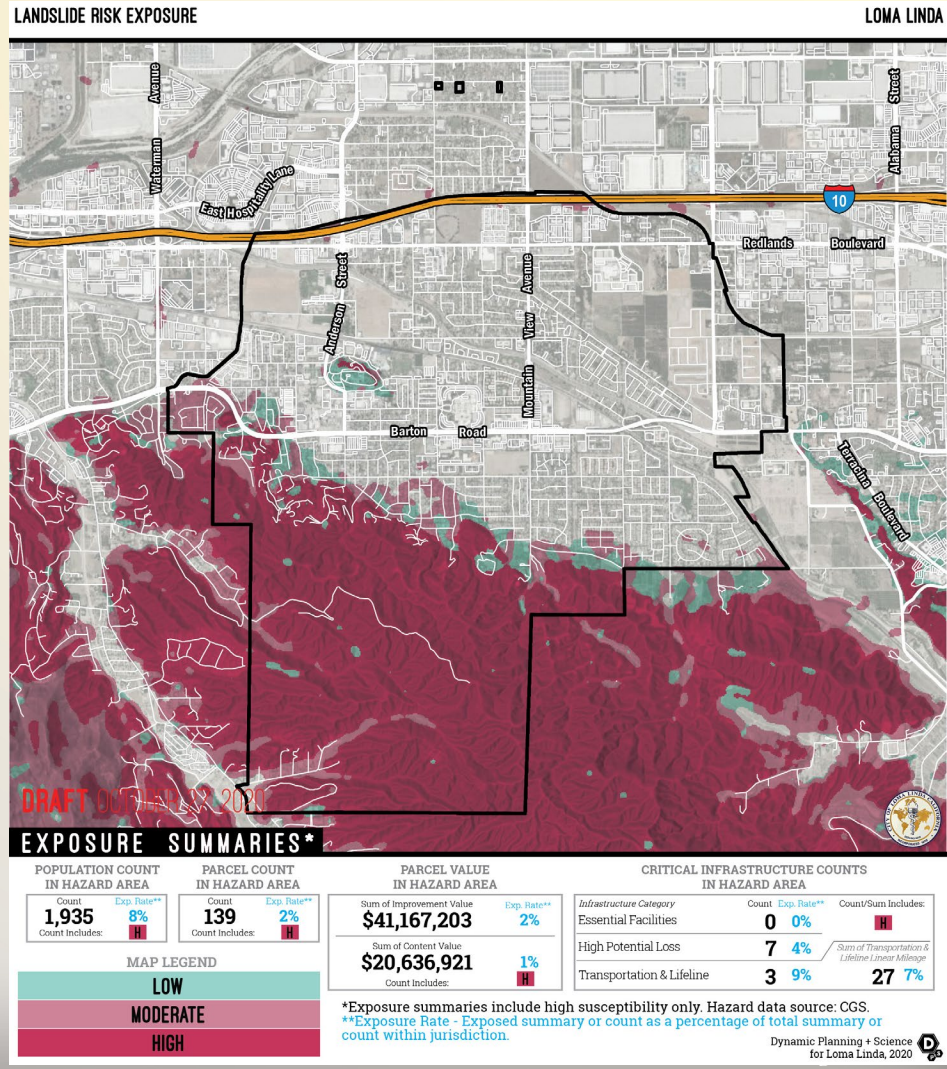
- MODERATE
- HIGH (H)
- VERY HIGH (VH)

*Exposure summaries include high and very high risk areas. Hazard data source: Cal Fire, CPUC.

**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

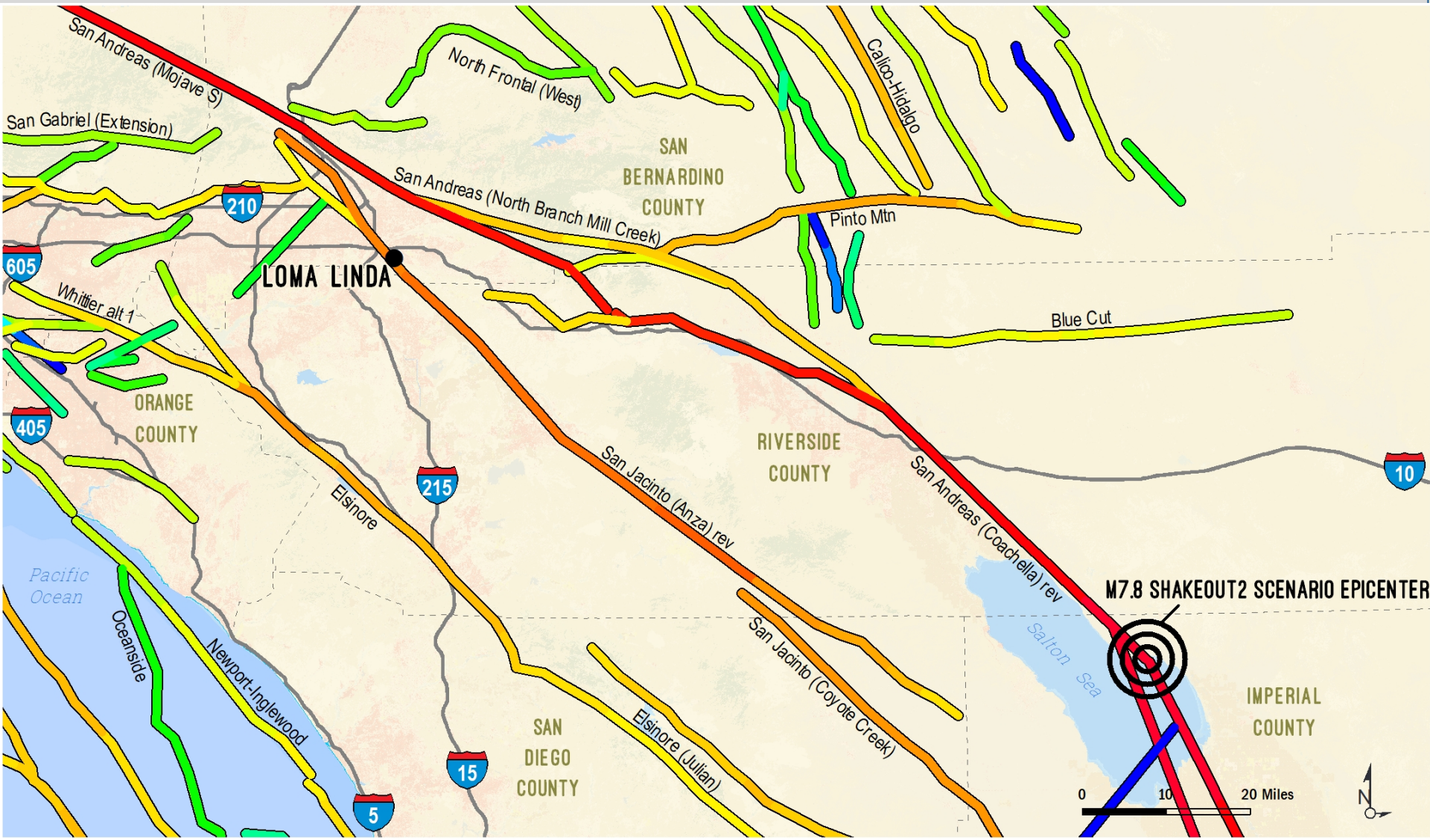
Exposure Maps: Flood and Slope Failure





EQ Scenario selection

- **Step one:** Understand probability of large-scale earthquakes in the area.
- **Step two:** Explore EQ Scenarios available from USGS
- **Step three:** Research EQ risk available about local active faults.
- **Step four:** Select Scenarios
- **Step five:** Use scenarios in conjunction with FEMA software to run damage estimation models.



UCERF3 Fault Probabilities

NOTE: Fault Locations are uncertain by up to several km

www.wgcep.org/UCERF

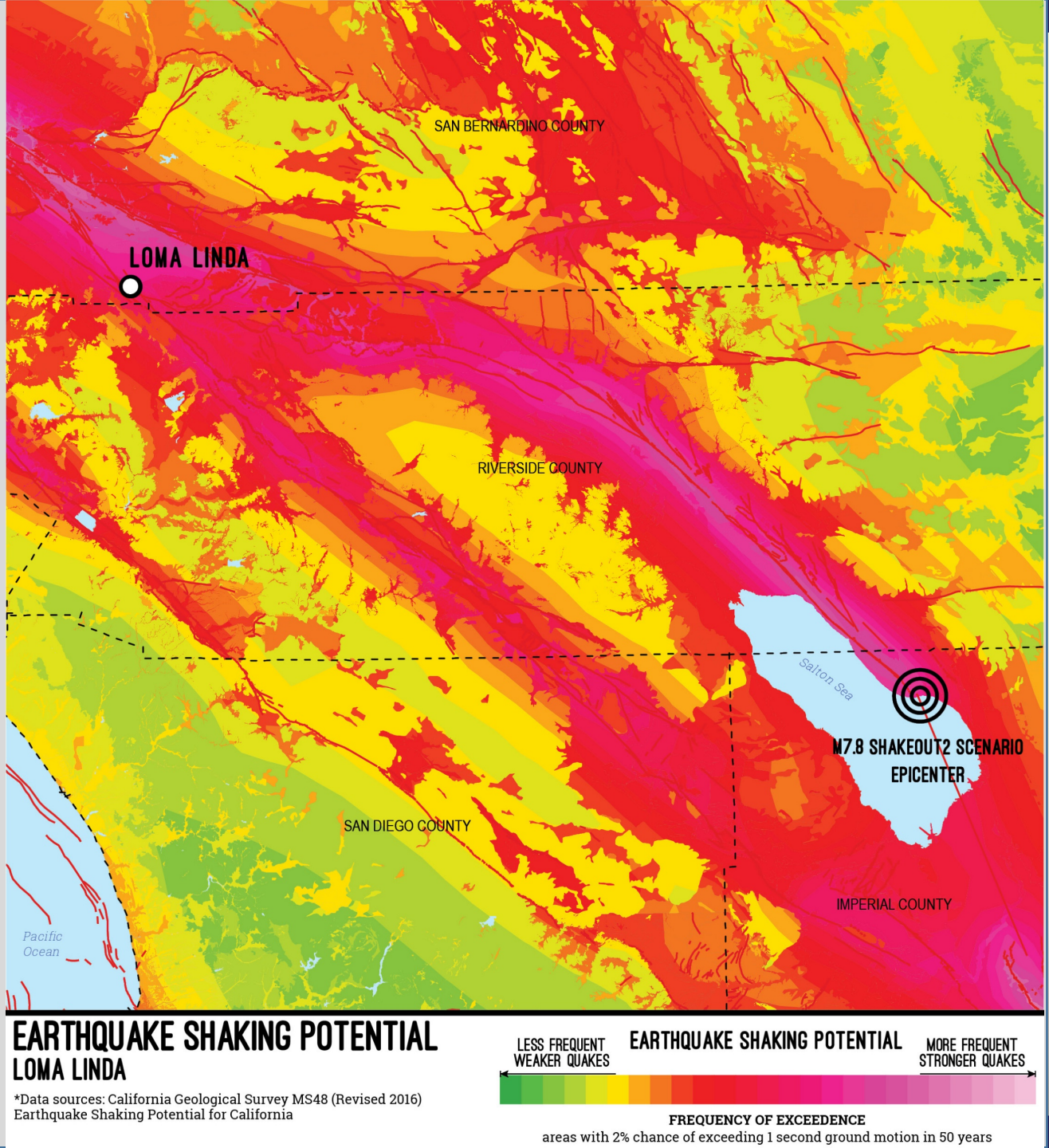
30 Year M≥6.7 Probability

0.01% 0.1% 1% 10% 100%

Earthquake Probability ShakeMap

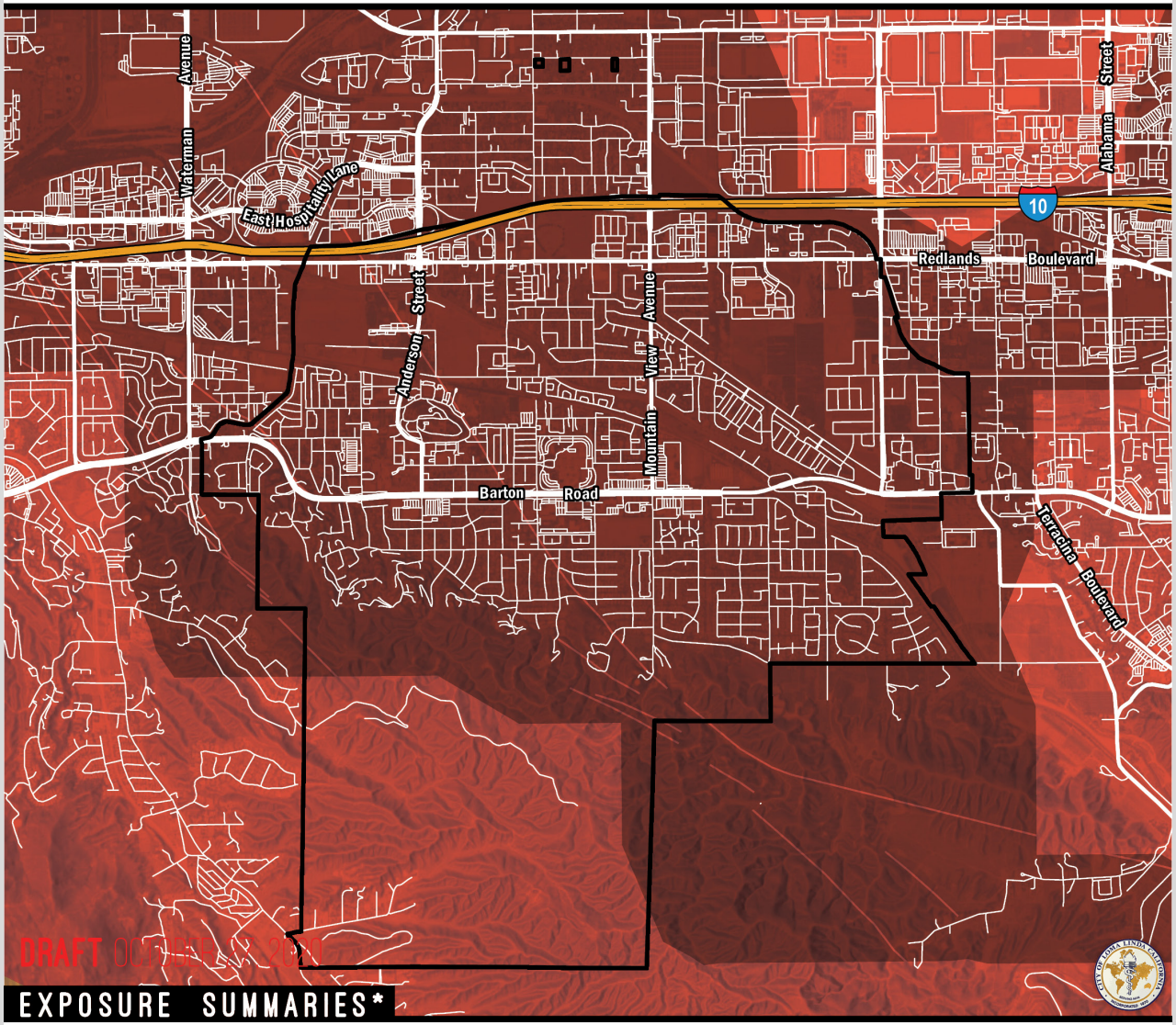
- CGS mapping shows the relative intensity of ground shaking in California from based upon local fault rupture potential.
- The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500-year average repeat time.

Source: 2016 California Geological Survey (CGS) data



SHAKEOUT2 (M7.8)

LOMA LINDA



EXPOSURE SUMMARIES*

POPULATION COUNT IN HAZARD AREA

Count	Exp. Rate**
23,961	100%
Count Includes:	VS + + E

PARCEL COUNT IN HAZARD AREA

Count	Exp. Rate**
5,661	100%
Count Includes:	VS + + E

PARCEL VALUE IN HAZARD AREA

	Exp. Rate**
Sum of Improvement Value	
$2,377,019,848	100%
Sum of Content Value	
$2,264,947,136	100%
Count Includes:	VS + + E

CRITICAL INFRASTRUCTURE COUNTS IN HAZARD AREA

Infrastructure Category	Count	Exp. Rate**	Count/Sum Includes:
Essential Facilities	21	100%	VS + + E
High Potential Loss	196	100%	*Sum of Transportation & Lifeline Linear Mileage*
Transportation & Lifeline	34	100%	379 100%

MAP LEGEND

III	IV	V	VI	VII	VIII	IX	X
WEAK	LIGHT	MODERATE	STRONG	VERY STRONG	SEVERE	VIOLENT	EXTREME

MMI

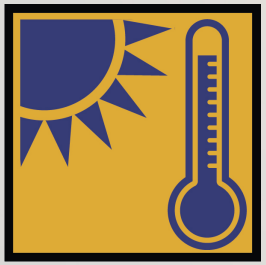
*Exposure summaries include very strong, severe, violent, and extreme MMI classes.
Hazard data source: USGS.
**Exposure Rate - Exposed summary or count as a percentage of total summary or count within jurisdiction.

Dynamic Planning + Science for Loma Linda, 2020

Drought and Climate Change

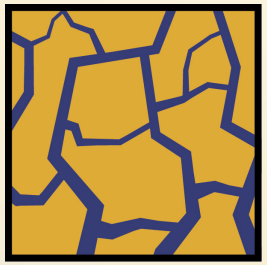
Climate Change could cause increased frequency and durations of:

EXTREME HEAT



SEVERE WEATHER

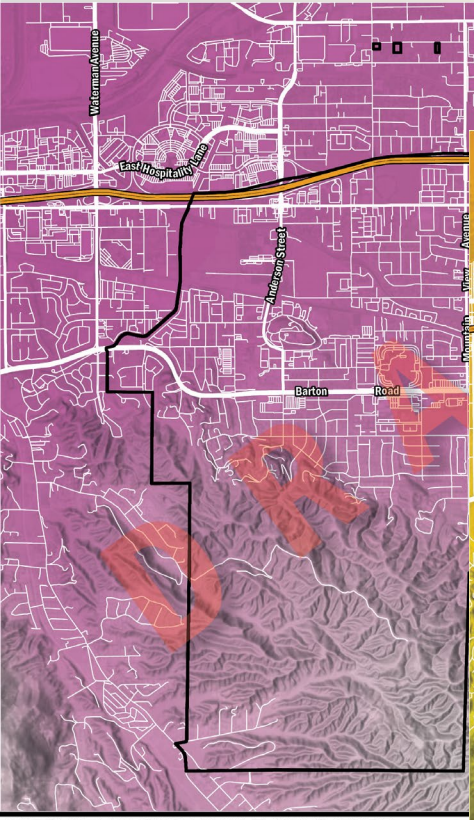
DROUGHT



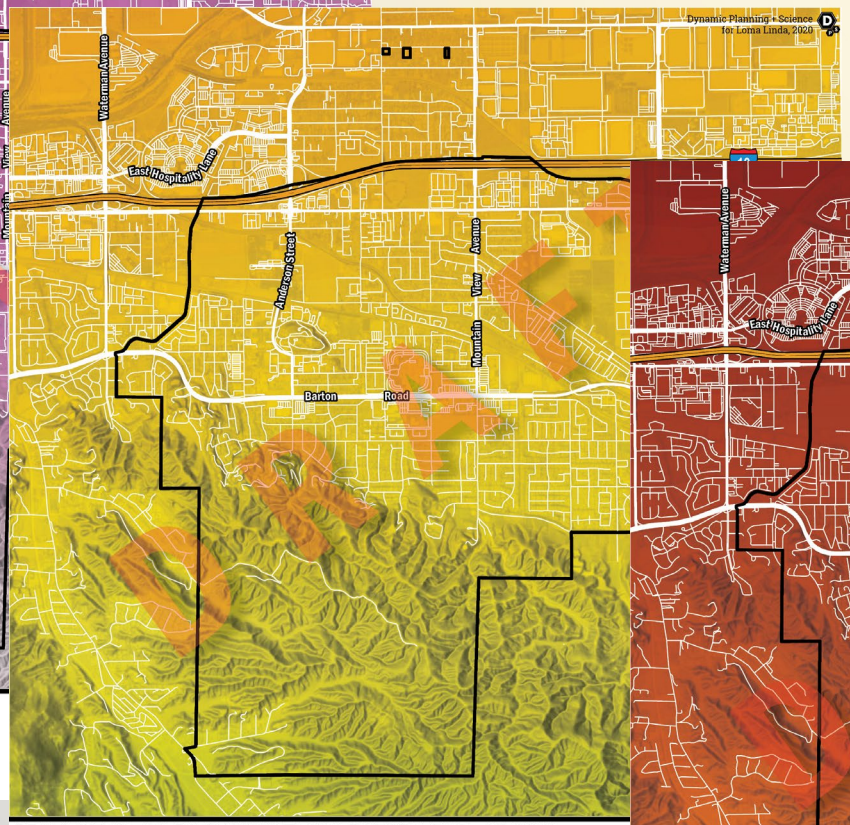
HIGH WIND

LEVEE FAILURE

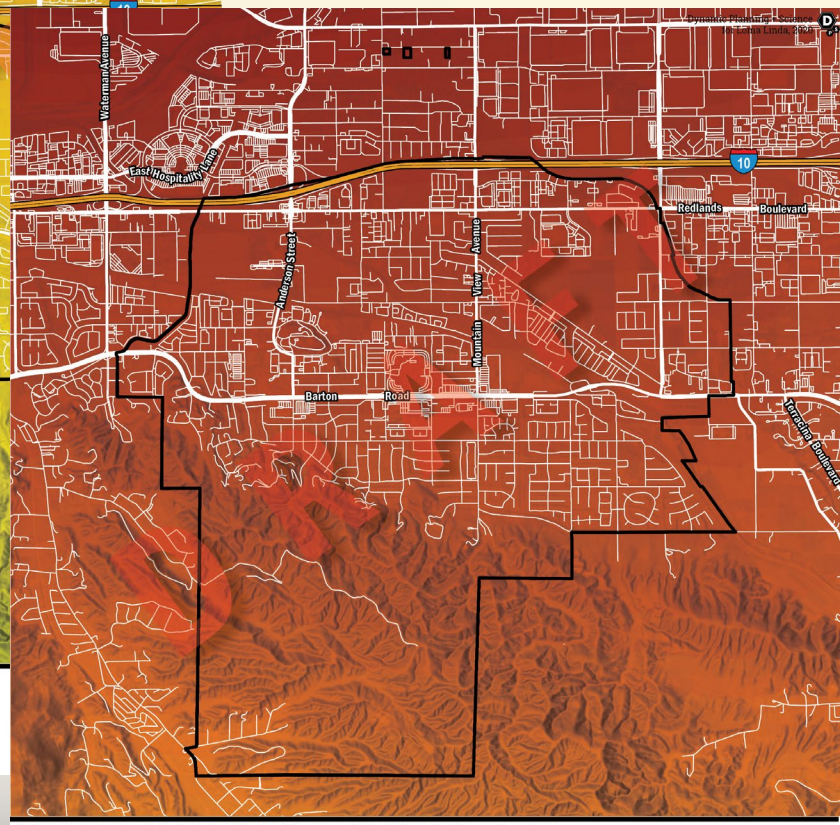
Climate Change Projections



CURRENT AVERAGE MAX TEMPERATURE
LOMA LINDA
*Data sources: PRISM 30-yr Norms Annual Max Temp.



PROJECTED AVERAGE MAX TEMPERATURE RCP 4.5 2100
LOMA LINDA
*Data sources: Cal-Adapt CanESM2 RCP 4.5.



PROJECTED AVERAGE MAX TEMPERATURE RCP 8.5 2100
LOMA LINDA
*Data sources: Cal-Adapt CanESM2 RCP 8.5.

MAP LEGEND
77°F
85°F

MITIGATE HAZARDS
mitigatehazards.com

RAMP | MITIGATE HAZARDS

Risk Assessment Mapping Platform (RAMP)

RAMP

- Provides stakeholders the ability to interact with risk assessment data.
- Not a replacement for local knowledge but reinforcement of known vulnerabilities.
- Provides flood risk exposure summaries for parcels, populations and critical facilities data within FEMA's mapped floodplains.
- Useful in all phases of emergency management.

Let's pinpoint your vulnerabilities

- **Use your tools**
- **Use preexisting documents**
  - Plans; CWPPs, Safety Elements, CIPs
  - Reports; Drainage Reports, Building Reports
- **Use your local knowledge!**

Risk Assessment

POLL-EV

PLEASE NAVIGATE TO:

- pollev.com/dynamicplanning

Mitigation Strategies General Discussion

Potential mitigate actions and outstanding issues

Prior 2011 Mitigation Actions

- Anderson Bridge retrofit completed (completed, previous MA)
- Mission Zanja channel improvement (partially completed, previous MA)
- Urban-Wildland Interface Hillside Weed Abatement
- Loma Linda University Medical Center: Seismic Retrofit Project

Additional Opportunities (not included in 2011 LHMP)

- 2010 Flood created opportunity for construction of flood control basins in the foothills south of the city to mitigate flood hazards
- Replacement of water mains and installation of fiberoptic cables to enhance water system capabilities

Potential Mitigation Actions

Typical Mitigation Categories

- **Plans and Regulations**
  - Ordinances, Regulations
- **Structural Projects**
  - Utility Undergrounding, Structural Retrofits
- **Natural Systems Protection**
  - Stream restoration, erosion control

Potential Mitigation Actions

Typical Mitigation Categories

- **Education Programs**
  - Outreach materials, websites, presentations
- **Preparedness and Response Actions**
  - Mutual aid agreements, equipment purchases, notification protocols

Mitigation Action Ideas

- Work with Edison on future undergrounding projects.
- Identify new crossing alternatives over the railroad ROW and flood-control channel.
- Coordinate with existing care facilities about trainings and exercises.
- Construction of an additional water reservoir to increase water supply in case of earthquake
- Install a vertical isolation system for LLUH
- Implement a Nixle evacuation system for City residents and businesses

Outreach Updates

- Continue pushing the online survey out to any and every group/organization that can assist with outreach
- Water Bill Insert distribution anticipated to occur in November and December
- Leverage CERT volunteers for additional outreach assistance.

Next Steps

Next Steps (4 Month Window)

- Finalize Risk Assessment
- Start Damage Assessments
- Develop Hazard Profiles in Narrative Format
- Start Exercises #2 and #3
- Finalize

Upcoming Data Requests...

- Any damage resulting from natural hazard events.
- New Building Permits (municipalities).
- Capabilities Assessments.
- Successful Mitigation Activities.
- Reporting on Historic Mitigation Actions.

Thank You!!!

Aaron Pfannenstiel, AICP

Atlas Planning Solutions

aaron@atlasplanning.org

Phone: 909-374-4828

Ethan Mobley, AICP

Dynamic Planning + Science

ethan@dynamicplanning.co

Phone: 970-323-4331

First Name	Last Name	Email	Registratio	Approval Status
Robert	McCray	robert.mcc	########	approved
Mark	Cloud	Mark.cloud	########	approved
Thomas	Ingalls	tingalls@lc	########	approved
City of Loma	Linda	jthaipejr@	########	approved
Eric	Schilt	eschilt@llu	########	approved
Frank	Sirna	fscert2014	########	approved
Elfega "Elli	Bergthold	elfega.berg	########	approved
Eleazar	Rubalcava	Erubalcava	########	approved
Melissa	Curtis	melissa.cu	########	approved
Esther	Martinez	emartinez(	########	approved
John	Trujillo	Jtrujillo@lc	########	approved
Lorena	Matarrita	lmatarrita(	########	approved
Ehren	Ngo	engo@llu.e	########	approved
Kristine	Scott	Kscott@so	########	approved
Ken	Morse	ken_morse	########	approved
Shannon	Kendall	skendall@l	########	approved

2020 Loma Linda Hazard Mitigation Plan Survey

I. Local Hazard Mitigation Plan Survey

Dear Community Member,

Is your home or place of work susceptible to damage from natural hazards? Do you want to recover quicker from disasters and prevent damage from future events? Your participation in this survey can help Loma Linda become safer. We know you are busy; we respectfully request a few moments of your time to respond to the brief survey below.

The City of Loma Linda is conducting a local effort to prepare a Local Hazard Mitigation Plan. This plan identifies natural hazards throughout the City and presents an assessment of critical facilities vulnerable to these hazards. The plan lists potential actions to reduce risk and future damage.

Your responses to this survey will inform the preparation of the plan. Thank you for your time and cooperation.

II. Hazard Awareness

1. **Please indicate whether you live or work in the City of Loma Linda.**
   a. I live in the City of Loma Linda.
   b. I work in the City of Loma Linda.
   c. I live and work in the City of Loma Linda.
   d. Neither applies to me, but I am interested in the City's resiliency.

2. **What is the ZIP code of your home?**

3. **Has a disaster in your current residence impacted you?**
   a. Yes
   b. No

4. **If you answered yes to the previous question, please select the type of disaster that you have been impacted by (select all that apply).**

Aircraft Incident	Drought
Slope Failure	Seismic Hazards
Flooding	Wildfire
Terrorism	Other
Hazardous Materials	
Climate Change	

5. If you selected Other above, please list any additional hazards that have previously impacted your neighborhood or home. (insert paragraph Option)

6. **The following hazards could potentially impact the City. Please mark the THREE (3) hazards that are of most concern to your neighborhood or home.**

Aircraft Incident	Drought
Slope Failure	Seismic Hazards
Flooding	Wildfire
Terrorism	Other
Hazardous Materials	
Climate Change	

7. If you selected Other above, please list any additional hazards that have previously impacted your neighborhood or home. (insert paragraph Option)

8. **The planning team is using various data sources to identify hazards in your community; however, some of these data sources do not provide data at a general citywide level. Are there any small-scale issues, such as ponding at a certain intersection during rain, that you would like the planning team to consider?**

   a. I am not aware of local hazards

   b. I am aware of local hazards

   Please provide as much detail as possible, including location and type of hazard.

9. **How concerned are you that climate change may create new hazardous situations in Loma Linda, or make existing natural hazards worse?**

   a. Very concerned
   b. Somewhat concerned
   c. Somewhat unconcerned
   d. Not at all concerned
   e. Unsure

10. **If you have taken any action to protect yourself against natural hazards, how confident are you that these actions will be sufficient to protect against more severe hazards that are expected because of climate change?**

    a. Very confident
    b. Somewhat confident
    c. Somewhat unconfident
    d. Not at all confident
    e. Unsure

11. **When do you think climate change will pose a threat to your health, property, livelihood, or overall wellbeing?**

    a. It already is
    b. Within the next five years
    c. In five to twenty years
    d. Not for at least another twenty years
    e. Never, or not in my lifetime

12. If you are a homeowner, do you have adequate homeowners' insurance to cover the hazards that could impact your home?

a. Yes, my insurance coverage should be adequate.
b. No, I don't believe my insurance coverage would be adequate for a major disaster.
c. Unsure
d. I do not have an insurance policy.
e. Not applicable; I rent my current residence.

13. If you rent your residence, do you have renters' insurance?

a. Yes
b. No
c. Not applicable; I own my residence.

14. Do you have flood insurance for your home?

a. Yes, I own my home and have flood insurance.
b. Yes, I rent my home and have flood insurance.
c. No, but I am interested in reviewing flood insurance options (http://www.floodsmart.gov/floodsmart/).

15. Have you done anything to your home to make it less vulnerable to hazards such as earthquakes, floods, and fires?

a. Yes
b. No
c. Not applicable; I rent my residence.

If not, do you plan to?

16. If a severe hazard event occurred today such that all services were cut off from your home (power, gas, water, sewer) and you were unable to leave or access a store for 72 hours, which of these items do you have readily available? Select all that apply.

a. Potable water (3 gallons per person)
b. Cooking and eating utensils
c. Can opener
d. Canned / nonperishable foods (ready to eat)
e. Gas grill/camping stove
f. Extra medications and contact lenses (if applicable)
g. First aid kit/supplies
h. Portable AM/FM radio (solar-powered, hand crank, or batteries)
i. Handheld "walkie-talkie" radios (with batteries)
j. Important family photos/documentation in a water- and fireproof container
k. Extra clothes and shoes
l. Blanket(s) / sleeping bag(s)
m. Cash
n. Flashlight (with batteries)
o. Gasoline
p. Telephone (with batteries)
q. Pet supplies
r. Secondary source of heat

For more information on emergency kits, visit: https://www.ready.gov/kit

What else do you have in your emergency kit?

17. **Are you familiar with the special needs of your neighbors in the event of a disaster situation (special needs may include limited mobility, severe medical conditions, memory impairments)?**
    a. Yes
    b. No

18. **Are you a trained member of your Community Emergency Response Team (CERT)?**
    a. Yes
    b. No, but I would like to learn more about CERT.
    c. No, I am not interested in being a trained CERT member.

    For more information about CERT, please visit:

    http://www.lomalindacert.com/

19. **How can the City help you become better prepared for a disaster? (choose all that apply)**
    a. Provide effective emergency notifications and communication.
    b. Provide training and education to residents and business owners on how to reduce future damage.
    c. Provide community outreach regarding emergency preparedness.
    d. Create awareness of special needs and vulnerable populations.
    e. Other (please specify)

If you do NOT work in the City of Loma Linda, please skip to question 21.

20. **What is the ZIP code of your workplace?**

21. **Does your employer have a plan for disaster recovery in place?**
    a. Yes
    b. No
    c. I don't know

22. **Does your employer have a workforce communications plan to implement following a disaster, so they are able to contact you?**
    a. Yes
    b. No

III. Recommendations and Future Participation

23. Would you like to be contacted when the Draft 2021 Loma Linda Hazard Mitigation Plan is available for review?

a. Yes; please notify me using my contact information in the next question.
b. No

24. If you would like to be notified of future opportunities to participate in hazard mitigation and resiliency planning, please provide your name and e-mail address. If you do not have an e-mail address, please provide your mailing address.

Full Name:	
E-Mail Address:	
Street Address:	
City, State, Zip:	

25. Please provide us with any additional comments/suggestions/questions that you have regarding your risk of future hazard events.

Thank you for taking the time to complete this survey. If you have any questions, or if you know of other people/organizations that should be involved, please contact Shannon Kendall at skendall@lomalinda-ca.gov.

2020 Loma Linda Hazard Mitigation Plan Survey

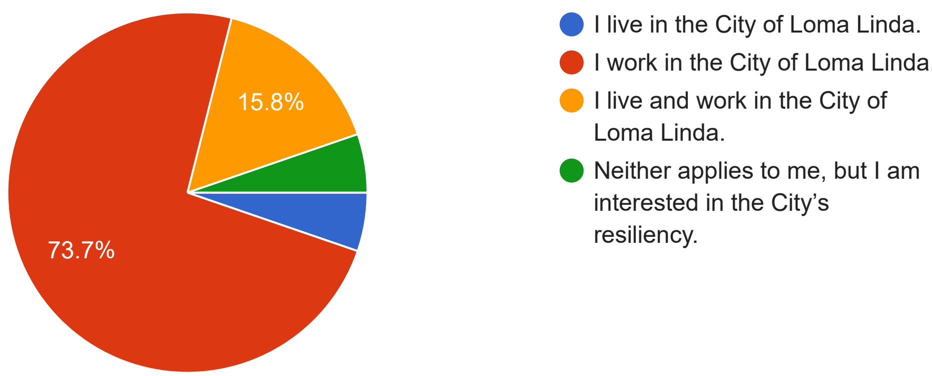
57 responses

Publish analytics

Hazard Awareness

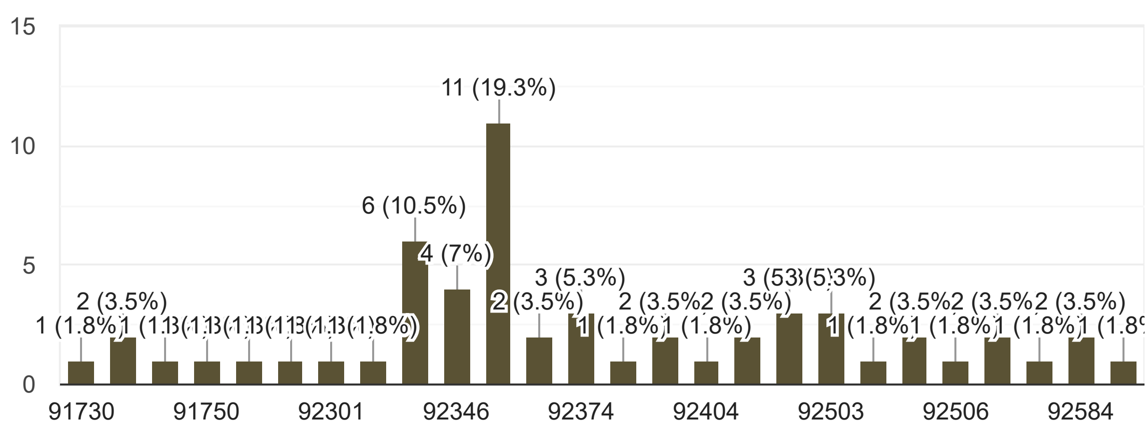
Please indicate whether you live or work in the City of Loma Linda.

57 responses



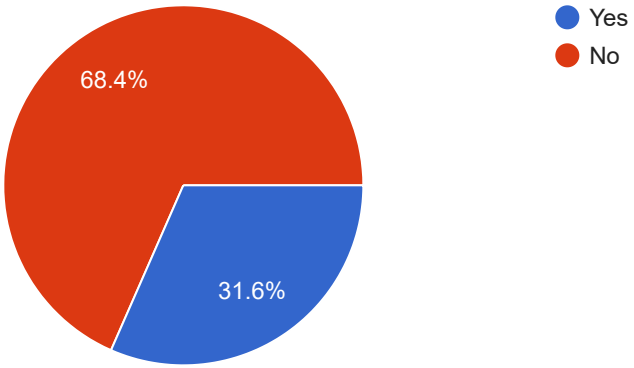
What is the ZIP code of your home?

57 responses



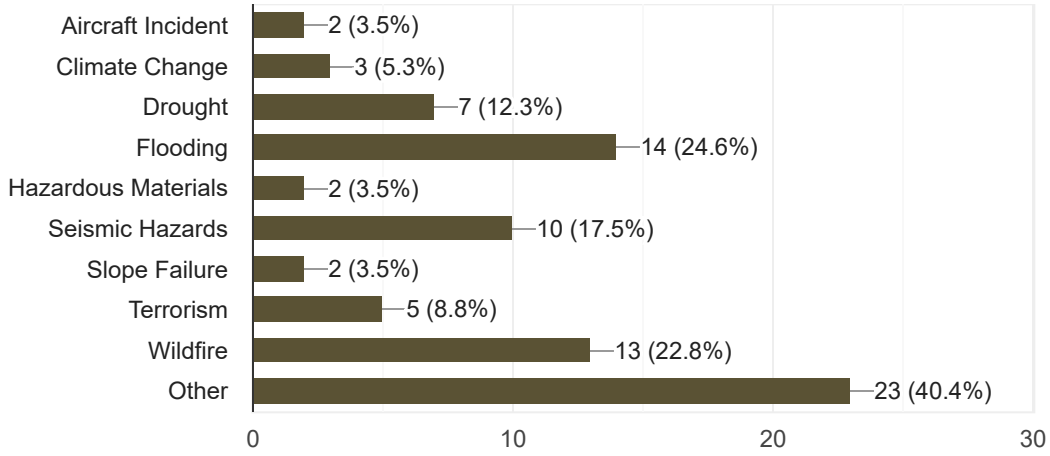
Has a disaster in your current residence impacted you?

57 responses



If you answered yes to the previous question, please select the type of disaster that you have been impacted by (select all that apply).

57 responses



If you selected Other above, please list any additional hazards that have previously impacted your neighborhood or home. (Otherwise put "N/A")

57 responses

N/A

n/a

Pandemic

NA

na

Does not apply to me.

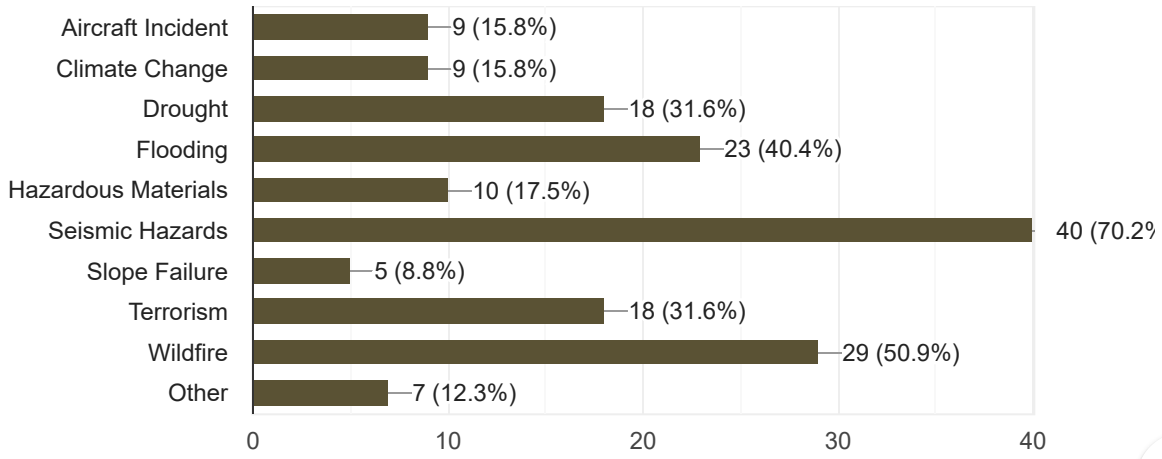
Wild animals, such as small Coyotes and/or Cougar spotted on my front porch going after my cat.

COVID Pandemic

Does not apply but I had to answer the question.

The following hazards could potentially impact the City. Please mark the THREE (3) hazards that are of most concern to your neighborhood or home.

57 responses



If you selected Other above, please list any additional hazards that have previously impacted your neighborhood or home. (Otherwise put "N/A")

57 responses

N/A

n/a

NA

na

Homeless encampments; increased homeless roaming the neighborhood; general safety

Overhanging electric cables (Edison)

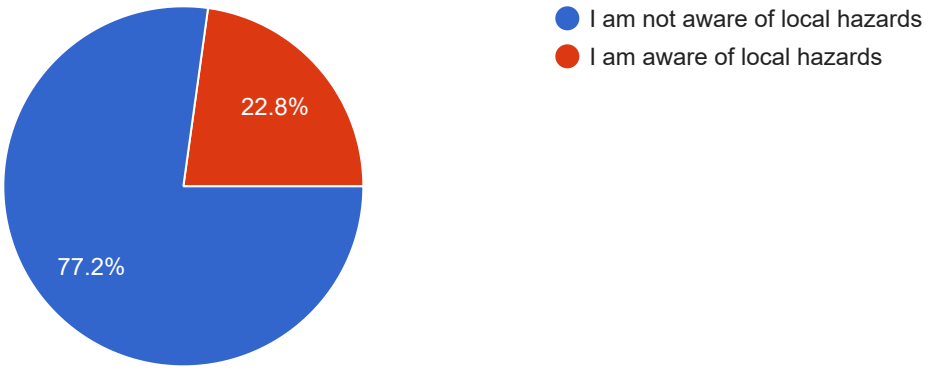
Severe Weather

Flooding

Local crime

The planning team is using various data sources to identify hazards in your community; however, some of these data sources do not provide data at a general citywide level. Are there any small-scale issues, such as ponding at a certain intersection during rain, that you would like the planning team to consider?

57 responses



If you indicated “I am aware of local hazards” above, please provide as much detail as possible, including the location and type of hazard. (Otherwise put "N/A")

57 responses

N/A

n/a

NA

na

Potential for flooding at Loma Linda Academy during periods of heavy rain. Potential for flooding at the base of the South Hills along Lawton and Beaumont Avenues when the hillside interfaces with homes.

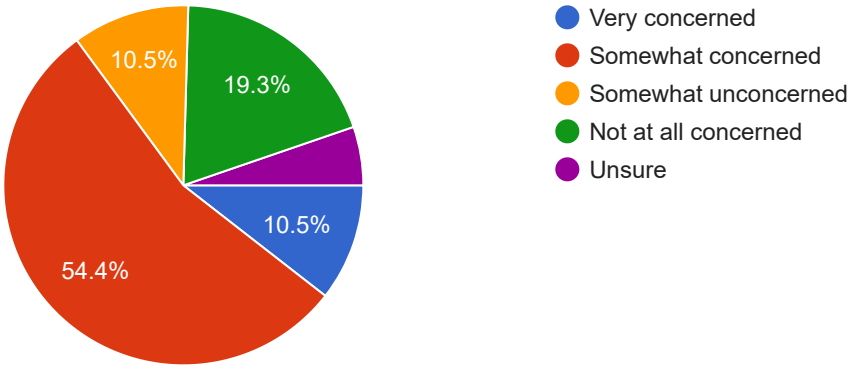
Debris flow from hills south of town. Catch basins overwhelmed.

Does not apply to me.

street flooding at Richardson between Redlands Blvd and the 10 freeway at the hotel exit of Richardson

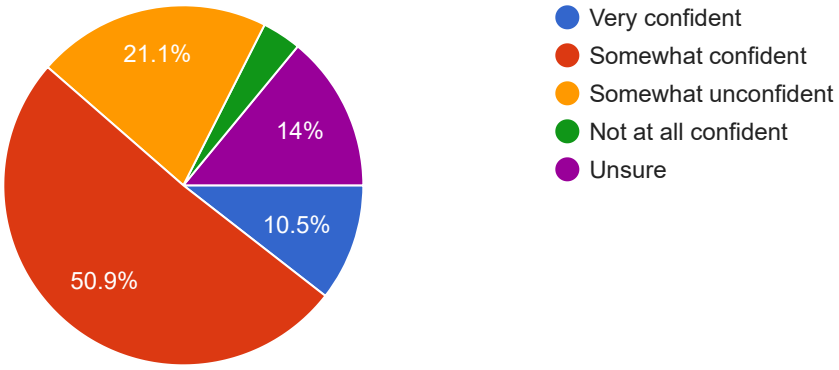
How concerned are you that climate change may create new hazardous situations in Loma Linda, or make existing natural hazards worse?

57 responses



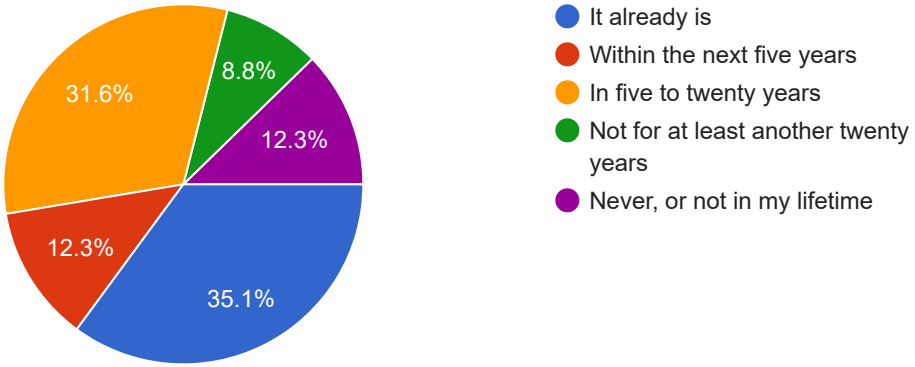
If you have taken any action to protect yourself against natural hazards, how confident are you that these actions will be sufficient to protect against more severe hazards that are expected because of climate change?

57 responses



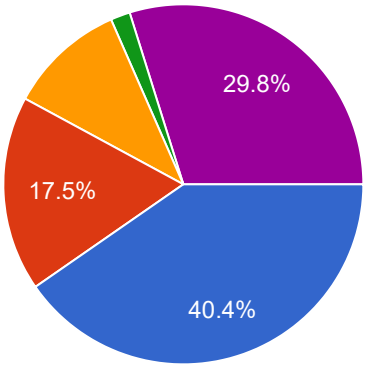
When do you think climate change will pose a threat to your health, property, livelihood, or overall wellbeing?

57 responses



If you are a homeowner, do you have adequate homeowners' insurance to cover the hazards that could impact your home?

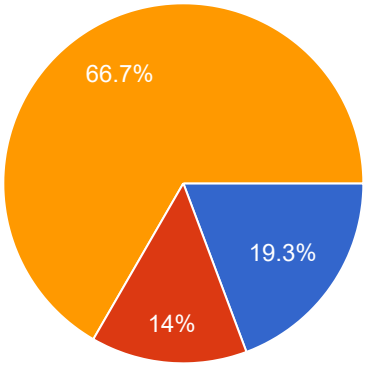
57 responses



- Yes, my insurance coverage should be adequate.
- No, I don't believe my insurance coverage would be adequate for a major disaster.
- Unsure
- I do not have an insurance policy.
- Not applicable; I rent my current residence.

If you rent your residence, do you have renters' insurance?

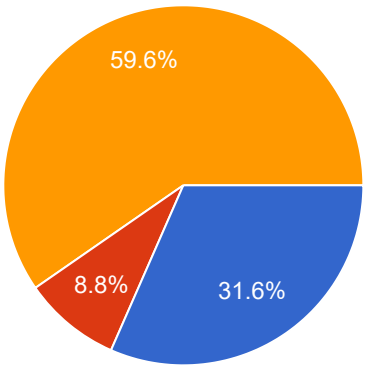
57 responses



- Yes
- No
- Not applicable; I own my residence.

Do you have flood insurance for your home?

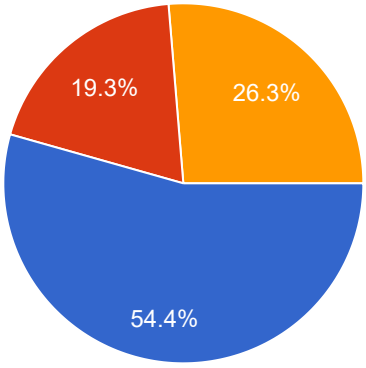
57 responses



- Yes, I own my home and have flood insurance.
- Yes, I rent my home and have flood insurance.
- No, but I am interested in reviewing flood insurance options (http://www.floodsmart.gov/floodsmart/).

Have you done anything to your home to make it less vulnerable to hazards such as earthquakes, floods, and fires?

57 responses



- Yes
- No
- Not applicable; I rent my residence.

If you answered no above, do you plan to do anything to your residence to make it less vulnerable to hazards such as earthquakes, floods, and fires? (Otherwise put "N/A")

57 responses

N/A

n/a

NA

Does not apply to me.

Have items more secure to not fall to the ground

I plan to

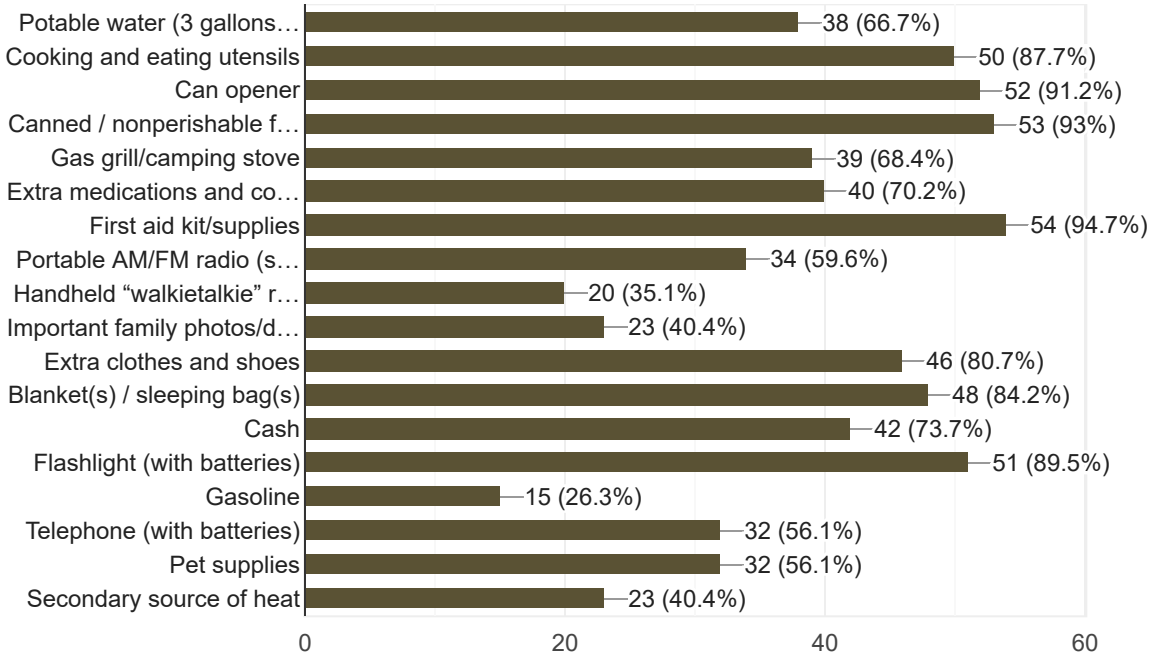
na

"N/A"

Yes

If a severe hazard event occurred today such that all services were cut off from your home (power, gas, water, sewer) and you were unable to leave or access a store for 72 hours, which of these items do you have readily available? Select all that apply.

57 responses



What else do you have in your emergency kit? (If nothing else, put "N/A")

57 responses

N/A

n/a

Solar chargers with battery packs; shelters; sanitation supplies; disaster medical supplies;

shelter and sanitation supplies

HAM RADIO, WEAPONS

4x4 vehicle, mountain bikes, Camping trailer, self defense tools

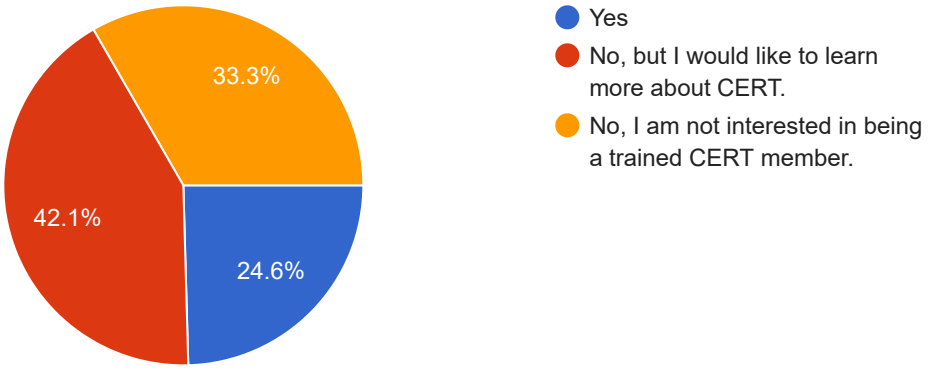
Medical triage items, list from CERT,

Disposable paper products, trash bags, firewood, lighter/matches, fire extinguisher, toiletries, sanitizing products, towels, small tools,

For more information on emergency kits, visit: https://www.ready.gov/kit

Are you a trained member of your Community Emergency Response Team (CERT)?

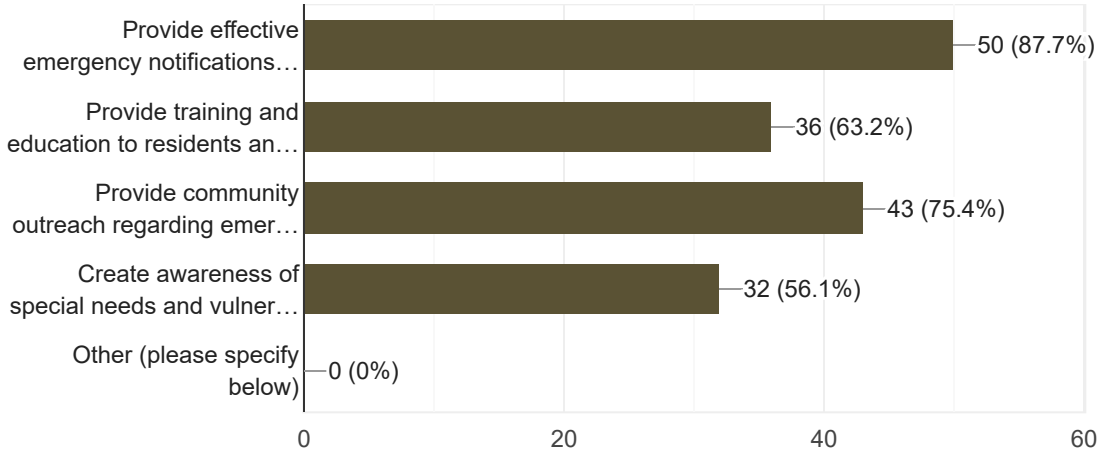
57 responses



For more information about CERT, please visit:http://www.lomalindacert.com/

How can the City help you become better prepared for a disaster? (choose all that apply)

57 responses



If you answered "Other" above, please specify below.

57 responses

N/A

n/a

NA

"N/A"

Does not apply to me.

None

na

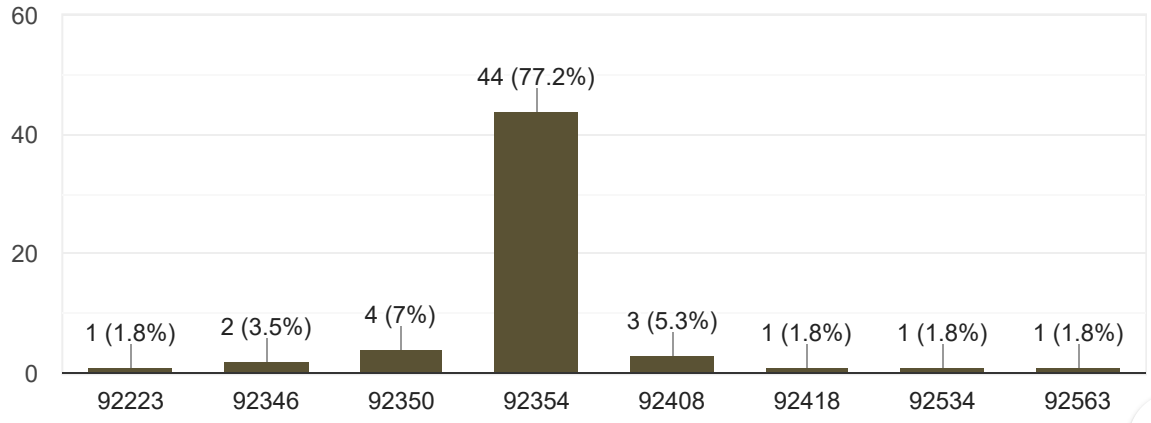
Send emails

send out informative fliers and scenario examples through mail.

If you do NOT work in the City of Loma Linda, please skip the next question

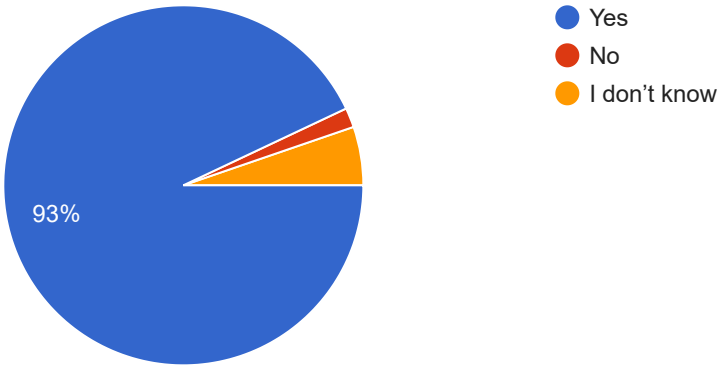
What is the ZIP code of your workplace?

57 responses



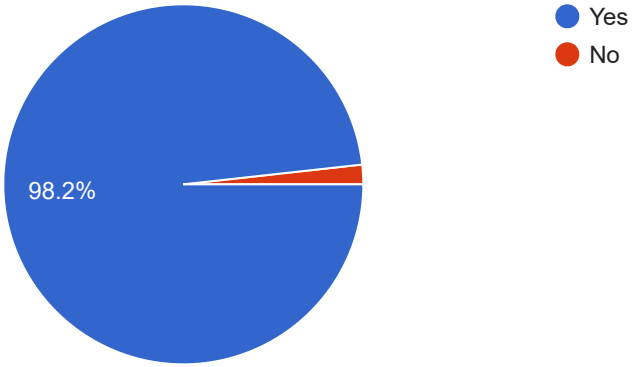
Does your employer have a plan for disaster recovery in place?

57 responses



Does your employer have a workforce communications plan to implement following a disaster, so they are able to contact you?

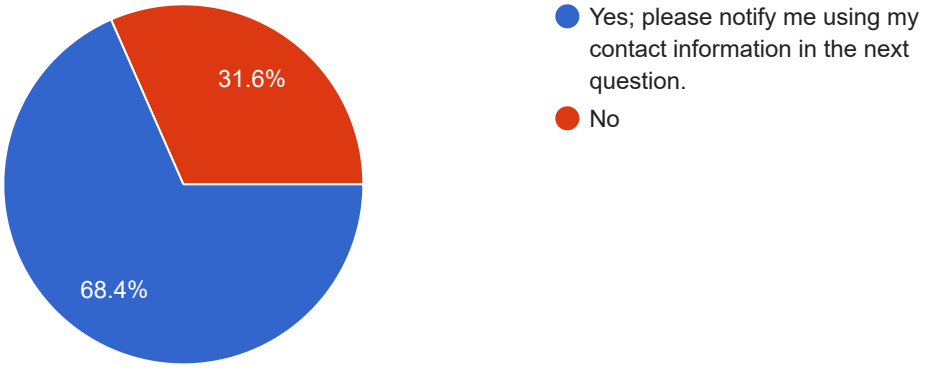
57 responses



Recommendations and Future Participation

Would you like to be contacted when the Draft 2021 Loma Linda Hazard Mitigation Plan is available for review?

57 responses



If you would like to be notified of future opportunities to participate in hazard mitigation and resiliency planning, please provide your name and e-mail address. If you do not have an e-mail address, please provide your mailing address. This information will be kept confidential.

57 responses

N/A

No

n/a

na

Kendallkm3@gmail.com

Cambria Boyer cboyer@llu.edu

Joe Bruno jbruno@llu.edu

ewills@llu.edu

No.

Please provide us with any additional comments/suggestions/questions that you have regarding your risk of future hazard events.

57 responses

N/A

n/a

None

NA

none

Thank you

Thanks for reaching out with this survey.

None.

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THE CITY OF LOMA LINDA

We are updating our Local Hazard Mitigation Plan

GET INVOLVED & PROVIDE YOUR INPUT

HTTPS://FORMS.GLE/XWRC2P3XXD5FVUZM6

VISIT OUR PROGRESS AT:

HTTPS://WWW.LOMALINDA-CA.GOV/OUR_CITY/DEPARTMENTS/COMMUNITY_DEVELOPMENT/HAZARD_MITIGATION_PLAN

The City of Loma Linda is preparing its Local Hazard Mitigation Plan!

What is an LHMP?

- Improves local resilience to hazards
- Funded through grant money from the Federal Emergency Management Agency (FEMA)
- Prepared by city staff
  - Support from key city stakeholders
  - Support from technical consultants
- Incorporates community member feedback
- Draft will be available for public review February 2021
- Final adoption in the spring 2021
  - Pending Cal OES approval
  - Pending FEMA approval

Follow our progress/Take the survey

What does an LHMP do?

- Summarizes our community's threats, such as –
  - drought, flooding, earthquakes, wildfires
- Identifies how climate change affects future hazards in the City
- Identifies how community members and assets are vulnerable to the threats of these hazards
- Outlines a strategy to aid in specific policy and action recommendations to City staff and community partners to improve resiliency to hazard events
- Includes steps on how to maintain and keep the plan updated and current

Why have an LHMP?

- Protect our community from current and future hazards
- Make Loma Linda eligible for more FEMA funding for additional hazard mitigation efforts (Robert T. Stafford Act and the Disaster Mitigation Act of 2000)
- Make Loma Linda eligible to receive disaster relief funding (California Government Code § 8685.9)

City of Loma Linda Hazard Mitigation Plan Announcement

The City of Loma Linda has begun preparation of a Local Hazard Mitigation Plan (LHMP), a five-year strategic plan to be better prepared for hazard events. Development of the plan, is being funded through a grant from the Federal Emergency Management Agency (FEMA). The plan is being prepared by City staff, with support from key stakeholders, and technical consultants. As part of the planning process the City will be seeking input from Loma Linda residents and businesses. Please check the City's website for future meetings, surveys, and online engagement opportunities.

https://www.lomalinda-ca.gov/our_city/departments/community_development/hazard_mitigation_plan

To take our survey, please use the following address:

https://forms.gle/XWrC2p3Xxd5FVuzm6

The plan will outline a Hazard Mitigation Strategy that will provide specific policy and action recommendations to City staff and community partners to improve how Loma Linda responds to hazard events. In addition to protecting Loma Linda from current and future hazards, having an LHMP will allow Loma Linda to be eligible for grants from FEMA , it will also make Loma Linda eligible to receive additional disaster relief funding from the State of California. Community participation is appreciated and is key to ensuring that the City's resident's concerns are heard and addressed. We look forward to hearing from you!