Hazard Mitigation Plan
City of Barstow, CA

Adoption Date: -- 2019 --

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Section 1 – Introduction

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 remain in compliance with regulations and Federal mitigation grant conditions. In that spirit, this Hazard Mitigation Plan (HMP) is an update of the City of Barstow approved by FEMA on September 2011. This HMP presents updated information regarding hazards being faced by the City of Barstow.

1.1 Your Jurisdiction

The City of Barstow is located within the County of San Bernardino, along Interstate 15. The City has 41.21 square miles in its incorporated boundaries, and a sphere of influence encompassing 197.97 square miles. 2016 census data list Barstow with a population of 23,916 residents.

1.2 Purpose of the Plan

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

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

After disasters, repairs and reconstruction are often completed in such a way as to simply restore to pre- disaster conditions. Such efforts expedite a return to normalcy; however, the restoring of things to pre- disaster conditions sometimes result in feeding the disaster cycle; damage, reconstruction, and repeated damage. Mitigation is one of the primary phases of emergency management specifically dedicated to breaking the cycle of damage. Hazard mitigation is distinguished from other disaster management functions by measures that make Barstow development and the natural environment safer and more disaster resilient. Mitigation generally involves alteration of physical environments, significantly reducing risks and vulnerability to hazards by altering the built environment so that life and property losses can be avoided or reduced.

Mitigation also makes it easier and less expensive to respond to and recover from disasters.

Also with an *approved* (and adopted) HMP, Barstow is eligible for federal disaster mitigation funds/grants (Hazard Mitigation Grant Program, Pre-Disaster Mitigation, and Flood Management Assistance) aimed to reduce and/or eliminate risk.

1.3 Authority

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

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 Community Profile

The section is to provide a broad perspective, brief history and describes the makeup and development of the community.

1.4.1. Physical Setting

The City of Barstow is located in the Mojave Desert of the County of San Bernardino, at an elevation of 2,175 feet. Barstow consists of square miles in its incorporated boundaries and a sphere of influence encompassing square miles. The City borders Interstate 15 to the north, Joshua Road to the east, the foothills of the San Bernardino Mountains to the south, and the Mojave River to the west.

Barstow is primarily desert-rural and consists of a typical mountain-and-basin topography with sparse vegetation. The natural geographic vulnerabilities are: Mojave River, San Bernardino Mountains, Dry Lake Bed, and the Desert Knolls area (generally an area with a slope greater than 15%).

Barstow experiences an average of 350 days of sunshine per year with summer temperatures ranging from 40 degrees Fahrenheit (F) to 110 degrees F., and winter temperatures dipping down to low 20 degrees F. to a high of 70 degrees F. Prevailing winds range from 5-20 knots/hour from the south/southwest to the northeast.

The Mojave River rises in the San Bernardino Mountains at the Lake Silverwood and Mojave River Forks Reservoirs. The River runs in an easterly direction the entire length of the City and then downstream past Barstow at the lower narrows as the river begins its way through Afton Canyon. Due to the porous soil and rapid evaporation, the River is primarily dry. A flow of water is present during major rains

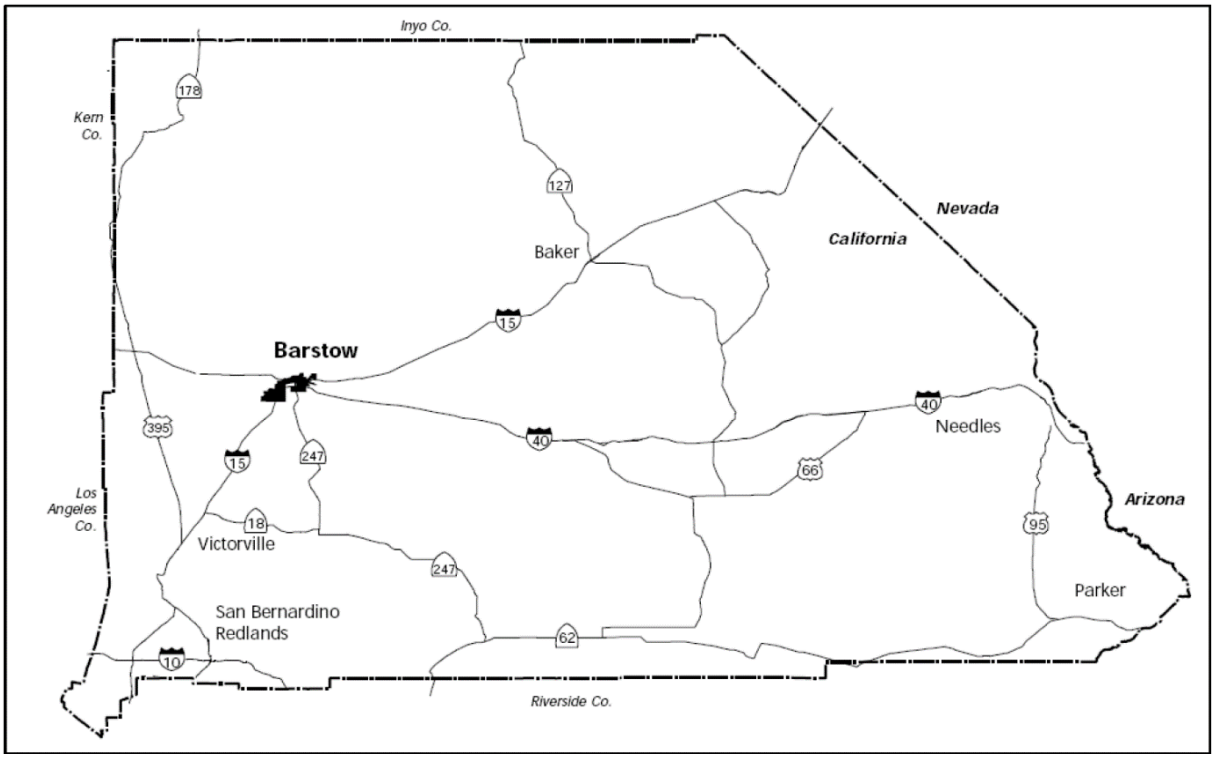


Figure 1-1; Regional Map
Source :www.Barstowca.org 2014

1.4.2 History

This section describes the development history for City Of Barstow.

More than 2,000 years ago, the Mojave Desert had been occupied by Indian tribes who lived beside the immense lakes that covered most of the Mojave. In the late 1800s, the Barstow area became a mining center. Daggett, 5 miles downriver, was founded in the 1860s. It was originally called Calico Junction but was renamed after California Lieutenant Governor John Daggett when silver was discovered 6 miles north in the Calico Mountains in 1882. The finding of silver in Calico and the building of the Southern Pacific Railroad from Mohave to Daggett in 1882 made the area a mining center. The famous 20-mule teams came into being when 10 teams were hitched together with two wagons and a water wagon to haul ore from Daggett to the City of Calico.

The Calico Railroad (later called the Daggett-Calico Railroad) started hauling ore from Calico to the Oro Grande Milling Company, across the river from Daggett in 1888. That same year, the Santa Fe Railroad arrived in City. The City was known as Waterman Junction until it was later named after the president of the Santa Fe, William Barstow Strong. The mine shut down in 1896 when all the silver had played out.

But in 1883, the borax rush hit Calico, and by 1902, three borax mines employing 200 men supported Daggett. It is estimated that borax taken from the Calico Hills amounted to more than $9 million, while more than $90 million in silver was removed. As the 20th century progressed, Calico and Daggett diminished while Barstow grew. It became a busy rail center and a jumping off place for immigrants entering the state on US Route 66, as made famous by John Steinbeck's novel "The Grapes of Wrath." Modern and historic facilities are still available along Barstow's Main Street, the original Route 66. Just off Main Street, at First Street, travelers can

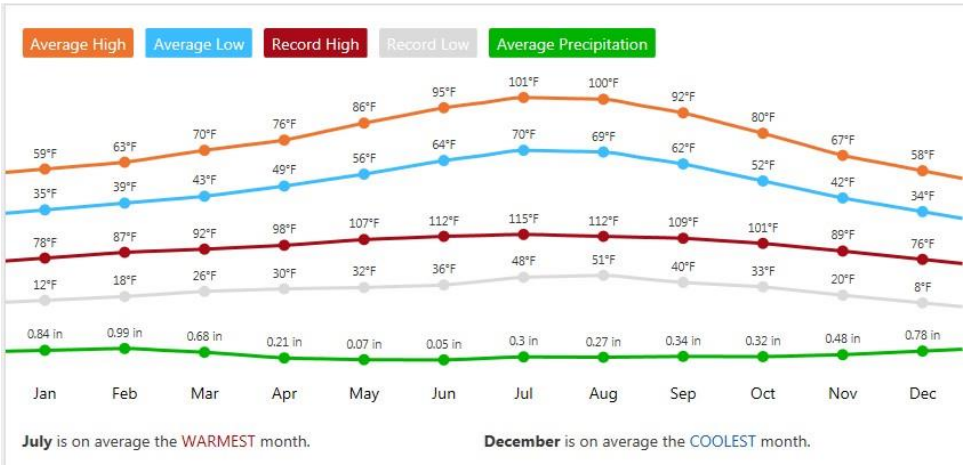
drive over an old iron bridge that leads to the railroad depot once the site of the historic Harvey House, originally opened in 1911.

With the construction of the modern Interstate Highway system Barstow's future of growth was assured, as I-40 and I-15 converged at the city limits with State Highway 58, making it the transportation hub of the western Mojave Desert.

1.4.3 Climate

The climate of Barstow is characterized by hot dry summers, mild winters and little rainfall. In summer, temperatures often reach above 100 degrees Fahrenheit (F). Winter temperatures are usually mildly cold but sometimes fall below 30ºF.

Figure 1-2; weather.com 2017



Precipitation generally occurs in mid to late winter months (December to February). Average total annual precipitation for the area averages 5.27 inches (in), with most rainfall occurring in January to February (usclimatedata.com 2017).

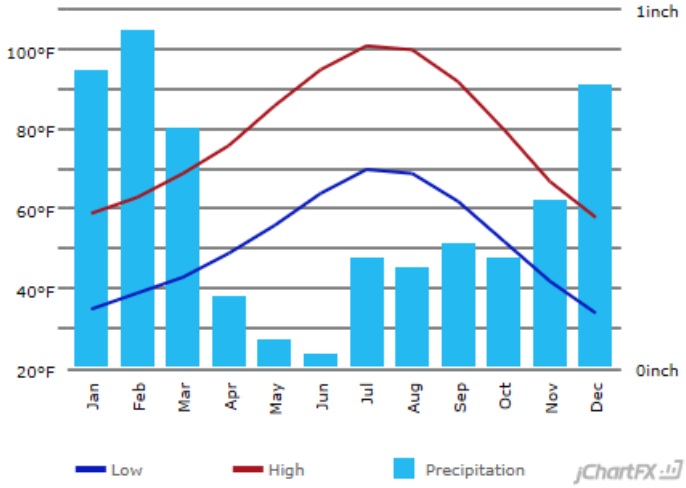


Figure 1-3 usclimatedata.com 2017

1.4.4 Demographics

San Bernardino County has been designated as a Coastal County within the State of California. The number of Americans residing in a coastal county passed the 159 million mark in 2010, making the coastal population larger than the entire U.S. population in 1950. Today, more than half of the U.S. population lives in a coastal area (as defined by the National Oceanic and Atmospheric Administration - NOAA), even though the 673 coastal counties constitute only about one fourth of the country's landmass.

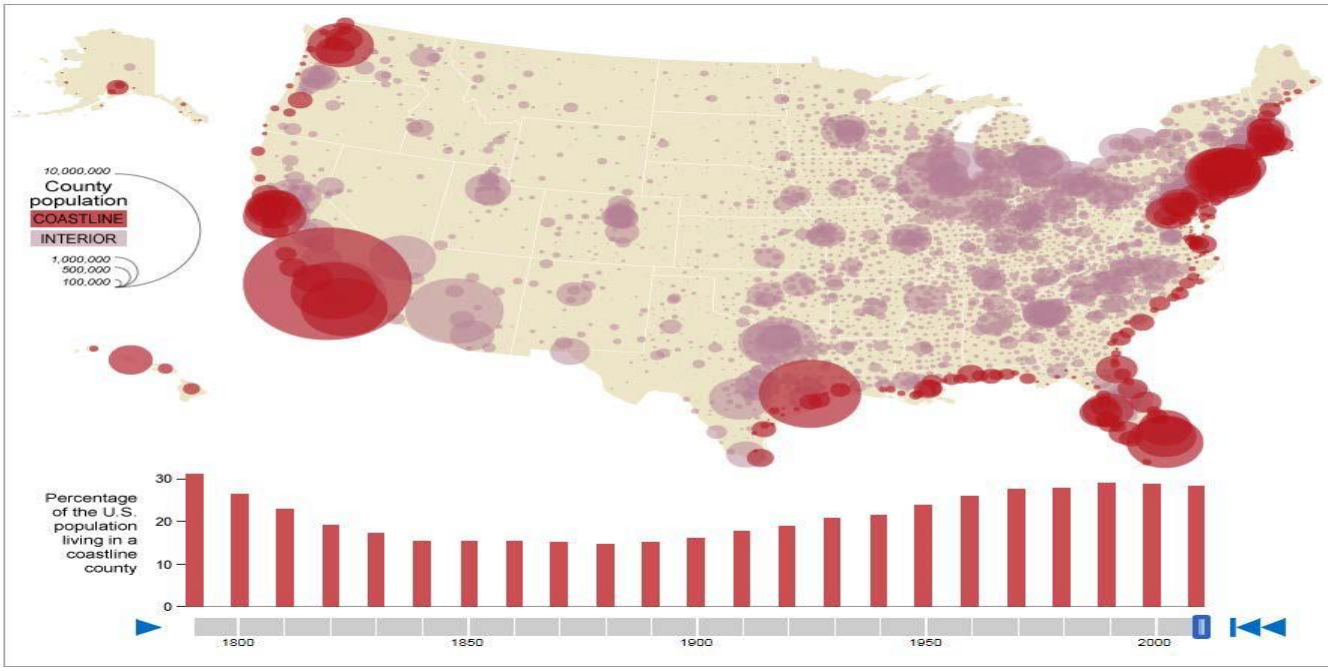


Figure 1-4 U.S. Census Bureau

As indicated by the map prepared by the U. S. Census Bureau, San Bernardino County is designated as a Coastal County within the State of California. Particular data exists demonstrating the effects of various types of risks within the county. It is important to use this information as a source point for evaluating the various risks that prevail not only in San Bernardino County, but the City of Barstow.

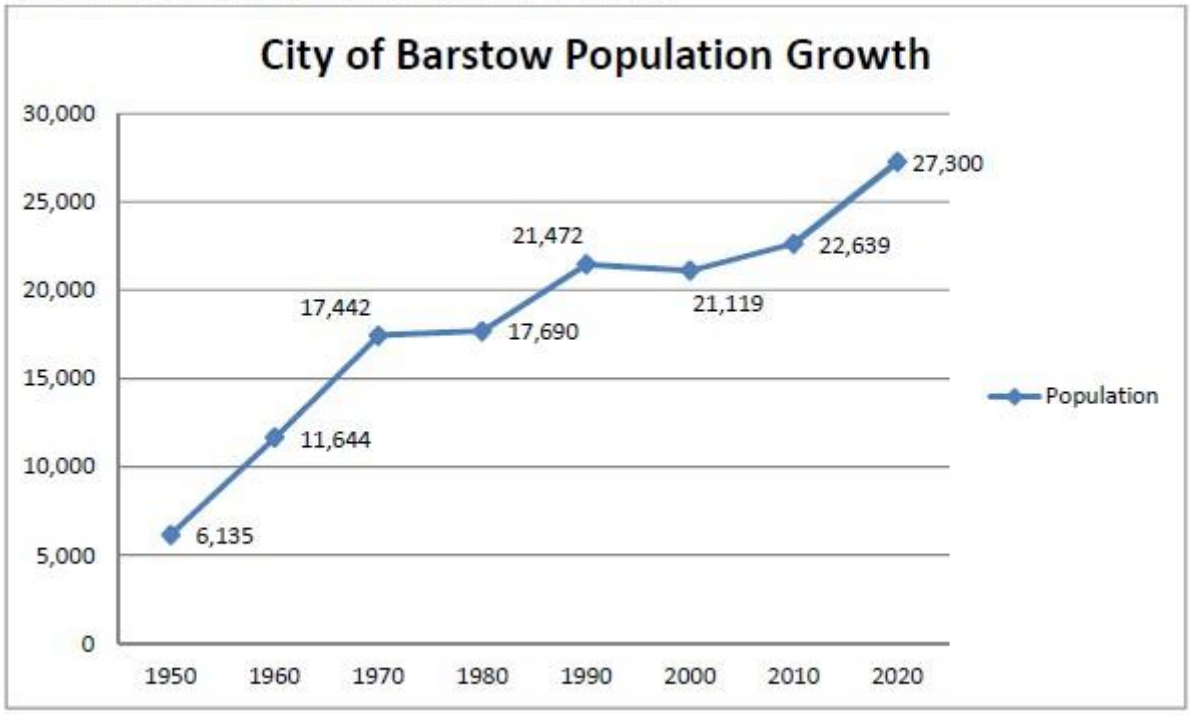
The growth in population of coastal areas illustrates the importance of emergency planning and preparedness for areas that are more susceptible to inclement weather conditions. The U.S. Census Bureau's official population estimates, along with annually updated socioeconomic data from the new American Community Survey, provide a detailed look at the nation's growing coastal population. Emergency planners and community leaders can better assess the needs of coastal populations using census data.
In 2010, the City of Barstow had a population of 22,639 and that population has increased to 23,835 in 2016, with a median age of 31.1 and an average household size of 2.75.

Table 1-1 U.S. Census Bureau

Demographic Overview	
Current Population	23,835
Current Regional Population	443,000
Avg. Household size	2.75
Median Age	31.1
Home Ownership	45.1%
Total Household	9,555

** Regional population estimate is based on a total of Victorville, Hesperia, Barstow, and Adelanto populations; unincorporated areas are not included in this estimate.*

Figure A-1: Barstow Population Growth, 1950-2020



Sources: U.S. Census (1950-2010) and SCAG 2012-2035 Regional Transportation Plan

Figure 1-5 U.S. City of Barstow General Plan

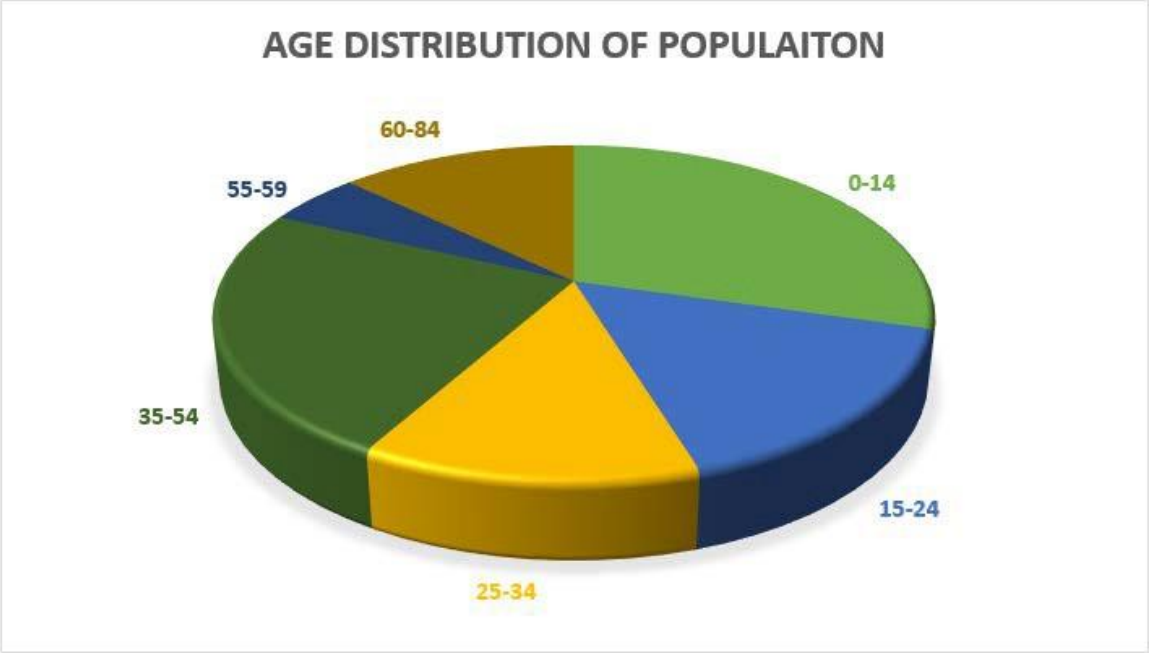


Figure 1-6 City of Barstow Demographics 2016 U.S. Census

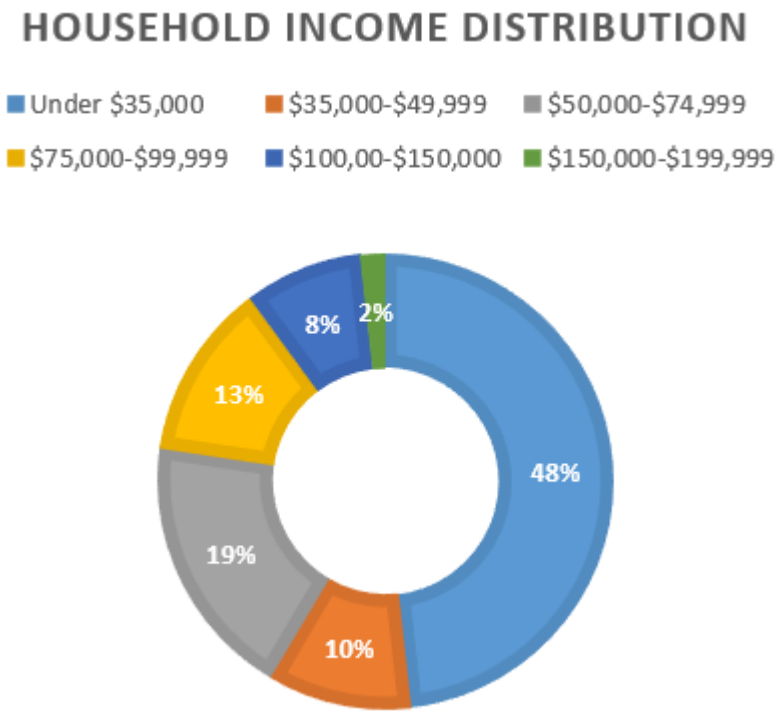


Figure 1-7 City of Barstow Demographics 2016 U.S. Census

Table 1-2 Income Level 2016 U.S. Census

Per Capita (2016)	Median Household (2016)	Average Household (2016)
$16,897	$37,085	$50,552

1.4.5 Existing Land Use

The Land Use Element establishes the vision of Barstow for its long-term development. The City has carefully reviewed development patterns and made modifications in order to better reflect changes in the city's development objectives and state land use and environmental quality guidelines and directives. This Element reflects the City's core values as enunciated in the General Plan Vision Statement. It focuses on the protection and enhancement of existing neighborhoods and the establishment of newly developed land uses designed to better serve existing residents, entice new residents to relocate to the community and provide a wider range of employment opportunities and commercial goods and services for inhabitants of Barstow and the surrounding area.

The legal framework for the Land Use Element is established in Government Code Section 65300 et. seq., which requires that all municipalities adopt land use plans for residential, commercial, industrial, open space and other uses for all lands within their boundaries. The Land Use Element affects all other Elements, but especially the Circulation Element, which is designed to assure that the City's land use pattern can be supported through an effective and efficient circulation system, as well as the Housing Element, which assures that adequate plans are made to accommodate residential opportunities for individuals and families across the household income spectrum. The Land Use Element also relates to all other elements, including Open Space and Conservation, which provides the basis for assuring that the City's environment remains conducive to healthy living on the part of its residents and that key resources such as air quality, biological diversity and open space continue to be protected and enhanced as the community develops.

The "horizon year", as described in the General Plan, is 2020; beyond the horizon year there is insufficient information to forecast in an informed manner the likely pattern, intensity and pace of future urban growth. Consequently, the population, housing, commercial and industrial growth estimates upon which this plan is based, as well as the environmental analysis that forms the basis of the Master Environmental Impact Report accompanying the General Plan are based upon development that analysis suggests is likely to occur by 2020. Between 2000 and 2010 population growth in Barstow occurred at a rate of approximately .7 percent annually; in the ensuing three years this growth rate remained essentially the same. For the remainder of the 2010 – 2020 decade (and for the purposes of the General Plan and Master EIR), population and housing growth are anticipated to occur at a 2.0 percent annual rate. The land use designations, goals and policies contained in this General Plan are intended to accommodate this level of projected future growth within the existing city boundaries, possibly augmented by lands that could potentially be annexed by 2020.

In addition to lands within the city boundaries and likely annexation areas, this plan contains designations for properties that fall outside the city but within its "Sphere of Influence". Under State law, Barstow's Sphere of Influence has been established by the San Bernardino County Local Agency Formation Commission (LAFCo). The Sphere of Influence defines the probable ultimate boundaries of the City at "build out", i.e. the point at which the City has grown to its maximum population capacity. In light of Barstow's historically low rate of population growth, the vast amount of

unincorporated land included in the city's Sphere of Influence (more than twice the acreage that falls within the current city limits) and the high cost of connecting most of these lands to the city's water and sewer infrastructure, most of the lands that fall outside of the city limits and beyond the properties likely to be annexed by 2020 are highly unlikely to be developed within the time frame encompassed by this General Plan. These lands have, therefore, been assigned an Interim Open Space/Resource Conservation land use designation. Over time, as the General Plan is subsequently revised and the viability of these lands as sites for development increases, it is intended that lands within this interim designation will ultimately be designated and developed for urban land uses. This approach to land use planning assures that the city's development occurs in a manner that is both economically and environmentally viable and sustainable.

Estate Residential (RE; 1 dwelling unit per 2.5+ acres)

This land use designation allows detached single family homes on lots of at least two and one-half gross acres. Adequate water supply must be provided for domestic and fire protection needs, as approved by the City Engineer. With regard to sewage disposal, individual septic tanks are subject to adequate leach fields and acceptable percolation tests as determined by the City Engineer and congruent with standards established by the Lahontan Regional Water Quality Control Board (RWQCB). Upon annexation to the City trunk line sewer facilities must be provided to serve the subdivision/development Streets shall consist of 28-feet minimum paving width, asphalt curb and drainage improvements as specified by the City Engineer. Pedestrian and/or bicycle pathways should be integrated into all new projects in this designation that are located along pedestrian and/or bicycle routes identified in the Circulation Element.

Low-Density Residential (LDR: 1 dwelling unit per 1 – 2.49 acres)

This designation allows detached single family homes on lots of between one and 2.49 gross acres. Adequate water supply must be provided for domestic and fire protection needs, as approved by the City engineer. Upon annexation to the City trunk line sewer facilities must be provided to serve the subdivision/development. Streets shall consist of 28-feet minimum paving width, with curbs and drainage improvements as specified by the City Engineer. Pedestrian and/or bicycle pathways should be integrated into all new projects in this designation that are located along pedestrian and/or bicycle routes identified in the Circulation element.

Single-Family Residential (SFR; maximum 7 dwelling units per acre)

This designation allows detached or semi-detached single-family homes on lots varying in size not to exceed a gross density of 7 dwelling units per acre. City sewer, water and street standards shall be established or maintained on lands so designated. Pedestrian and/or bicycle pathways should be integrated into all new projects in this designation that are located along pedestrian and/or bicycle routes identified in the Circulation element.

Medium-Density Residential (MDR; maximum 20 dwelling units per acre)

This designation has been assigned to multi-family developments and areas of potential multi-family development located within and adjacent to the City's developed core. The designation accommodates a variety of housing types, including duplexes, triplexes, apartments, garden-style units and Cityhouses. City sewer, water and street standards shall be established or maintained on lands so designated. Pedestrian and/or bicycle pathways should be integrated

into all new projects in this designation that are located along pedestrian and/or bicycle routes identified in the Circulation element.

Diverse-Use (16 dwelling units/acre residential; 50% lot coverage, 35' max height commercial)

This designation provides for diversity of compatible and mutually beneficial commercial and residential uses (such as housing, retail stores or offices) on a given parcel or combination of parcels. The designation is intended to encourage development featuring convenient linkages between commercial and residential uses that provides a buffer between major public or industrial areas or highways and lower density residential land uses. Additional benefits of the Diverse-Use designation include mitigation of traffic and air quality impacts associated with urban development.

DownCity Business and Cultural District (R66; limited diverse use)

This designation is intended to encourage the establishment and maintenance of tourist-oriented uses, such as museums, souvenir shops, bed and breakfast establishments, cafes and hotels, while discouraging uses that are less conducive to the promotion of tourism. The range of allowable land uses within this designation, consequently, is more restrictive than those allowed within the General Commercial land use classification.

General Commercial (GC; 50% lot coverage; 35' maximum building height)

The Barstow General Plan includes a single land use designation for commercial land uses in order to maximize the flexibility accorded to property owners and developers in terms of the types of commercial land uses allowed on lands so designated. While it is recognized that some commercial centers are likely to serve primary local, neighborhood-based customers and others may be geared toward highway travelers, all of these uses can be accommodated within the General Commercial land use designation. Administrative uses such as offices are also allowable within the GC land use designation, rather than limiting such uses to lands designated exclusively for office use.

General Industrial (GI; 50% lot coverage, 45 foot maximum building height)

The industrial designation allows for a variety of activities ranging from manufacturing, warehousing and distribution to industrial plants. As is the case for commercial uses, the General Plan includes a single land use designation for all types of industrial uses, employing the Conditional Use Permit process to ensure compatibility with adjacent uses.
Public/Quasi Public (P/QP; 50% lot coverage, 35 foot maximum building height)
This designation includes a range of public facility, service and utility functions, including schools, government offices, libraries, parks, utilities and transportation easements.

Open Space/Conservation (OS/C)

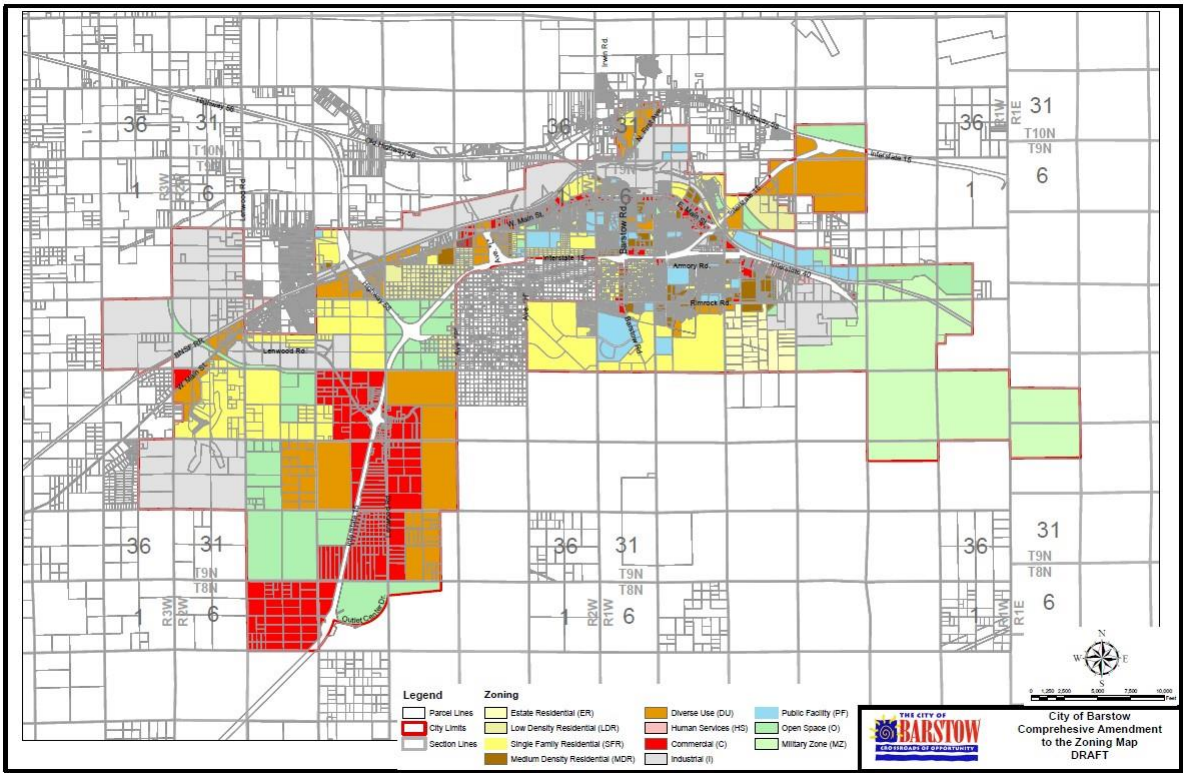
This designation applies to lands with high environmental resource value, such as habitat for threatened or endangered species, scenic vistas or archaeological significance. The majority of these lands fall under public (e.g. BLM) or quasi-public (e.g. PG&E) ownership.

Interim Open Space/Resource Conservation (IOS/RC)

Lands within the city's Sphere of Influence that are not expected to be developed within the time frame of the current General Plan (2015 – 2020) due to cost constraints associated with the expansion of city infrastructure have been assigned this interim designation. It is anticipated that subsequent revisions to the General Plan will result in gradual, planned conversion of these lands to urban uses at such time as is warranted by market demand and economic viability.

Exhibit L-1 (General Plan Land Use Diagram) illustrates the distribution of land use designations within Barstow's city limits and sphere of influence. Table L-1 provides an estimate of acreage within each land use designation.

Geographically speaking, the pattern of future development in Barstow will be to the south and southwest



1.5 Development Trends

No major developments have occurred in the City or in the unincorporated areas since the 2011 HMP was adopted. The limited development that did occur was scattered throughout the area with no one area being singled out. Existing and current development is in accordance with the Land Use Zones and complies with all Fire, Flood and Seismic codes of the City, County and State. This includes commercial, industrial and residential developments.

The City is optimistic about the potential for future development. The High Desert area of San Bernardino County is one of the best places in the world for solar energy development because of its high altitude, the number of sunny days each year, and existing power infrastructure.

- Many large solar energy projects are being proposed on the Bureau of Land Management (BLM) property located in the High Desert. BLM has received right-of-way requests encompassing more than 300,000 acres for the development of approximately 34 large solar thermal power plants generating approximately 24,000 megawatts. These projects have not submitted an Application for Certification (AFC) with the California Energy Commission at the time of this writing.

When these projects come to fruition, they will not affect the area to a great extent. Minimal staffing is required to operate these types' facilities and their very nature places them in remote locations of the County.

The County has also started development of a bullet train. The bullet train will connect Victorville, CA and Las Vegas, NV generally following the I-15 corridor (NOTE: There are discussions of additional bullet trains connecting San Bernardino to Los Angeles, San Diego, San Bernardino County and San Francisco/Sacramento).

While not all of these development trends may be recognized over the next five (5) years, all future development will be planned in accordance with the Barstow General Plan Land Use Zones that identifies potential hazards within individual site plan submissions. Additionally, all development will comply with the Fire, Flood and Seismic Codes of the County of San Bernardino and the State of California at the time of development.

Section 2 – Plan Adoption

2.1 Adoption by local governing body

A (draft) Resolution of the City of Barstow, California, adopting the Local Hazard Mitigation Plan as required by the Disaster Mitigation Act of 2000 is included in this Plan (located before the Table of Contents). Upon receipt of an "approvable pending adoption" status from FEMA, the City will formally adopt the Resolution and forward adopting documentation to FEMA.

2.2 Promulgation Authority Information

This Hazard Mitigation Plan was reviewed and approved by the following Promulgation Authorities:

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2.3 Primary Point of Contact

The Point of Contact for information regarding this plan is:

Jamie Williams
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Section 3 - Planning Process

The planning process for the City's Hazard Mitigation Plan included the creation of a Planning Team representing various agencies and organizations whose input was vital to the plan. The Planning Team reviewed, analyzed, revised, and updated each Section within this Plan as required. Pursuant to Section 4(F) of the Crosswalk, the process used to review and analyze each Section is included within that Section.

3.1. Preparing for the Plan.

Hazard Mitigation Planning is a process State, Tribal, and local governments use to identify risks and vulnerabilities associated with natural disasters, and to develop long-term strategies for protecting people and property from future hazard events. Planning creates a way to solicit and consider input from diverse interests. Involving stakeholders is essential to building community-wide support for the plan. In addition to emergency managers, the planning process involves other government agencies (e.g., zoning, floodplain management, public works, community, and economic development, businesses, civic groups, environmental groups, and schools.

San Bernardino County Fire OES hired a contractor (Dynamic Planning + Science) to offer support to the Cities/City, and Special Districts to update the 55 local HMP's. The DPS Team offers experienced, field-tested Hazard Mitigation and planning professionals who have developed similar comprehensive HMPs. This support includes providing technical expertise, resource material and tools to ensure that the updates are in compliance with federal requirements of the program. The tools, resource material, and other project related information are being maintained on a project portal (https:www.mitigatehazards.com) to ensure the consistent information is available to all participants.

Additionally, it was concluded that the Plan will include information and data supplied by supporting local agencies as listed in Section 3.2 "Coordination with Other Jurisdictions, Agencies, and Organizations", and 3.3 "Public Involvement", of this Plan, along with internet surveys published on the City's website, public comments received during community-wide events, discussions during quarterly Disaster Council meetings and other sources developed through discussions during Planning Team meetings.

Drafting the Hazard Mitigation Plan was accomplished in 8 Phases:

- Phase 1 – Establish the Planning Team
- Phase 2 – Coordination with Other Jurisdictions, Agencies, and Organizations
- Phase 3 – Public Involvement
- Phase 4 – Assess the Hazards
- Phase 5 – Set Goals
- Phase 6 – Review and Propose Possible Mitigation Measures
- Phase 7 – Draft the Hazard Mitigation Plan
- Phase 8 – Adopt the Plan

The public was invited to a meeting held on April 17 2017. At this meeting the team discussed each section of the plan and referenced the sections for revising of the information. There were several other attempts to solicit public input with little attendance or input from the community.

During the planning process, representatives of the team talked to representatives from the neighboring communities, including Barstow, Hesperia, and Victorville. We shared ideas and about the hazards of each community.

The Planning team reviewed technical information on each of the hazards identified and incorporated the information into the plan update.

3.1.1 Building The Planning Team

To complete these objectives, the City compiled a qualified team with various expertise, including public safety, engineering and public works, water infrastructure, and emergency response agencies to participate in, and guide the development of the City's comprehensive Hazard Mitigation Plan. In addition, Barstow solicited public involvement throughout the planning process, including the release of a public survey through the City's website, allowing the public to comment during the drafting stage, and making the draft Plan available to allow the public to comment on its content. The Planning Team agreed that the updated plan will conform to the requirements of 44 CFR Section 201.6 and will include a description and documentation of:

- Why the update is necessary and how the update will build on the existing approved mitigation plan.
- The process and data deficiencies/limitations that will be addressed.
- The participatory planning process used to develop the plan to include how each section was reviewed and analyzed and how/why the decision was made to modify (or not) specific areas in the plan.
- The opportunities provided for public participation, modified as necessary, based on previous experience.
- The contribution from other stakeholders.
- The new/additional research conducted and data included in the plan.
- The modified risk assessment based on latest best available data.
- The prioritized mitigation action plan.
- The progress made in local mitigation efforts.
- The plan maintenance process to include: an evaluation of what was supposed to happen verses what happened; a discussion of how the community was involved in the plan maintenance process; and a discussion of how the mitigation plan was incorporated into other planning mechanisms, and what worked/did not work.

Leadership, management and oversight for the plan development process were provided through the City's Planning Team. The Planning Team was led by the Emergency Services Officer. Team members were selected based on current emergency management responsibilities and familiarity with prior mitigation planning and programs.

This Hazard Mitigation Plan was compiled and authored by members of the following Planning Team:

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Fire Chief

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3.2 Coordination with other Jurisdictions, Agencies, and Organizations

The City of Barstow Planning Team consulted members from adjacent jurisdictions as well as the County of San Bernardino. Email invites were provided to each neighboring jurisdiction/agency starting with the kick-off meeting in August 2016 (See Appendix B.2).

Table 3-3 Coordination with other Jurisdictions, Agencies, and Organizations

Agency	Representative	Title/Position
Barstow Unified School District	Deidre Burchman	Risk Manager
American Red Cross	Don Gordon	Disaster Program Manager
Cal Office of Emergency Services		HMP Division
City of Hesperia	Rachel Molina	Assistant to City Manager
City of Victorville	Dana Welborn	Emergency Services Officer
County of San Bernardino	Miles Wagner	Emergency Services Officer
Disaster Service Workers	Mark Yosten	ECS
FEMA		Region IX HMP Division
Liberty Utilities (Water)	Kevin Phillips	Manager
National Weather Service	Alex Tardy	Manager-Meteorologist
St. Joseph/St. Mary Medical (Hospital)	Shannon Welsh	Executive Director
Southern California Edison	Bob Stiens	Gov. Affairs Rep.
Southwest Gas Company	Bill Hensley	Executive Officer
Victor Valley Transit Authority	Christine Plasting	Senior Procurement Specialist

In addition, the City of Barstow participated in the San Bernardino County Fire Department Office of Emergency Services (OES) Stakeholder meetings noted in Table 3-4. San Bernardino County Fire OES hired a contractor (Dynamic Planning) to support the County, Cities and City, and Special Districts to update the local Hazard Mitigation Plans and the County's HMP. The Dynamic Planning Team, offered experienced, field-tested Hazard Mitigation and planning professionals who have developed similar comprehensive Hazard Mitigation Plans. This support included providing technical expertise, resource material and tools to help ensure that the updates are in compliance with federal requirements of the program.

Table 3-4 Stakeholder meetings

Date	Item	Location
06/23/2016	Stakeholders Kickoff Meeting #1	SBC OES
10/26/2016	Stakeholders Update Meeting #2	SBC OES
12/15/2016	Stakeholders Update Meeting #3	SBC OES
2/14/2017	Stakeholders Update Meeting #4	Virtual Meeting
3/28/2017	Stakeholders Update Meeting #5	SBC OES

3.3 Public Involvement/ Outreach

The City of Barstow undertook a number of methods to inform the public of the effort to solicit their input on the Hazard Mitigation Plan and efforts of the City involving mitigation and emergency preparedness. On an ongoing basis, the City participates in public events and meetings to inform and solicit feedback regarding emergency preparedness and mitigation from the public.

Public outreach efforts included the creation of a survey for all City residents including those who work but do not live in the City. A total of 20 citizens participated in the survey. Other public outreach efforts included discussion on items during the CERT monthly meeting on March 30, 2018 and a presentation was given at the April 16, 2018 City Council meeting.

3.3.1 Mitigation Survey

The Planning Team developed a web-based hazard mitigation survey to identify and plan for future disasters. The survey was designed to help the Planning Team determine the level of knowledge local citizens already have about potential disasters and assess areas of vulnerability to various types of disasters. The survey was available to the public starting on March 22, 2017 and concluded on July 17, 2017. Citizens have provided input about their concerns about each hazard, what they are doing to prepare for and to mitigate high-risk hazards and what activities the City should engage to prepare for, mitigate, and respond to the highest risk hazards.

3.3.2 Web Posting

The survey mentioned above was posted on the City of Barstow's website along with social media postings allowing the public to access the site through https://www.surveymonkey.com/r/ZDGF3YJ. The public was invited to submit comments on the Hazard Mitigation Plan Update and to attend the April 16, 2018 Joint City Council/Fire Board Meeting where the update was discussed.

3.3.3 Public Meeting Process

The City continues to hold public meetings and provides notice of these meetings through posted Agendas and through the City's web site (www.Barstowca.org). Prior to the submission of the draft Hazard Mitigation Plan, the item will be placed on the agenda for a public hearing and posted for public review on the City's web site. The Planning Team will determine how public comments, if offered, would be included in the draft plan prior to final adoption.

3.4 Assess the Hazard

Data collection and document review are important first steps in the identification and screening of hazards. The Planning Team identified new or emerging hazards, obtained updated hazard maps, hazard probability research studies and reports, reviewed data from new or updated local plans (i.e. safety element of the General Plan, threat assessments, disaster planning scenarios, etc.) and obtained information about emergencies or disasters that have occurred since the 2011 Hazard Mitigation Plan to provide insights into which parts of the risk assessment warrants updates.

The first step in this process was to identify which natural hazards are present in the community, augmenting the 2011 Hazard Mitigation Plan as necessary. The intent of screening of hazards is to help prioritize which hazard creates the greatest concern in the community. This step had the planning team review a total of sixteen hazards via the FEMA Hazard Summary Sheet (See Appendix D.1, D.2). The Hazard Summary Sheet was used to summarize hazard description information and identify which hazards are most significant to the City. We considered those hazards that ranked medium to high into Step 2. We also included Climate Change since it is a requirement. The summary sheet includes classifications for location and maximum probable extent.

The second step had the planning team review a total of six hazards- wildfire, flood, earthquake, erosion, flooding and climate change. These six hazards were put through Dynamic Planning + Science Risk Factor (RF) Approach. The RF approach combines historical data, local knowledge, and consensus

Opinions to produce numerical values that allow identified hazards to be ranked against one another. These criteria are used to evaluate hazards and identify the highest risk hazard in the project region. Additional information regarding these steps are discussed in further detail in Section 4.1.

Table 3-5 RF Approach

Rank	Natural Hazards	Probability (1-4)	Factor1 = (Probability Index * .30)	Impact (1-4)	Factor2 = (Impact Index * .30)	Spatial Extent (1-4)	Factor3 = (Spatial Extent Index * .20)	Warning Time (1-4)	Factor4 = (Warning Time Index * .10)	Duration (1-4)	Factor5 = (Probability Index * .10)	RF Factor Total = (Add Factors 1-5)
1	Hazard 1		0		0		0		0		0	0
2	Hazard 2		0		0		0		0		0	0
3	Hazard 3		0		0		0		0		0	0
4	Hazard 4		0		0		0		0		0	0
5	Hazard 5		0		0		0		0		0	0
6	Hazard 6		0		0		0		0		0	0

3.5 Goal Setting

Project and community hazard mitigation goals and objectives for the City of Barstow were set by the Planning Team to guide the development of the Plan using FEMA National Mitigation Strategies and Goals to substantially increase public awareness of natural hazard risks so that the public demands safer communities in which to live and work; and to significantly reduce the risk of loss of life, injuries, economic costs, and destruction of natural and cultural resources that result from natural hazards.

As part of this process, the Planning Team also reviewed the County of San Bernardino's Operational MJHMP, the State of California MJHMP, Floodplain Management Plans, and adjacent local jurisdiction MJHMPs to ensure the Goals and Objectives were comprehensive and compatible.

3.6 Review and Propose Mitigation Measures

A wide variety of mitigation measures that can be identified to help reduce the impact of the hazards or the severity of damage from hazards was examined. The projects were identified to help ensure the implementation of the Planning Team's goals and objectives. The following categories were used in the review of possible mitigation measures:

1. Public Information and Education- Outreach projects and technical assistance.
2. Preventive Activities- Zoning, building codes, storm water ordinances
3. Structural Projects- Detention basins, reservoirs, road and bridge improvements
4. Property Protection- Acquisition, retrofitting
5. Emergency Services- Warning, sandbagging, road signs/closures, evacuation
6. Natural Resource Protection: Wetlands, protection, best management practices.

Once the projects were identified, the Planning Team utilized the STAPLEE methodology to assess and prioritize the projects.

STAPLEE stands for the following:

- **Social:** Social criteria are based on the idea that community consensus is a necessary precondition for successful implementation of mitigation measures (i.e., measures should be supported and accepted by the entire community). This also means that measures should not affect adversely a particular segment of the population or a particular neighborhood, or adversely impact local cultural values or resources.
- **Technical**: Technical criteria address the technical feasibility of the proposed measures, in terms of effectiveness, secondary impacts, and the technical capabilities of the community to implement and sustain these measures.

- **Administrative:** Administrative criteria address the administrative capabilities required to implement each mitigation measure. For example, does the City have the necessary organization, staff, and funding sources to implement and sustain the mitigation process?
- **Political:** Political criteria consider the need for political support for mitigation measures. This means that all stakeholders in the political process, especially political organizations and institutions both inside and outside of the community, should support the measure.
- **Legal:** Legal criteria are used to determine the appropriate legal authority necessary to implement each mitigation measure and whether such an authority can be delegated. The mitigation measure is examined from the standpoint of current statutes, codes, ordinances, and other regulations, as well as the possible legal ramifications of the measure's implementation.
- **Economic:** Economic criteria address the cost-effectiveness of the proposed measure and its economic impact on the community. It is only reasonable to expect that the benefits of implementation will exceed the costs incurred. Economic considerations also consider the economic impact on the community's future development.
- **Environmental:** Environmental criteria have become an important consideration in examining mitigation options. Although most mitigation measures are usually beneficial for the environment, some measures may have adverse effects, which must be considered and addressed.

3.7 Draft the Hazard Mitigation Plan

The Hazard Mitigation Plan Update was drafted by the Planning Team. As indicated previously, the Planning Team used the 2011 HMP as a starting point but revised it to reflect updated information. The Planning Team also used the FEMA Guidance and materials provided to aide in the Planning Team's understanding of the level of detail and type of information that is excepted in each section.
The development of actions and projects to meet the goals and objectives identified in the HMP is based on the City's abilities under state law; zoning, health regulations and financial resources available to reduce losses and vulnerability from potential hazards. The HMP's goals and objectives are long-term and support the City's mitigation strategy.

Following the identification of goals and objectives, the mitigation planning regulation 44 CFR 201 requires the City to identify, analyze and prioritize alternative actions by hazard types. Federal guidance for the HMP recommends that the City develop objectives/actions that can be implemented using local tools, such as, capital improvement projects, special district funds, or executing changes by adopting laws, policies, or procedures. HMP requirements recommend the consideration of mitigation actions that may are not currently feasible, but may be possible following a catastrophe event.

The City is required, after five years of implementing mitigation strategies, to update goals and actions. In all HMP updates, the goals and objectives may be reaffirmed or updated based on current conditions, including the completion of mitigation proposals, an updated risk assessment. At five-year intervals, the City is required to review any changes of approved HMP to determine whether goals were met or if they remain consistent with current conditions.
While some Planning Team members were responsible for updating select sections, all members are responsible for reviewing and commenting on the entire HMP. The Planning Team Project Manager was responsible for version control and distribution of the final HMP for review.

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

3.8 Adopt the Plan

After the public review, the draft plan will be submitted to Cal OES/FEMA for review and approval. FEMA will provide the City with an "Approval Pending Adoption" letter if the Hazard Mitigation Plan update meets all federal requirements. Upon receipt of this letter, the final plan will be submitted to the City Council for consideration and adoption. Once adopted, the final Resolution will be submitted to FEMA for incorporation into the Hazard Mitigation Plan.

The City of Barstow's adoption of the Hazard Mitigation Plan is only the beginning of this effort. City offices, other agencies, and private partners will implement the Hazard Mitigation Plan activities. The Plan will be submitted and updated to FEMA every five years, which is required by FEMA in order to remain eligible for post-disaster mitigation funding.

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Section 4 - Risk Assessment

The risk assessment is the process of measuring the potential impact to life, property and economic impact resulting from natural hazards. The intent of the Risk Assessment is to identify, as much as practicable given existing/available data, the qualitative and quantitative vulnerabilities of a community. The results of the risk assessment allow for a better understanding of the impacts of natural hazards to the community and provides a foundation in which to develop and prioritize mitigation actions to reduce damage from natural disasters through increased preparedness and response times and 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 population. It identifies the characteristics and potential consequences of hazards, how much of the City of Barstow could be affected by a hazard, and the impact on City area assets. The Risk Assessment approach consists of three (3) components:

- Hazard Identification – Identification and screening of hazards (Section 4.1)
- Hazard Profiles – Review of historic occurrences and assessment of the potential for future events (Section 4.2)
- Vulnerability Assessment – Determination of potential losses or impacts to buildings, infrastructure and population (Section 4.3)

4.1 Hazard Identification

Per FEMA Guidance, the first step in developing the Risk Assessment is identifying the hazards. The City's HMP Planning Team reviewed a number of 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.

The planning team used the below Table 4-1 which provides a list of hazards identified in the 2010 San Bernardino County Multijurisdictional Hazard Mitigation Plan Update, the County of San Bernardino 2007 General Plan Safety Element, Barstow's 2011 Hazard Mitigation Plan and the 2013 CA State Hazard Mitigation Plan. This table was used to develop a preliminary list of fifteen hazards for the City's HMP Planning Team to evaluate which hazards were truly relevant to the City and which ones are not. For example, expansive soils was considered to be of little relevance, while earthquake, flooding, and wildfire were indicated in almost all hazard documentation.

Table 4-1 SBC & COB hazard Identification

Hazards	2010 San Bernardino County Multijurisdictional Hazard Mitigation Plan Update	County of San Bernardino 2007 General Plan Safety Element	Barstow 2011 Hazard Mitigation PLan	2013 CA State Hazard Mitigation Plan
Climate Change				■
Dam Inundation			■	■
Drought	■		■	■
Earthquake/ Geologic Hazards	■	■	■	■
Erosion				■
Expansive Soils				■
Extreme Cold				■
Extreme Heat	■		■	■
Flood	■	■	■	■
Hazardous Waste		■		■
High Winds/ Straight Line Winds	■	■	■	
Lightning	■			
Terrorism				■
Wildfire	■	■	■	■
Winter Storm (Heavy Snowfall)			■	■

In addition to a document review, previous hazard occurrences were used to identify hazards for this plan. Previous hazard occurrences provide a historical view of hazards that have affected the City in the past, and thus provide a window into the potential hazards that can affect our community in the future. Information about federal and state disaster declarations in San Bernardino County (declarations are declared by County) was compiled from FEMA and Cal EMA's databases, as shown in Table 4-2. Though not a complete snapshot of hazard incidences in the County (since not all hazard events are federally or state declared), Table 4-2 provided the City's HMP Planning Team with solidified accounts of the types and extent of disasters that have affected the County dating back to 1965 when flooding affected entire regions of San Bernardino County.

As indicated in the below table large regional incidents have affected San Bernardino County, including the California Wildfires of 1999. Most recently, disasters for terrorist attacks (2015), flood (2011) and severe storms (2010) were declared in San Bernardino County. The disaster declarations in Table 4-2, provide a baseline for consideration in the hazard prioritization process.

Table 4- 2 Federal and State Declared Disasters

Disaster Number	Declaration Date	Disaster Type	Incident Type	Title
Federal Declarations				
Major Disaster Declarations				
1952	1/26/2011	DR	Flood	Severe Winter Storms, Flooding, and Debris and Mud Flows
1884	3/8/2010	DR	Severe Storm(s)	Severe Winter Storms, Flooding, and Debris and Mud Flows
1731	10/24/2007	DR	Fire	Wildfires, Flooding, Mud Flows, and Debris Flows
1689	3/13/2007	DR	Freezing	Severe Freeze
1585	4/14/2005	DR	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mud and Debris Flows
1577	2/4/2005	DR	Severe Storm(s)	Severe Storms, Flooding, Debris Flows, and Mudslides
1498	10/27/2003	DR	Fire	Wildfires, Flooding, Mudflow and Debris Flow Directly
1203	2/9/1998	DR	Severe Storm(s)	Severe Winter Storms and Flooding
1046	3/12/1995	DR	Severe Storm(s)	Severe Winter Storms, Flooding Landslides, Mud Flow
1044	1/10/1995	DR	Severe Storm(s)	Severe Winter Storms, Flooding, Landslides, Mud Flows
1005	10/28/1993	DR	Fire	Fires, Mud/Landslides, Flooding, Soil Erosion
979	2/3/1993	DR	Flood	Severe Winter Storm, Mud & Land Slides, & Flooding
947	7/2/1992	DR	Earthquake	Earthquake & Aftershocks
935	2/25/1992	DR	Flood	Rain/Snow/Wind Storms, Flooding, Mudslides
894	2/11/1991	DR	Freezing	Severe Freeze
872	6/30/1990	DR	Fire	Fires
690	9/22/1983	DR	Flood	Flash Flooding
687	7/1/1983	DR	Flood	Flooding
677	2/9/1983	DR	Coastal Storm	Coastal Storms, Floods, Slides & Tornadoes
635	11/27/1980	DR	Fire	Brush & Timber Fires
615	2/21/1980	DR	Flood	Severe Storms, Mudslides & Flooding
547	2/15/1978	DR	Flood	Coastal Storms, Mudslides & Flooding
521	9/21/1976	DR	Flood	Flooding, Tropical Storm Kathleen
295	9/29/1970	DR	Fire	Forest & Brush Fires
253	1/26/1969	DR	Flood	Severe Storms & Flooding
223	1/2/1967	DR	Flood	Severe Storms & Flooding
211	12/7/1965	DR	Flood	Heavy Rains & Flooding
145	2/25/1963	DR	Flood	California Severe Storms, Heavy Rains, & Flooding
47	12/23/1955	DR	Flood	California Flood
15	2/5/1954	DR	Flood	California Flood & Erosion

Disaster Number	Declaration Date	Disaster Type	Incident Type	Title
Fire Management Assistance Declarations				
5147	8/16/2016	FM	Fire	Blue Cut Fire
5144	8/7/2016	FM	Fire	Pilot Fire
5089	7/17/2015	FM	Fire	North Fire/ Pine Fire
2955	9/2/2011	FM	Fire	Hill Fire
2841	10/4/2009	FM	Fire	Sheep Fire
2836	9/1/2009	FM	Fire	Pendleton Fire
2833	8/31/2009	FM	Fire	Oak Glen Fire
2792	11/15/2008	FM	Fire	Freeway Fire Complex
3279	10/23/2007	EM	Fire	Wildfires
2738	10/22/2007	FM	Fire	Grass Valley Fire
2728	9/15/2007	FM	Fire	Butler 2 Fire
2653	7/12/2006	FM	Fire	Sawtooth Fire Complex
3248	9/13/2005	EM	Hurricane	Hurricane Katrina Evacuation
2503	10/25/2003	FM	Fire	Old Fire
2501	10/23/2003	FM	Fire	Ca-Grand Prix Fire-10-23-2003
2497	9/6/2003	FM	Fire	Ca-Bridge Fire-09-05-2003
2491	8/19/2003	FM	Fire	Ca-Locust Wildfire-08-19-2003
2464	9/24/2002	FM	Fire	Williams Canyon Fire (Mt. Baldy)
2433	6/17/2002	FM	Fire	Louisiana Fire (Cajon Pass)
2425	6/17/2002	FM	Fire	California Blue Cut Fire (Cajon Pass/ Oak Hills)
Emergency Declarations				
3279	10/23/2007	EM	Fire	Wildfires
3248	9/13/2005	EM	Hurricane	Hurricane Katrina Evacuation
3140	9/1/1999	EM	Fire	Ca-Wildfires-08/25/1999
CAL OES/ State Emergency And Disaster Proclamations/ Executive Orders				
Other Disasters				
2464	9/24/2002	FS	Fire	Williams Fire
2433	6/27/2002	FS	Fire	Louisiana Fire
State Declarations				
5147	8/16/2016	FM	Fire	Blue Cut Fire
CDAA	12/18/2015	CDAA	Terrorist Attack	Waterman Incident Mass Shooting
None	8/5/2014	None	Severe Storm(s)	August Severe Weather - Dir. Concurrence
None	1/17/2014	None	Drought	California Drought
None	12/1/2011	None	Winds	December High Wind Event – Rancho Cucamonga
1952	1/21/2011	DR	Flood	Severe Winter Storms, Flooding, and Debris and Mud Flows
None	11/20/2010	None	Water	Golden State Water Company (GSWC) Contamination
1884	3/8/2010	DR	Severe Storm(s)	Severe Winter Storms, Flooding, and Debris and Mud Flows

Disaster Number	Declaration Date	Disaster Type	Incident Type	Title
2841	10/4/2009	FM	Fire	Sheep Fire
2836	9/1/2009	FM	Fire	Pendleton Fire
2833	8/31/2009	FM	Fire	Oak Glen Fire
2792	11/17/2008	FM	Fire	Freeway Fire Complex - (Ex. Ord. S-15-08 11/18/08)
None	10/15/2008	None	Fire	October Fire events (Foxborough, San Antonio, San Bernardino)
None	10/15/2008	None	Winds	San Bernardino Wind Event - (Ex. Ord. S-11-08 10/16/08)
1731	10/24/2007	DR	Fire	Wildfires, Flooding, Mud Flows, and Debris Flows
3279	10/23/2007	EM	Fire	Wildfires
2738	10/22/2007	FM	Fire	Grass Valley Fire
2728	9/15/2007	FM	Fire	Butler 2 Fire
None	7/27/2007	None	Severe Storm(s)	Severe Weather/Flooding (City of Needles)- Dir. Concurrence
1689	3/13/2007	DR	Freezing	Severe Freeze
2653	7/12/2006	FM	Fire	Sawtooth Fire Complex
3248	9/13/2005	EM	Hurricane	Hurricane Katrina Evacuation
1585	4/14/2005	DR	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mud/Debris Flows
1577	2/4/2005	DR	Severe Storm(s)	Severe Storms, Flooding, Debris Flows, and Mudslides
2503	10/25/2003	FM	Fire	Old Fire
2501	10/23/2003	FM	Fire	Ca-Grand Prix Fire-10-23-2003
CDAA 2003-02	8/22/2003	CDAA	Flood	Summer Floods (Yucca Valley/Lower Desert)
None	3/7/2003	None	Fire Danger	Bark Beetle Infestation (San Bernardino Mountains)
None	1/17/2001	None	Energy	Statewide Energy Emergency
3140	9/1/1999	EM	Fire	Ca-Wildfires-08/25/1999
1203	2/9/1998	DR	Severe Storm(s)	Severe Winter Storms and Flooding
1044	1/10/1995	DR	Severe Storm(s)	Severe Winter Storms, Flooding, Landslides, Mud Flows
1005	10/28/1993	DR	Fire	Fires, Mud/Landslides, Flooding, Soil Erosion
979	2/3/1993	DR	Flood	Severe Winter Storm, Mud & Land Slides, & Flooding
947	7/2/1992	DR	Earthquak e	Earthquake & Aftershocks
935	2/19/1992	DR	Flood	California Snow Storms, Flooding, & Mudslides
894	1/11/1991	DR	Freeze	California Severe Freeze
145	2/14/1963		Severe Storms	California Severe Storms, Heavy Rains, & Flooding
47	12/22/1955		Flood	California Flood
15	2/5/1954		Flood	California Flood & Erosion

Disaster Number	Declaration Date	Disaster Type	Incident Type	Title
County Declarations				
5147	8/16/2016	FM	Fire	Blue Cut Fire
5144	8/9/2016	FM	Fire	Pilot Fire
CDAA	12/15/2015	CDAA	Terrorist Attack	Waterman Incident Mass Shooting
None	6/25/2015	None	Fire	Lake Fire
None	8/5/2014	None	Severe Storm(s)	August Severe Weather - Dir. Concurrence
None	8/5/2014	None	Drought	California Drought
None	4/30/2014	None	Fire	Etiwanda Fire
2955	9/3/2011	FM	Fire	Hill Fire
1952	1/21/2011	DR	Flood	Severe Winter Storms, Flooding, and Debris and Mud Flows
None	11/20/2010	None	Water	Golden State Water Company (GSWC) Contamination
1884	1/21/2010	DR	Severe Storm(s)	Severe Winter Storms, Flooding, and Debris and Mud Flows
2841	10/4/2009	FM	Fire	Sheep Fire
2836	9/1/2009	FM	Fire	Pendleton Fire
2833	9/1//2009	FM	Fire	Oak Glen Fire
2792	11/16/2008	FM	Fire	Freeway Fire Complex - (Ex. Ord. S-15-08 11/18/08)
None	10/14/2008	None	Fire	October Fire events (Foxborough, San Antonio, San Bernardino)
None	10/14/2008	None	Wind	San Bernardino Wind Event
1731	10/24/2007	DR	Fire	Wildfires, Flooding, Mud Flows, and Debris Flows
3279	10/22/2007	EM	Fire	Wildfires
2738	10/22/2007	FM	Fire	Grass Valley Fire
2728	9/14/2007	FM	Fire	Butler 2 Fire
None	8/8/2007	None	Water Shortage	Lucerne Valley Water Crisis
1689	1/17/2007	DR	Freezing	Severe Freeze
2653	7/11/2006	FM	Fire	Sawtooth Fire Complex
None	9/30/2005	None	Fire	Thurman Fire (San Bernardino Mountains)
3248	9/8/2005	EM	Hurricane	Hurricane Katrina Evacuation
1585	10/26/2004	DR	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mud and Debris Flows
1577	10/26/2004	DR	Severe Storm(s)	Severe Storms, Flooding, Debris Flows, and Mudslides
None	10/26/2004	None	Severe Storm(s)	Winter Storms (10/21 & 10/28/04)
None	6/29/2004	None	Water Shortage	Acute Water Shortage (Wrightwood 07, 08, & 09/04)
2503	10/21/2003	FM	Fire	Old Fire
2501	10/21/2003	FM	Fire	Ca-Grand Prix Fire-10-23-2003

Disaster Number	Declaration Date	Disaster Type	Incident Type	Title
CDAA 2003-02	8/22/2003	CDAA	Flood	Summer Floods (Yucca Valley/Lower Desert)
None	9/24/2002	None	Infestatio n	Bark Beetle Infestation (San Bernardino Mountains)
3140	9/1/1999	EM	Fire	Ca-Wildfires-08/25/1999
None	7/12/1999	None	Flood	County Flood July 99 (Forest Falls, Barstow, and Big Bear)
1203	2/24/1998	DR	Severe Storm(s)	Severe Winter Storms and Flooding
None	3/19/1997	None	EQ	Earthquake (Barstow/Calico RP)
None	2/1/1996	None	Hazmat	Cajon Pass Train Derailment/Hazmat Incident
1044	1/6/1995	DR	Severe Storm(s)	Severe Winter Storms, Flooding, Landslides, Mud Flows
None	6/26/1994	None	Heat/Fire Danger	Severe Heat & Wildland Fire Threat
979	1/8/1993	DR	Flood	Severe Winter Storm, Mud & Land Slides, & Flooding
947	6/28/1992	DR	Earthquak e	Earthquake & Aftershocks
935	2/18/1992	DR	Flood	Rain/Snow/Wind Storms, Flooding, Mudslides
894	1/14/1991	DR	Freezing	Severe Freeze
872	6/28/1990	DR	Fire	Fires
None	3/13/1990		Earthquak e	Upland Earthquake
None	10/31/1988		Fire	Texas Fire (Watershed Damage)
None	9/3/1987		Fire	Wildland Fires
None	7/13/1984		Weather	Unstable Weather Conditions (City of Big Bear Lake, CSD, Co. Flood Control, Victor Valley Waste Water Authority, Juniper Riviera County Water District)
687	7/1/1983	DR	Flood	Flooding
677	3/7/1983	DR	Coastal Storm	Coastal Storms, Floods, Slides & Tornadoes
635	11/5/1980	DR	Fire	Brush & Timber Fires
615	1/15/1980	DR	Flood	Severe Storms, Mudslides & Flooding
None	9/29/1979		Gasoline Shortage	Gasoline Shortage Emergency
None	6/28/1979		Water Shortage	Water Shortage (Lake Gregory)
None	7/21/1960		Fire	Major and Widespread Fires

4.2 Hazard Prioritization

The City of Barstow HMP Planning Team used a two-step process to derive at our final four hazards to profile.

The first step had the planning team review a total of sixteen hazards via the FEMA Hazard Summary Sheet (See Appendix D.1, D.2). The Hazard Summary Sheet was used to summarize hazard description information and identify which hazards are most significant to the City. We considered those hazards that ranked medium to high into step two. We also included Climate Change since it is a new requirement. The summary sheet includes classifications for location and maximum probable extent.

The second step had the planning team review a total of six hazards- *wildfire, flood, earthquake, erosion, flooding and climate change*. These six hazards were put through Dynamic Planning + Science Risk Factor (RF) Approach (See Appendix D.3, D.4). The RF approach combines historical data, local knowledge, and consensus opinions to produce numerical values that allow identified hazards to be ranked against one another. These criteria are used to evaluate hazards and identify the highest risk hazard in the project region.

The RF approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). RF values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and duration. Each degree of risk is assigned a value ranging from 1 to 4 and a weighing factor for each category should be agreed upon by the planning committee.

The following values were derived for each hazard from the planning team: Earthquake-3.6, Wildfire-2.3, Flooding-2.25, Extreme Heat-1.9, Climate Change-1.7, and Erosion-1.4. Due to limited resources the planning team agreed to focus on the top three hazards which ranked within moderate to high risk (2.0-4.0). Climate change was included as a requirement per FEMA for 2017. See Figure 4-1 for final results.

LHMP RISK FACTOR EXCEL WORKSHEET

HAZARD PRIORITIZATION /

MITIGATE HAZARDS

Rank	Natural Hazards	Probability (1-4)	Factor1 = (Probability Index * .30)	Impact (1-4)	Factor2 = (Impact Index * .30)	Spatial Extent (1-4)	Factor3 = (Spatial Extent Index * .20)	Warning Time (1-4)	Factor4 = (Warning Time Index * .10)	Duration (1-4)	Factor5 = (Probability Index * .10)	RF Factor Total = (Add Factors 1-5)
1	Climate Change	1	0.3	1	0.3	3	0.6	1	0.1	4	0.4	1.7
2	Earthquake	3	0.9	4	1.2	4	0.8	4	0.4	3	0.3	3.6
3	Erosion	1.5	0.45	1	0.3	1	0.2	3	0.3	1.5	0.15	1.4
4	Extreme Heat	2.5	0.75	1	0.3	2.5	0.5	1	0.1	2.5	0.25	1.9
5	Flooding	2	0.6	2	0.6	2	0.4	4	0.4	2.5	0.25	2.25
6	Wildfire	2	0.6	2	0.6	2	0.4	4	0.4	3	0.3	2.3

The RF approach combines historical data, local knowledge, and consensus opinions to produce numerical values that allow identified hazards to be ranked against one another. These criteria were used to evaluate hazards and identify the highest risk hazard in the Lawndale region.
The RF approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). RF values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and duration. Each degree of risk is assigned a value ranging from 1 to 4 and a weighing factor for each category was agreed upon by the MPC.

Calculated Field

Figure 4-1: RF Final Worksheet as Agreed Upon by Planning Team

4.3 Hazards Profiles

The planning team initially identified six hazards to be included on the RF Approach Worksheet; some of these hazards were ultimately ranked low risk/low impact or could potentially be secondary to higher ranked hazards. As a result, it was the consensus of the Planning Team to focus on the three hazards that scored High and Moderate Risk in the RF Approach Worksheet (See Figure 4-1): ***Earthquake, Flooding***, and ***Wildfires***. ***Climate Change*** is included as a requirement per FEMA for 2017. These four hazards will be identified in detail starting with 4.3 and beyond. The following natural hazards were reviewed and analyzed by the Planning Team but due to their limited risk and inclusion on other hazards they will not be included as one of the hazards identified with mitigationstrategies:

1. Dam Failure ranked low by the planning team in the initial Hazard Summary and may be secondary to earthquakes, therefore dam failure was not included as a primary hazard. A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams typically are constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure resulting in downstream flooding or a severe natural occurrence, such as an earthquake.

   Dam failure can result from any one or a combination of the following causes:

   - Prolonged periods of rainfall and flooding, which causes most failures;
   - Inadequate spillway capacity, resulting in excess overtopping flows;
   - Internal erosion caused by embankment or foundation leakage or piping;
   - Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam andabutments;
   - Improper design, including the use of improper construction materials and construction practices;
   - Negligent operation, including failure to remove or open gates or valves during high flow periods;
   - Failure of upstream dams on the samewaterway;
   - Landslides into reservoirs, which cause surges that result inovertopping;
   - High winds, which can cause significant wave action and result in substantial erosion; and Earthquakes, which typically cause longitudinal cracks at the tops of embankments that weaken entire structures.

Description:

Two major dams -- Cedar Springs Dam and Mojave Dam -- could have a significant impact on the City of Barstow in the event of dam failure. Both are located in the San Bernardino National Forest in the upper portion of the Mojave River Basin, southwest of Barstow. The Cedar Springs Dam and the Mojave Dam are both managed and operated by the State Department of Water Resources. See Table 4-3 for detailed information on both dams.

Table 4-3: Local Dam Data

	Cedar Springs Dam	Mojave Dam
DWR Number	1-063	9000-021
National ID	CA00049	CA10021
Dam Type	Rock	Earth
Crest Length	2,235 ft.	2,200 ft.
Height (measured above the dam crest)	236 ft.	204 ft.
Crest Width	42 ft.	20 ft.
Total Freeboard	23 ft.	21 ft.
Reservoir	Lake Silverwood	Mojave River Forks
Reservoir Storage Capacity	78,000 acre-ft.	89,700 acre-ft.
Reservoir Drainage Area	34.0 sq. miles	70.3 sq. miles

Fortunately, neither the Cedar Springs Dam nor the Mojave Dam have experienced dam failure. For Barstow to be affected by flood waters due to dam failure, both of these dams would need to fail simultaneously or the failure of the Cedar Springs Dam would need to occur at a time when rising flood waters were already a problem at the Mojave Dam.

Failure of these dams during a catastrophic event, such as a severe earthquake, is considered to be an unlikely event. Both dams have performed well in past earthquakes due to the type and method of construction.

2. Drought and Water Shortage ranked as a low hazard but provided for discussion based on the recent drought that the state of California is in and the amount of rain that has been produced in the early months of 2017.

A drought is a period of drier-than-normal conditions that results in water-related problems. Precipitation (rain or snow) falls in uneven patterns across the country. When no rain or only a small amount of rain falls, soils can dry out and plants can die. If dry weather persists and water supply problems develop, the dry period can become a drought. Droughts differ from typical emergency events such as floods or forest fires, in that they occur slowly over a multiyear period.

California has faced numerous challenges in recent years, including a nearly decade-long drought on the Colorado River, snowpacks that are below normal, and court-mandated reductions in the amount of water available for delivery by the State Water Project. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline. Climate change, population growth, and the increasing instability of the water supplies in the delta formed by the confluence of the Sacramento and San Joaquin rivers threaten to exacerbate the crisis. Drought will also be discussed in our required hazard ofclimate change.

Extreme Heat initially ranked as a medium hazard by the planning group but once we put it through the Risk Factor Worksheet it scored a 1.9 which would drop it to Low Risk. Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat. Temperatures in Barstow often reach 10 degrees above average however they rarely last more than a few days. Heat will also be discussed in our required hazard of climate change.

3. Erosion initially ranked as a low to medium hazard by the planning team but once we put it through the Risk Factor Worksheet it scored a 1.4 which would drop it to Low Risk. Since the City of Barstow is located in an area of extreme topographic relief between the valley and the surrounding mountains and is therefore subject to erosion, runoff, and sedimentation. Key factors affecting these processes include climate, topography, soil and rock types.

Natural erosion may be accelerated by human activities such as agricultural or land development, as well as grading that may involve altering natural drainage patterns. Grading and construction activities such as soil compaction, and cut and fill slopes also increase the potential for erosion, and sedimentation. The increase in impermeable surfaces associated with development may impact conditions downstream of development, increasing the potential for flooding and sedimentation.

The planning team viewed erosion as secondary to flooding and with limited history of erosion occurring in Barstow the planning team did not include it as a primary hazard.

4. High Winds initially ranked as a low to medium hazard by the planning team. Although high winds and gusts are common to Barstow, the planning team did not include it on the Risk Factor Worksheet because the disruption of services and spatial extent to our community is extremely minimal. When it has occurred, the impacts are isolated with only infrequent reports of personal property damage due to property not being secured properly. If disruption of services occur, services are normally restored within a fewhours.

4.4 Flood Hazard Profile

Floods are the second most common and widespread of all natural disasters faced by the region and cities and city like Barstow. 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.

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 (at least one of which is the policyholder's property) 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."

Floods can be slow or fast rising but generally develop over a period of hours or days. Mitigation includes any activities that prevent an emergency, reduce the chance of an emergency happening, or lessen the damaging effects of unavoidable emergencies. Investing in mitigation measures now, such as: engaging in floodplain management activities, constructing barriers such as levees, and purchasing flood insurance will help reduce the amount of structural damage and financial loss from other types of property damage should a flood or flash floodoccur.

The standard for flooding is the 1% annual chance flood, commonly called the 100-year flood, the benchmark used by the FEMA to establish a standard of flood control 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.

While not considered a "high risk area", the City does have areas that are considered "flood potential". The most crucial areas pertaining to flooding are along the banks of the Mojave River (consisting of limited residential) and Soap Mine Rd area. Flooding is expected to occur within the general location of these risk areas, and not expected to threaten or endanger the safety or well being of the entire community. It is noted that flooding in the risk areas can occur rapidly depending on the heaviness and severity of rainfall and run-off.

4.4.1 National Flood Insurance Program (NFIP)

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. As a participating member of the NFIP, City of Barstow is dedicated to protecting more than 48 homes with policies currently in force. Like most communities participating in NFIP, FEMA has prepared a detailed Flood Insurance Study (FIS) for areas of San Bernardino County, including the City of Barstow. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance of flood (the 100-year flood) and the 0.2-percent annual chance of flood (the 500-year flood). Base flood elevations and the boundaries of the 100 and 500- year floodplains are shown on FIRMs (Flood Insurance Rate Maps). More information on location and geographic extent of the FIRMs see Figure 4-2.

The City of Barstow entered the regular phase of the NFIP on January 1 1975. As a participant in the NFIP, the City of Barstow is dedicated to regulating development in the FEMA regulated floodplain areas in accordance with NFIP criteria. Before a permit to build in a floodplain area is issued, Barstow ensures that two basic criteria are met:

- All new buildings and developments undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain developments must not aggravate existing flood problems or increase damage to other properties.

Structures permitted or built in the County/City before the NFIP regulatory requirements were incorporated into the City of Barstow ordinances (before the effective date of the City of Barstow's FIRM) are called "pre-FIRM" structures. For Barstow, pre-FIRM structures are those permitted or built before January 1 1975.

Extensive FEMA NFIP databases are used to track claims for every participating community including Barstow. NFIP insurance data provided by FEMA indicates that as of January 31 2018 there were ***48*** policies in the City of Barstow, resulting in ***$11,706,000*** of insurance in force; this amounts to ***$42,515*** in total premiums. The City of Barstow has seen flash flooding that has flooded 10 properties in which there has been no repetitive loss from flooding.

There have been ***4*** closed paid losses totaling ***$21,799.27***. Of the closed ***4*** paid losses there has been ***0*** substantial damage claims. Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to it's before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

4.4.2 Past Flood Occurrences

Historical Events: The following describes the historical events associated with this hazard:

1. Storm Event; 9/3/01 (Declaration #090301-01)
A severe rain and windstorm occurred on or about September 3 2001. A local declaration was issued by the City Council.

- Debris removal
- Sandbagging and road closures
- Down tree removal
- Repair severe road edge erosion
- Base fill, grade, and recompact

Hazard: Flooding
Deaths: 0
Injuries: 0
Displaced People: unknown

Source: City of Barstow records; Desert Dispatch newspaper

2. Series of Rainstorms; 1/8/2005 (FEMA-1577-DR)

A series of severe rainstorms occurred in southern California on or about December 27, 2004 to January 11, 2005. Governor Schwarzenegger proclaimed a State of Emergency for San Bernardino County on January 15, 2005, and President Bush declared a major disaster on February 4, 2005 for public assistance. The local Emergency Operations Center was not activated.

The series of rainstorms caused significant rainfall in Barstow over one 24-hour period. Sandbags were issued throughout the week. The rainstorms caused the release of up to 5,500 CFS of water from Silverwood Lake reservoir over a 3-4 day period. At one point the water in the Mojave River measured at 6-feet.

- Debris removal
- Sandbagging and road closures
- Remove/replace asphalt and curbing
- Repair severe road edge erosion
- Base fill, grade, and recompact

Source: Daily Press newspaper

Hazard: Flooding
Deaths: 0
Injuries: 0
Displaced People: 0

3. Series of Rainstorms; 1/22/10 (FEMA-1844-DR)

A series of severe rainstorms occurred in southern California on or about January 17, 2010 to February 6, 2010. A local declaration was issued by the City Council (Resolution #4593-2010). Governor Schwarzenegger proclaimed a State of Emergency for San Bernardino County on January 22, 2010, and President Bush declared a major for public assistance. Work throughout the community included:

- Debris removal
- Sandbagging and road closures
- Remove/replace asphalt and curbing
- Repair severe road edge erosion
- Channel clean out

Hazard: Flooding
Deaths: 0
Injuries: 0
Displaced People: unknown

Source: City of Barstow records; Desert Dispatch newspaper

4. Storm Event; August 3 2014

Flooding occurred due to an isolated storm event in the Barstow area on August 3, 2014. A local declaration was issued by the City Council (Resolution # 4765-2014) Rapid moving water flooded and damaged the area of West Barstow and the Lenwood commercial area. Several swift water rescues occurred with one vehicle washed off route 66 highway stopping 1-2 miles downstream. Damage to a 21" sewer line occurred and a portion washed away. Approximately 20 single family residences suffered damage. Work throughout the community included:

- Sandbagging and road closures
- Debri removal
- Repair severe road erosion
- Channel clean out
- Remove/replace asphalt and curbing

Source: City of Barstow Records; Desert Dispatch newspaper

Hazard: Flooding
Deaths: 0
Injuries: 0
Displaced People: unknown

5. Isolated Storm Event; July 1 2016

Isolated storm occurred in the Barstow area on July 1, 2016 causing major flooding and mudflow in the east section of residential housing. Several residents were damaged by mud flow. City of Barstow Public Works assisted by the Fire Department went door to door in the hardest hit area (Higgins and Joshua Tree area) to assess and assist as necessary with storm damage. Work throughout the community included:

- Sandbagging and road closures
- Mud and debris removal
- Retention basin cleanout/water removal
- Repair shoulder erosion

Hazard: Flash Flooding

Deaths: 0

Injuries: Unknown

Displaced People: Unknown

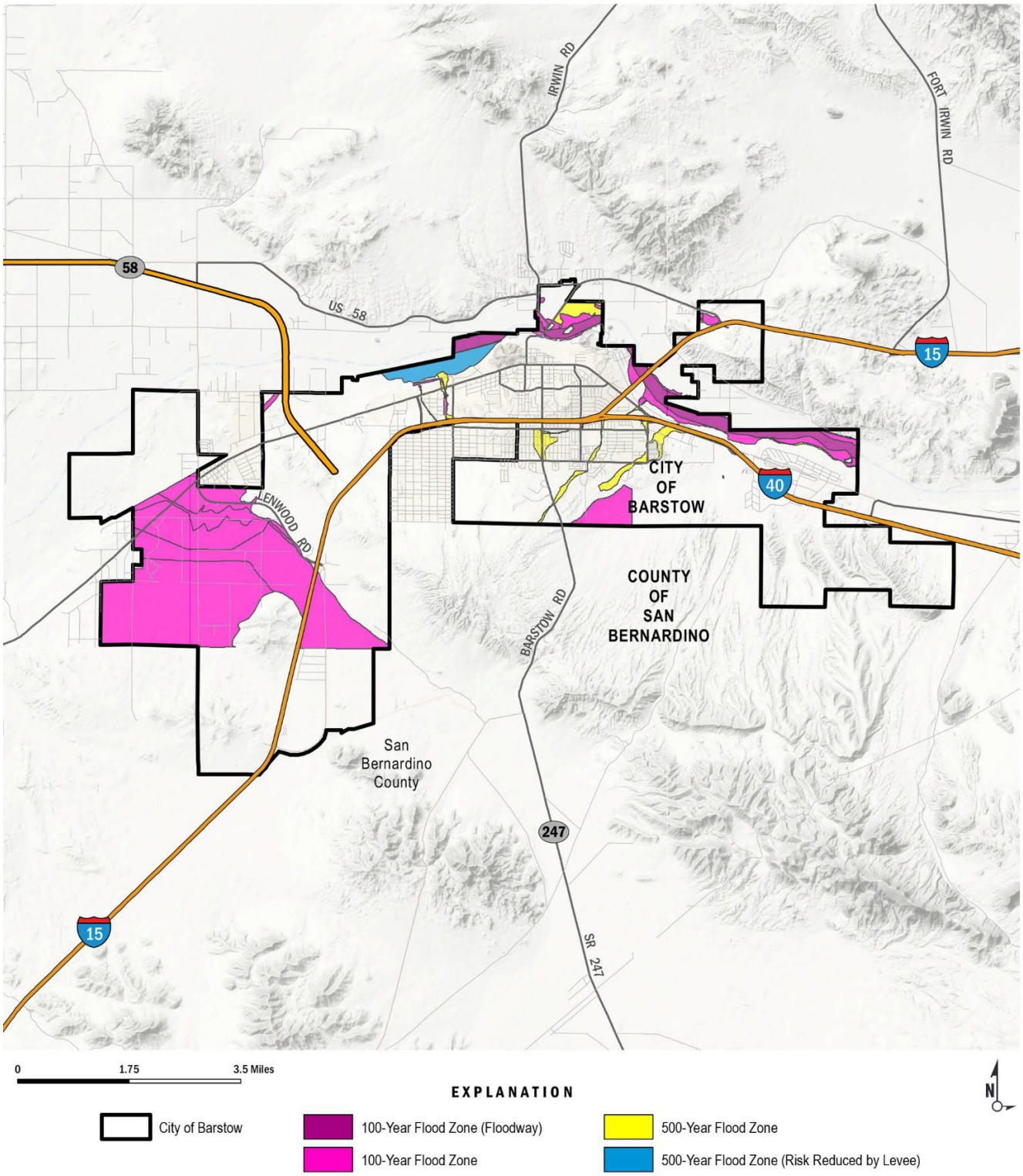

Figure 4-2: 100/500 Flood Zone Map

4.4.3 Location/ Geographic Extent

A majority of the flood risk within the City of Barstow is specifically subject to inundation as a result of heavy rainfall and resulting stream and drainage canal overflows. The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies, and helps identify the location and extent of flooding in areas across the City. This area is also referred to as the SFHA, and is a convenient tool for assessing vulnerability and risk in flood-pronecommunities.

Figure 4-2 shows 100-year and 500-year floodplain zones, which are estimated inundation areas based on a flood that has a 1-percent (100-year) and 2-percent (500-year) chance of occurring in any given year. City of Barstow contains over 2,859 acres of identified flood hazard areas. Table 4-4 provides the total area for both the 100-year and 500-yr. flood hazard areas.

Table 4-4: Special Flood Hazard Area for Barstow

Flood Hazard Type	Sum of Acres	Sum of Square Miles
100-Year Flood	4,988	7.79
100-Year, Floodway	547	0.85
500-Year Flood	396	0.62
500-Year, Protected by Levee	251	0
Total	**6,182**	**9.66**

The following zones are found within the City of Barstow. There are fifteen (15) FIRM maps that cover the City corporation limits. Zone D does not exist in the city as it is a designation for the unstudied, unincorporated areas of the county. It surrounds and is adjacent to the city boundaries in multiple areas.

FIRM Flood Zones

Zone	Description
A	Area with a 1% annual chance of flooding (100-year). No depths or Base Flood Elevations (BFEs) are determined.
AE	Area with a 1% annual chance of flooding (100-year). Base Flood Elevations (BFEs) are determined.
AO	Area with a 1% annual chance of flooding (100-year). Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
X (Shaded)	Areas of 0.2% annual chance flood (500-year); areas of 1% annual chance flood (100-year) with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from the 1% annual chance flood (100-year).
X	Areas determined to be outside the 0.2% annual chance flood plain (500-year).

4.4.4 Magnitude/Severity

In urban areas like Barstow, flood problems are typically intensified as new homes and other structures are built. 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. However, in the absence of flood water conveyance systems, the City's development code requires flood mitigation in the form of onsite detention, retention, and infiltration.

4.4.4.1 Flash Flooding (From San Bernardino County Operational Area Plan)

Flash flooding tends to occur in the summer and early fall because of the monsoon rains and is typified by increased humidity and high summer temperatures.

The desert area contains many mountain ranges that are steep and experience summer thunder storms causing flash floods in many dry washes on the desert floor. The water collects in dry lake beds throughout the desert area. Environmental permit processing has delayed or prohibited work in the washes to provide flow lines to many bridges on county highways. Many highways do not have bridges but convey water across the road with dip crossings. Flash flooding causes road and bridge wash outs and erosion of earthen channels and basins when they occur near these facilities. Cities and Citys often experience street closures for several days due to sediment transport and road damage. Because of the sheet flow character of the desert, many private properties experience erosion and sediment deposits.

The urban valley also can experience flash flooding in its narrow canyons and within the many unimproved creeks and interim channels feeding the Santa Ana River. The valley floor in many areas is very flat so even minor rain events can produce flooding of roads and private property.

In coordination with local jurisdictions, the County of San Bernardino Flood Control District has prepared Master Drainage plans for many cities and Citys to provide a plan for reducing flooding due to minor storms. Maps can be found on the County's Department of Public Works website here:

http://cms.sbcounty.gov/dpw/FloodControl/Planning/MPD.aspx

However, local resources are not sufficient to cover the cost of the construction of the drainage systems. The densely populated (75% of the county population) urban valley region contains the headwaters of the Santa Ana River. The San Gabriel and San Bernardino Mountains border the North side of the valley are steep reaching 5,000 feet with alluvial fans which are developed and densely populated.

4.4.5 Frequency/ Probability of Future Occurrences

The FIRM maps not only identify the flood hazard zones for insurance and floodplain management purposes, but also provide a statement of probability of future occurrence.

A 500-year flood has a 0.2-percent chance of occurring in any given year; a 100-year flood has a 1-percent chance, a 50- year flood has a 2-percent chance, and a 10-year flood has a 10-percent chance of occurrence. 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. The FIRM maps typically identify components of the 500-year and 100-year floodplains.

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4.5 Wildfire Hazard Profile

As defined in the California Fire Protection (CAL FIRE) 2010 Strategic Fire Plan, a wildfire event is an unwanted wildland fire including unauthorized human-caused fires, escaped wildfire use events, escaped prescribed wildfire projects, and all other wildfires.

4.5.1 Regulatory Environment

Wildfire regulatory requirements are mandated by the State of California and the City of Barstow.

4.5.1.1 State

Wildfire State Responsibility Area (SRA) Fire Safe Regulations outline basic wildland fire protection standards for local jurisdictions. SRA Fire Safe Regulations (if policed) can decrease the risk of wildfire events in the wildland interface. SRA Fire Safe Regulations do not supersede local regulations, which equal or exceed minimum state regulations. The State statute for wildfire protection is Public Resources Code, Section 4290. Requirements in the code include information on the following (CA Fire Alliance):

1. Road Standards for Fire Equipment Access
2. Standards for Signs Identifying Streets, Roads and Buildings
3. Minimum Private Water Supply Reserves for Emergency Fire Use
4. Fuel Breaks and Greenbelts

4.5.1.2 Local

The Barstow Fire Protection District provides fire protection services to the City of Barstow and the surrounding area. It is a subsidiary District of the City whose northern boundary extends past the Mojave River, and extends east as far as the dry lakes toward Yermo. It serves the City and unincorporated areas of San Bernardino County, with a total service area of over 60 square miles. District staff includes paid, professional personnel and support staff.

The Fire Protection District maintains a mutual aid agreement with, San Bernardino County Fire Department, and the Bureau of Land Management. This agreement allows for fire departments within the region to actively support one another regardless of geographic or General Plan V-41 jurisdictional boundaries. A joint dispatch center serving the mutual aid agencies is located in Rialto. There are currently a total of 20 paid staff in the Fire Protection District.

4.5.2 Past Occurrences

Wildfire events are a concern to the City of Barstow. Cal FIRE maintains a database of wildfire perimeters. Table 4-5 gives the dates and fire names of the historical wildfires that have burned within or near City limits. In the past five years there have been six significant wildland fires in the High Desert Area. These fires are listed in Table 4-5, and several of the more damaging fires are discussed below.

Table 4-5: Wildfire Occurrences 2011-2016

Year	Fire Name	Acres
6/1/2011	Roundup	144
6/9/2011	Bowen	295
7/3/2011	Deep	119
3/31/2015	River Bottom	185
8/7/2016	Pilot	8,110
8/16/2016	Blue Cut	36,274
Total		**45,127**

Source: Cal Fire

River Bottom Fire: On March 31, 2015 a fire erupted within Mojave Narrows Regional Park and quickly spread towards homes in Apple Valley, North of the Town of Apple Valley . A few outbuildings and vehicles were lost but no homes. The fire was contained by the next day. American Red Cross opened a shelter for those evacuated at Sitting Bull Academy.

Pilot Fire: The Pilot Fire started at about 12:10 pm on Sunday August 7, 2016 near the Miller Canyon OHV area off of Highway 138. The Pilot Fire burned 8110 acres and was declared controlled on August 16, 2016 as a result of significant rainfall. School Districts in the area were closed for a few days due to air quality.

Blue Cut: The Blue Cut Fire started on August 16, 2016 at 10:36 AM in the Cajon Pass along Old Cajon Blvd. north of Kenwood Avenue west of Interstate 15. The fire quickly spotted across Cajon Creek and grew into a large wildland fire. During the course of the fire fight, railroad lines, local roads, highway 138 and Interstate 15 were closed along with a large evacuation area that included Lytle Creek, Wrightwood, Summit Valley, Baldy Mesa, Phelan and Oak Hills.

At the peak of the battle to control this blaze there were 2,684 personnel actively involved in the fight to contain the Blue Cut Fire. These personnel have come from all over the nation to help with this firefight. The Blue Cut Fire burned 36,274 acres, destroying an estimated 105 single family residences and 216 outbuildings. In addition, 3 single family residences and 5 other structures were damaged.

4.5.3 Location/Geographic Extent

Wildfires present a significant threat in the unincorporated area of Barstow, particularly in the summer months when temperatures are high and precipitation is rare. The period between June and September is typically considered "fire season".

The area known as the Lenwood in the western area of the City is a fire hazard area due to the abundance of brush and blow sand, which makes it difficult to gain access to fight fire. This area is primarily in the unincorporated region of Barstow with homes scattered throughout the vegetation.

The Mojave Riverbed is the second significant threat of wildland fire in the Barstow area. Because of its significant slope to the bottom of the riverbed and the soft soil, it is difficult to gain access to this area to fight fire. The Mojave River runs along the City's Northern boundary with residential properties along Riverside Drive.

4.5.4 Magnitude/Severity

The magnitude and severity of a wildfire event is measured by calculating the number of acres burned in a specific wildfire event. CAL FIRE adopted Fire Hazard Severity Zone maps for LRA in June 2008. The Fire Severity Zones are identified as Very High, High, and Moderate fire hazard severity throughout the County and are mapped for Barstow in Figure 4-3. According to LRA Barstow has nothing higher than moderate fire hazardseverity.

Fire Severity Zones are used in determining additional protective measures required when building new structures or remodeling older structures within the particular zone. Additional measures must be taken on the property around a structure in the higher ranked fire Severity Zones.

Fire hazard mapping is a way to measure the physical fire behavior to predict the damage a fire is likely to cause. Fire hazard measurement includes vegetative fuels, probability of speed at which a wildfire moves the amount of heat the fire produces, and most importantly, the burning fire brands that the fire sends ahead of the flaming front.

The model used to develop the information in accounts for topography, especially the steepness of the slopes (fires burn faster as they burn up-slope.). Weather (temperature, humidity, and wind) also has a significant influence on fire behavior. The areas depicted as moderate and high in are of particular concern and potential fire risk in these are constantly increasing as human development, and the wildland urban interface areasexpand.

4.5.5 Frequency/Probability of Future Occurrences

In San Bernardino County, wildfire season commences in late Spring when temperatures begin to rise, humidity is low, and drier conditions persist. The season continues into the Fall, when the County experiences high velocity, very dry winds coming out of the desert. A statewide drought beginning in 2011 has caused the state to be the driest it's been since record keeping began back in 1895 (California, 2016). This has caused extremely dry conditions in unincorporated areas of the County creating plentiful fuel sources forwildfires.

USGS LANDFIRE (Landscape Fire and Resource Management Planning Tools), is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations. Historical fire regimes, intervals, and vegetation conditions are mapped using the Vegetation Dynamics Development Tool (VDDT). This USGS data supports fire and landscape management planning goals in the National Cohesive Wildland Fire Management Strategy, the Federal Wildland Fire Management Policy, and the Healthy Forests Restoration Act.

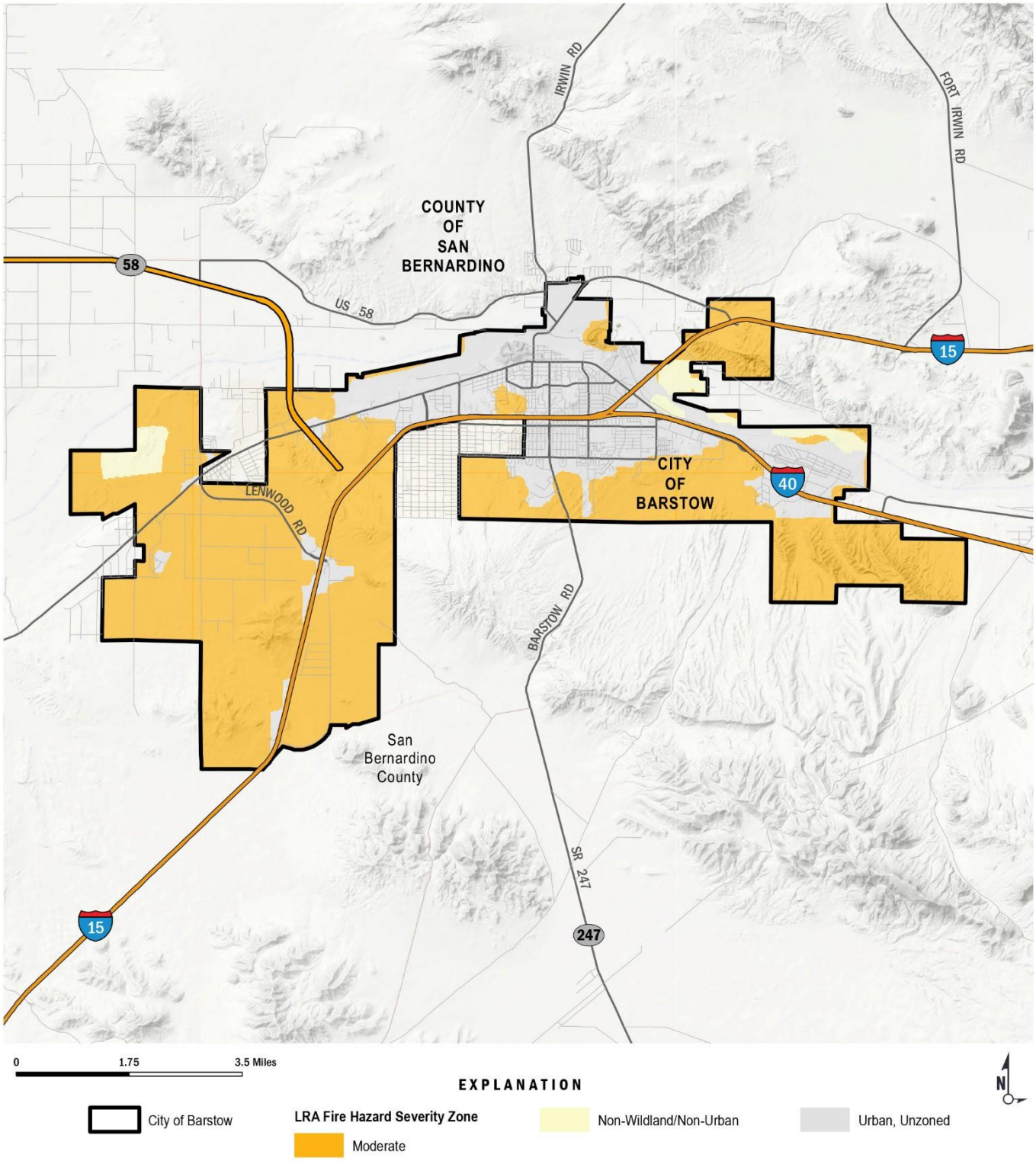


Figure 4-3: Wildfire Hazard Severity Zones

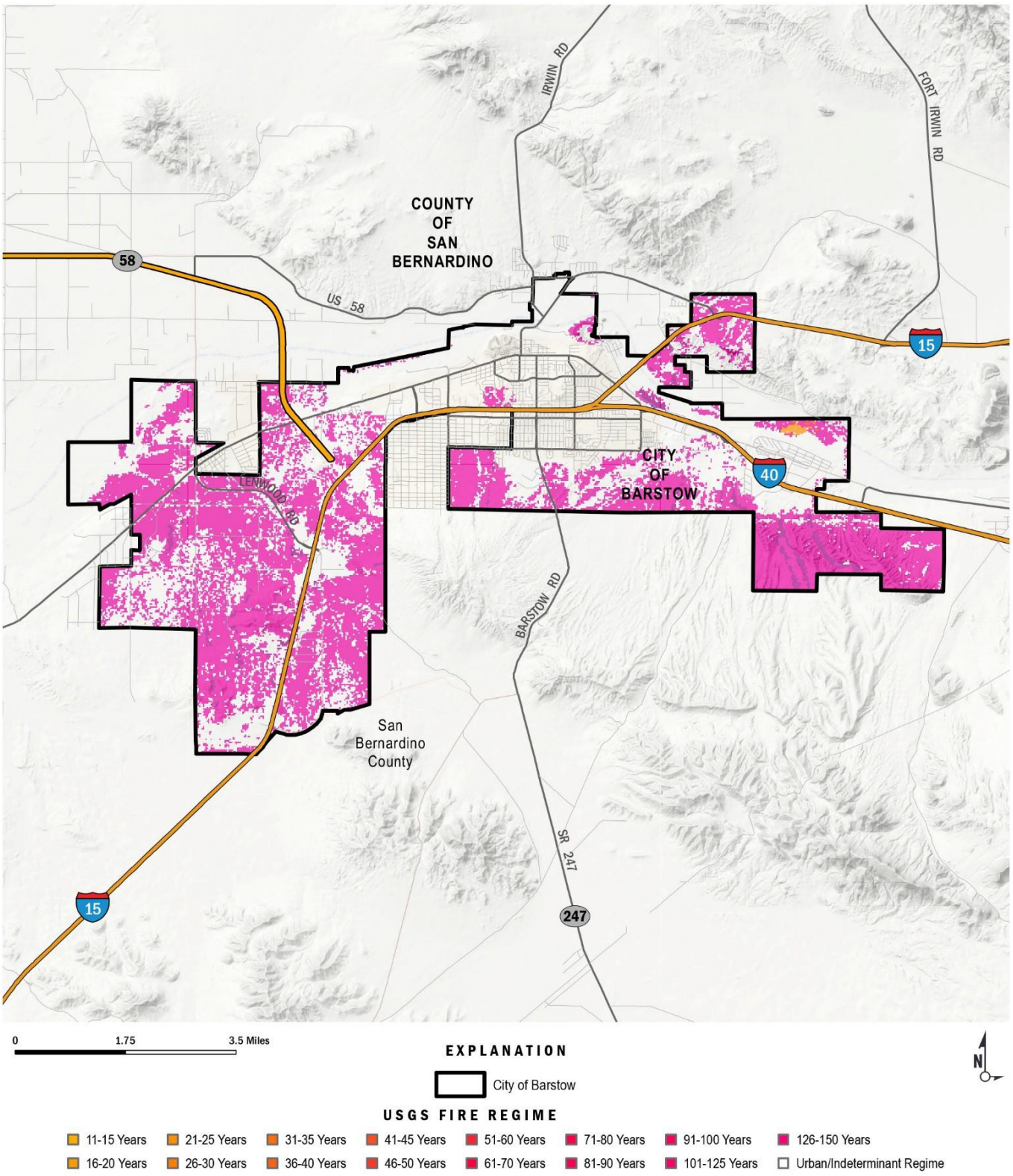


Figure 4-4: Wildfire Return Interval Map

As part of the USGS Landfire data sets, the Mean Fire Return Interval (MFRI) layer quantifies the average period between fires under the presumed historical fire regime. MFRI is intended to describe one component of historical fire regime characteristics in the context of the broader historical time period represented by the Landfire Biophysical Settings (BPS) layer and BPS Model documentation.

MFRI is derived from the vegetation and disturbance dynamics model VDDT (Vegetation Dynamics Development Tool) (LF_1.0.0 CONUS only used the vegetation and disturbance dynamics model LANDSUM). This layer is created by linking the BpS Group attribute in the BpS layer with the Refresh Model Tracker (RMT) data and assigning the MFRI attribute. This geospatial product should display a reasonable approximation of MFRI, as documented in the RMT. See Figure 4-4 for predicted fire return interval for the jurisdictional area.

For more information on the USGS wildfire mapping tools visit: http://www.landfire.gov/fireregime.php

4.6 Earthquake/Geologic Hazard Profile

An earthquake is both the sudden slip on an active fault and the resulting shaking and radiated seismic energy caused by the slip (USGS, 2016). The majority of major active faults in the Barstow area are strike-slip faults. For this type of fault, during an earthquake event, one side of a fault line slides past the other. The rupture from this type of fault extends almost vertically into the ground.

Earthquakes are a significant concern to Barstow. The area around Barstow is seismically active since it is situated on the boundary between two tectonic plates. Describe seismic activity and faults for the region. Earthquakes can cause serious structural damage to buildings, overlying aqueducts, transportation facilities, utilities, and can lead to loss of life. In addition, earthquakes can cause collateral emergencies including dam and levee failures, fires, and landslides. Seismic shaking is by far the single greatest cause of damage from an earthquake in Barstow, followed by liquefaction.

Liquefaction occurs when loosely packed sandy or silty materials saturated with water are shaken hard enough to lose strength and stiffness. Liquefied soils behave like a liquid and are responsible for tremendous damage in an earthquake. For example, it can cause buildings to collapse, pipes to leak, and roads to buckle.

4.6.1 Regulatory Environment

Numerous building and zoning codes exist at a state and local level to decrease the impact of an earthquake event and resulting liquefaction on residents and infrastructure. Building and zoning codes include the Alquist-Priolo Earthquake Fault Zoning Act of 1972, Seismic Hazards Mapping Act of 1990, 2013 California Standards Building Code (CSBC), and City of Barstow's General Plan. To protect lives and infrastructure in the City of Barstow, the following building and zoning codes are used.

4.6.1.1 State

The 1971 San Fernando Earthquake resulted in the destruction of numerous structures built across its path. This led to passage of the Alquist-Priolo Earthquake Fault Zoning Act. 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. This Act increases construction standards at locations where ground failures are probable during earthquakes. Active faults in San Bernardino County have been included under the Alquist-Priolo Geologic Hazards Zones Act and Seismic Hazards Mapping Act.

4.6.1.2 Local

The 2016 California Building Standards Code (also known as Title 24) became effective for the County on January 1st, 2017. Title 24 includes CBC Section 3417: Earthquake Evaluation and Design for Retrofit of Existing Buildings which can be viewed at http://www.documents.dgs.ca.gov/bsc/2015TriCycle/Pre-Cycle-2015/CBC-CEBC/BSC-0X-15-ET-Pt10-Agenda-4d.pdf.

The 2016 CSBC is based on the International Building Codes (IBC), which is widely used throughout the United States. CSBC was modified for California's conditions to include more detailed and stringent building requirements. The City of Barstow, Building and Safety Department utilizes the 2016 CSBC to regulate the infrastructure in the City of Barstow.

This includes unreinforced masonry (URM) buildings. For new buildings, City of Barstow includes earthquake safety provisions, with enhancements for essential services buildings, hospitals, and public schools.

4.6.2 Past Occurrences

The HMP Planning Team noted the following regional and local events for the seismic activity in Barstow. Table 4-6 shows earthquakes greater than Magnitude 4.0 that have been felt within or near Barstow area in the last five years

Table 4-6: Earthquakes: 2011-2016 San Bernardino County

Date	Name
1/15/2014	Fontana 4.4
7/5/2014	Running Springs 4.6
6/11/2014	Barstow 4.0
7/25/2015	Fontana 4.2
9/16/15	Big Bear Lake 4.0
12/30/2015	Muscoy 4.4
1/6/2016	Banning 4.4
2/20/2016	Lucerne Valley 4.3

There are hundreds more small (M<4.0) earthquakes that have occurred within San Bernardino County during this same time frame. Those with a magnitude of below 4.0 are not listed.

4.6.3 Location/Geographic Extent

Historical and geological records show that Southern California has a long history of seismic events. The risk of seismic hazards to residents of Barstow is based on the approximate location of earthquake faults within and outside the region. This map includes Alquist-Priolo Geologic Hazards Zones Act created under the Seismic Hazards Mapping Act and the USGS Quaternary Fault and Fold Database of the United States. The USGS database contains information on faults and associated folds in California that are believed to be sources of M>6 earthquakes during the Quaternary (the past 2.6 million years).

Figure 4-5 shows fault zones nearest to Barstow. Per the California Department of Conservation's Earthquake Fault Zone Maps, Barstow is near the following active fault zones or regulatory fault zones managed by the Department of Conservation. Some of these fault lines along with probability of occurrence are shown in Figure 4-7.

4.6.3.1 North Frontal Fault

The North Frontal fault is closest to and therefore has the potential to generate the strongest seismic shaking in the area. The North Frontal fault is a partially blind reverse fault zone comprised of several fault splays; it trends south along the eastern flank of the San Bernardino Mountains, and has a combined total length of approximately 40 miles. Several of the fault splays interact with other faults that traverse the region. The most significant fault with which the North Frontal relates is the Helendale fault, which offsets and divides the North Frontal into two main segments, referred to as the East and West segments. The West segment is approximately 22 miles long, and is less than 0.5 miles from Barstow at the closest point.

The North Frontal fault is considered an active fault, based on its having moved within the last 10,000 years. However, it has not been studied in detail, and while it is has been attributed a slip rate of approximately 0.5 mm per year, the parameters

of this fault are not well understood. It is thought that movement on this fault causes an average uplift rate of the San Bernardino Mountains of about 1 mm per year. The West segment of the North Frontal fault zone is considered capable of generating a maximum magnitude 7.2 earthquake, based on its length. Such an earthquake on this fault would generate peak ground accelerations in the planning area of between about 1.1g and 0.4g, which converts to Modified Mercalli intensities as high as XI. Based on rupture of the East segment of the North Frontal fault zone in a 6.7 earthquake, ground shaking of about 0.26g to 0.14g would be felt in the planning area. This converts to Modified Mercalli intensities in the IX to VIII range.

4.6.3.2 Helendale Fault

There are several right-lateral strike-slip faults within what is known as the Eastern California Shear Zone, of which the Helendale fault is the westernmost. Approximately 9 to 23% of the total movement along the North American/Pacific plate boundary motion occurs along this zone. The Helendale fault itself is 56 miles long, but it also seems to form a continuous fault with the South Lockhart fault to the north. The southern end of the Helendale fault apparently offsets the North Frontal fault, as discussed above, forming the East and West segments. The Helendale fault extends to the northeast of the planning area, outside of Barstow's northeastern corporate limits and within the Sphere of Influence. The Helendale fault has an annual slip rate calculated at 0.8 mm/year; it has a recurrence interval for large surface-rupturing events of 3,000 to 5,000 years. Based on currently available data, the California Geological Survey estimates that a

maximum earthquake of magnitude 7.3 along the combined Helendale-South Lockhart faults would generate horizontal peak ground accelerations in Barstow of between 0.75g and 0.3g, with Modified Mercalli Intensities of between XI and IX.

4.6.3.3 San Andreas Fault

Southern California is probably best known for the San Andreas Fault, a 400-mile long fault running from the Mexican border to a point offshore, west of San Francisco. Geologic studies show that over the past 1,400 to 1,500 years, large earthquakes have occurred at about 130-year intervals on the southern San Andreas fault.

The San Andreas Fault zone is located approximately 23 miles southwest of Barstow. The longest fault in the State of California, it extends approximately 750 miles from Cape Mendocino in northern California to the Salton Sea in southern California. The San Andreas, a right-lateral transform fault, is regarded as a "Master Fault" that controls the seismic hazard for central and southern California. The magnitude 8.0 Fort Tejon earthquake, which occurred in 1857, is the last major earthquake to have occurred on the southern San Andreas. As previously discussed, at least one other fault occurs closer to Barstow and has the potential to cause stronger ground

shaking, and therefore more damage, than the San Andreas Fault. Nonetheless, the San Andreas Fault is considered to have a high probability of causing an earthquake in the near future and should therefore be considered in all seismic hazard assessment studies in southern California givenits.

The Fort Tejon earthquake in 1857 ruptured the Cholame, Carrizo, and Mojave segments of the San Andreas fault, and displacements occurred along of as much as 27 feet of the rupture zone. It is estimated that peak ground accelerations in Barstow as a result of the 1857 earthquake may have been as high as 0.38g. Another similar earthquake that ruptured the entire southern San Andreas Fault, with its epicenter along the section of fault closest to Barstow, could generate even higher peak ground accelerations in Barstow, estimated at between 0.48g and 0.25g.

4.6.3.4 Lenwood – Lockhart – Old Woman Springs Faults

Another of the Eastern California Shear Zone faults is the Lenwood fault, a right-lateral strike slip fault approximately 47 miles long. It has a slip rate of about 0.8 mm/year. Based on trenching studies, this fault has ruptured at least three times and these ruptures have occurred as recently as approximately 200 to 400 years ago. Other ruptures are estimated as occurring between 5,000 and 6,000 years ago, and 8,300 years ago. Therefore a recurrence between major surface ruptures

is estimated at between 4,000 to 5,000 years. Prior to the 1992 Landers earthquake the yearly slip rate on this fault had been recorded but not verified.

The Lockhart fault is approximately 44 miles long and is north of the Lenwood fault. The North Lockhart fault, a segment that evidences no activity within the last 11,000 years, is approximately 6 miles. The Lockhart fault is estimated to have an interval of between 3,000 and 5,000 years for majorsurface-rupture.

The Old Woman Springs segment is about 6 miles long and is the main trace in a complex fault system where the Eastern segment of the North Frontal Fault Zone and the Lenwood fault intersect. It is considered an active fault.

The Lenwood and Lockhart faults essentially form a continuous, 90-miles long system. While there is no evidence that both of these faults have ruptured together in the past, such an event may be possible, as evidenced by rupture of five separate fault segments during the Landers earthquake. The technical background study assumes a scenario wherein the Lenwood and Lockhart faults, together with the Old Woman Springs fault, rupture together in a magnitude 7.5 maximum earthquake. Such an event would generate peak ground accelerations in Barstow of about 0.42g to 0.19g, with Modified Mercalli Intensities in the IX to VIII range. A smaller magnitude event involving rupture along only one of these faults ruptures would cause lesser ground motions in Barstow than those reportedabove.

4.6.3.5 Cleghorn Fault

The Cleghorn fault, also known as the Silverwood Lake fault due to its extension across the lake, is approximately 19-miles long. Studies suggest that the fault zone has had about 650 feet of motion in the last 50,000 to 100,000 years, which results in a slip rate of 2 to 4 mm/year. A magnitude 6.5 earthquake on this fault is considered capable of generating horizontal peak ground accelerations in the Barstow area of between about 0.33g and 0.11g, with Modified Mercalli Intensities in the IX to VII range.

4.6.3.6 Cucamonga Fault

The Cucamonga fault zone is approximately 16-miles long. As one element of the Transverse Ranges family of thrust faults, it runs along the southern front of the San Gabriel Mountains from San Antonio Canyon eastward to the Lytle Creek area. It has a slip rate of between approximately 5.0 and 2.0 mm/year with an estimated average recurrence interval of 625 years. The Cucamonga fault is thought capable of generating a maximum magnitude 6.9 earthquake, based on length, and such a scenario would result in peak horizontal ground acceleration in the Barstow area of between about 0.28g and 0.15g, with Modified Mercalli intensities in the IX to VIII range.

4.6.3.7 Landers (or Kickapoo) Fault

The group of faults that ruptured during the 1992 Landers earthquake, including the Homestead Valley, Kickapoo, and Johnson Valley faults, and segments of the Burnt Mountain and Eureka Peak faults, are known as the Landers fault. The Landers fault now refers to the Kickapoo fault. These faults are part of the Eastern Mojave Shear Zone and were discovered after they ruptured the surface during the 1992 Landers earthquake. It is estimated that intervals between major ruptures is in the thousands of years, The 1992 earthquake resulted in substantial lateral displacement along some of these faults, for instance nearly 9.5 feet in the case of the Kickapoo fault. Individually, these faults could rupture in smaller earthquakes. Their combined lengths allowed for the magnitude 7.3 earthquake that shook southern California on June 28, 1992.

Ground shaking in the Barstow area due to a Landers-type earthquake on these faults would cause horizontal ground accelerations of between 0.27g and 0.14g, with Modified Mercalli intensities in the IX to VIII range.

4.6.3.8 Sierra Madre Fault

The Sierra Madre fault zone or complex is approximately 47 miles long and extends along the base of the San Gabriel Mountains from the San Fernando Valley to San Antonio Canyon; from there it continues southeastward as the Cucamonga fault. The estimated slip rate of the Sierra Madre fault is estimated to be approximately 0.6 mm/year with a recurrence interval of about 8,000 years. Recent studies suggest that the last rupture event on the eastern segments of the fault occurred about 8,000 years ago, therefore, the Sierra Madre fault may be near the end of its cycle, and therefore it has potential generate an earthquake in the not too distant future. The Sierra Madre fault is estimated to be capable of producing a magnitude 7.2 earthquake, resulting in peak horizontal ground accelerations in Barstow of between about 0.21g and 0.14g

4.6.3.9 Gravel Hills – Harper Lake Fault

This fault zone is between 31 and 44 miles long, depending on how many fault segments are included and is considered active. The estimated annual slip rate on this fault zone is 0.9 mm/year; the recurrence interval between earthquakes is about 3,500 years. The combined fault segments are estimated to be capable of generating 7.1 magnitude earthquake, which would generate peak horizontal ground accelerations in the Barstow area of between 0.20g and 0.11g, with Modified Mercalli intensities in the VIII to VII range.

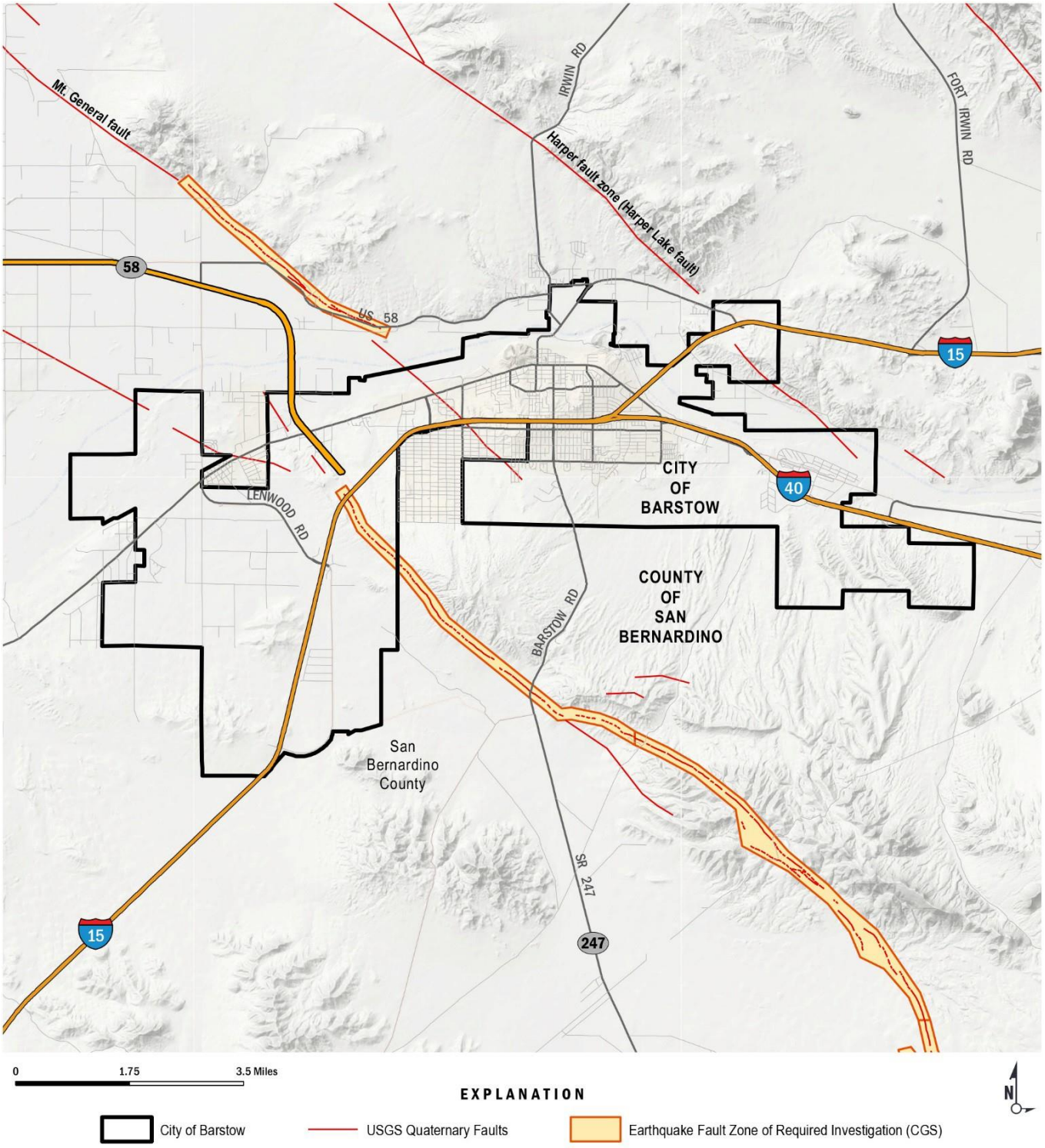


Figure 4-5: Active Fault Map

Source: Department of Conservation & USGS

4.6.4 Magnitude/Severity

Classification of seismic events is based on their magnitude and intensity. The intensity of ground shaking is determined by several factors, such as the earthquake's magnitude, the distance from the epicenter, and the geologic composition of local soils and rocks. Seismic intensity is most commonly measured by the Modified Mercalli Intensity (MMI) scale, which includes twelve levels of damage. The MMI is derived from actual observations of damage to structures and human reactions to earthquakes. Based on this scale, an earthquake tremor at Level I earthquake tremor is generally not felt and is considered unlikely to result in damage, whereas a Level XII earthquake results in total destruction. Earthquake intensities may result in damage such as partial or complete collapse of masonry structures, severe damage to complete destruction of underground pipelines, rock and landslides, and massive damage or destruction of bridges, overpasses and other improvements.

Figure 4-6 shows MMI classes for Barstow based on the Great Shakeout Scenario of a magnitude 7.8 earthquake along the southern San Andreas Fault.

Earthquake magnitude is measured by the Richter Scale on a continuum of one to nine, with each level-of-magnitude increase representing a tenfold increase in the amplitude of the waves on a seismogram. The most notable historic earthquake in the Barstow region was the Landers earthquake of 1992, which had a magnitude of 7.3 on the Richter Scale. The Landers earthquake, so named for its epicenter near the small desert community of Landers, also ruptured five other separate faults.

The largest earthquake likely to occur on a fault or fault segment within a specified period of time is considered the Maximum Probable Earthquake (MPE). The MPE is useful during emergency and engineering planning. It provides a means to assess the potential seismic risk within a region, is referenced to establish safe construction and design parameters, and facilitates the preparation of policies and programs that are responsive to the potential impacts of an earthquake.

Defined as the largest earthquake a fault is estimated to be capable of generating, the Maximum Credible Earthquake (MCE) also provides a useful gauge for emergency and engineering planning efforts. In the Barstow area, the North Frontal fault (West) is expected to generate a magnitude 7.2 earthquake with a Peak Ground Acceleration (PGA) ranging from 1.13g to 0.38g, which is equivalent to a Level XI to X on the Modified Mercalli Intensity Scale (MMI). Table 4-7 shows a list of faults that could generate significant impacts within Barstow and the surrounding area.

Potential adverse effects from earthquakes may be substantial and range from property damage, to the loss of public services and facilities, to loss of life. Barstow and the surrounding area are most susceptible to severe impacts associated with strong ground shaking.

Strong ground shaking can cause other geologic hazards, including landslides, ground lurching, structural damage or destruction, and liquefaction, which can further disrupt affected areas through fire, the interruption of essential services or damage to facilities and infrastructure, such as water, sewer, gas, electric, transportation, communications, drainage, as well as release of hazardous materials. Dam or water tank failure brought about by seismic activity can result in flood inundation. There are no faults mapped by the State of California within the Cities' corporate limits or within either of the proposed annexation areas; however shaking will be felt as a result of faults within portions of the City's Sphere of Influence (Figure 4-6)

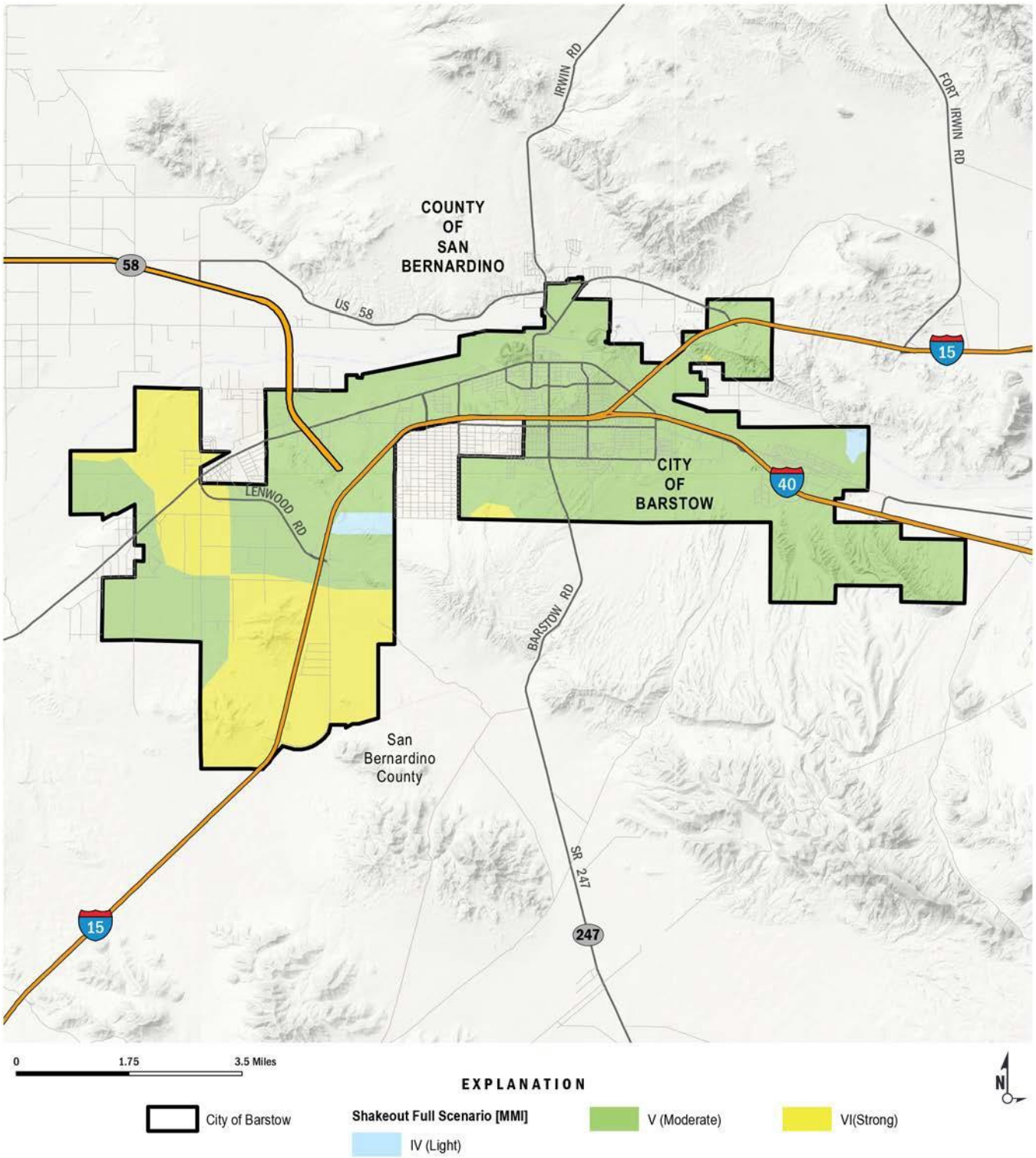


Figure 4-6: Great Shakeout Scenario MMI Classes

4.6.5 Frequency / Probability of Future Occurrences

While earthquakes occur less frequently than other primary natural hazard events, they have accounted for the greatest combined losses (deaths, injuries, anddamage costs) in disasters since 1950 in California andhave the greatest catastrophic disaster potential (Cal EMA, 2010).

The USGS estimates that the probability of an earthquake occurring over the next 30 Years in the Southern California with a magnitude of 6.7 or greater is 93 percent. Table 4-8 from the USGS lists Average time between earthquakes in the Southern California region together with the likelihood of having one or more such earthquakes in the next 30 years (starting from 2014). "Readiness" indicates the factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquakes. The values from the USGS include aftershocks. It is important to note that actual repeat times will exhibit a high degree of variability, and will almost never exactly equal the average listed in the table.

Table 4-8: Southern California Region Earthquake Probability

Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events	Readiness
5	.7	100%	1.0
6	2.3	100%	1.0
6.7	12	93%	1.0
7	25	75%	1.1
7.5	87	36%	1.2
8	522	7%	1.3

Source: USGS UCERF3: A New Earthquake Forecast for California's Complex Fault System FS 2015-3309

Uniform California Earthquake Forecasts (UCERF) estimated the likelihood that California will experience a magnitude 8 or larger earthquake in the next 30 years has increased from about 4.7% in 2007 (UCERF2 [1]) to about 7.0% for the thirty-year duration starting in 2014 (UCERF3 [2]). Several of the major Southern California faults have a high probability of experiencing a Magnitude 6.7 or greater earthquake within the next 30 years (Figure 4-7); 59% probability of a M6.7 or greater on the Southern San Andreas Fault, 31% probability on the San Jacinto Fault, and 11% probability on the Elsinore Fault. These probabilities were determined by the USGS and CGS in a 2008 study (2007 Working Group on California

[1] USERF2 = 2008 California Earthquake Probabilities. In April 2008, scientists and engineers released a new earthquake forecast for the State of California called the UCERF. Compiled by USGS, Southern California Earthquake Center (SCEC), and the California Geological Survey (CGS), with support from the California Earthquake Authority, it updates the earthquake forecast made for the greater San Francisco Bay Area by the 2002 Working Group for California Earthquake Probabilities.

[2] UCERF3 = 2014 California Earthquake Probabilities. UCERF3 is the first type of model, representing the latest earthquake-rupture forecast for California. It was developed and reviewed by dozens of leading scientific experts from the fields of seismology, geology, geodesy, paleoseismology, earthquake physics, and earthquake engineering. As such, it represents the best available science with respect to authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes throughout the state (further background on these models, especially with respect to ingredients, can be found in U.S. Geological Survey Fact Sheet 2008–3027, http://pubs.usgs.gov/fs/2008/3027/)

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

Figure 4-7 shows the locations of major faults in California, including the four (4) major faults in Southern California in relation to San Bernardino County region. These faults are the Southern San Andreas, the San Jacinto, the Elsinore, and the Garlock Faults. There are also many smaller faults within San Bernardino County capable of producing significant earthquakes. However, these four faults are considered by the United States Geological Survey (USGS) and the California Geological Survey (CGS) to be the most dangerous in the County. (California Geological Survey Special Publication 42, Interim Revision 2007, "Fault-Rupture Hazard Zones in California" - Alquist-Priolo Earthquake Fault Zoning Act).

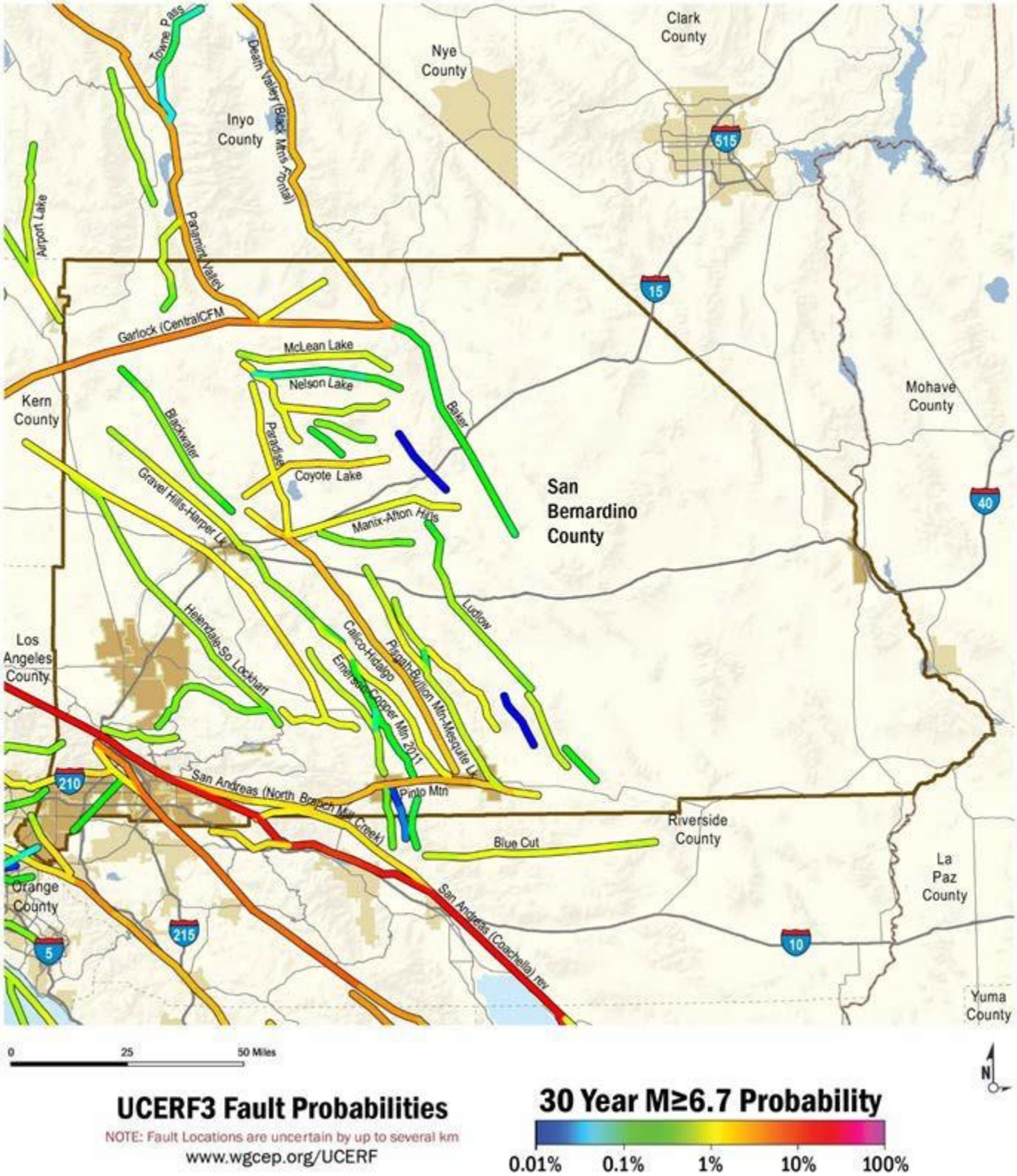


Figure 4-7: UCERF 3 Fault Probabilities

4.7 Climate Change

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 whole Earth. 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 oceancirculation);
- 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.).

The effects of climate change are varied: warmer and more varied weather patterns, melting ice caps, and poor air quality, for example. As a result, climate change impacts a number of natural hazards.

The 2013 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

4.7.1 Regulatory Environment

4.7.1.1 The 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 the regional transportation plan (RTP) and contains land use, housing, and transportation strategies to meet GHG reductions targets. In San Bernardino County, the South Coast Air Quality Management District facilitates compliance with the federal Clean Air Act and implements the state's air quality program.

The Office of Planning and Research's General Plan Guidelines and SB 375 builds upon Assembly Bill 162 (flood protection) and Senate Bill 1241 (fire protection) and supports Safeguarding California implementation.

SB 375 also supports Assembly Bill 2140 which requires that a City/County General Plan contains a safety element in addition to a Hazard Mitigation Plan. AB 2140 also requires a vulnerability assessment, adaptation goals, policies and objectives, and a set of feasible implementation measures.

4.7.1.2 California Adaptation Planning Guide(APG)

The State of California has been taking action to address climate change for over 20 years, focusing on both greenhouse gas emissions reduction and adaptation. The California Adaptation Planning Guide (APG) continues the state's effort by providing guidance and support for communities addressing the unavoidable consequences of climate change.

Based upon specific factors, 11 Climate impact regions were identified. Some of the regions were based on specific factors particularly relevant to the region. As illustrated in Figure 4-8 San Bernardino County is located in the Desert Region.

4.7.1.3 RESOURCE CONSERVATION AND OPEN SPACE ELEMENT

The City's location within the Mojave Desert has allowed its residents to enjoy clear skies and favorable weather conditions due to the elevation, prevailing winds and distance to more densely developed cities.

Smog, contaminants and other Impacts to healthy air quality are not as prevalent in the City as they are in cities below the Cajon Pass. Strategies including incorporation of design features into new development, businesses and minimizing fugitive dust generation will help reduce air quality impacts and enhance the desired livability of the City.

The City is located within the Mojave Desert Air Basin, an assemblage of mountain ranges and valleys with a geographic area that incorporates most of San Bernardino County, and parts of Los Angeles County, Kern County and Riverside County. The San Gabriel Mountains and the San Bernardino Mountains separate the Mojave Desert Air Basin from the San Bernardino Valley and the South Coast Air Quality Management District.

The Mojave Desert Air Basin is a "non-attainment" area for federal and state air quality standards for ozone and state standards for particulate matter less than 10 microns and 2.5 microns in diameter (PM10 & PM2.5) excluding some areas in the western portions of the Mojave Desert Air Quality Management District. Additionally, because Barstow exceeded state and/or federal standards for ozone and nitrogen dioxide for several days in 2012 the City is defined by law as a nonattainment area for these pollutants as well.

The Mojave Desert Air Quality Management District (MDAQMD), regulates air quality improvement programs within the basin, and works to improve regional air quality to achieve federal and state standards. The District comments on all air quality and related matters within its jurisdiction, and provide comments regarding air quality impacts from projects. The City has continued to work with the MDAQMD and in accordance with the applicable Air Quality Management Plan to improve regional air quality. The City's air quality is largely impacted by significant concentrations of ozone and particulate matter. Local air quality is determined by the type and amount of contaminants emitted into the atmosphere, the size and topography of the air basin and weather conditions particularly, wind speed and direction. Ozone and particulate matter monitors located in the City reveal both contaminants exceeding federal and state ambient air quality standards, although ozone concentrations have decreased over the years. However, it has been recognized by the California Air Resources Board that these ozone concentrations are largely influenced by prevailing winds transporting ozone from other downwind regional sources and affecting local readings.

Photochemical ozone modeling conducted by the South Coast Air Quality Management District and California Air Resources Board indicates that the basin would be in compliance of standards without the influence of the transported air pollution from other upwind regions.

Particulate matter concentrations have fluctuated historically but the annual average concentrations are generally over the state standards. The City is impacted significantly by fugitive dust primarily from unpaved roads, construction activities, and local disturbed areas. These particulates can have an adverse impact on sensitive receptors in the population including children, the elderly, persons with respiratory or cardiovascular illness, and people exercising outdoors.

The City contains several logistics and warehousing uses that have heavy trucking operations. However, the local air quality conditions result largely from sources outside the immediate area, as prevailing winds carry air pollution from the valleys south of the Cajon Pass and west of the Tehachapi Mountains.

The City has recently adopted a local alternative energy ordinance that will encourage and facilitate production of clean energy for local homes and businesses. The implementation of these renewable energy sources in residential, commercial, and industrial developments will lessen the City's energy consumption, thereby decreasing the amount of air pollutants generated. In addition, the utilization of recycling programs in the City will further reduce air pollutant emissions because new products will not have to be produced.

A Climate Action Plan is proposed for adoption by the City sometime after the adoption of the General Plan Update which will further address reductions of greenhouse gas emissions. Additional information concerning local air quality and greenhouse gases can be found in the technical reports that are included as attachments to the General Plan Master Environmental Impact Report.

Taken from the City of Barstow General Plan 2015-2020

Figure 4-8: Climate Impact Regions

The Desert is a heavily urbanized inland region (4.3+ million people) made up of sprawling suburban development in the west near the South Coast region and vast stretches of open, largely federally owned desert land to the east. Prominent cities within the desert portion include Palm Springs (44,500+) and El Centro (42,500+). The region's character is defined largely by the San Gabriel Mountains, San Gorgonio Mountains, San Jacinto Mountains, and smaller inland mountains reaching through the desert to the Colorado River, which borders the region on the east. Communities in the Desert region should consider evaluating the following climate change impacts:

- Reduced water supply
- Increased temperature
- Reduced precipitation
- Diminished snowpack
- Wildfire risk
- Public health and social vulnerability
- Stress on special-status species

4.7.2 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 earthquake and floods that occur over a finite time period, climate change is an on- going 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.

According to the California State Hazard Mitigation Plan (SHMP), the worst single heat wave event in California occurred in Southern California in 1955, when an eight-day heat wave resulted in 946 deaths. The July 2006 heat wave in California caused approximately 140 people deaths over a 13-day period.

4.7.3 Location/Geographic Extent

The effects of climate change are not limited by geographical borders. San Bernardino County, the State of California, the United States, and the rest of the world are all at risk to climate change. As such, the entire County is at risk to the effects of climate change.

Figure 4-9 and Figure 4-10 provide Cal Adapt[3] modeled decadal July high temperature averages for 2010 and 2090. These figures provide current decade-long July temperature averages and possible annual high heating trends for the remaining portion of the century. The data presented in the figures represent a "projection" of potential future climate scenarios, they are not predictions. These figures illustrate how the climate may change based on a variety of different potential social and economic factors. The visualizations are comprised of average values from Coupled Climate model 2.1 (GFDL), Community Climate System Model Version 3 (CCSM3), Coupled Global Climate Model Version 3 (CNRM) and Parallel Climate Model 1 (PCM1).

During the next few decades, scenarios project average temperature to rise between 1° and 2.3°F; however, the projected temperature increases begin to diverge at mid-century so that, by the end of the century, the temperature increases projected in the higher emissions scenario (A2) are approximately twice as high as those projected in the lower emissions scenario (B1). Customizable maps can be viewed at http://cal-adapt.org/temperature/decadal/

[3] Cal-Adapt has been funded to provide access to data and information that has been produced by the State's scientific and research community. The data available in this site offer a view of how climate change might affect California at the local level.

Figure 4-9: Climate Impact Regions: July Decadal Average High Temperature Map; 2010

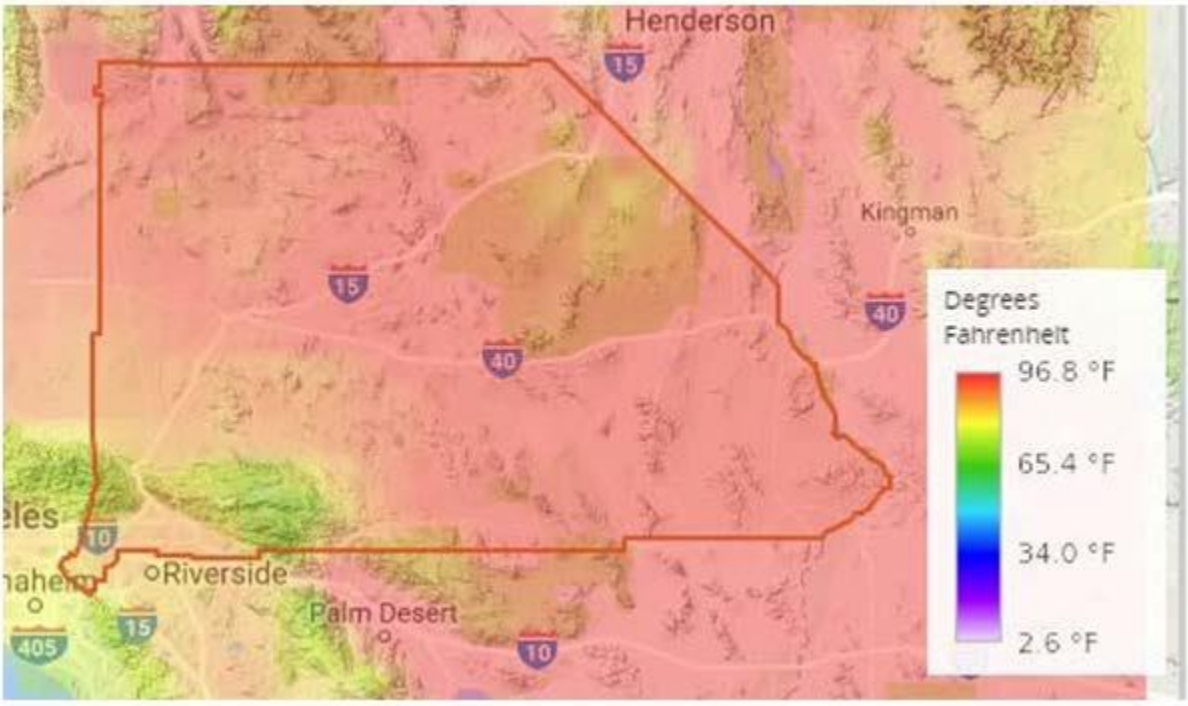


Figure 4-10: Climate Impact Regions: July Decadal Average High Temperature Map; 2090

4.7.4 Magnitude/Severity

The California Adaptation Planning Guide has calculated projections for changes in temperature, precipitation, heat waves, snowpack and wildfire risk in the desert area, as shown in Table 4-9. Hotter, drier conditions are expected to exist in the desert area, increasing the risk for other naturalhazards.

Table 4-9: Summary of Cal-Adapt Climate Projections for the Desert Region

Effect	Ranges
Temperature Change, 1990-2100	January increase in average temperatures: 2°F to 4°F by 2050 and 5°F to 8°F by 2100 July increase in average temperatures: 3°F to 5°F by 2050 and 6°F to 9°F by 2100 (Modeled high temperatures; high carbon emissions scenario)
Precipitation	Generally, annual rainfall will decrease in the most populous areas. Wetter areas like the western part of Riverside and southwestern San Bernardino counties will experience a 2 to 4 inch decline by 2050 and 3.5 to 6 inch decline by the end of the century. Big Bear is expected to lose around 8 inches per year by 2090. Southern Imperial County will have a small decline of about 0.5 inches. The eastern, desert portion of the region will see little to no change in annual rainfall. (CCSM3 climate model; high carbon emissionsscenario)
Heat Wave	Heat waves are defined by five consecutive days over temperatures in the 100s over most of the region. Three to five more heat waves will be experienced by 2050, increasing to 12 to 16 in the western parts of the region to more than 18 to 20 in the eastern parts of the region.
Snowpack	March snowpack in the Big Bear area will diminish from the 2.5- inch level of 2010 to 1.4 inches in 2030 and almost zero by 2090. (CCSM3 climate model; high emissions scenario)
Wildfire Risk	Most areas are projected to have the same or slightly increased likelihood of wildfire risk. The major exceptions are the Mecca San Gorgonio and San Jacinto Mountains, where wildfire will be 1.5 and 2.0 times more likely. (GFDL model, high carbon emissions scenario)

Source: Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org]

The California Climate Adaptation Strategy (CAS), citing a California Energy Commission study, states that "over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined." This study shows that California is getting warmer, leading to an increased frequency, magnitude, and duration of heat waves. These factors may lead to increased mortality from excessive heat, as shown in Figure 4-11.

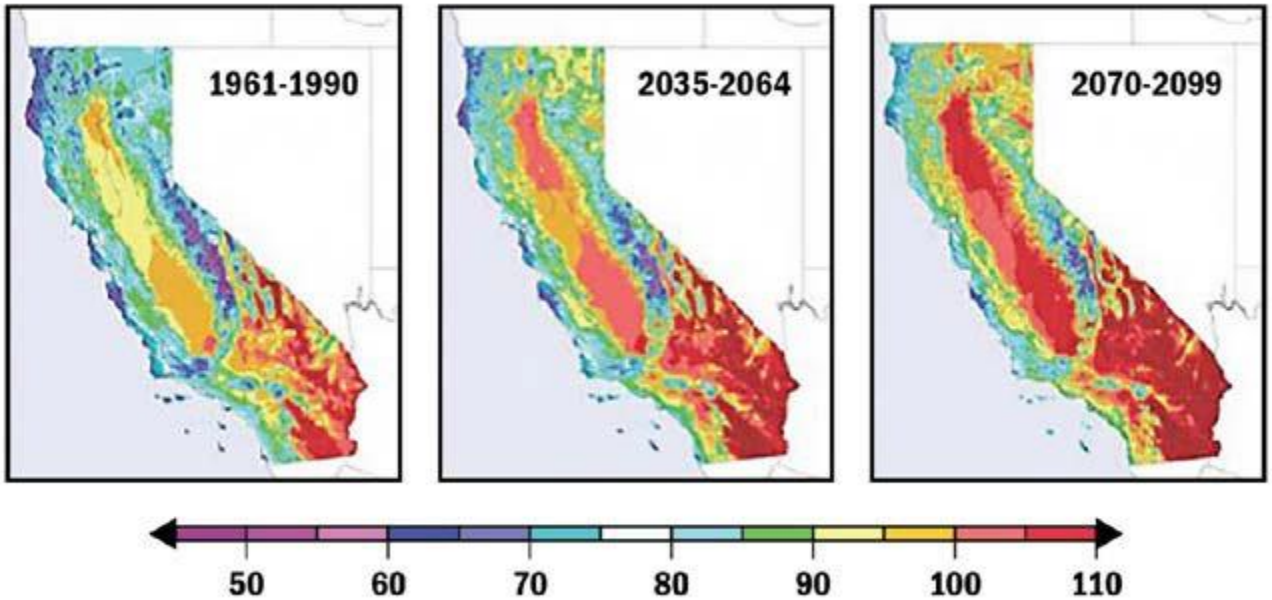


Figure 4-11: California Historical and Projected Temperature Increases - 1961 to 2099

Source: Dan Cayan; California Climate Adaptation Strategy

4.7.5 Frequency/Probability of Future Occurrences

Climate change is one of the few natural hazards where the probability of occurrence is influenced by human action. In addition, unlike earthquake and floods that occur over a finite time period, climate change is an on-going hazard.

The 2009 Climate Adaptation Strategy (CAS) delineated how climate change may impact and exacerbate natural hazards in the future, including wildfires, extreme heat, floods, drought, and levee failure:

- Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in San Bernardino County 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.
- The Desert region relies on water from the Colorado River and the State Water Project. Both of these sources begin with mountain snowpack. Climate change will result in drastically reduced supply from these sources. Declining snowpack in the San Gabriel Mountains, San Gorgonio Mountains, and San Jacinto Mountains will lead to permanently diminished local water supply.
- Higher temperatures will melt the snowpack earlier and drive the snowline higher, resulting in less snowpack to supply water to California users.
- Droughts are likely to become more frequent and persistent in the 21st century.

- Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and/or more extensive flooding.
- Storms and snowmelt may coincide and produce higher winter runoff. Together, these changes will increase the probability of dam and levee failures in the San Bernardino County Flood Control District.
- Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire risk through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations, both of which affect forest health and reduce forest resilience to wildfires. An increase in 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.

4.8 Vulnerability Assessment

The hazard exposure analysis has been developed with best available data and follows methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses. There are other intangible losses that could result from a natural hazard event, such as losses of historic or cultural integrity or damage to the environment that are difficult to quantify. Other costs, including response and recovery costs, are often unrecoverable and are not addressed in this document.

4.8.1 Methodology

A vulnerability assessment was conducted for each of the identified priority hazards. Geospatial data is essential in determining population and assets exposed to particular hazards. Geospatial analysis can be conducted if a natural hazard has a particular spatial footprint that can be overlaid against the locations of people and assets. In the City of Barstow, wildfire, flood, and earthquakes have known geographic extents and corresponding spatial information about each hazard.

Several sources of data are necessary to conduct a vulnerability analysis. Figure 4-12 provides an exhibit of the data inputs and outputs used to create the vulnerability analysis results presented in this section. U.S. Census data is the primary source in determining natural hazard exposure to residents. Census data has been used to determine the population at risk, which is generally referred to as population exposure. Population exposure is provided for wildfire, flooding, and earthquakes as potential hazards later in this section.

Together with the U.S. Census data, asset data was used to provide a snapshot of how City assets are affected by natural hazards. For purposes of this vulnerability analysis, asset data includes parcels and critical infrastructure within the City of Barstow boundaries. Critical infrastructure is described as assets that are essential for people and a community to function. Critical infrastructure includes such as utilities, Barstow owned facilities, bridges, schools, and other community facilities that provide essential services to residents.

Critical facilities data was developed from a variety of sources including Barstow owned and maintained data, state and federal government datasets, and private industry datasets. A critical infrastructure spatial database was developed to translate critical facilities information into georeferenced [4] points. Critical facility points are intersected with the spatial hazard layers to develop a list of “at risk” critical facilities. The City of Barstow’s critical facilities that intersect with natural hazards are referred to as facilities with hazard “exposure”. Exposure results are presented later in this section.

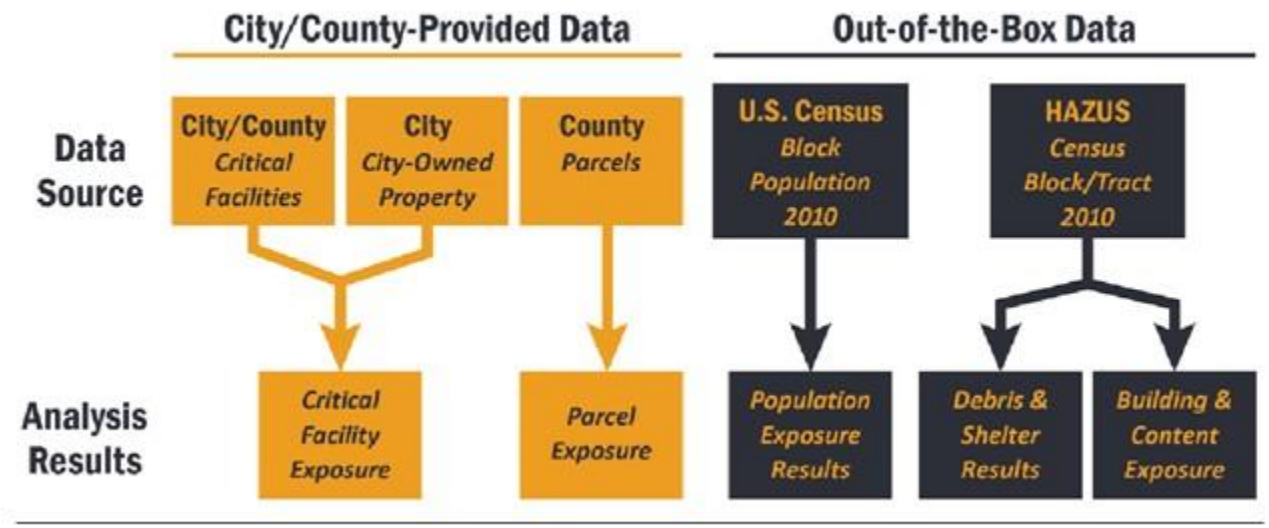


Figure 4-12: Data Source and Methodology

Lastly, FEMA's Hazus 3.2 (Hazus) software was implemented to conduct detailed loss estimation for flood and earthquake. 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 graphically illustrate the limits of identified high-risk locations due to possible earthquakes and floods.

The vulnerability and potential impacts from priority hazards that do not have specific mapped areas nor the data to support additional vulnerability analyses are discussed in more general terms following the discussion on wildfire, flooding, dam failure and earthquake hazards.

4.8.2 Population and Assets

To describe vulnerability for each hazard, it is important to understand the "total" population and "total" assets at risk. The exposure for each hazard described in this section will refer to the percent of total population or percent of total assets. This provides the possible significance or vulnerability to people and assets for the natural hazard event and the estimated damage and losses expected during a "worst case scenario" event for each hazard. Sections below provide a description of the total population, critical facilities, and parcel exposure inputs.

[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.

4.8.2.1 Population

To develop hazard-specific vulnerability assessments, population near natural hazard risks should be determined to understand the total "at risk" population. We can understand how geographically defined hazards may affect the City of Barstow by analyzing the extent of the hazard in relation to the location of population. For purposes of the vulnerability assessment approximately 100% of the City population is exposed to one or more hazards within or near Barstow's boundaries. Each natural hazard scenario affects the City of Barstow residents differently depending on the location of the hazard and the population density of where the hazard could occur. Vulnerability assessment sections presented later in this section summarize the population exposure for each natural hazard.

4.8.2.2 Vulnerable Populations

The severity of a disaster depends on both the physical nature of the extreme event and the socioeconomic nature of the populations affected by the event. Important socioeconomic factors tend to influence disaster severity. A core concept in a vulnerability analysis is that different people, even within the same region, have a different vulnerability to natural hazards.

4.8.2.2.1 Income and Housing Condition

Income or wealth is one of the most important factors in natural hazard vulnerability. This economic factor affects 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, when disaster strikes, low income residences are far more likely to be injured or left without food and shelter during and after natural disasters.

Figure 4-13 shows the median household income distribution for the City of Barstow in 2012. 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 Barstow between 2010 and 2014 was $39,514. In the United States during the same period, the median house household income was $50,157. The map in Figure 4-13 shows 2012 household income estimates using Census 2010 geographies.

4.8.2.2.2 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. The elderly often also have declining vision and hearing and often miss reports of upcoming natural hazard events. Children, especially young children, have the inability to provide for themselves. In many cases, both children and the elderly depend on others to care for them during day-to-day life.

Finally, both children and the elderly have fewer financial resources and are frequently dependent on others for survival. In order 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 the City, State and Federal emergency management agencies and organizations. See Figure 4-14 and Figure 4-15 for location of vulnerable population by age within the City of Barstow.

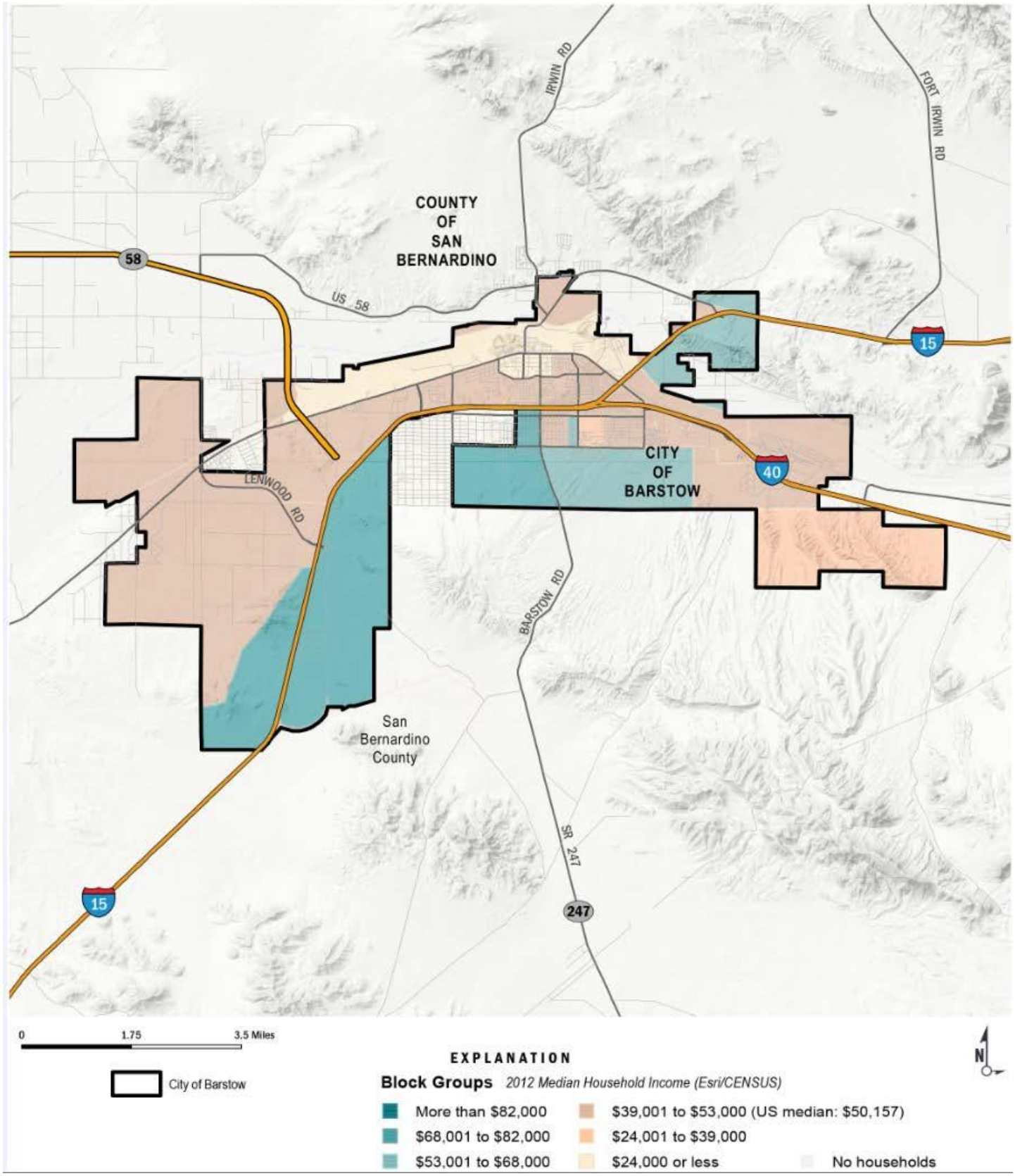


Figure 4-13: Median Household Income Distribution Map

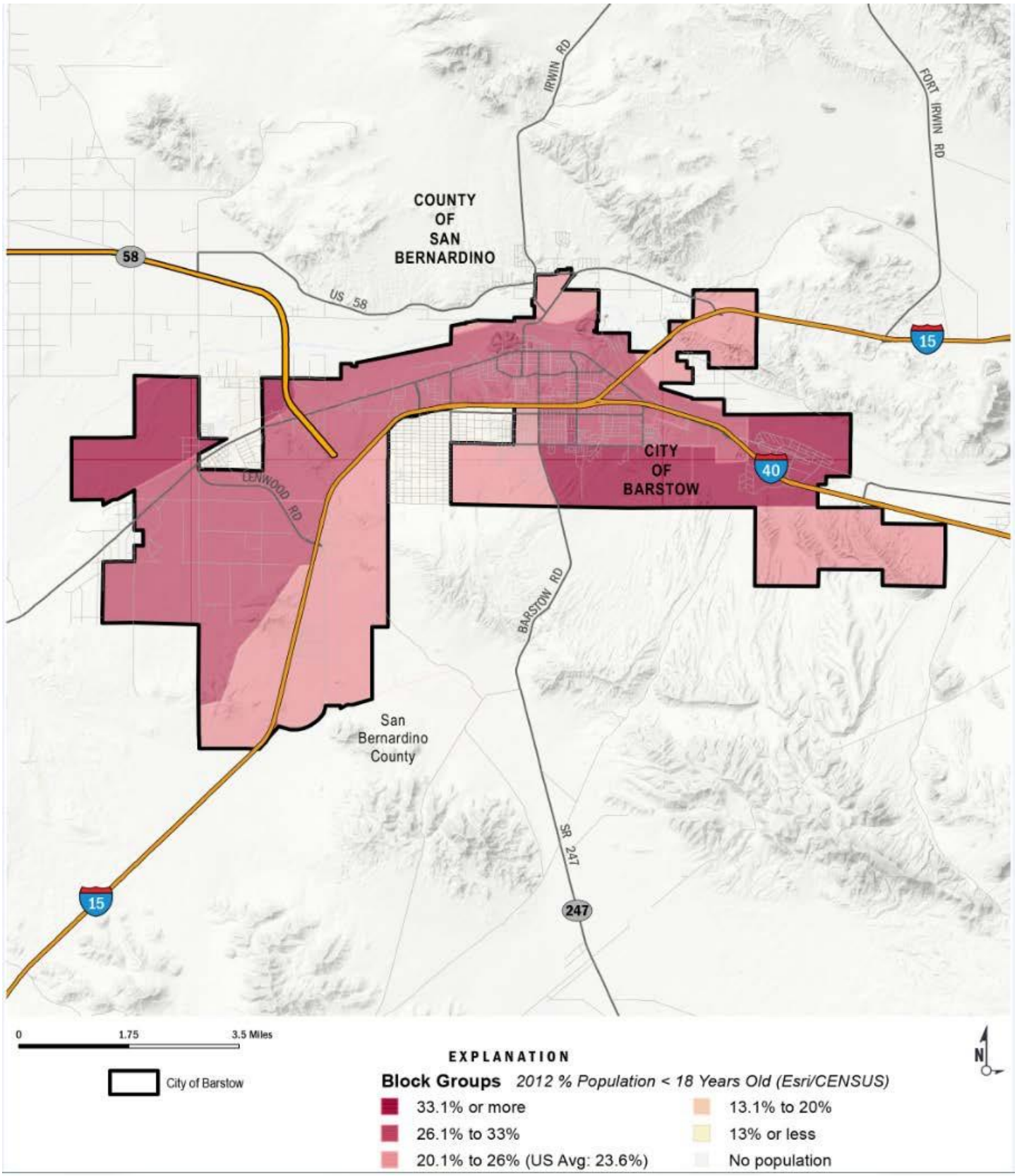


Figure 4-14: Population under 18

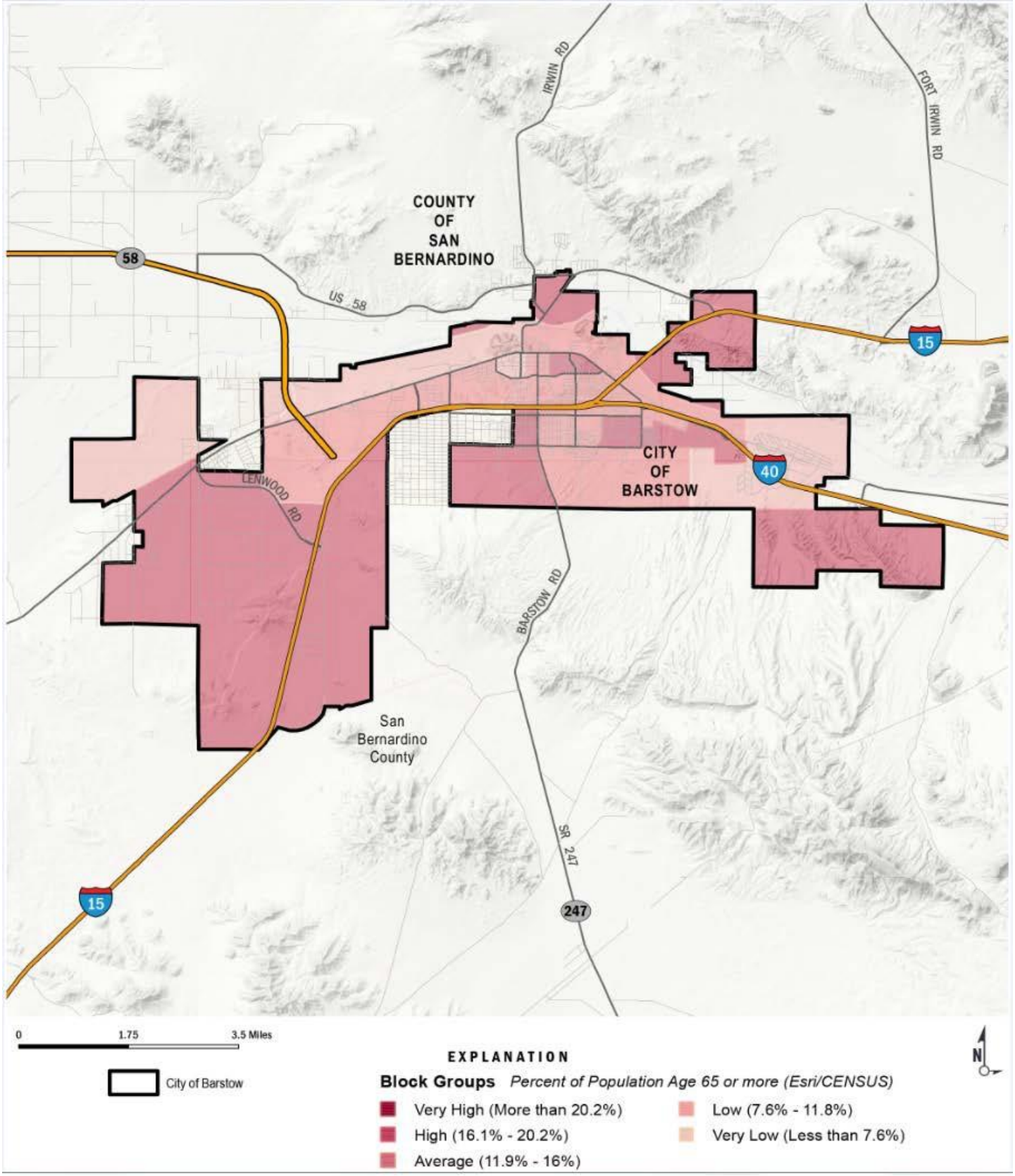


Figure 4-15: Population Over 65

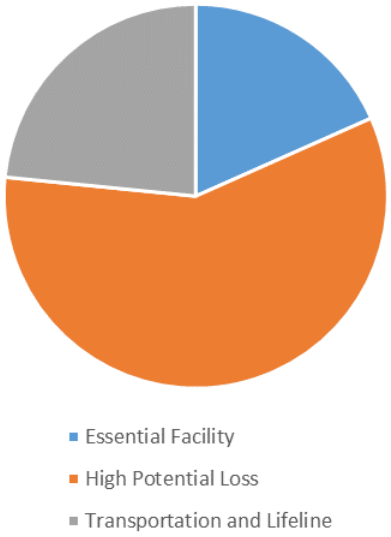
4.8.3 Critical Facilities

Critical facilities are of particular concern when conducting hazard mitigation planning. Critical facilities are defined as essential services, and if damaged, would result in severe consequences to the health, safety, and welfare of the public.

An inventory of critical facilities based on data from the County and other publicly sourced information were used to develop a comprehensive inventory of facility points and lifelines. Critical facility points include fire stations, buildings containing hazardous materials (HAZMAT), schools, transportation, utilities, and government buildings. Lifelines include transportation routes only. A current representation of the critical facilities and lifelines are provided in Table 4-10. Some critical facility information has been omitted from documentation due to national security purposes. The Emergency Preparedness Department manages and maintains a complete list of critical facilities.

4-10: Critical Facility Points

Infrastructure Type	Total Feature Count
Essential Facility	29
EOC	1
Fire Station	3
Hospital	5
Police Station	2
School	18
High Potential Loss	92
Hazmat	77
Utility-Communication Facility	2
Utility-Waste Water Facility	1
Vulnerable Population-Adult Residential Care	2
Vulnerable Population-Child Care	8
Vulnerable Population-Foster/Home Care	2
Transportation and Lifeline	37
Highway Bridge	31
Railway Bridge	3
Bus Facility	1
Rail Facility	2
Grand Total	**158**



4.8.3 HAZUS- MH Inputs

FEMA's loss estimation software, Hazus 3.2, was used to analyze the City of Barstow 's building risk to flood and earthquake hazards. Hazus contains a database of economic, demographic, building stock, transportation facilities, local geology, and other information that can be used for several steps in the risk assessment process. Hazus software operates on structure square footage, structure replacement, and content replacement costs aggregated to the census block and tract levels depending on type of hazard analysis. Figure 4-16 and Figure 4-17 provides value data for building categories at the census block and census tract levels. Census block and census tracts are used to provide input information for the Hazus analysis presented in thisreport.

The project team used these newly updated DFIRM data into HAZUS to assess potential losses in the mapped 100-year (with and without levee protection) and 500-year flood zones. The City of Barstow 's results are provided in Table 4- 13.

Note: The Hazus software utilizes different census level information inputs to develop loss estimates depending on the hazard module. The flood module uses census block information while the earthquake module uses census track information. It is important to understand the total values of each as estimated damage to the community is presented on a percent of total value basis.

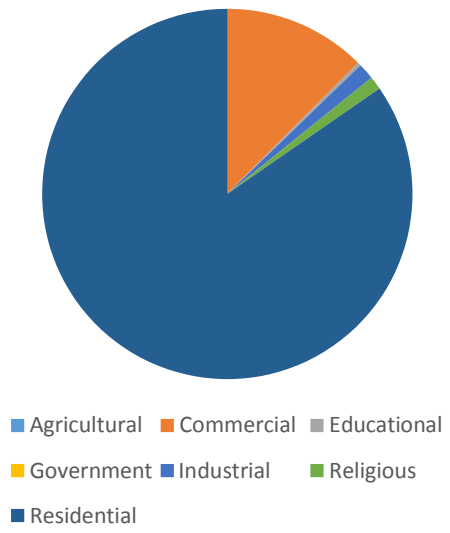
Also building losses are those losses associated with damage to the fixed elements of a structure, such as the foundation, walls, or floors. Content losses are those losses associated with damage to structural elements not permanently fixed within a structure, such as furniture, appliances, and personal possessions.

Table 4-11: Entire City of Barstow Hazus Flood Census Block Input Values

Building Type	Building Replacement Costs ($000)	Building Replacement Cost (% of Total Value)	Content Replacement Cost ($000)	Content Replacement Cost (% of Total Value)	Total Estimated Loss ($000)	Total Loss Estimation (% of Total Value)	Total Value ($000)
Agricultural	1	0.02%	8	0.20%	9	0.22%	4,062.00
Commercial	1,178	0.17%	3,626	0.52%	4,976	0.71%	697,096.00
Educational	29	0.02%	192	0.13%	223	0.15%	149,821.00
Government	-	0.00%	-	0.00%	-	0.00%	58,819.00
Industrial	135	0.29%	248	0.53%	408	0.87%	46,860.00
Religious	108	0.13%	821	1.00%	934	1.14%	81,972.00
Residential	8,003	0.33%	4,346	0.18%	12,373	0.51%	2,412,189.00
Grand Total	**9,454**	**0.27%**	**9,241**	**0.27%**	**18,923**	**0.55%**	**3,450,819**

Total Building Input Values by Occupancy

Census Block Level



Total Content Input Values by Occupancy

Census Block Level

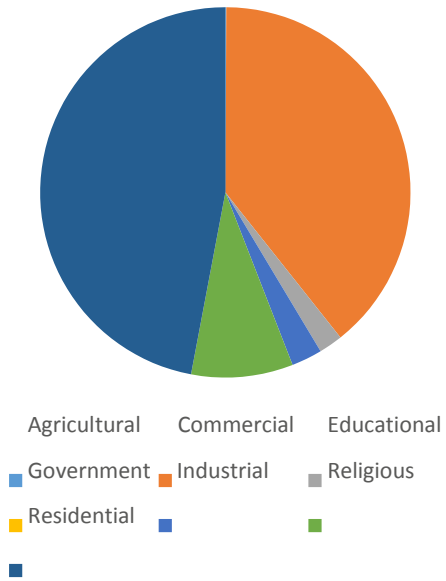
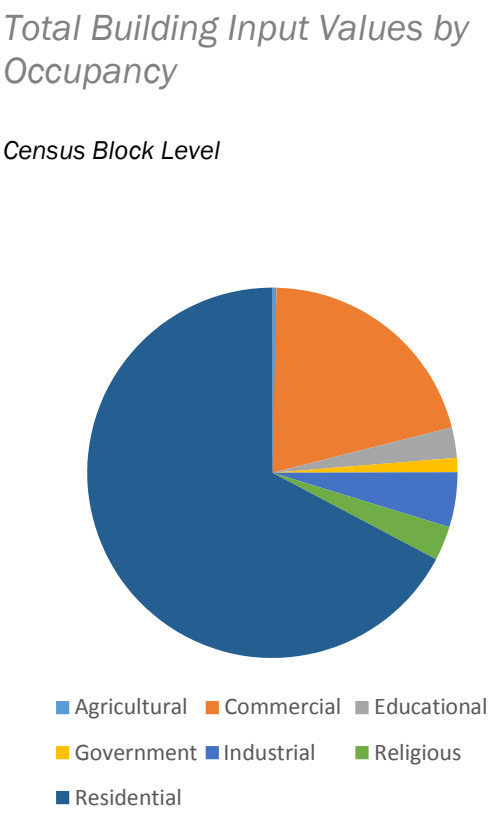


Figure 4-16: Census Block Building and Content Exposure Values-Flood

Table 4-12: Entire City of Barstow Hazus Earthquake Census Tract Input Values

Building Type	Building Replacement Costs ($000)	Building Replacement Cost (% of Total Value)	Content Replacement Cost ($000)	Content Replacement Cost (% of Total Value)	Total Estimated Loss ($000)	Total Loss Estimation (% of Total Value)	Total Value ($000)
Agricultural	52	0.4%	19	0.1%	71	0.5%	13,674.00
Commercial	3,080	0.3%	1,241	0.1%	4,321	0.5%	940,574.00
Educational	397	0.2%	205	0.1%	602	0.3%	182,993.00
Government	184	0.3%	71	0.1%	255	0.4%	67,148.00
Industrial	713	0.5%	339	0.2%	1,051	0.7%	143,939.00
Religious	446	0.3%	177	0.1%	623	0.5%	135,030.00
Residential	10,011	0.2%	2,257	0.1%	12,268	0.3%	4,387,160.00
Grand Total	**14,883**	**0.3%**	**4,309**	**0.1%**	**19,193**	**0.3%**	**5,870,518**



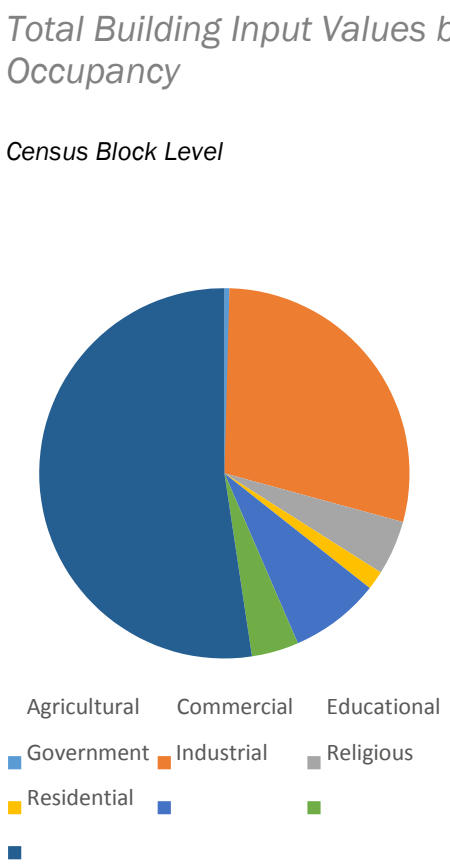


Figure 4-17: Figure 4 17: Census Tract Building and Content Exposure Values-EQ

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4.9 Vulnerability Assessment-Flooding

Flooding has shown to be a natural hazard with concerns in the City of Barstow as described in the flood hazard profile. Historically, San Bernardino County has been subject to flooding during periods of heavy rainfall, falling primarily between the months of October through April, which causes streams and drainage canals to become overwhelmed and overflow their banks and/or inundate storm drainage systems. Occasionally, overbank flows in the City of Barstow have resulted in flooding of residential properties, road blockages, and traffic disruptions. In urbanizing areas, the increase in paved areas associated with new development decrease the amount of open land available to absorb rainfall and runoff, thus increasing the volume of water that must be carried away bywaterways.

4.9.1 Population living with Flood Risk

Of greatest concern in the event of a flood is the potential for loss of life. Using 2012 population data aggregated by census blocks, an estimate was made of the population exposed to the 100- and 500-year floodplain. To account for census blocks that were partially within the floodplain, a weighted average was employed to calculate the proportion of the population within the floodplain. The results of the population overlay are shown in Figure 4-18. More than 1400 residents live near or within the 100-year floodplain and approximately 1500 residents live within the 500-year floodplain.

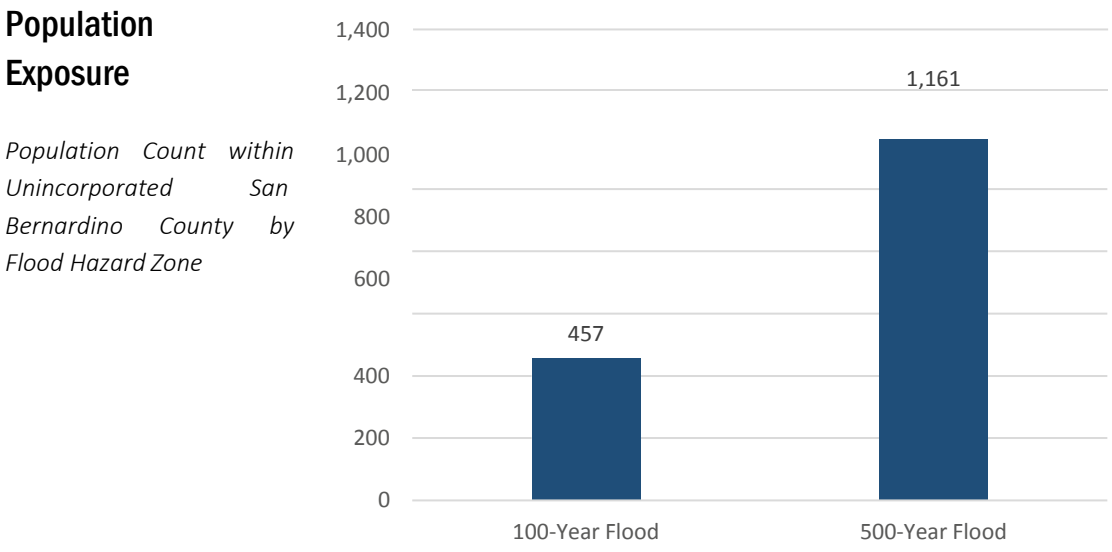

Figure 4-18: Population Exposed to NFIP Flood Zones

4.9.2 Residential Parcel Value with Flood Risk

The County'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 location of the structure 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 4-13 shows the count of at-risk parcels and their improvement and land exposure values.

Table 4-13: Parcels Exposed to NFIP Flood Zones

Flood Hazard Zone	Improved Parcel Count	Improvement Value Exposure ($000)	Land Value Exposure ($000)	Total Exposure ($000)
100-Year Flood	97	74,255	20,764	95,019
500-Year Flood	182	36,487	5,593	42,081
500-Year, Protected by Levee	-	-	-	-
Grand Total	**279**	**110,742**	**26,357**	**137,099**

Notes:
1-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.
Parcel information is for all county parcels with greater than $20,000 in assessed parcel improvement value only. The San Bernardino County Assessor's roles only provide spatial information on assessed improvement and land values.

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 structures. Also, it is important to remember that the County Assessor's values are well below actual market values; thus, the actual value of assets at risk may be significantly higher than those included herein.

4.9.3 Critical Facilities Exposure

Critical facilities data were overlain 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 railroads that are blocked or damaged can prevent access throughout the area and can isolate residents and emergency service providers needing to reach vulnerable populations or to makerepairs.
- Bridges washed out or blocked by floods or debris from floods also can causeisolation.
- Creek or river floodwaters can back up drainage systems causing localizedflooding.
- Floodwaters can get into drinking water supplies causingcontamination.
- Sewer systems can be backed up causing waste to spill into homes, neighborhoods, rivers, and streams.
- Underground utilities can also bedamaged.

Table 4-14 and Table 4-15 provides an inventory of critical facilities in the floodplain for Barstow and provides the locations of lifelines relative to the floodplain in the areas of the Barstow . With a total of nine essential facilities, high potential losses, and transportation and lifeline structures located in either the 100- or 500-year flood zone, the impact to the community could be devastating if these critical facilities were damaged or destroyed during a flood event.

Table 4-14: Critical Facility Exposed to NFIP Flood Zones

Infrastructure Type	100 Year Flood Zone	500 Year Flood Zone	500 Year Flood Zone, Protected by Levee	Total Feature Count
Essential Facility	0	1	0	1
EOC	0	0	0	0
Fire Station	0	0	0	0
Government Facility	0	0	0	0
Hospital	0	0	0	0
Police Station	0	0	0	0
School	0	1	0	1
High Potential Loss	7	7	0	14
Dam	0	0	0	0
Economic Element-Major Employer	0	0	0	0
Hazmat	7	7	0	14
Historic/Cultural Resource-Historic	0	0	0	0
Utility-Communication Facility	0	0	0	0
Utility-Electric Power Facility	0	0	0	0
Utility-Natural Gas Facility	0	0	0	0
Utility-Potable Water Facility	0	0	0	0
Utility-Waste Water Facility	0	0	0	0
Vulnerable Population-Adult Residential Care	0	0	0	0
Vulnerable Population-Child Care	0	0	0	0
Vulnerable Population-Flood Zone	0	0	0	0
Vulnerable Population-Foster/Home Care	0	0	0	0
Vulnerable Population-Mobile Home Park	0	0	0	0
Vulnerable Population-RV Park	0	0	0	0
Vulnerable Population-Senior Care	0	0	0	0
Transportation and Lifeline	3	2	2	7
Highway Bridge	3	1	2	6
Railway Bridge	0	0	0	0
Bus Facility	0	0	0	0
Rail Facility	0	1	0	1
Airport Facility	0	0	0	0
Grand Total	**10**	**10**	**2**	**22**

Table 4-15: Lifelines Exposure to NFIP Flood Zones

Infrastructure Type	Total Linear Mileage
Transportation and Lifeline	**263**
Railway	**39**
Roads	**225**
Interstate Highway	31
State / County Highway	29
Primary Highway	3
Local Road, Major	8
Local Road	121
Other Minor Road	16
Vehicular Trail	-
Cul-de-Sac / Traffic Circle	0
Ramp	16
Service Road	-
Grand Total	**263**

4.9.4 Loss Estimation Results

The Hazus analysis was used to assess the risk from and vulnerability to flooding within the City of Barstow. Hazus buildings data is aggregated to the census block level, known as the general building stock (GBS), which has a level of accuracy acceptable for hazard mitigation planning purposes. The following sections describe risk to and vulnerability of the GBS within Barstow's mapped regulatory floodplain. The total value of exposed buildings and content within Barstow's planning area was generated using Hazus and is previously summarized in Table 4-11

Hazus calculates losses to structures from flooding by considering the depth of flooding and type of structure. Using historical flood insurance claim data, the software estimates the percentage of damage to structures and their contents by applying established depth-damage curves. Damage estimates are then translated to estimated dollar losses. The results are summarized in Figure 4-19 and Figure 4-20.

An estimated $3.9 million of damage could occur in the City of Barstow's regulatory floodplain if all flooding sources experienced a 100-year flood event. If all flooding sources experienced a 500-year flood event in Barstow there could be an additional $254,000 in damage, for a total of near $4.15 million in lo, Table 4-16.

Table 4-17 & 4-18 show loses for each building type for both the 100-year and 500-year flood event. The Total City Value shown at the end of each of these tables represents an estimate of the total value of these building types throughout the entire City of Barstow.

While there are several limitations to the FEMA Hazus model, 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 mitigate flood damage. 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.

Table 4-16: Flood Loss Estimation (Based on Depth) in NFIP Flood Zones

Flood Hazard Zone	Building Loss ($000)	Building Loss (% of Total Value)	Content Loss ($000)	Content Loss (% of Total Value)	Total Estimated Loss ($000)	Total Estimated Loss (% of Total Value)
100-Year	$ 1,578.00	0.0%	$ 3,587.00	0.1%	$ 5,336.00	0.2%
500-Year	$ 7,876.00	0.2%	$ 5,654.00	0.2%	$ 13,587.00	0.4%

*Note: *from table 4-11 'Hazus Floods Census Block Input Values' totals*
1- Building Replacement Costs($000) = $2,102,414
2- Content Replacement Cost($000) = $1,348,405
3- Total Value($000) = $3,450,819

Table 4-17: 100-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Replacement Costs ($000)	Building Replacement Cost (% of Total Value)	Content Replacement Cost ($000)	Content Replacement Cost (% of Total Value)	Total Estimated Loss ($000)	Total Loss Estimation (% of Total Value)	Total Value ($000)
Agricultural	-	0.00%	-	0.00%	-	0.00%	4,062.00
Commercial	919	0.13%	2,712	0.39%	3,780	0.54%	697,096.00
Educational	20	0.01%	116	0.08%	137	0.09%	149,821.00
Government	-	0.00%	-	0.00%	-	0.00%	58,819.00
Industrial	113	0.24%	211	0.45%	345	0.74%	46,860.00
Religious	42	0.05%	292	0.36%	334	0.41%	81,972.00
Residential	484	0.02%	256	0.01%	740	0.03%	2,412,189.00
Grand Total	**1,578**	**0.05%**	**3,587**	**0.10%**	**5,336**	**0.15%**	**3,450,819**

*Note: *from table 4-11 'Hazus Floods Census Block Input Values' totals*
1- Building Replacement Costs($000) = $2,102,414
2- Content Replacement Cost($000) = $1,348,405
3- Total Value($000) = $3,450,819

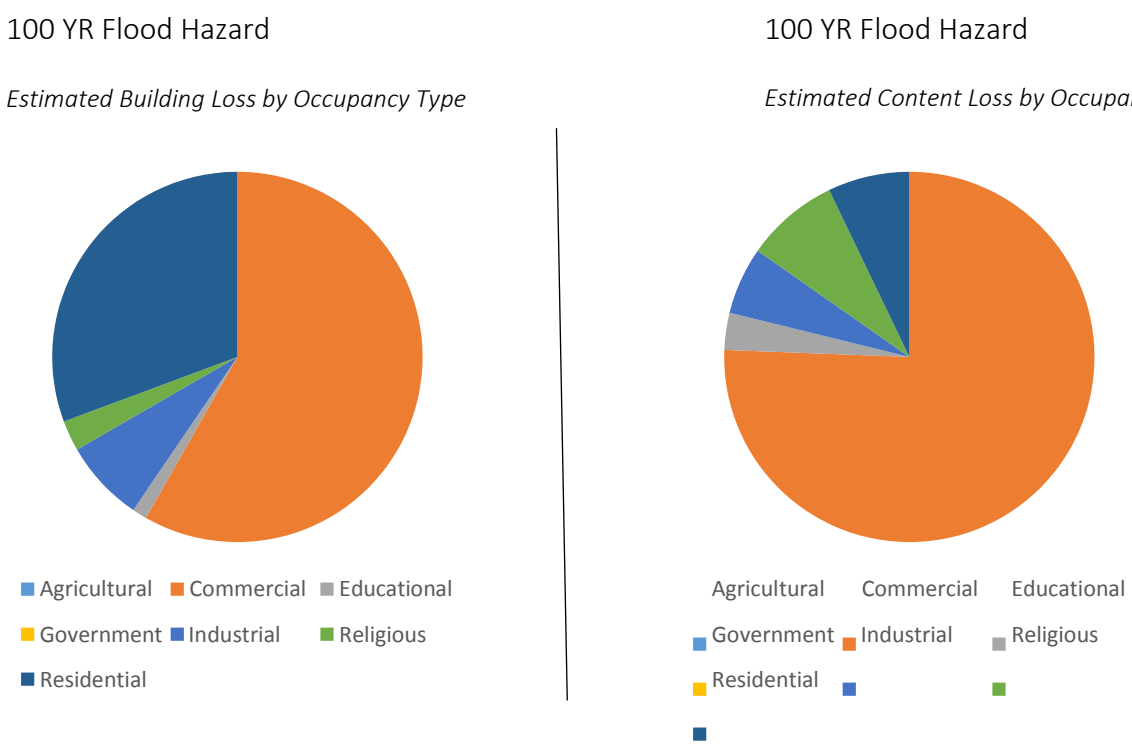

Figure 4-19: Total Building and Content Loss by Occupancy Type

Building Type	Building Replacement Costs ($000)	Building Replacement Cost (% of Total Value)	Content Replacement Cost ($000)	Content Replacement Cost (% of Total Value)	Total Estimated Loss ($000)	Total Loss Estimation (% of Total Value)	Total Value ($000)
Agricultural	1.00	0.02%	8.00	0.20%	9.00	0.22%	4,062.00
Commercial	259.00	0.04%	914.00	0.13%	1,196.00	0.17%	697,096.00
Educational	9.00	0.01%	76.00	0.05%	86.00	0.06%	149,821.00
Government	-	0.00%	-	0.00%	-	0.00%	58,819.00
Industrial	22.00	0.05%	37.00	0.08%	63.00	0.13%	46,860.00
Religious	66.00	0.08%	529.00	0.65%	600.00	0.73%	81,972.00
Residential	7,519.00	0.31%	4,090.00	0.17%	11,633.00	0.48%	2,412,189.00
Grand Total	**7,876**	**0.23%**	**5,654**	**0.16%**	**13,587**	**0.39%**	**3,450,819**

*Note: *from table 4-11 'Hazus Floods Census Block Input Values' totals*
1- Building Replacement Costs($000) = $2,102,414
2- Content Replacement Cost($000) = $1,348,405
3- Total Value($000) = $3,450,819

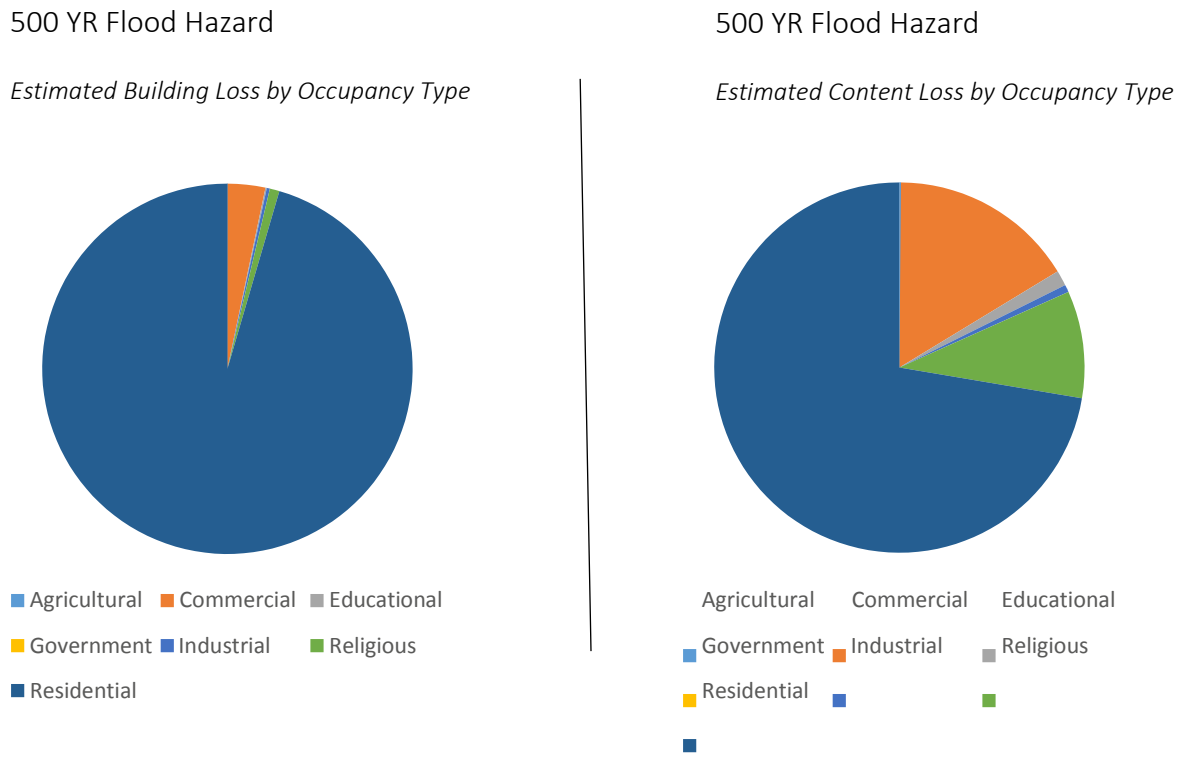

Figure 4-20: Total Building and Content Loss by Occupancy Type

4.9.5 The Local Data Collection

The City of Barstow collects data regarding flooding and drainage issues from the public on a regular basis. Data is collected through our website and used to identify areas of concerns throughout the City. Majority of the data is received after heavy rains but data can also be obtained due to broken water mains or private property issues regarding water. Figure 4-21 below is a copy of the Service Request section of the web site that is used to collect data.

Figure 4-21: Flooding/Drainage Resident Service Request

4.10 Vulnerability Assessment-Wildfire

Risk to the City of Barstow from wildfire is of concern. Fuel loads along geographical and topographical features create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. During the May to October fire season the dry vegetation, hot and sometimes windy weather, combined with continued growth in the interface areas, results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become large and out-of-control.

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 associated with the City of Barstow summer season activities. 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, there are three major factors that sustain wildfires and predict a given area's potential vulnerability to burn. These factors are fuel, topography, and weather.

- Fuel – Fuel is the material that feeds a 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. Manmade 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. Development in the area along the Mojave River currently possess the highest vulnerability to 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 the City of Barstow include:

- Nature and frequency of ignitions
- Residential population along the Mojave River

4.10.1 Population at Risk

Wildfire risk is of greatest concern to populations residing in the moderate wildfire hazard zones. According to the LRA Fire Hazard Severity Zone Barstow has a moderate risk of wildfire within some of the City's boundaries. Barstow's census block data was used to estimate populations within the hazard zones. There are a significant number of people living within the interface described in the wildfire profiles. More than 30,000 residents in the city limits live within areas considered moderate fire hazard, see Figure 4-21.

Population Exposure

Population Count by Wildfire Hazard Zone

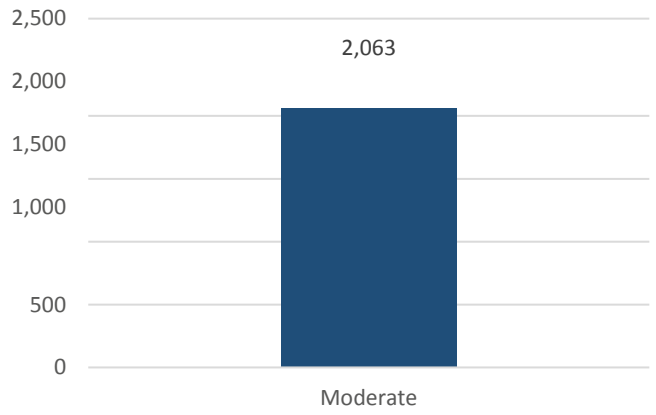

Figure 4-22: Population at risk from Wildfire Hazards

4.10.2 Residential Parcel Value at Risk

The County'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 location of the structure 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 was developed in some way. Only improved parcels were analyzed. Figure 4-19 exhibits portions of the City of Barstow that have significant assets at risk to wildfire in the Moderate fire severity zones.

Table 4-18: Residential Buildings and Content at Risk from Wildfire

Fire Hazard Severity Hazard Zone	Improved Parcel Count	Improvement Value Exposure ($000)	Land Value Exposure ($000)	Total Exposure ($000)
Moderate	468	109,236	32,026	141,262
Non-Wildland/Non-Urban	1	69	23	92
Urban Unzoned	5,524	1,664,210	527,014	2,191,224
Total	**5,993**	**1,773,515**	**559,063**	**2,332,578**

Note:
1-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 Assessordata.
2- Parcel information is for all county parcels with greater than $20,000 in assessed parcel improvement value only. The San Bernardino County Assessor's roles only provide spatial information on assessed improvement and land values

4.10.3 Critical Facilities at Risk

Critical facilities data were overlain with fire hazard severity zone data to determine the type and number of facilities within each risk classification. Lists only included the critical facilities in the High and Very High wildfire hazard zones for the City of Barstow. Since Barstow only has Medium risk classification within City boundaries there are no critical facilities at risk.

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4.11 Vulnerability Assessment-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, 2016). The degree of infrastructure damage depends on the magnitude, focal depth, distance from 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 the City of Barstow residents, the Great Shakeout scenario was chosen modeled by the California Integrated Seismic Network (CISN). The 2008 Great Southern California ShakeOut was based on a potential magnitude 7.8 earthquake on the southern San Andreas Fault— approximately 5,000 times larger than the magnitude 5.4 earthquake that shook southern California on July 29, 2008. Such an earthquake will cause unprecedented damage to Southern California—greatly dwarfing the massive damage that occurred in Northridge's 6.7-magnitude earthquake in 1994. The hazard foot print for this scenario was used to develop exposure results for population, critical facilities, and single family residential parcel values. FEMA Hazus analyses was used to conducted loss estimation for both scenarios and include building and content loss estimation results based on peak ground acceleration, peak ground velocity, and peak spectral acceleration modeled for the 7.8 earthquake on the San Andreas Fault.

Barstow follows all existing building codes as required by Section 17992 of the Health and Safety Code of the State of California and the Barstow Municipal Code.

4.11.1 Population at Risk

According to the 2010 US Census, the population of the City of Barstow is 69,130. Though rural residential construction is not particularly vulnerable to earthquakes, the chosen earthquake scenarios will directly or indirectly expose the entire population of the City of Barstow to ground shaking. Depending on the time of day and exact location of the modeled epicenter, the earthquake scenarios could be experienced differently. Figure 4-23 exhibit the population totals in each modeled earthquake severity zone. Population location is based upon information taken during the 2010 U.S. Census.

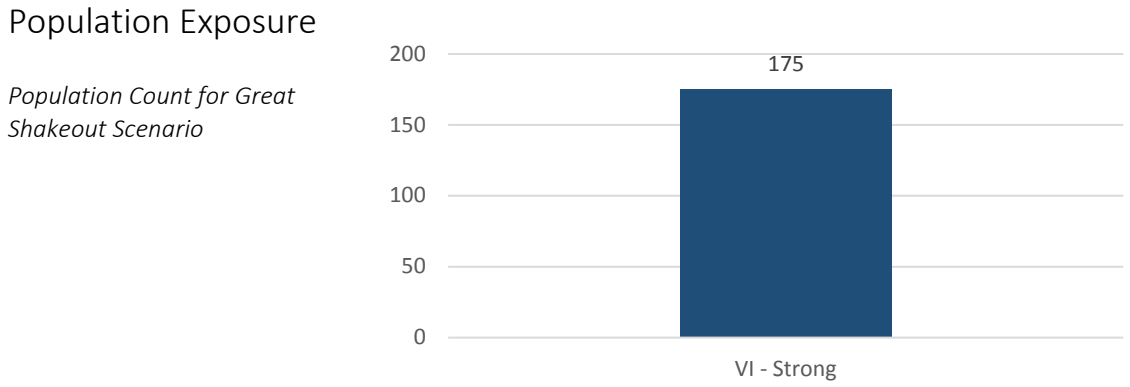


Figure 4-23: Population Exposure to The Great Shakeout EQ Shake Severity Zone

4.11.2 Residential Parcel Value at Risk

The County'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 location of the structure 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 analysis indicates residential parcels the chosen scenario will experience similar, but different shaking patterns. 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 4-19: Residential Parcel Value Exposure from Southern California Great Shakeout

Shake Severity Zone	Improved Parcel Count	Improvement Value Exposure ($000)	Land Value Exposure ($000)	Total Exposure ($000)
IV - Light	-	-	-	-
V - Moderate	5,952	1,725,380	550,996	2,276,376
VI - Strong	40	48,135	8,067	56,202
VII - Very Strong	-	-	-	-
VIII - Severe	-	-	-	-
IX - Violent	-	-	-	-

Notes:
1-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.
2- Parcel information is for all county parcels with greater than $20,000 in assessed parcel improvement value only. The San Bernardino County Assessor's roles only provide spatial information on assessed improvement and land values.

4.11.3 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 railroads that are blocked or damaged can prevent access throughout the area and can isolate residents and emergency service providers needing to reach vulnerable populations or to 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 affects 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 to the Great Shakeout Scenario. The building codes have been amended to include provisions for seismic safety at various bench marks years. Depending on "year built", each critical facility presented in the tables may have varying damage potential.

Table 4-20: Critical Facilities with EQ Risk Southern California Great Shakeout

Infrastructure Type	Violent Shake Zone (IX)	Severe Shake Zone (VIII)	Strong Shake Zone (VI)	Moderate (V)	Total Feature Count
Essential Facility	-	-	-	29	29
EOC	-	-	-	1	1
1Fire Station	-	-	-	3	3
Government Facility	-	-	-	1	1
Hospital	-	-	-	-	-
Police Station	-	-	-	2	2
School	-	-	-	18	18
High Potential Loss	4	-	-	87	92
Dam	-	-	-	-	-
Economic Element-Major Employer	-	-	-	-	-
Hazmat	4	-	-	72	77
Historic/Cultural Resource-Historic	-	-	-	1	1
Utility-Communication Facility	-	-	-	2	2
Utility-Electric Power Facility	-	-	-	-	-
Utility-Natural Gas Facility	-	-	-	-	-
Utility-Potable Water Facility	-	-	-	-	-
Utility-Waste Water Facility	-	-	-	1	1
Vulnerable Population-Adult Residential Care	-	-	-	-	-
Vulnerable Population-Child Care	-	-	-	-	-
Vulnerable Population-Flood Zone	-	-	-	-	-
Vulnerable Population-Foster/Home Care	-	-	-	-	-
Vulnerable Population-Mobile Home Park	-	-	-	-	-
Vulnerable Population-RV Park	-	-	-	17	17
Vulnerable Population-Senior Care	-	-	-	-	-
Transportation and Lifeline	1	-	-	36	37
Highway Bridge	1	-	-	30	31
Railway Bridge	-	-	-	3	3
Bus Facility	-	-	-	1	1
Rail Facility	-	-	-	2	2
Airport Facility	-	-	-	-	-
Grand Total	**10**	**-**	**-**		**318**

4.11.3.1 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.

4.11.3.2 Transportation

Earthquake events can significantly impact bridges which often provide the only access to some neighborhoods. Since soft soil regions generally follow floodplain boundaries, bridges that cross water courses are considered vulnerable. Since City bridges provide access across water courses, they are vulnerable to earthquakes. Key factors in the degree of vulnerability are the bridge's age and type of construction which indicate the standards to which the bridge was built. Special attention will be paid to the multiple bridges that cross interstates. Interstates would serve as major emergency response and evacuation routes.

4.11.3.3 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 provide best available transportation infrastructure data and it should be assumed that these systems are exposed to breakage and failure.

Table 4-21: Lifelines with EQ Risk; Southern California Great Shakeout Scenario

Infrastructure Type	Total Linear Mileage
Transportation and Lifeline	**263**
Railway	**39**
Roads	**225**
Interstate Highway	31
State / County Highway	29
Primary Highway	3
Local Road, Major	8
Local Road	121
Other Minor Road	16
Cul-de-Sac / Traffic Circle	0
Ramp	16
Service Road	-
Grand Total	**263**

4.11.3.4 Loss Estimation Results

The Hazus Level 2 analysis was used to assess the risk from and vulnerability to earthquake shaking within the City of Barstow. Hazus buildings data is aggregated to the census tract level for earthquake models, known as the general building stock (GBS), which has a level of accuracy acceptable for planning purposes. Where possible the GBS was enhanced using GIS data from the county as described previously. The following sections describe risk to and vulnerability of the GBS within the City of Barstow. Hazus calculates losses to structures from earthquake shaking by considering the amount of ground displacement and type of structure. The software estimates the percentage of damage to structures and their contents by applying established building fragility curves. Damage estimates are then translated to estimated dollar losses.

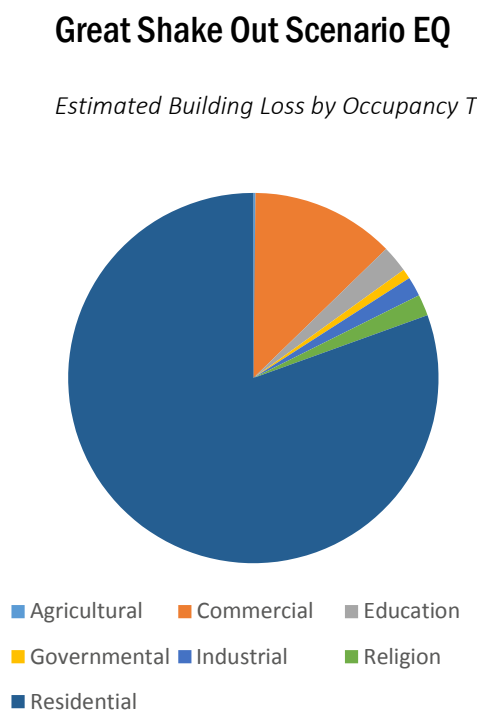
For each Great Shake Out Scenario ground shaking data (shakemaps) were acquired from CISN and imported into Hazus. The shakemap data consist of peak ground velocity, peak ground acceleration, peak spectral acceleration at 0.3 seconds, and peak spectral acceleration at 1.0 seconds. The earthquake module operates on census tracts that often include population and structures in the incorporated cities and the unincorporated area within a single tract. Due to this fact the results include census tracts that have a substantial portion of land within the incorporated area (loss estimates for some tracts will include structures in incorporated cities).

The results are summarized in Table 4-24 and Figure 4-22 for the Great Shake Out Scenario. It is important to understand that the Hazus earthquake module uses the census tract as its enumeration unit rather than the more detailed census block. The loss estimation values for earthquakes are much higher than those of the flooding and dam failure due to this fact. The portions of incorporated areas included within boundary census tracts elevate the values due to the inclusion of additional GBS. Though the difference between census tracts and census blocks are extremely disparate, the most important summary information is the percent of loss estimation against the total value.

In the Great Shake Out Scenario, residential damage will be the greatest. While there are several limitations to the FEMA Hazus model, it does allow for potential loss estimation. 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.

Table 4-22: Estimated Building and Content Loss Great Shake Out Scenario EQ

Building Type	Building Replacement Costs ($000)	Building Replacement Cost (%)	Content Replacement Cost ($000)	Content Replacement Cost (%)	Total Value ($000)
Agricultural	$ 6,837	50.0%	$ 6,837	50.0%	$ 13,674
Commercial	$ 455,397	48.4%	$ 485,177	51.6%	$ 940,574
Education	$ 85,384	46.7%	$ 97,609	53.3%	$ 182,993
Governmental	$ 31,261	46.6%	$ 35,887	53.4%	$ 67,148
Industrial	$ 61,642	42.8%	$ 82,297	57.2%	$ 143,939
Religion	$ 67,515	50.0%	$ 67,515	50.0%	$ 135,030
Residential	$ 2,924,365	66.7%	$ 1,462,795	33.3%	$ 4,387,160
Total	**$ 3,632,401**	**62%**	**$ 2,238,117**	**38%**	**$ 5,870,518**



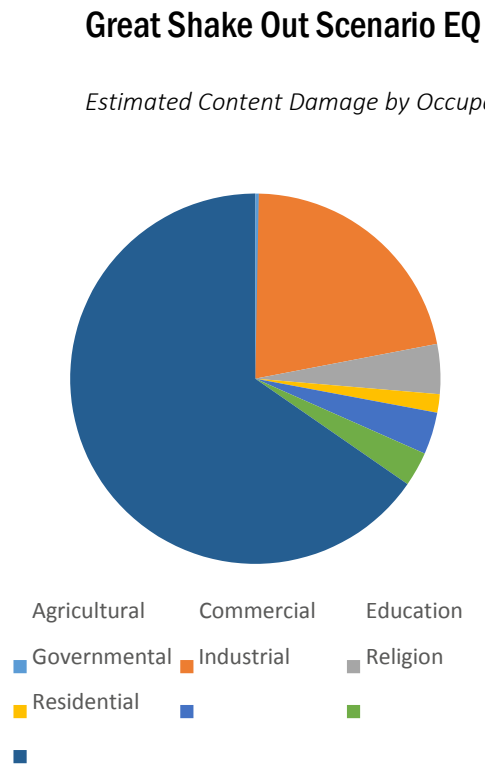


Figure 4-24: Estimated Building and Content by Occupancy Type Shake Out Scenario EQ

4.12 Climate Change

4.12.1 The Impact of Climate Change

Climate change can increase hazards associated with wildfires, rising sea levels, and groundwater supply. Public health can suffer due to greater temperature extremes and more frequent extreme weather events, increases in transmission of infectious disease, and increases in air pollution. Agricultural production can be altered by changes in temperature and rainfall patterns.

Rises in temperature have the potential, for example, to cause a shift in the hydrological cycle. While predicted patterns vary with latitude and global location, roughly 75% of analyzed climate change models agree that within the western United States there will be a 10% to 40% decrease in stream flows by 2050. This may be due to a decrease in precipitation levels, which has been evident in the drought conditions suffered by the southwest in recent years, as well as an increase in evaporation, which is temperature dependent and increases as temperatures climb. It has been predicted that a change in the global average surface temperature of 2°C would be at the low end of the possible range. According to the Institute for the Study of Planet Earth at the University of Arizona, it is estimated that a 2°C increase in temperature corresponds to a 9% to 21% decrease in stream flow on the Colorado River.

The coast of California is likely to see a rise in sea level that could threaten shorelines, cause increased erosion, and loss of life and property. Sea level rise and storm surges could lead to flooding of low-lying property, loss of coastal wetlands, erosion of cliffs and beaches, saltwater contamination of drinking water, and damage to roads, causeways, and bridges.

Between the beginning of the industrialized era and 2005, the atmospheric concentration of CO2 in the atmosphere had increased by 35%, methane by 151%, and nitrous oxide by 18%.

It is estimated that in 2004, total GHG emissions were 20,135 teragrams (Tg) of carbon dioxide equivalents (Tg CO2e), excluding emissions/removals from land use, land use change, and forestry. The U. S. Environmental Protection Agency in 2004 estimated that the U.S. contributed 35% of global GHG emissions, with a total of 7074.4 Tg CO2e, an increase of 15.8% over 1990 emissions.

California is the second largest greenhouse gas contributor in the U.S. and the sixteenth largest in the world. From 1990 to 2003, California's GHG emissions increased 12%. In 2004, California produced 492 Tg CO2e, which is approximately 7% of all U.S. emissions. Transportation is responsible for 41 percent of the state's total GHG emissions; while electricity generation represents 22% of the state's GHG emissions. Conversely, emissions from residential and commercial fuel use in California decreased 9.7% from 1990 to 2004. This decrease may be due to increases in the effectiveness of energy conservation in buildings (Title 24 requirements) and more efficientappliances.

4.12.2 Population at Risk

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 information provided by 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 heat wave of 1980, more than 1,250 people died.

4.12.3 Critical Facilities

The Cities Resource Conservation and Open Space Element updated in 2015 addresses concerns that affect the City in regards to Climate Change. Currently, the focus is on reducing Greenhouse Gas Emissions (GHG) at existing facilities, homes, businesses and institutions. Reducing GHG for new developments in the same categories are discussed in detail as priority measures. This hazard mitigation plan will defer to the Resource Conservation and Open Space Element for measures and mitigation strategies related to Climate Change in an effort to provide consistent practices.

4.12.3.1 RESOURCE CONSERVATION AND OPEN SPACE ELEMENT

The City's location within the Mojave Desert has allowed its residents to enjoy clear skies and favorable weather conditions due to the elevation, prevailing winds and distance to more densely developed cities.

Smog, contaminants and other Impacts to healthy air quality are not as prevalent in the City as they are in cities below the Cajon Pass. Strategies including incorporation of design features into new development, businesses and minimizing fugitive dust generation will help reduce air quality impacts and enhance the desired livability of the City.

The City is located within the Mojave Desert Air Basin, an assemblage of mountain ranges and valleys with a geographic area that incorporates most of San Bernardino County, and parts of Los Angeles County, Kern County and Riverside County. The San Gabriel Mountains and the San Bernardino Mountains separate the Mojave Desert Air Basin from the San Bernardino Valley and the South Coast Air Quality Management District.

The Mojave Desert Air Basin is a "non-attainment" area for federal and state air quality standards for ozone and state standards for particulate matter less than 10 microns and 2.5 microns in diameter (PM10 & PM2.5) excluding some areas in the western portions of the Mojave Desert Air Quality Management District. Additionally, because Barstow exceeded state and/or federal standards for ozone and nitrogen dioxide for several days in 2012 the City is defined by law as a nonattainment area for these pollutants as well.

The Mojave Desert Air Quality Management District (MDAQMD), regulates air quality improvement programs within the basin, and works to improve regional air quality to achieve federal and state standards. The District comments on all air quality and related matters within its jurisdiction, and provide comments regarding air quality impacts from projects. The City has continued to work with the MDAQMD and in accordance with the applicable Air Quality Management Plan to improve regional air quality. The City's air quality is largely impacted by significant concentrations of ozone and particulate matter. Local air quality is determined by the type and amount of contaminants emitted into the atmosphere, the size and topography of the air basin and weather conditions particularly, wind speed and direction. Ozone and particulate matter monitors located in the City reveal both contaminants exceeding federal and state ambient air quality standards, although ozone concentrations have decreased over the years. However, it has been recognized by the California Air Resources Board that these ozone concentrations are largely influenced by prevailing winds transporting ozone from other downwind regional sources and affecting local readings.

Photochemical ozone modeling conducted by the South Coast Air Quality Management District and California Air Resources Board indicates that the basin would be in compliance of standards without the influence of the transported air pollution from other upwind regions.

Particulate matter concentrations have fluctuated historically but the annual average concentrations are generally over the state standards. The City is impacted significantly by fugitive dust primarily from unpaved roads, construction activities, and local disturbed areas. These particulates can have an adverse impact on sensitive receptors in the population including children, the elderly, persons with respiratory or cardiovascular illness, and people exercising outdoors.

The City contains several logistics and warehousing uses that have heavy trucking operations. However, the local air quality conditions result largely from sources outside the immediate area, as prevailing winds carry air pollution from the valleys south of the Cajon Pass and west of the Tehachapi Mountains.

The City has recently adopted a local alternative energy ordinance that will encourage and facilitate production of clean energy for local homes and businesses. The implementation of these renewable energy sources in residential, commercial, and industrial developments will lessen the City's energy consumption, thereby decreasing the amount of air pollutants generated. In addition, the utilization of recycling programs in the City will further reduce air pollutant emissions because new products will not have to be produced.

A Climate Action Plan is proposed for adoption by the City sometime after the adoption of the General Plan Update which will further address reductions of greenhouse gas emissions. Additional information concerning local air quality and greenhouse gases can be found in the technical reports that are included as attachments to the General Plan Master Environmental Impact Report.

Section 5. Community Capability Assessment

The City of Barstow strives to protect and maintain the health, safety and welfare of the community on a day-to-day basis, and takes extra measures to reduce the impacts of natural or technological hazards. The City can use a variety of different tools, assets, and authorities to effectively prepare for, mitigate toward, respond to and recover from emergencies and disasters. These include voluntary and mandatory measures; individual and community efforts; private and public actions; and preventive as well as responsive approaches. Mitigation activities include educating citizens, enforcing building and development codes, constructing capital improvement projects, adopting plans, establishing incentive programs, and improving emergency preparedness andresponse.

The capabilities available to the City of Barstow fall into the following broad categories: Agencies and People; Existing Plans; Regulations, Codes, Policies, and Ordinances; Mitigation Programs and Fiscal Resources. Identifying and documenting these capabilities provides the basis for developing future mitigation opportunities and how they can be implemented within existing City programs.

5.1 Active Mitigation Programs

City of Barstow Capability Assessment

- Storm Water Management: Yes
- Zoning Management: Yes
- Subdivision Management: Yes
- Elevation Certificates Maintained: Yes
- National Flood Insurance Program Community: Yes
- National Flood Insurance Join Date: 1/17/1975
- NFIP Number: 060271
- NFIP Rating: Not Available
- Land Use Plan: Yes
- Land Use Plan Last Update: 2015
- Community Zoned: Yes
- Zoned Date: 4/27/10
- Established Building Codes: Yes
- Building Codes Last Updated: 2016
- Type of Building Codes: California Building Code
- Local Electric Utilities: Southern California Edison
- Local Water Utilities: Golden State Water
- Local Natural Gas Utilities: South West Gas
- Local Telephone Utilities: Frontier
- Fire Insurance Rating: ISO 4 (City Limits) ISO 4X (Unincorporated Areas)
- Fire Insurance Rating Date: December 2016
- Previous Mitigation Plan: 2011

5.2 Local Planning and Regulatory Capabilities (Supporting Possible Mitigation Activities)

The State of California recommends that the General Plan is updated every 10-20 years; depending mostly on whether or not the plan is meeting the community's needs. The Barstow General Plan was last updated and adopted in 2015. The Land Use Element of the General Plan establishes land use designations that apply to lands within the City's incorporated boundaries and within some of the City's sphere of Influence (see Section LU, for a listing of the Land Use districts in the Land Use Element).

In addition to the general plan, the information in Table 5-1 *is used to construct mitigation actions aligned with existing planning and regulatory capabilities of the* City of Barstow *. Planning and regulatory tools typically used by local jurisdictions to implement hazard mitigation activities are building codes, zoning regulations, floodplain management policies, and other County programs or planning documents.*

Table 5-1: Planning and Regulatory Capabilities

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Multi-Hazard	California Building Codes	Building & Safety Dept.	California Residential Code California Code of Regulations, Title 24, Part 2.5. California Building Code California Code of Regulations, Title 24, Part 2, Volumes 1 and 2.
Multi-Hazard	Municipal Codes	Building & Safety Dept.	Section 17992 of the Health & Safety Code of the State of CA and City of Barstow Municipal Code.

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Drought	Urban Water Management Plan (UWMP)	Each water agency is responsible for own plan.	Visit each water agency for plan or visit https://www.gswater.com/ for their plan.
Drought	City of Barstow Landscape Ordinance	Planning Division	City of Barstow makes every effort to plan for drought. Included in the Barstow Municipal Code Sec. 19.26.070. - Design standards the installation of all landscaping and irrigation shall comply with all of the requirements identified under section 12.12.020 (Sight distance and height clearance), section 19.06.040 (Clear-sight/sight distance and height clearance) and section 19.06.080 (Landscaping) of the Barstow Municipal Code, City of Barstow Landscape Manual, *Drought* Tolerant Materials list and adopted irrigation details.
Drought	2010 California Drought Contingency Plan	California Dept. of Water Resources	Section VI provides an overview of drought preparedness strategies from the California Water Plan Update. Section VII provides a brief description of local, utility, and State agency drought response roles. Situation and assessment reports will be distributed to appropriate agencies and will be posted on the DWR Drought website (www.water.ca.gov/drought).
Flood	Flood Resistant Construction	Building & Safety	California Building Codes stipulates existing Flood Resistant Construction standards.
Flood	NFIP Administration	Engineering Dept.	NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. As a participating member of the NFIP, the City is dedicated to protecting homes of more than 48 policies currently in force.

5.3 Administrative and Technical Mitigation Capabilities

This section contains a summary of administrative and technical capabilities organized by the City of Barstow staff. The department(s) responsible for the capability is also listed. Each department can provide greater detail of the resources available under each capability.

Staff/Personnel Resources	Dept. / Agency	Comments
Planners or engineers (with natural and/or human caused hazards knowledge)	Public Works, Local Utilities, Planning, & Engineering Dept.	Fire Prevention can assist as well.
Planners (with land use / land development knowledge)	Planning Division	Train staff on how to reduce hazards in their own homes.
Engineers or professionals trained in building and/or infrastructure construction practices (includes building inspectors)	Engineering, Planning & Public Works Dept.	http://myhazards.caloes.ca.gov/
Floodplain Management	Engineering Dept.	City Engineer manages NFIP.
Land/Building surveyors	Engineering Dept.	Services are available through consultant contract.
Personnel skilled in Geographic Information Systems (GIS)	Planning Division	Managed by City Planner.
Grant writers or fiscal staff to handle large/complex grants	Each Dept. manages own smaller grants	Numerous types of federal, state, local, and private grants have been administered for mitigation at the local level in California. .
Construction Equipment	Public Works Dept.	Public Works departments owns and maintains large pieces of equipment available for construction and moving and removal of earthen material.
Emergency Management Personnel	Police Department, Fire Departments and Emergency Management	Emergency Management Function is handled by the Fire Chief and reports directly to the City Manager. Utilize http://myhazards.caloes.ca.gov/ for staff and public information.
Care and Sheltering	CERT, Regional Red Cross	Care and sheltering during extreme disaster related events when evacuations orders are mandatory.

5.4 Local Fiscal Capabilities

This section provides a summary of local fiscal capabilities. The department(s) responsible for the revenue raising activity is also listed. Each department can provide greater detail of the resources available under each capability.

Table 5-3: Local Fiscal Capabilities

Financial Resources	Dept. / Agency	Comments
Permitting Fees	Building & Safety, Engineering, Planning & Finance Dept.	Development fees
General Fund Revenue	City Council or Finance Dept.	Identify line item budget in the next budget cycle for mitigation activities and mitigation strategies mitigation strategies.
Sewer and Trash Funds	Finance Dept.	
Capital Improvements Program	All Departments	Each department handles own
State and Federal Community Development Dept. Block Grants (CDBG)	Economic Development	Community Development
Home Investments Partnership Program	Economic Development	

5.5 San Bernardino County Capabilities

This section contains a summary of City of Barstow and San Bernardino County programs and capabilities organized by hazard type. The example tables below provide details on possible City and County Capabilities that the Barstow community can coordinate with or use as an implementation mechanism for local mitigation activities.

5.5.1 City of Barstow Wildfire Mitigation Programs

Table 5-4: Wildfire Mitigation Programs

Hazard	Program	Responsible Agency	Comments
Wildfire	*Southern California Edison (SCE)*	*Southern California Edison (SCE)*	*SCE removes dead trees near power lines to reduce fire hazards. For more information see County OES website or hazard mitigation plan.*
Wildfire	*Inland Empire Fire Safe Alliance*	*Inland Empire Fire Safe Alliance*	*The Alliance was created to act as a forum for all Fire Safe Councils in San Bernardino County. For more information see County OES website or hazard mitigation plan.*

5.5.2 County Flood Mitigation Programs

Table 5-5: Count Flood Mitigation Programs

Hazard	Program	Responsible Agency	Comments
Flood	Flood Area Safety Taskforce (FAST)	Flood Control District	The FAST Organization stresses liaison with the communities, provides for community education and information, and places emphases on Community and city partnerships. For more information see County OES website or hazard mitigation plan.
Flood	Alluvial Fan Task Force	Alluvial Fan Task Force	The Task Force reviews the state of knowledge regarding alluvial fan floodplains, determine future research needs, and, if appropriate, develop recommendations relating to alluvial fan floodplain management, with an emphasis on alluvial fan floodplains that are being considered for development. For more information see County OES website or hazard mitigation plan.

5.5.3 City of Barstow & SB County Public Education and Alert Programs

Table 5-6: Public Education and Alert Programs

Hazard	Program	Responsible Agency	Comments
Multi-Hazard	CERT	City of Barstow	The Community Emergency Response Team (CERT) Program educates people about disaster preparedness and trains them in basic response skills. For more information on the CERT program visit www.barstowca.org
Multi-Hazard	California Disaster Corps	SB County Fire District	The Disaster Corps is a first-in-the-nation effort to professionalize, standardize and coordinate highly trained disaster volunteers statewide. This program initiative was built collaboratively in partnership with California Volunteers from the ground up through public-private partnerships and with a wide range of subject matter experts. Visit www.sbcfire.org.
Multi-Hazard	Emergency Notification System	Barstow PD Dispatch	The City of Barstow is actively pursuing the purchase of a system that will better warn residents of both man-made and natural emergencies. The goal is to quickly send phone calls, text messages, emails and social media messages to the public so they can be better informed/prepared for emergencies. Projected for FY 20/21
Multi-Hazard	IPAWS	SB County Fire District	During an emergency, alert and warning officials need to provide the public with life-saving information quickly. The Integrated Public Alert and Warning System (IPAWS) is a modernization and integration of the nation's alert and warning infrastructure and will save time when time matters most, protecting life and property. Federal, State, Territorial, Tribal, and local alerting authorities can use IPAWS and integrate local systems that use Common Alerting Protocol (CAP) standards with the IPAWS infrastructure. IPAWS provides public safety officials with an effective way to alert and warn the public about serious emergencies using the Emergency Alert System (EAS), Wireless Emergency Alerts (WEA), the National Oceanic and Atmospheric Administration (NOAA) Weather Radio, and other public alerting systems from a single interface.

5.6 State and Federal Fiscal Resources

To augment local resources, the table in this section provides a list of potential funding programs and resources provided by state and federal agencies and programs which can be used for local hazard mitigation activities.

Table 5-7: Potential Funding Programs/Grants from State & Federal Agencies

Agency / Grant Name	Potential Programs/Grants
California DWR Proposition 50/84: **Integrated Regional Water Management (IRWM) Program.**	***DWR has a number of IRWM grant program funding opportunities. Current IRWM grant programs include planning, implementation, and storm water flood management.*** http://www.water.ca.gov/irwm/grants/index.cfm Proposition 84, the Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act, which provides $1,000,000,000 (P.R.C. §75001-75130) for IRWM Planning and Implementation. CA Dept. of Water Resources' Flood Emergency Response Projects are posted on the webpage at: http://www.water.ca.gov/floodmgmt/hafoo/fob/floodER/
California Housing and Community Development (HCD) Emergency Solutions Grant (ESG) Program	***To fund projects that serve homeless individuals and families with supportive services, emergency shelter/transitional housing, assisting persons at risk of becoming homeless with homelessness prevention assistance, and providing permanent housing to the homeless population. The Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act of 2009 places new emphasis on assisting people to quickly regain stability in permanent housing after experiencing a housing crisis and/or homelessness.*** http://www.hcd.ca.gov/fa/esg/index.html
CalTrans Division of Local Assistance / Safe Routes to School Program	California Dept. of Transportation. Federal funding administered via Caltrans. Local 10% match is the minimum requirement. http://www.dot.ca.gov/hq/LocalPrograms/saferoutes/saferoutes.htm
CA State Office of Historic Preservation (OHP) / Statewide Historic Preservation Plan	Local Government**;** OHP's Local Government Unit (LGU) offers guidance and assistance to city and county governments to preserve historic properties including damage from natural hazards.
U.S. Dept. of Energy / Energy Efficiency and Conservation Block Grant Program	***Provides funding for weatherization of structures and development of building codes/ordinances to ensure energy efficiency and restoration of older homes.*** http://www1.eere.energy.gov/wip/eecbg.html
Dept. of Homeland Security (DHS) / FEMA Grants	For more information on current grants visit: http://www.fema.gov/grants

Agency / Grant Name	Potential Programs/Grants
Office for Victims of Crime: **Antiterrorism and Emergency Assistance Program (AEAP)**	***The Office for Victims of Crime supports communities responding to terrorist attacks and cases of mass violence. The AEAP Assistance Programs include crisis response, consequence management, criminal justice support, crime victim compensation and training and technical assistance.*** ***More information can be obtained at:*** https://www.ovc.gov/AEAP/
U.S. Department of State Office of Antiterrorism Assistance (ATA): **Antiterrorism Assistance Program**	Antiterrorism Assistance Program The ATA program trains civilian security and law enforcement personnel from friendly governments in police procedures that deal with terrorism. Since its inception in 1983, the program has trained and assisted over 84,000 foreign security and law enforcement officials from 154 countries. Learn more by visiting: http://www.state.gov/m/ds/terrorism/c8583.htm
California Emergency Management Agency (Cal EMA) / Proposition 1B Grants Programs	The Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006, approved by the voters as Proposition 1B at the November 7, 2006 general election, authorizes the issuance of nineteen billion nine hundred twenty-five million dollars ($19,925,000,000) in general obligation bonds for specified purposes, including grants for transit system safety, security, and disaster response projects. http://www.calema.ca.gov/EMS-HS-HazMat/Pages/Emergency-Management-Homeland-Security-and-Hazard-Mitigation-Grant-Programs.aspx
California Proposition 1: **The Water Bond (AB 1471)**	Authorize $7.545 billion in general obligation bonds for state water supply infrastructure projects, such as public water system improvements, surface and groundwater storage, drinking water protection, water recycling and advanced water treatment technology, water supply management and conveyance, wastewater treatment, drought relief, emergency water supplies, and ecosystem and watershed protection and restoration. The State Water Resources Control Board (State Water Board) will administer Proposition 1 funds for five programs. The estimated implementation schedule for each is outlined in Five Categories: ▪ Small Community Wastewater ▪ Water Recycling ▪ Drinking Water ▪ Stormwater ▪ Groundwater Sustainability http://www.waterboards.ca.gov/water_issues/programs/grants_loans/proposition1.shtml
Assistance to Firefighters Grant	The primary goal of the FP&S Grants is to enhance the safety of the public and firefighters with respect to fire and fire-related hazards. The Grant Programs Directorate administers

Agency / Grant Name	Potential Programs/Grants
Program (AFG); Fire Prevention and Safety (FP&S)	the FP&S Grants as part of the AFG Program. FP&S Grants are offered to support projects in two activity areas: 1). Fire Prevention and Safety (FP&S) Activities designed to reach high-risk target groups and mitigate the incidence of death and injuries caused by fire and fire-related hazards. 2). Research and Development (R&D) Activity To learn more about how to prepare to apply for a project under this activity, please see the FP&S Research and Development Grant Application Get Ready Guide. https://www.fema.gov/fire-prevention-safety-grants

5.7 The Budget in Brief

The City of Barstow has a total adopted budget for all funds in the amount of $54.0 million for Fiscal year 2017-18. Adopted Budget reflects the operating and capital spending plans for the General Fund, Special Revenue Funds, Capital Project Funds, Debt Service and Enterprise Funds.

In comparison to the total adopted FY17-18 budget, on an all funds basis the operating budget comprises 64.5% of the total budget. The adopted operating budget was $34.9 million, an increase of $ 1.98 million as compared to FY 16-17 budget.

Section 6. Mitigation Strategy

6.1 Mitigation Overview

The City of Barstow's mitigation strategy is derived from the in-depth review of the existing vulnerabilities and capabilities outlined in previous sections of this plan, combined with a vision for creating a disaster resistant and sustainable community for the future. This vision is based on informed assumptions, recognizes both mitigation challenges and opportunities, and is demonstrated by the goals and objectives outlined below. The mitigation measures identified under each objective include an implementation plan for each measure. The measures were individually evaluated during discussions of mitigation alternatives and the conclusions used as input when priorities were decided. All priorities are based on consensus of the Planning Team.

Mitigation measures are categorized generally for all hazards and specifically for the four risk hazards facing the City that were extensively examined in the risk assessment section: climate change, earthquakes, floods, and wildfires.

The intent of the mitigation strategy is to provide the City of Barstow with a guidebook to future hazard mitigation administration. This will help the staff to achieve compatibility with existing planning mechanisms, and ensure that mitigation activities provide specific roles and resources for implementation success.

6.1.1 Mitigation 5 Year Progress Report

The following, Table 6-1, identifies the completed, deleted, or ongoing actions or activities from the previously approved 2011 plan. Due to changes in funding availability and management's change of priorities, some 2011 mitigations actions have been removed from the 2017 mitigation actions. Mitigation efforts are being focused on the community as a whole as opposed to the actions that may only benefit a small percentage of the community.

Table 6-1: Mitigation 5 Year Progress Report

Mitigation Action	Completed	No longer priority	Ongoing	Comments
Work to ameliorate problems related to windblown sand, as well as water and related soil erosion.			X	On Going, strategy is to put sand and dirt back where it came from
Carefully evaluate and regulate development in areas subject to natural or man-made hazards.			X	Code enforcement and permit processes is used to mitigate man-made hazards
Address Flash Flood hazards by completing drainage mitigation	X			Completion of Avenue H & Avenue I Drainage

Mitigation Action	Completed	No longer priority	Ongoing	Comments
Address Flash Flood hazards by completing drainage mitigation	X			Completion of Laverne Avenue& West Main drainage Street Drainage project. Phase I and II complete.
Construction of new Community Hospital to mitigate earthquake hazard	X			Completion of new community hospital
Pond reconstruction phase I project, Main line road work and sewer in casement project	X			Completed projects to mitigate flood, earthquake and flash flood hazards
Expansion and remodeling of Barstow City Hall and Police Station			X	Ongoing seeking funding
First avenue bridge approach rehabilitation			X	In process working through grant funding process and regulatory process

6.2 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. Community issues and weaknesses are presented by individual hazard in Table 6-2 to Table 6-6.

Table 6-3: Earthquake Problem Statements Table

Problem Description	Problem Type	Action No.
1. Lack of public notification system in the City	Public Notification	AH 1.1
1. Potential damage to essential facilities and major bridges.	Infrastructure	EQ 1.1, 1.2, 1.3
2. Public awareness and preparedness of earthquake risks at businesses and homes	Public Education and Notification	EQ 2.1
3. Some residents live in the Strong shaking zone in the Great Shakeout Scenario	Vulnerable Populations	EQ 2.1

Table 6-4: Wildfire Problem Statements Table

Problem Description	Problem Type	Action No.
1. Vegetative fuels in open spaces and backing up to resident's property/homes.	Maintenance Policy	WF 1.1
3. Public education on brush clearance and defensible space.	Public Education and Notification	WF 3.1

Table 6-5: Flood Problem Statements Table

Problem Description	Problem Type	Action No.
1. Drainage issues along major transportation roads throughout City	Lifeline/Infrastructure	FL 1.1, 1.2, 1.3
2. Debris/sediment buildup in storm culverts and basins after major storms	Maintenance	FL 2.1

Table 6-6: Climate Change Problem Statements Table

Problem Description	Problem Type	Action No.
1. Greenhouse gas emissions with residential and commercial properties.	Utilities	1.1
2. Greenhouse gas emissions with residential and commercial vehicles	Transportation	1.1

6.3 Mitigation Goals, Objectives, and Projects

The Mitigation Goals included overall goals established by the City (contained within the City's General Plan) to guide the establishment and priorities of specific goals, objectives and mitigation measures for each high risk hazard. In reviewing and updating the mitigation goals and actions, it was the Planning Team's consensus that the following goals remain in this HMP update. Our mitigation projects for each hazard are stated within the mitigation actions for each respective hazard. The City's 2015 General Plan is on file at City Hall, 220 E Mountain View Barstow, Ca 92311 and is available for review during normal business hours. The General Plan is also available online at www.barstowca.org.

6.3.1 All Hazard (AH)

Goal: Improve emergency services management capability

Objective 1: Develop warning and evacuation notification system for residents and businesses.

> ***AH Action 1.1:*** Implement a public notification system to increase ability to alert the public to potential emergency situations and hazards.

Objective 2: Identify the need for, and acquire, any special emergency services and equipment to enhance response capabilities for hazards.

> ***AH Action 2.1:*** Upgrades to newly relocated EOC

6.3.2 Earthquake/Geologic Hazards (EQ)

Goal: The protection and safety of human life, land, and property from the effects of seismic and geotechnical hazards shall be increased. (General Plan)

Earthquake Objective 1: The City shall coordinate and cooperate with public and quasi-public agencies to ensure that major infrastructure, utility systems and roadways have continued functionality in the event of a major earthquake.

> ***EQ Action 1.1*:** Seismic retrofit of City Hall.
> ***EQ Action 1.2:*** Seismic analysis of Waste Water Treatment Plant.
> ***EQ Action 1.3:*** Rehabilitation First Avenue Bridge
> ***Responsible Agency:*** Planning Division, Public Works Division, City Engineer, Public and Quasi-Public Utilities.
> ***Schedule:*** Ongoing.

Earthquake Objective 2: The City shall actively support and participate in local and regional efforts to educate the public on reducing earthquake risks.

> ***EQ Action 2.1*:** Increase number of residents who complete public education programs such as CERT for earthquake risks and response.
> ***Responsible Agency:*** Emergency Preparedness
> ***Schedule:*** Ongoing.

6.3.3 Wildfire (WF)

Goal: Continue to reduce fire hazards in the City of Barstow.

Wildfire Objective 1*:* Reduce fire risk in open spaces through vegetation management policies.

> ***WF Action 1.1*:** Continue and enhance the hazard abatement program to reduce wildfire hazards.
> ***Responsible Agency:*** Code Enforcement
> ***Schedule:*** ongoing.

Wildfire Objective 2*:* Improve understanding of locations, potential impacts, and linkage between hazards, vulnerability, and measures needed to protect life and property.

> ***WF Action 2.1:*** Continue to identify areas vulnerable to wildfire due to inadequate water supply for firefighting and implement improvements such as expansion of water supply and storage hydrants.
> ***Responsible Agency:*** *Community and Economic Development**,*** Fire District
> ***Schedule:*** ongoing.

6.3.4 Flood (FL)

Goal: Protect lives and property from flooding hazards through a comprehensive system of flood control facilities throughout the City. (General Plan, Flooding and Hydrology Element)

Flood Objective 1: Maintain the City's local and regional drainage system through proactive planning and coordination with other responsible agencies.

> ***FL Action 1.1 Drainage system upgrade Phase II Laverne Drainage Project.***
> ***FL Action 1.2 Drainage system upgrade I Ave***
>
> ***Responsible Agencies:*** Engineering Division, Public Works Division.
> ***Schedule:*** 5-10 years

Flood Objective 2: Assure that adequate access to roadways is maintained during major storm events, and that safe all-weather crossings over drainage facilities and flood control channels are provided where necessary.

6.3.5 Climate Change (CC)

Goal: Reduce the impacts of climate change on the City and limit human activities that change the atmosphere's makeup.

Climate Change Objective 1: Meet greenhouse gas (GHG) reduction targets set forth by the City of Barstow Resource Conservation and Open Space Element

CC Action 1.1: Continue implementing measures to reduce GHG and energy usage as identified in the City of Barstow Resource Conservation and Open Space Element

> ***Responsible Agency:*** Planning Division
> ***Schedule:*** ongoing

6.4 Considering Mitigation Alternatives

The HMP Planning Team participated in the development and review of mitigation actions with a wide range of alternatives. To narrow mitigation alternatives for inclusion, FEMA's six broad categories of mitigation alternatives were used. Each FEMA category is described below. The HMP Planning Team developed several mitigation alternatives for implementation under each mitigation category.

Prevention (PRV):

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning ordinances
- Building codes
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Riverine/fault zone setbacks

PRV Alternatives:

Evaluate the City's regulations that manage flood risk and consider additional standards to help prevent flood problems from increasing. These include:

- Changes in zoning ordinance to designate special land uses for flood-prone areas
- Enhanced subdivision regulations
- Enhanced stormwater regulations to reduce stormwater runoff, especially for new development Other additional higher standards in the flood management code

Consider additional policies and regulations to enhance the preservation of open space in flood-prone and wild land fire high risk areas.

Property Protection (PPRO):

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Building elevation
- Critical facilities protection
- Retrofitting (e.g., wind proofing, flood proofing, seismic design techniques, etc.)
- Insurance

PPRO Alternatives:

Establish a program to evaluate RL and flood-prone properties for implementation of property protection measures.

Consider promoting and supporting voluntary property protection measures through several activities, ranging from financial incentives to full funding.

Promote flood insurance for flood-prone properties with a focus on the SFHA and properties with historical flooding areas.

Evaluate publically owned facilities and critical facilities for property protection measures, including flood insurance.

Public Education and Awareness (PE&A):

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects including neighborhood and community outreach
- Speaker series / demonstration events
- Hazard mapping
- Real estate disclosures
- Materials library
- School children educational programs
- Hazard expositions

PE&A Alternatives:

Enhance the City's Public Information Program to include both the public and private sectors. An education and outreach measure to ensure the community understands their role in protecting themselves in a disaster event.

- Safety precautions for all types of hazards, but especially floods, earthquakes, wildfires, and drought
- Knowing where emergency evacuation routes and shelters are located
- Family and emergency preparedness measures
- Mitigation measures for residents at the home

Enhance public outreach program to include all hazards. Appropriate ways to spread information are:

- Websites and social media
- Mailings to residents, in water bill
- Newsletter
- Displays, particularly at special events
- Handouts, flyers and other materials, which can be distributed at special events and at presentations

Natural Resource Protection (NRP):

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, steep slopes, and open land. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Vegetation Management (e.g., fire resistant landscaping, fuel brakes,etc.)
- Erosion and sediment control
- Habitat preservation and restoration

NRP Alternatives:

Enhance public education and outreach efforts to inform the public about our recycling programs and energy saving tips and upgrades.

Inform the public and local businesses how important it is to use drought tolerant landscaping.

Keep promoting water conservation policy's in effect to keep water usage low.

Emergency Services (ES):

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning Systems
- Construction of evacuation routes
- Sandbag staging for flood protection
- Obtain StormReady certification
- Provide alert and notification to residents through social media for flood risk
- Evacuate and shelter populations displaced due to flooding
- Training

Staff Structural Projects (SP):

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Stormwater diversions / detention / retentioninfrastructure/drywells
- Utility upgrades
- Seismic Retrofits
- New construction standards

SP Alternatives:

The City has previously constructed flood control and drainage facilities that move storm and flood waters more efficiently

and reduced potential for flooding. The City should identify and prioritize additional projects in Barstow.

The City should continue to implement regional drainage improvement projects to reduce stormwater runoff and the potential for flooding along local drainages.

6.5 Mitigation Priorities

During the development of the risk assessment for the City of Barstow, the Planning Team proposed and discussed alternative mitigation goals, objectives, and specific mitigation measures that the City should undertake to reduce the risk from the three high-risk hazards facing the City.

6.5.1 Prioritization Process

Multiple factors were considered to establish the mitigation priorities included in this plan. The Planning Team utilized the 2011 rankings and the last five-year disaster related occurrences to develop the Hazard Summary Worksheet and Risk Factor Final Worksheet identified in Section 4.1 and in Appendix D.1-D.4) to help assess mitigation priorities and determined that the highest priority rankings would be assigned to those mitigation measures that met three primary criteria:

1. Greatest potential for protecting life and property.
2. Greatest potential for maintaining critical City functions and operability following a disaster.
3. Achievability in terms of community support and cost effectiveness.

All rankings were determined by the consensus of the Planning Team. As described in the previous section on hazard and risk assessment, clearly earthquakes have the potential to affect the largest number of people, critical facilities and buildings and to cause the greatest economic losses. This fact, combined with the relatively high probability of an earthquake occurrence in the next several decades, makes increasing disaster resistance and readiness to earthquakes a high priority.

Given the extreme importance of maintaining critical government functions in times of disaster and the large number of the population who depend and rely on government services and infrastructure, those mitigation measures that improve government disaster resistance, readiness, or recovery capacity are generally given higher priority than mitigation of privately owned buildings in which the loss or damage affects relatively few.

Earthquake, flooding, wildfire, and climate change mitigation actions are identified and assigned a priority according to their importance, cost, funding availability, to what degree project planning has been completed and the anticipated time to implement the measures.

The Planning Team discussed alternative mitigation strategies and mitigation measures during workshops, provided their preferences and suggested additional mitigation measures that the City should consider. The Planning Team reviewed the list of possible objectives and mitigation measures, made a final selection and then prioritized the individual mitigation measures considered most appropriate for City of Barstow.

6.5.1.1 Public Input for Mitigation Prioritization:

Public input is an essential step in validating the prioritization of mitigation actions. Valuable information was gathered regarding the perception of hazard threats to residents through a community survey.

The community survey found that 35.85%% of respondents had experienced an earthquake within the City of Barstow, 23.8% experienced wildfire, and 30.77% had experienced flooding. When asked which hazards would be very likely to cause damage to buildings or harm residents in the City, respondents believed drought, wildfire and earthquake were the most likely to cause damage.

6.5.2 Cost Benefit:

The action plan was prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program.

A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, 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 costs and benefits of these projects and the planning team arrived at such ratings notated in Table 6-7.

Cost ratings were defined as:

High—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
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.
Low—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

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 the reduction of 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 (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

6.5.3 Goal, Objective, and Mitigation Action Matrix

Based upon the risk assessment, the City's capabilities and public input, Table 6-7 shows primary objectives and corresponding mitigation actions selected for further implementation and development during the next planning cycle. The following table provides details for each mitigation action with mitigation action descriptions, FEMA mitigation category, responsible party, and timeframe. Implementation Action Plans for each action number highlighted in Table 6-x are shown in further detail in Section 7 (Implementation).

RF Factor	Action No.	Priority Rating	Action Description
EARTHQUAKE			
3.6	EQ 1.1	1	Seismic retrofit of City Hall.
3.6	EQ 1.2	3	Seismic analysis of Waste Water Treatment Plant.
3.6	EQ 1.3	2	Rehabilitation First Avenue Bridge
FIRE			
2.3	WF 1.1	2	Continue and enhance the hazard abatement program to reduce wildfire hazards.
2.3	WF 2.1	1	Continue to identify areas vulnerable to wildfire due to inadequate water supply for firefighting and implement improvements such as expansion of water supply and storage hydrants.
FLOOD			
2.25	FL 1.1	1	Drainage system upgrade Phase II Laverne Drainage Project.
2.25	FL 1.2	2	Drainage system upgrade Avenue I
2.25	FL 2.1	3	Purchase resources such as skid steer loader, dump truck, vactor truck and automatic sandbag machine needed to perform routine and annual maintenance for roadways and drainage facilities.
CLIMATE CHANGE			
1.7	CC 1.1	1	Continue implementing measures to reduce GHG and energy usage as identified in the City of Barstow Resource Conservation and Open Space

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Action No.	Mitigation Action	Description / Background	Mitigation Category	Funding	Cost/Benefit	Lead Dept.	Timeline
AH 1.1	Implement a public notification system to increase ability to alert the public to	The City currently does not have a City wide notification system for residents, business owners	Emergency Services	General Fund Grants	High/High	Emergency Preparedness/PIO	5-10 years
EQ 1.1	Seismic analysis of the City Hall Development Services Building.	Seismic analysis of City Hall would provide information on needed improvements to the building to respond to seismic activity.	Structural Projects	General Fund Grants	High/High	Engineering	5-10 years
EQ 1.2	Seismic analysis of Waste Water Treatment Plant.	Seismic analysis of the Waste Water Treatment Plant would provide information on needed improvements to the facility to respond to seismic activity.	Engineering	Grants	High/High	Building & Safety	3-5 years
EQ 1.3	Rehabilitation First Avenue Bridge	Engineering Department is in the planning stages for replacement of First Street Bridge	Engineering	Grants	High/High	Engineering	3-5 years
EQ 2.1	Increase number of residents who complete public education programs such as CERT for earthquake risks and response.	Barstow has a successful CERT programs in the High Desert. To increase public education and preparedness, expansion of CERT program is necessary.	Public Education & Awareness	General Fund Grants	Low/High	Emergency Preparedness	On going
WF 1.1	Continue and enhance fire hazard abatement program.	The Fire Hazard/Weed Abatement Program goal is to have combustible vegetation and debris removed to reduce available fuel for fires. Continuation and enhancement of the program is necessary to decrease wildfires throughout city.	Natural Resource Protection	General Fund, Grants	Medium/High	Code Enforcement	On going

WF 1.2	Continue to identify areas vulnerable to wildfire due to inadequate water supply for firefighting and implement improvements such as expansion of water supply and storage hydrants.	There are some areas of Barstow that have sparse development and limited water supply for firefighting capabilities. The Fire District will continue to identify these areas and develop improvements to increase water supply.	Structural Projects	BFFPD, General Fund, Grants	Medium/High	BFPD	On going
FL 1.1	Drainage system upgrade Phase II Laverne Drainage Project.	During and after a major storm, flooding occurs on Laverne. City Engineering department has identified the need to build a basin for flowing water during and after a storm.	Engineering	General Fund Grants	Low/Medium	Engineering	5-10 years
FL 1.2	Drainage system upgrade Avenue I	This area has been identified by our Engineering Department as an area in need of upgrades to combat flooding after a storm.	Engineering	General Fund Grants	Low/Medium	Engineering	3-5 years

Section 7. Plan Maintenance

7.1 Monitoring, Evaluating and Updating the HMP

As a living document it is important that this plan becomes a tool in the City of Barstow'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 of Barstow. This section describes the incorporation of the HMP into existing Barstow's planning mechanisms, and how the Barstow staff will continue to engage the public.

7.2 Plan Adoption

To comply with DMA 2000, the City Council has officially adopted the 2017 City HMP. The adoption of the 2017 HMP recognizes Barstow's commitment to reducing the impacts of natural hazards within City's limits. A copy of the 2017 HMP adoption resolution is included in the front of the approved HMP document.

7.3 Implementation

Over time, Implementation Strategies will become more detailed and the City's mitigation planners will work to provide greater detail for priority mitigation actions. In conjunction with the Mitigation Implementation Plan Worksheet and Mitigation Action Reporting Form outlined at the end of Section 7 these will be extremely useful as a plan of record tool for updates. Each implementation strategy worksheet provides individual steps and resources needed 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 6. By using planning mechanisms already in use and familiar to City departments and organizations, it 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. Section 6 provides more information on existing planning mechanisms.
- **Updated work plans**- policies, or procedures; hazard mitigation concepts and activities can help integrate the 2017 HMP 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. Appoint duties to new and existing staff to expand training outreach city wide.

7.4 Future Participation

The City of Barstow's HMP Planning Committee, established for this update, will become a permanent advisory body to administer and coordinate the implementation and maintenance of the 2017 HMP.

Other duties include reviewing and promoting mitigation opportunities, informing and soliciting input from the public and developing grant applications for hazard mitigation assistance.

7.5 Schedule

The HMP will be updated every five years, as required by DMA 2000. The formal update process will begin at least one year prior to the expiration of the City Council adoption date of the HMP notated at the beginning of this plan. However, should a significant disaster occur within Barstow, the HMP Planning Committee will reconvene within 30 days of the disaster to review and update the HMP as needed. The City Council will adopt written updates to the HMP as a DMA 2000 requirement.

7.6 Process

The HMP Planning Committee will coordinate with responsible agencies/departments identified for each mitigation action. These responsible agencies/departments will monitor and evaluate the progress made on the implementation of 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. A HMP Mitigation Action Progress Report worksheet, provided in at the end of the this section 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:

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

An Annual HMP Review Questionnaire worksheet, provided in the Appendix D.7, has been developed as part of this HMP to provide guidance to the HMP Planning Committee on what should be included in the evaluation. 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 2017 HMP in 2022. The questions identified above would remain valid during the preparation of the 2022 update.

7.7 Incorporation of 2011 LHMP Into Existing Planning Mechanisms

The Local Hazard Mitigation Plan and related strategies have been incorporated into the following City of Barstow Plans. Listed below are the plans and related sections used out of the City of Barstow 2011 LHMP.

During the planning process for new and updated local planning documents the LHMP will be used to ensure consistency with the hazard mitigation goals and strategies across the plans.

- City of Barstow Emergency Operations Plans
    - Risk Assessment
- City of Barstow Ordinances
    - Mitigation Strategy and Risk Assessment
- Flood and Storm-water Management Plans
    - Community Capability Assessment, Mitigation Strategy and Risk Assessment
- Capital Improvement Plans and Budgets
    - Community Capability Assessment,Mitigation Strategy and Risk Assessment
- Other plans, regulation, and practices with a mitigation focus.
    - Community Capability Assessment,Mitigation Strategy and Risk Assessment

7.8 Incorporation into Existing Planning Mechanisms

Incorporation of the hazard mitigation plan recommendations into City plans and policies is part of our implementation plan. Plans include:

- City of Barstow Emergency Operations Plans
- City of Barstow Ordinances
- Flood and Storm-water Management Plans
- Capital Improvement Plans and Budgets
- Other plans, regulation, and practices with a mitigation focus.

Incorporation of the hazard mitigation plan into the City's General plan is scheduled to occur at the next General Plan Update, 2020. At this time the city will adopted the LHMP in accordance with the federal Disaster Mitigation Act of 2000 (P.L. 106-390) as part of the safety element of its general plan adopted pursuant to subdivision (g) of Section 65302.

7.9 Continued Public Involvement

A critical part of maintaining an effective and relevant Hazards Mitigation Plan is ongoing public review and comment. Consequently, the City is dedicated to the direct involvement of its citizens in providing feedback and comments on the plan on a continued basis. The public will continue to be apprised of Local Hazard Mitigation Plan actions through the City's website and through the local media.

The City of Barstow will continue to promote and secure hazard mitigation, preparedness, response, and recovery actions via:

- Continued participation in the Operational Area Coordinating Council meeting.
- Regular revision of the Emergency Operations Plan and the Hazard Mitigation Plan as outlined respectively
- Annual drills and training with Emergency Operations Center staff
- Support of an Emergency Preparedness Program
- Promotion at community events whenever possible

All proposed changes to the plan will be subject to citizen review prior to City Council action. The City will follow its standard public input process, consistent with the process used in the initial plan development, which is described in Section 3 of this Plan.

7.10 2017 HMP Mitigation Action Implementation Plans

Mitigation Action Implementation Plan	
Action:	
Implementing Agencies	
Lead Agency (ies):	City of Barstow
Roles and Responsibilities:	
Support Agency (ies):	
Roles and Responsibilities:	
Preliminary Identified Tasks:	
1.	
2.	
3.	
Implementation Costs	
Estimated Capital Costs:	
Estimated Maintenance Costs:	
Implementation Resources	
Financial Resources (Funding):	
Technical Assistance Resources:	
Required Equipment, Vehicles, and Supplies	
Office Supplies	
Vehicles	
Implementation Timeframe	
Estimated Mitigation Action Start Date:	
Estimated Mitigation Action Completion Date:	

7.11 Blank Mitigation Action Reporting Forms

Your jurisdictional may wish to use these mitigation actions reporting forms on an annual, semiannual, or quarterly basis.

Progress Report Period:_____to _____

(date) (date)

Project Title:_____

Project ID#_____

Responsible Agency:_____

Address:_____

City: _____

Contact Person:_____

Phone#:_____Email _____

List Supporting Agencies and Contacts:_____

Total Project Cost:_____

Funding Source:_____

Anticipated Cost Overrun/Underrun:_____

Date of Project Approval:_____Start date of the project:_____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase):_____

Milestones	Completed (✓)	Projected Date of Completion

HMP Goal Addressed: _____

Indicator of Success:_____

Project Status:

□ Project on schedule □ Cost unchanged □ Project completed

□ Cost overrun* □ Project delayed*

*explain_____

Summary of progress on project for this report:

A. What was accomplished during this reportingperiod?

B. What successes have you encountered, ifany?

C. What obstacles, problems, or delays have you encountered, if any?

D. How was each problem resolved?

E. Based on the past experiences (successes and obstacles), what changes, if any, need to be made to ensure completion?

Next Steps: What are the next step(s) to be accomplished over the next reporting period?

Other Comments:

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Appendix A

A.1 Copy of City Resolution adopting HMP

B.1 Planning Committee Team

Barstow HMP Team

Emergency Management	Jamie Williams
Fire District	Jamie Williams
Parks and Rec	Terri Peralta
Public Works	Mike Brown
City Planning	Gaither Lowenstein
City Utilities	Domingo Gonzales
City Administration	Cindy Prothro

Key Stakeholders

GSW	Jessie Ramirez
City of Victorville	Dana Welborn
City of Hesperia	Rachel Molina
BUSD	Jeff Malan
American Red Cross	Don Gordon
County of SB	Cindy Serrano
SW Gas	Bill Hensley
Edison	Bob Steins
Cal OES	HMP division
FEMA	HMP division

B.2 Coordination with other Jurisdictions

2016 HAZARD MITIGATION PLAN UPDATE

NOTICE OF INTENT TO PARTICIPATE

Individual Completing Notice of Intent to Participate:

Jurisdiction or Agency Name:	**City of Barstow / Barstow Fire Protection District**
Emergency Manager:	**Rich Ross**
Address:	**861 Barstow Rd**
City:	**Barstow** State: CA Zip Code: **92311**
Telephone No.:	**760-256-2254**
Email:	rross@barstowca.org

☒**YES**, we intend to participate in the 2016 Local Hazard Mitigation Plan Update.

☐NO, we will not participate in the 2016 Local Hazard Mitigation Plan Update.

If the YES box is checked, please complete the below information:

LHMP Point of Contact:

Name:	**Jamie Williams**
Title:	**Captain**
Telephone No. 1:	**760-256-2254**
Telephone No. 2:	
Email Address:	**Jwilliams2@barstowca.org**
Mailing Address:	**861 Barstow Rd Barstow Ca 92311**

Alternate Point of Contact:

Name:	
Title:	
Telephone No. 1:	
Telephone No. 2:	
Email Address:	
Mailing Address:	

We understand the County contracted consultant will not be writing the updates for the LHMP for our jurisdiction.

Emergency Manager/Agency Representative: Jamie Williams

Date: 6/8/16

Return completed form to: San Bernardino County Fire/Office of Emergency Services at miles.wagner@oes.sbcounty.gov by June 2, 2016.

Joint Special CC/Successor/BFPD
04/16/18 07:00:PM
Fire Department
Jamie Williams
Report
Doc ID: 3348

FIRE AGENDA ITEM

AGENDA MATTER:

UPDATED DRAFT 2017 HAZARD MITIGATION PLAN

EXECUTIVE SUMMARY:

Staff began updating the Hazard Mitigation Plan (HMP) in April 2017. The plan requires an inclusive approach by working with key stakeholders, department heads and community members during the planning process. An update was also provided to Council on April 17, 2017.

The City participated with the San Bernardino County Office of Emergency Services in the planning process to revise the HMP according to compliance standards set forth by the Federal Emergency Management Agency (FEMA). The City's review and revision of the HMP reflects changes in development, progress of previously identified mitigation projects in the 2011 Plan, and hazard priorities.

The HMP describes the hazards that can affect the City, assesses the community's risk from these hazards and provides actions or projects that the community desires to mitigate vulnerabilities.

DISCUSSION:

The Federal Disaster Mitigation Act of 2000 (DMA) establishes requirements for state and local entities to prepare and keep updated a comprehensive HMP. In order to be eligible for pre- and post-disaster mitigation grants each jurisdiction must submit a plan to the California Office of Emergency Services (Cal OES) and FEMA for approval. The regulation requires that the HMP be updated and resubmitted to FEMA for approval every five years in order for jurisdictions to remain eligible for FEMA grant programs.

FISCAL IMPACT:

None. However, the adoption of the HMP is a pre-requisite for receiving pre-disaster mitigation grant funds, disaster response reimbursements and mitigation project reimbursements linked to damages resulting from a federal and/or state disaster declaration.

RECOMMENDED ACTION:

Approve the Updated draft 2017 Hazard Mitigation Plan for submission to CalOES.

1

HAZARD MITIGATION

Update

2

Definition of Hazard Mitigation

- Hazard Mitigation is defined as any sustained action that is taken to eliminate or reduce risk to people and property from the effects of natural disasters.
- Mitigation is a proactive phase of the Emergency Management four cycle phase in hopes to specifically dedicated to break the cycle of damage, to reduce reconstruction and repeated damage.
- FEMA has required agencies and organizations that apply for the hazard mitigation grant, to have a documented plan on how losses will be reduced or eliminated.
- A jurisdiction covered by a plan that has expired is not able to pursue funding under the Robert T. Stafford Act for which a current hazard mitigation plan is a prerequisite.

3

Why The Update Process?

- As a DMA 2000 requirement, the LMP must be updated every five (5) years to remain in compliance with regulations and Federal mitigation grant conditions
- Federal regulations require hazard mitigation plans to include a plan for monitoring, evaluating, and updating the hazard mitigation plan.
- The update process provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies.
- A jurisdiction covered by a plan that has expired is not able to pursue funding under the Robert T. Stafford Act for which a current hazard mitigation plan is a prerequisite.

4

Update Process

City of Barstow Local Hazard Mitigation Plan

5

Updated Categories

- This update will focus on six identified categories
  - Earthquake
  - Climate Change
  - Drought
  - Flood
  - Wildfire
  - Anti-Terrorism

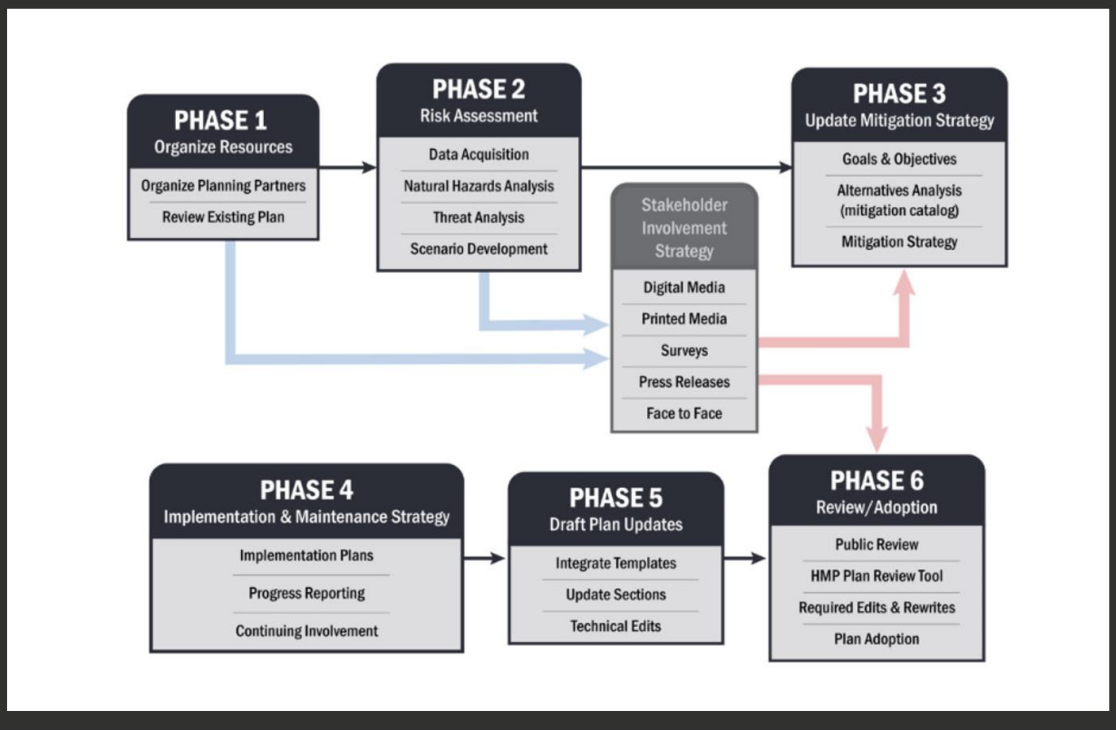
6

Mitigation Strategy Update

- Mitigation strategy sections identifies and updates the following:
  - Overview
  - 5 Year Progress Report
  - Risk Assessment / Vulnerability Assessment
  - Mitigation Goals, Objectives, Projects
  - Mitigation Alternatives
  - Mitigation Priorities
  - Mitigation Strategy

Community Capability Assessment

- Mitigation strategy sections identifies and updates the following:
  - Active Mitigation Programs
  - Local Planning and Regulatory Capabilities
  - Administrative and Technical Mitigation Capabilities
  - Local Capabilities
  - San Bernardino County Capabilities
  - State and Federal Fiscal Resources



Appendix C

C.1 Survey

C.2 Survey Results

Local Hazard Mitigation Plan Survey

Published online at www.barstowca.org

The Federal Disaster Mitigation Act of 2000 (DMA 2000) requires a community to have an approved hazard mitigation plan in order to be eligible to apply for and receive FEMA hazard mitigation funds. Receipt of FEMA funding is critical to implementing identified hazard mitigation projects and programs.

Barstow has received a grant from California Officer of Emergency Services (Cal OES) to prepare and/or update a Local Hazard Mitigation Plan (LHMP). The purpose of mitigation planning is to identify policies and to take actions that can be implemented over the long term to reduce risk and future losses when an emergency or disaster occurs. Mitigation plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage.

We need your feedback! This questionnaire is designed to obtain your input about areas in Barstow that may be vulnerable to various types of natural disasters. The information you provide will help us identify and coordinate projects focused on reducing the risk of injury or damage to property from future hazard events (e.g. wildfires, floods, earthquakes).

The survey should take approximately 12-15 minutes to complete and is anonymous. Your information will be kept confidential. The final results of the survey will be included within the LHMP and posted on the Barstow's webpage at:

www.barstowca.org

Do you...(Check all that apply).

- ☐ Live in the Barstow
- ☐ Work in the Barstow
- ☐ Visit the Barstow but live and work elsewhere

Which of the following types of natural disasters have you or someone in your household experienced in the past 20 years within the Barstow area?

- ☐ Flooding
- ☐ Drought
- ☐ Wildfire
- ☐ Landslide
- ☐ High Heat
- ☐ Earthquake
- ☐ Severe Weather
- ☐ Other: _____

What do you believe is the likelihood that these natural hazards will cause damage buildings or harm residents to the Barstow area? Please check ONE response for each hazard.

	Very likely	Likely	Somewhat Likely	Not Likely at all
Drought	○	○	○	○
Earthquake	○	○	○	○
Wildfire	○	○	○	○
Liquefaction	○	○	○	○
Flood	○	○	○	○
Landslide/Mudflow	○	○	○	○
Severe Weather	○	○	○	○
High Heat	○	○	○	○

Please indicate how you feel about the following statement:
Information about the risks from natural hazards is readily available and easy to locate.

- ○ Strongly Disagree
- ○ Somewhat Disagree
- ○ Neither Agree nor Disagree
- ○ Somewhat Agree
- ○ Strongly Agree

Please indicate how you feel about the following statement:
It is my responsibility to educate myself and take actions that will reduce my exposure to the risks from natural hazards.

- ○ Strongly Disagree
- ○ Somewhat Disagree
- ○ Neither Agree nor Disagree
- ○ Somewhat Agree
- ○ Strongly Agree

Please indicate how you feel about the following statement:
It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks from natural hazards.

- ○ Strongly Disagree
- ○ Somewhat Disagree
- ○ Neither Agree nor Disagree
- ○ Somewhat Agree
- ○ Strongly Agree

How much money would you be willing to spend at one time to protect your home or business from natural hazards? (For example, by flood proofing a basement, performing seismic upgrades, or doing dry weed abatement for fire risk)

The answers will help Barstow staff to find applicable hazard mitigation grant programs requiring local funding match.

- ○ Not willing to spend money on this
- ○ Less than $250
- ○ $250 - $499
- ○ $500 - $1,000
- ○ More than $1,000
- ○ Not Sure

How much money would you be willing to spend each year to protect your home or business from natural hazards in the form of flood and/or earthquake insurance?

The answers will help Barstow staff to find applicable hazard mitigation grant programs requiring local funding match.

- ○ Not willing to spend money on this
- ○ Less than $250
- ○ $250 - $499
- ○ $500 - $1,000
- ○ More than $1,000
- ○ Not Sure

Which of the following incentives would encourage you to protect your home against natural hazards? (Check all that apply)

- ☐ Insurance premium discount
- ☐ Mortgage discount or Low Interest Loan
- ☐ Financial assistance for property upgrades or equipment
- ☐ "Rebate" program
- ☐ Technical assistance
- ☐ Labor assistance
- ☐ Grant funding that requires “cost share”
- ☐ Building permit fee reduction or waiver
- ☐ Property tax break or incentive
- ☐ Financial assistance for equipment
- ☐ Other: _____

What protection methods do you believe the City, County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within the Barstow?

(Please check ONE answer for each statement). This information will assess community beliefs on developing hazard mitigation programs and strategies.

	High Priority	Medium Priority	Low Priority
Retrofit and strengthen essential facilities such as police and fire facilities, schools and hospitals.			
Retrofit infrastructure such as roads, bridges, drainage facilities, water supply, waste water and power supply facilities.			
Fund projects such as flood walls, drainage improvements, fuel breaks, and bank stabilization projects.			
Strengthen codes and regulations to include higher standards in hazard areas.			
Assist vulnerable property owners with securing funding for mitigation / property protection.			
Provide better public information about risk, and the exposure to hazards within Barstow.			
Carry out projects to restore the natural environments capacity to absorb the impacts from natural hazards.			
Acquire emergency generators for essential government facilities and buildings identified as care and shelters.			

Do you own or rent your home or business?

- Own
- Rent

Is your home or business located in or near a FEMA designated floodplain?

- Yes
- No
- Not Sure

Do you have flood insurance?

- Yes
- No
- Not Sure
- Other:

Is your home or business located near an earthquake fault?

- Yes
- No
- Not Sure
- Other: _____

Do you have earthquake insurance?

- Yes
- No
- Not Sure
- Other: _____

To the best of your knowledge, does your homeowner's, renter's, or general insurance policy provide coverage for damage from natural hazards?

- Yes
- No
- Not Sure
- Do not have property insurance

Have you ever had problems obtaining homeowner's or renter's insurance due to risks from natural hazards?

- Yes
- No
- Not Sure
- Never tried obtaining hazard insurance

When you moved into your home, did you consider the impact a natural hazard event could have on your home?

- Yes
- No
- Not Sure

Was the presence of a natural hazard risk zone (for example, wild fire area or flood zone) disclosed to you by a real estate agent, seller or landlord before you purchased or moved into your home?

- Yes
- No
- Not Sure

Would natural hazard real estate disclosures or risk information influence your decision on where to buy or rent a home?

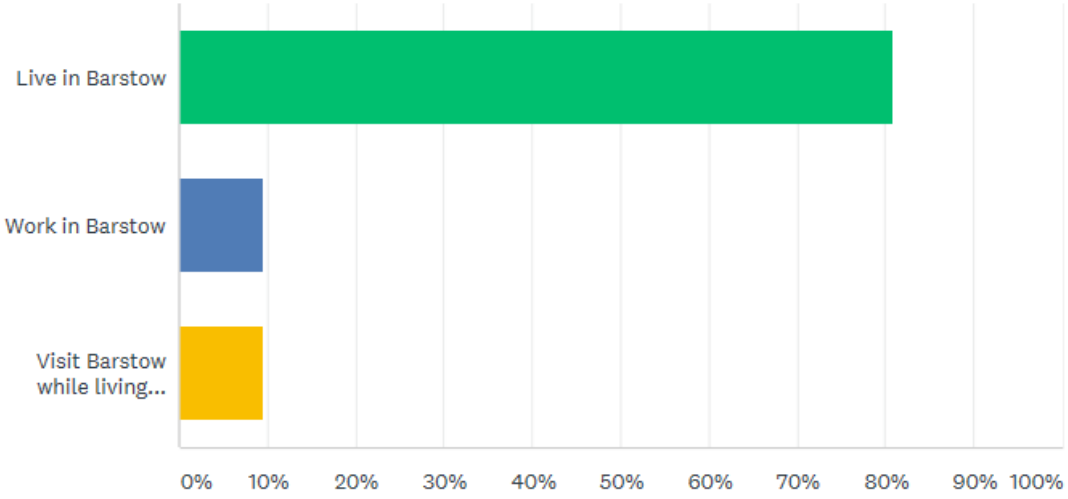
- ○ Yes
- ○ No
- ○ Not Sure

Thank you again for completing the survey!!!! Please provide any additional comments that you may have regarding hazard mitigation and community protection against natural disasters.

Hazard Mitigation Survey Results

Do You:

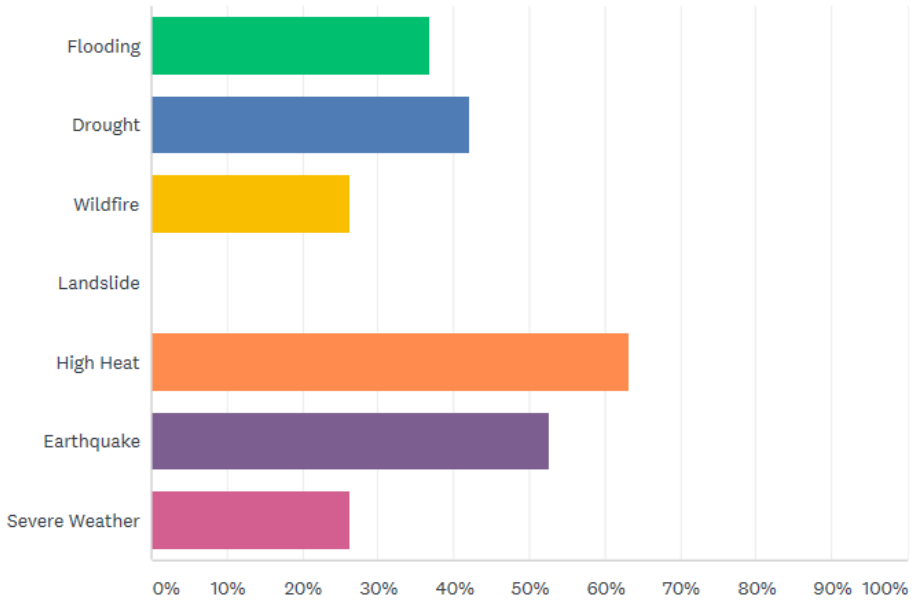
Answered: 21 Skipped: 0



ANSWER CHOICES	RESPONSES	
Live in Barstow	80.95%	17
Work in Barstow	9.52%	2
Visit Barstow while living and working elsewhere	9.52%	2
TOTAL		21

Which of the following types of natural disasters have you or someone in your household experienced in Barstow?

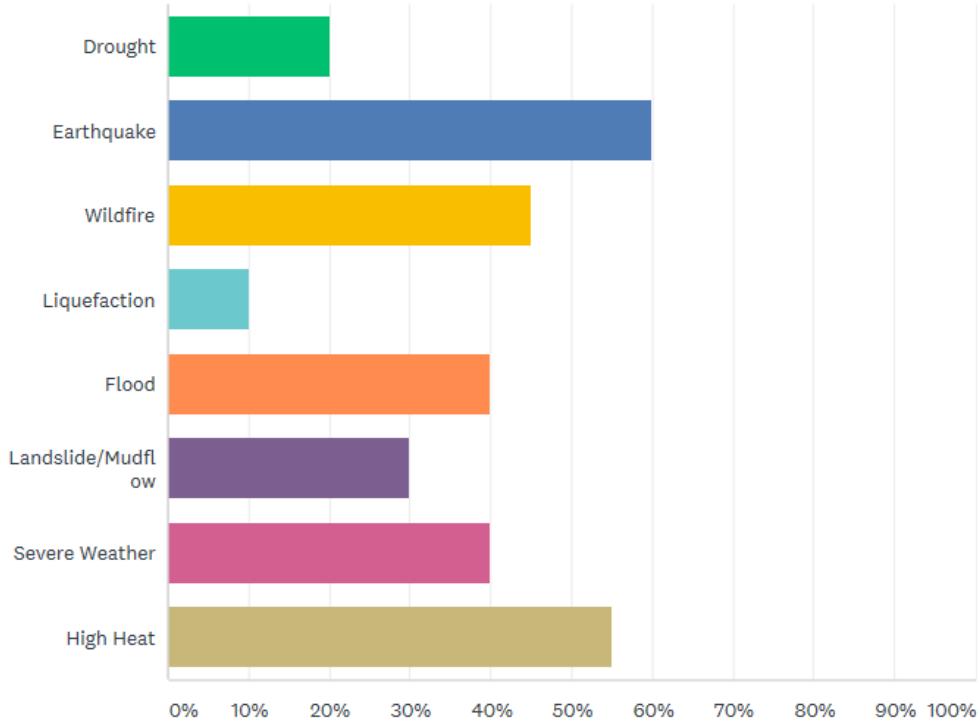
Answered: 19 Skipped: 2



ANSWER CHOICES	RESPONSES	
Flooding	36.84%	7
Drought	42.11%	8
Wildfire	26.32%	5
Landslide	0.00%	0
High Heat	63.16%	12
Earthquake	52.63%	10
Severe Weather	26.32%	5
Total Respondents: 19		

Please select which natural hazards you believe would cause severe damage to buildings or residents within the City of Barstow?

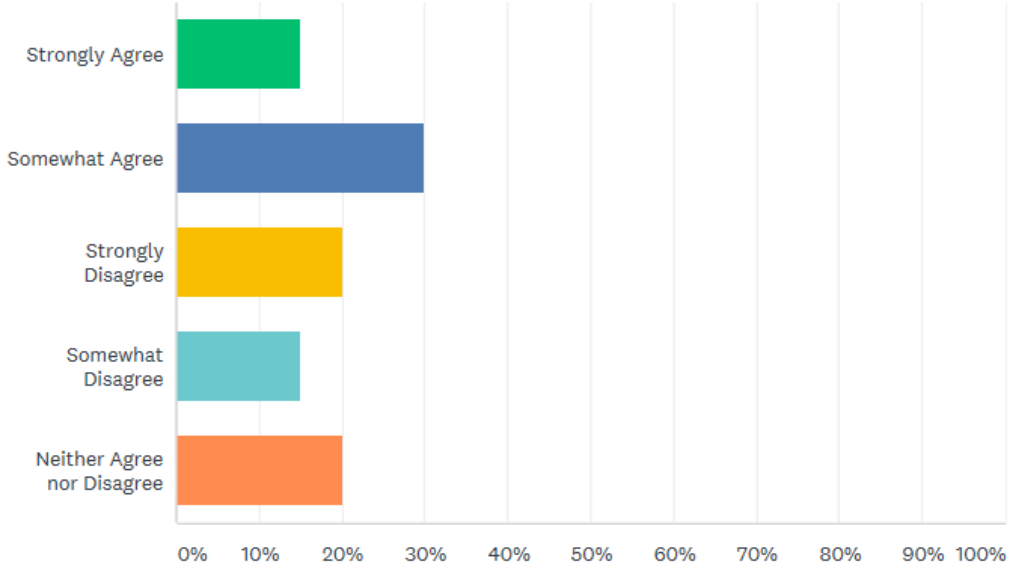
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Drought	20.00%	4
Earthquake	60.00%	12
Wildfire	45.00%	9
Liquefaction	10.00%	2
Flood	40.00%	8
Landslide/Mudflow	30.00%	6
Severe Weather	40.00%	8
High Heat	55.00%	11
Total Respondents: 20		

Please indicate how you feel about the following statement: Information about the risks from natural hazards is readily available and easy to locate?

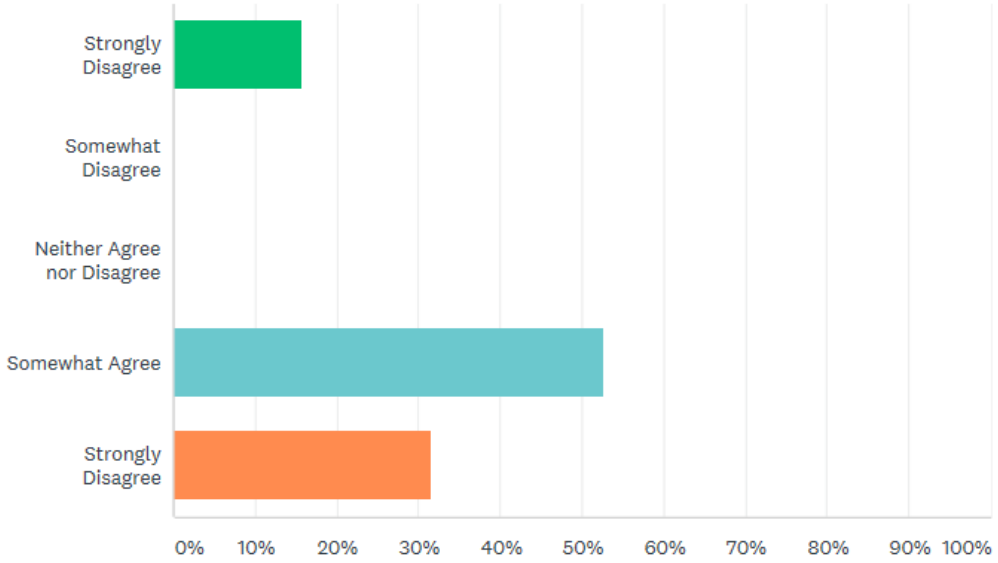
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Strongly Agree	15.00%	3
Somewhat Agree	30.00%	6
Strongly Disagree	20.00%	4
Somewhat Disagree	15.00%	3
Neither Agree nor Disagree	20.00%	4
TOTAL		20

Please indicate how you feel about the following statement: It is my responsibility to educate myself and take actions that will reduce my exposure to the risks from natural hazards.

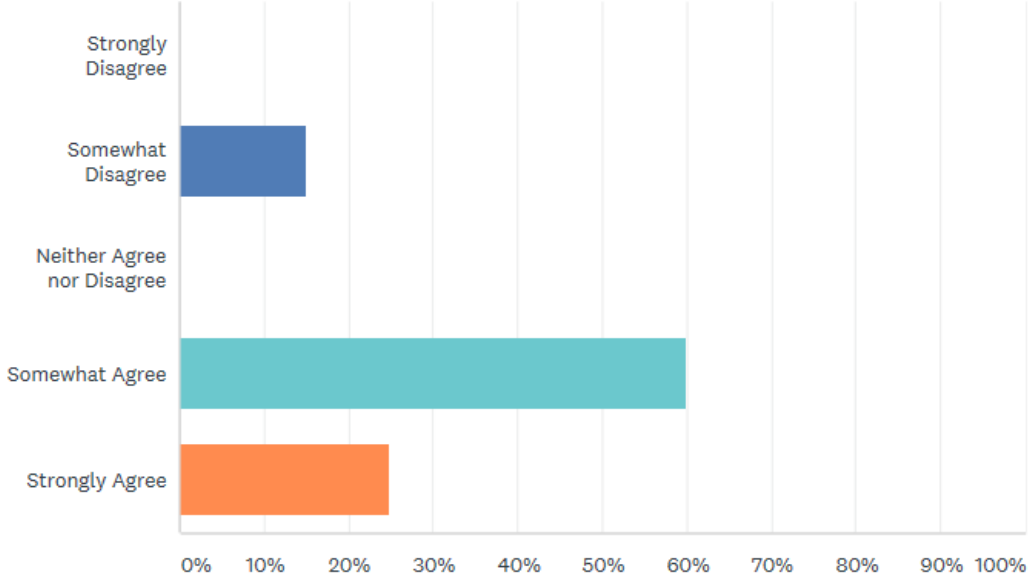
Answered: 19 Skipped: 2



ANSWER CHOICES	RESPONSES	
Strongly Disagree	15.79%	3
Somewhat Disagree	0.00%	0
Neither Agree nor Disagree	0.00%	0
Somewhat Agree	52.63%	10
Strongly Disagree	31.58%	6
TOTAL		19

Please indicate how you feel about the following statement: It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks from natural hazards.

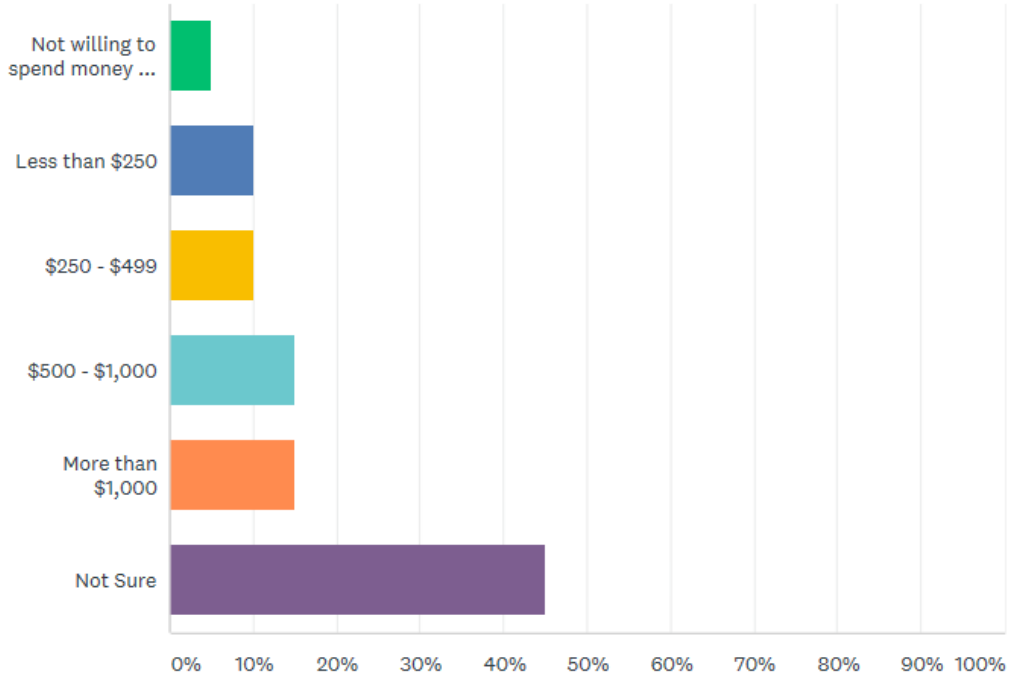
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Strongly Disagree	0.00%	0
Somewhat Disagree	15.00%	3
Neither Agree nor Disagree	0.00%	0
Somewhat Agree	60.00%	12
Strongly Agree	25.00%	5
TOTAL		20

How much money would you be willing to spend at one time to protect your home or business from natural hazards? (For example, by flood proofing a basement, performing seismic upgrades, or doing dry weed abatement for fire risk) The answers will help Barstow staff to find applicable hazard mitigation grant programs requiring local funding match.

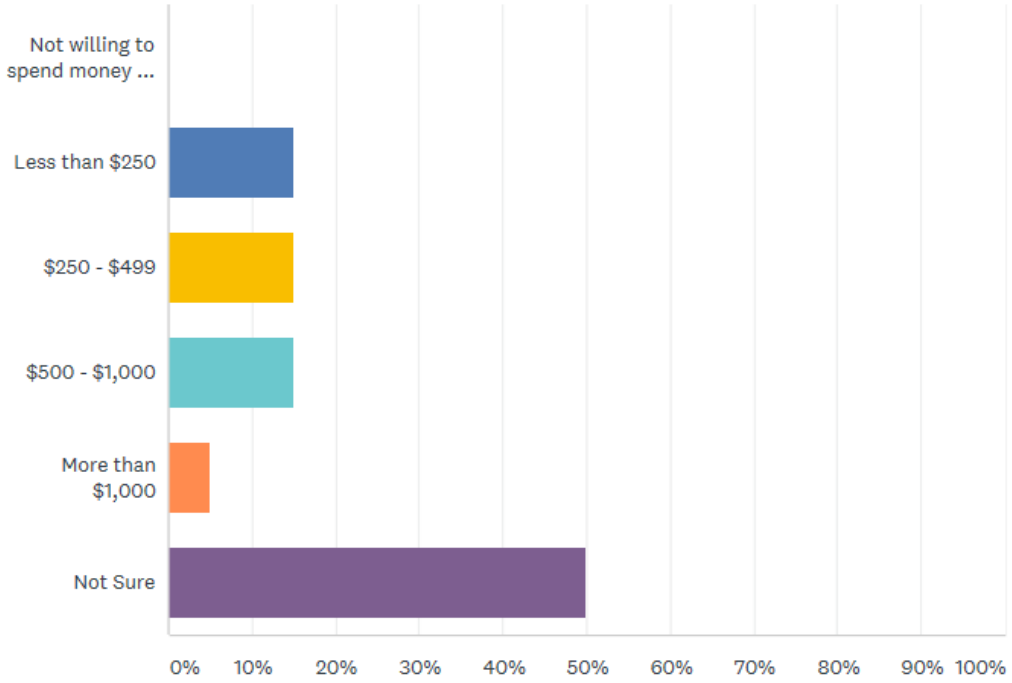
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Not willing to spend money on this	5.00%	1
Less than $250	10.00%	2
$250 - $499	10.00%	2
$500 - $1,000	15.00%	3
More than $1,000	15.00%	3
Not Sure	45.00%	9
TOTAL		20

How much money would you be willing to spend each year to protect your home or business from natural hazards in the form of flood and/or earthquake insurance? The answers will help Barstow staff to find applicable hazard mitigation grant programs requiring local funding match.

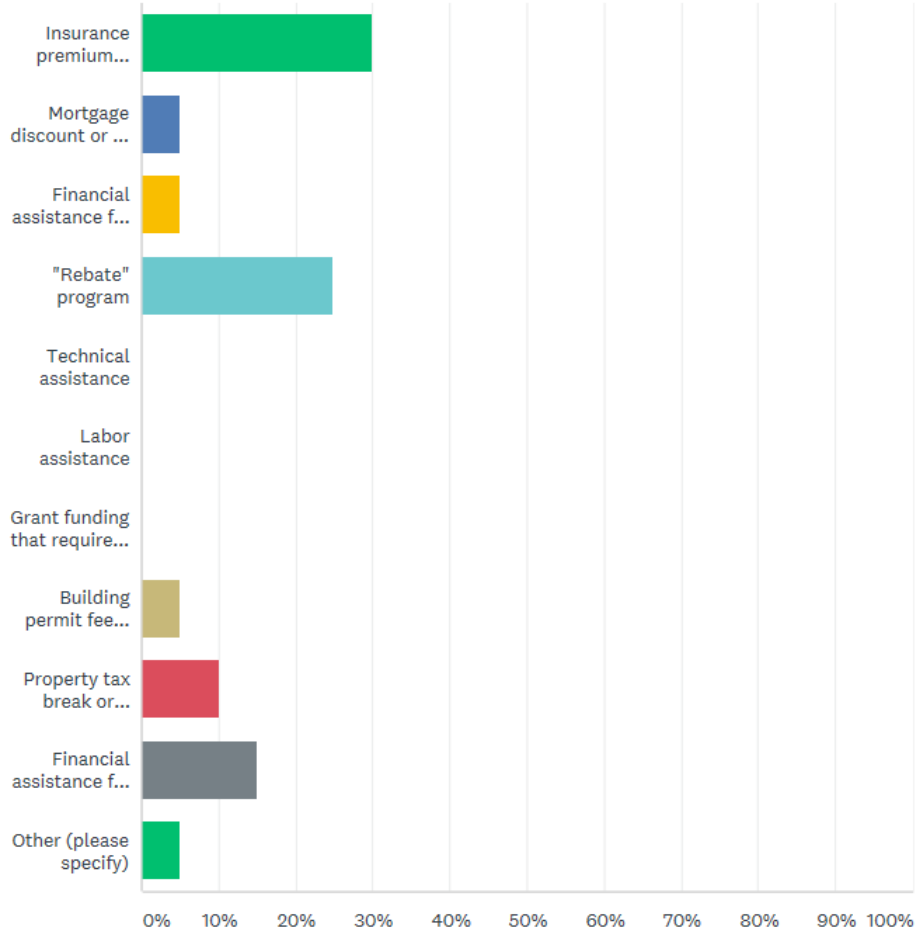
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Not willing to spend money on this	0.00%	0
Less than $250	15.00%	3
$250 - $499	15.00%	3
$500 - $1,000	15.00%	3
More than $1,000	5.00%	1
Not Sure	50.00%	10
TOTAL		20

Which of the following incentives would encourage you to protect your home against natural hazards? (Check all that apply)

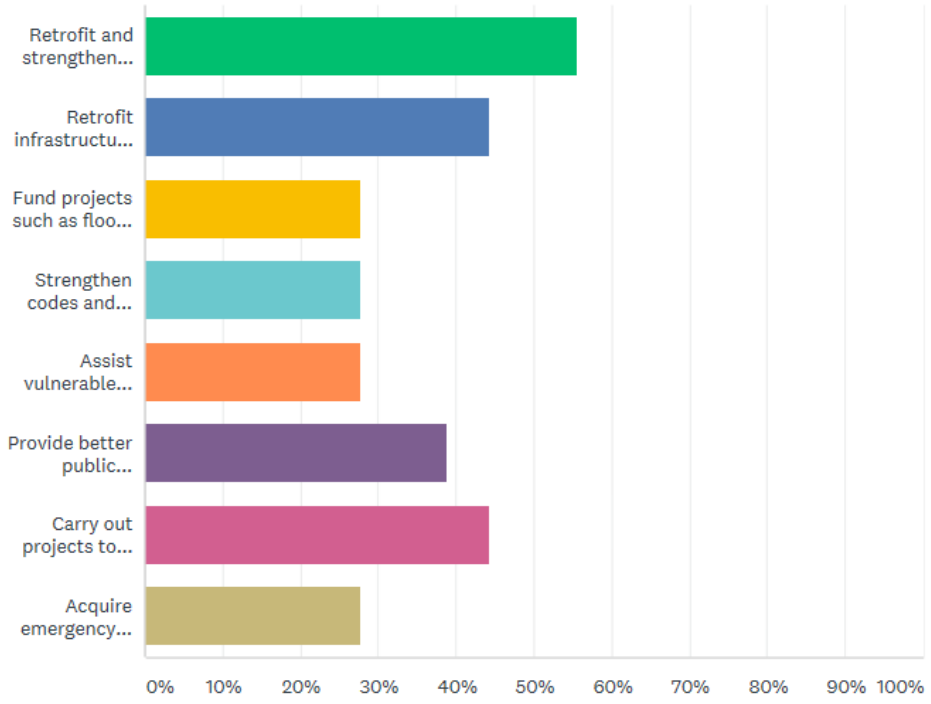
Answered: 20 Skipped: 1



ANSWER CHOICES		RESPONSES	
Insurance premium discount		30.00%	6
Mortgage discount or Low Interest Loan		5.00%	1
Financial assistance for property upgrades or equipment		5.00%	1
"Rebate" program		25.00%	5
Technical assistance		0.00%	0
Labor assistance		0.00%	0
Grant funding that requires “cost share”		0.00%	0
Building permit fee reduction or waiver		5.00%	1
Property tax break or incentive		10.00%	2
Financial assistance for equipment		15.00%	3
Other (please specify)	Responses	5.00%	1
TOTAL			20

What protection methods do you believe the City, County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within the Barstow? This information will assess community beliefs on developing hazard mitigation programs and strategies. Please select all that apply.

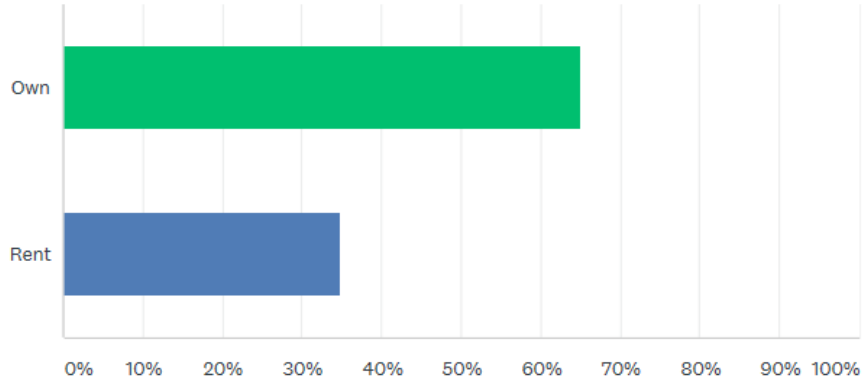
Answered: 18 Skipped: 3



ANSWER CHOICES	RESPONSES	
Retrofit and strengthen essential facilities such as police and fire facilities, schools and hospitals.	55.56%	10
Retrofit infrastructure such as roads, bridges, drainage facilities, water supply, waste water and power supply facilities.	44.44%	8
Fund projects such as flood walls, drainage improvements, fuel breaks, and bank stabilization projects.	27.78%	5
Strengthen codes and regulations to include higher standards in hazard areas.	27.78%	5
Assist vulnerable property owners with securing funding for mitigation / property protection.	27.78%	5
Provide better public information about risk, and the exposure to hazards within Barstow.	38.89%	7
Carry out projects to restore the natural environments capacity to absorb the impacts from natural hazards.	44.44%	8
Acquire emergency generators for essential government facilities and buildings identified as care and shelters.	27.78%	5
Total Respondents: 18		

Do you own or rent your home or business?

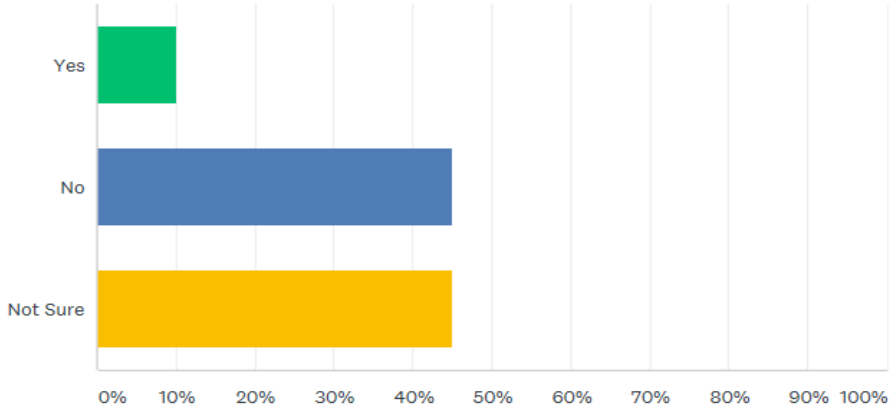
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Own	65.00%	13
Rent	35.00%	7
TOTAL		20

Is your home or business located in or near a FEMA designated floodplain?

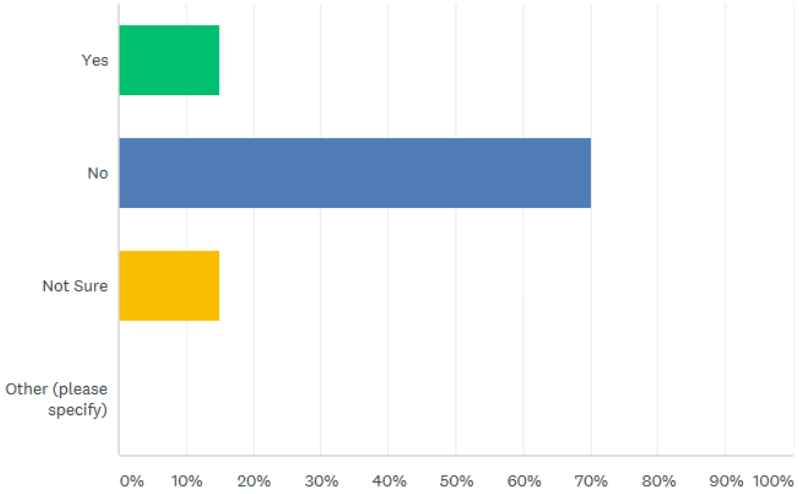
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	10.00%	2
No	45.00%	9
Not Sure	45.00%	9
TOTAL		20

Do you have flood insurance?

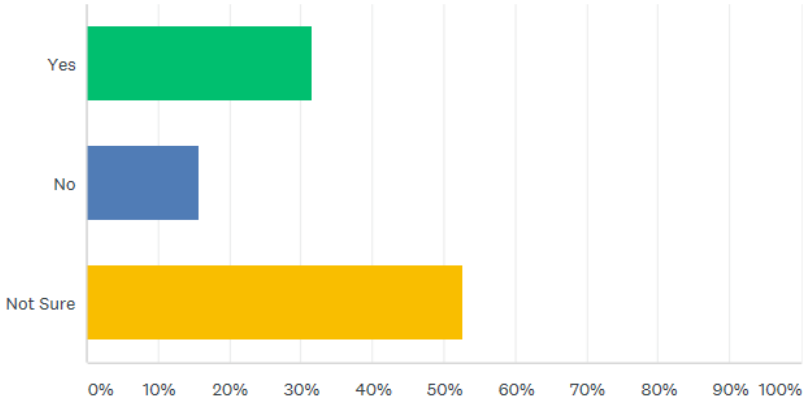
Answered: 20 Skipped: 1



ANSWER CHOICES		RESPONSES	
Yes		15.00%	3
No		70.00%	14
Not Sure		15.00%	3
Other (please specify)	Responses	0.00%	0
TOTAL			20

Is your home or business located near an earthquake fault?

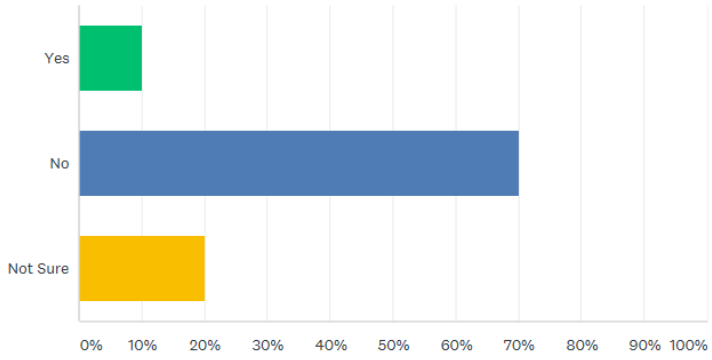
Answered: 19 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	31.58%	6
No	15.79%	3
Not Sure	52.63%	10
TOTAL		19

Do you have earthquake insurance?

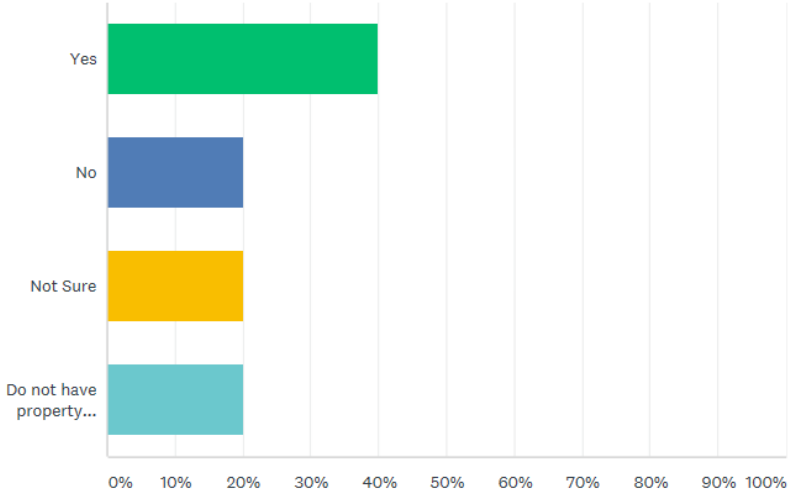
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	10.00%	2
No	70.00%	14
Not Sure	20.00%	4
TOTAL		20

To the best of your knowledge, does your homeowner's, renter's, or general insurance policy provide coverage for damage from natural hazards?

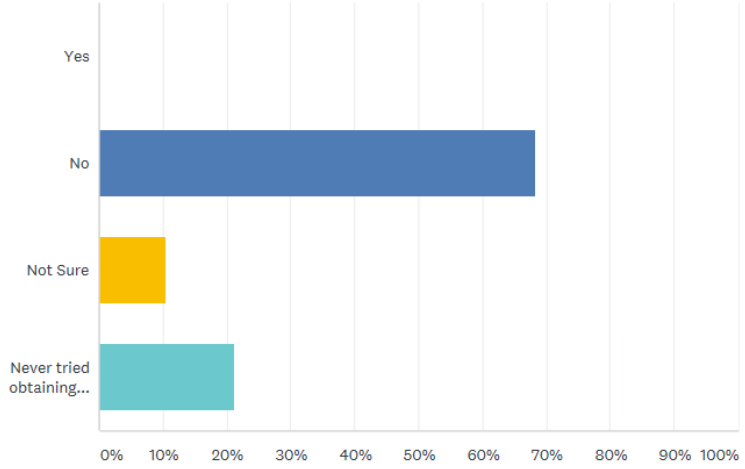
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	40.00%	8
No	20.00%	4
Not Sure	20.00%	4
Do not have property insurance	20.00%	4
TOTAL		20

Have you ever had problems obtaining homeowner's or renter's insurance due to risks from natural hazards?

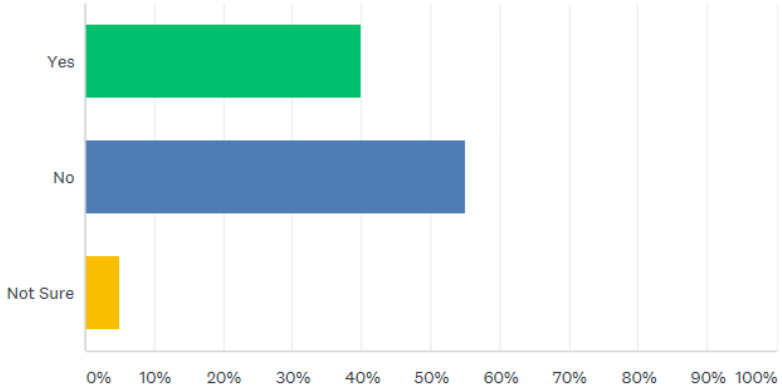
Answered: 19 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	68.42%	13
Not Sure	10.53%	2
Never tried obtaining hazard insurance	21.05%	4
TOTAL		19

When you moved into your home, did you consider the impact a natural hazard event could have on your home?

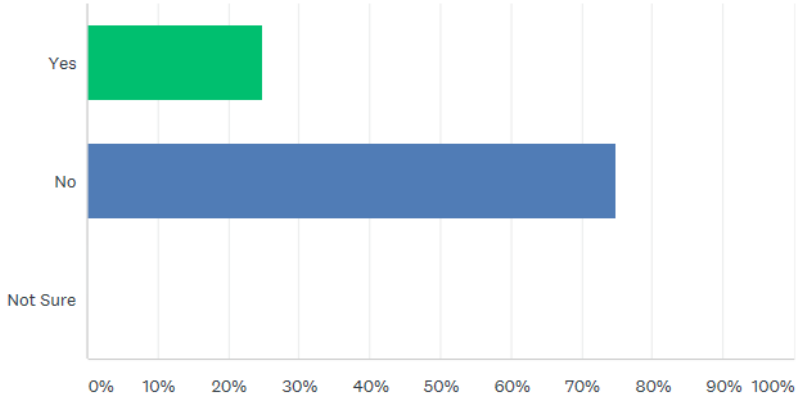
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	40.00%	8
No	55.00%	11
Not Sure	5.00%	1
TOTAL		20

Was the presence of a natural hazard risk zone (for example, wild fire area or flood zone) disclosed to you by a real estate agent, seller or landlord before you purchased or moved into your home?

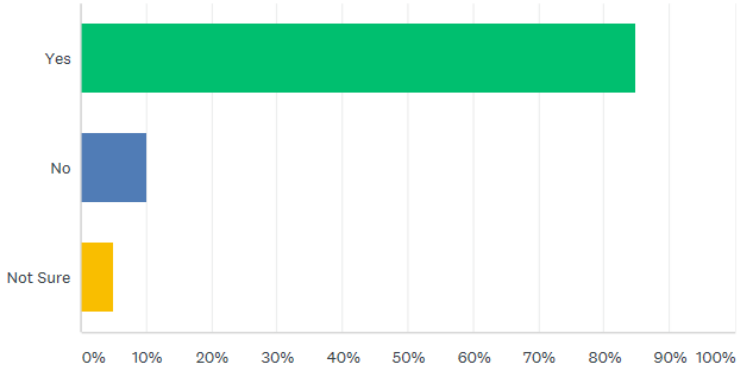
Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	25.00%	5
No	75.00%	15
Not Sure	0.00%	0
TOTAL		20

Would natural hazard real estate disclosures or risk information influence your decision on where to buy or rent a home?

Answered: 20 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	85.00%	17
No	10.00%	2
Not Sure	5.00%	1
TOTAL		20

Thank you again for completing the survey!!!! Please provide any additional comments that you may have regarding hazard mitigation and community protection against natural disasters.

Answered: 2 Skipped: 19

RESPONSES (2) WORD CLOUD TAGS (0)

Apply to Selected Filter by tag Search responses

Showing **2** responses

It would be great to see wider community programs in form of monthly or quarterly community meetings/classes that could share mitigation ideas that individuals could take. Perhaps even getting local business involved such has Homedepot to ensure supplies are available to the public to complete diy type mitigation projects.

8/21/2017 2:05 PM View respondent's answers Add tags

Several questions need editing, for example question #5 has two "Strongly Disagree" options, and question #9 is a single choice, not a multiple choice.

4/5/2017 11:55 AM View respondent's answers Add tags

Appendix D

D.1 Hazard Summary Worksheet Instructions

D.2 Hazard Summary Worksheet agreed upon by Planning Committee

D.3 Risk Factor Approach Instruction Sheet

D.4 Risk Factor Final Worksheet agreed upon Planning Committee

D.5 Mitigation Action Implementation Plan Worksheet

D.6 Mitigation Action Reporting Form

D.7 Annual HMP Review Questionnaire

D.1 Hazard Summary Worksheet Instructions

HAZARD SUMMARY WORKSHEET INSTRUCTIONS

Definitions for Classifications

Location (Geographic Area Affected)

- **Negligible:** Less than 10 percent of planning area or isolated single-point occurrences
- **Limited:** 10 to 25 percent of the planning area or limited single-point occurrences
- **Significant:** 25 to 75 percent of planning area or frequent single-point occurrences
- **Extensive:** 75 to 100 percent of planning area or consistent single-point occurrences

Maximum Probable Extent (Magnitude/Strength based on historic events or future probability)

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions

Hazard	Scale / Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index[3]	-1.99 to +1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli Scale[4]	I to IV	V to VII	VII	IX to XII
	Richter Magnitude[5]	2, 3	4, 5	6	7, 8
Hurricane Wind	Saffir-Simpson Hurricane Wind Scale[6]	1	2	3	4, 5
Tornado	Fujita Tornado Damage Scale[7]	F0	F1, F2	F3	F4, F5

Probability of Future Events

- **Unlikely:** Less than 1 percent probability of occurrence in the next year or a recurrence interval of greater than every 100 years.
- **Occasional:** 1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** 10 to 90 percent probability of occurrence in the next year or a recurrence interval of 1 to 10 years
- **Highly Likely:** 90 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1 year.

Overall Significance

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

D.2 Hazard Summary Worksheet agreed upon by Planning Committee

PLANNING TEAM MEETING - April 11 2017

Hazards Summary Worksheet

Use this worksheet to summarize hazard description information and identify which hazards are most significant to the planning area. The definitions provided on the following page can be modified to meet local needs and methods.

Hazard	Location (Geographic Area Affected)	Maximum Probable Extent (Magnitude/Strength)	Probability of Future Events	Overall Significance Ranking
~~Avalanche~~ Climate Change	N	W	O	Low
Dam Failure	L	W	U	Low
Drought	E	M	O	Low
Earthquake	E	S	L	High
Erosion	N	W	U	Low
Expansive Soils	N	W	U	Low
Extreme Cold	N	W	U	Low
Extreme Heat	E	M	L	MED
Flood	L	M	L	MED
Hail	N	W	U	Low
Hurricane	N	W	U	Low
Landslide	N	W	U	Low
Lightning	N	W	O	Low
Sea Level Rise	N	W	O	Low
Severe Wind	E	M	L	MED
Severe Winter Weather	E	M	L	MED
Storm Surge	N	W	O	Low
Subsidence	N	W	O	Low
Tornado	N	W	O	Low
Tsunami	N	W	O	Low
Wildfire	L	M-S	L	M-H

A-29

Risk Factor (RF) Approach

MITIGATE HAZARDS

For use in multi-hazard mitigation planning hazard prioritization exercises.

The RF approach combines historical data, local knowledge, and consensus opinions to produce numerical values that allow identified hazards to be ranked against one another. These criteria were used to evaluate hazards and identify the highest risk hazard in the project region.

The RF approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). RF values are obtained by assigning varying degrees of risk to five categories for each hazard: *probability, impact, spatial extent, warning time*, and *duration*. Each degree of risk is assigned a value ranging from 1 to 4 and a weighing factor for each category should be agreed upon by the planning committee. Based upon any unique concerns for the planning area, the planning committee may also adjust the RF weighting scheme. To calculate the RF value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the example equation below:

RF Value = [(Probability x .30) + (Impact x .30) +
(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

According to the default weighting scheme applied, the highest possible RF value is 4.0.

Please see the Risk Factor Criteria table on the following page for information on the risk factor weighting index and other definitions.

Risk Factor Index Criteria Table

Risk Assessment Category	Level	Degree of Risk Criteria	Index	Weight Value
PROBABILITY What is the likelihood of a hazard event occurring in a given year?	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%
	POSSIBLE	BETWEEN 1 & 10% ANNUAL PROBABILITY	2	
	LIKELY	BETWEEN 10 &100% ANNUAL PROBABILITY	3	
	HIGHLY LIKELY	100% ANNUAL PROBABILTY	4	
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 & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.	1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.	2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK.	3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.	4	
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	NEGLIGIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%
	SMALL	BETWEEN 1 & 10% OF AREA AFFECTED	2	
	MODERATE	BETWEEN 10 & 50% OF AREA AFFECTED	3	
	LARGE	BETWEEN 50 & 100% OF AREA AFFECTED	4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	MORE THAN 24 HRS	SELF DEFINED	1	10%
	12 TO 24 HRS	SELF DEFINED	2	
	6 TO 12 HRS	SELF DEFINED	3	
	LESS THAN 6 HRS	SELF DEFINED	4	
DURATION *How long does the hazard event usually last?*	LESS THAN 6 HRS	SELF DEFINED	1	10%
	LESS THAN 24 HRS	SELF DEFINED	2	
	LESS THAN 1 WEEK	SELF DEFINED	3	
	MORE THAN 1 WEEK	SELF DEFINED	4	

Due to the inherent errors possible in any disaster, the results of the risk factor analysis should only be used for planning purposes and in developing hazard priorities and concentrating jurisdictional resources. Before assigning risk factors and prioritization to hazards it is recommended to complete a draft of the hazard profiles and risk assessment information to aid in determining potential impacts. Before the hazard prioritization process you may want to consider the following risk assessment criteria:

- ✓ Inventory and summarize vulnerable assets
- ✓ Characterize repetitive flood loss properties
- ✓ Estimated harm to residents and estimated damages to buildings
- ✓ Describe vulnerability to future development

[Example Risk Factor Results from Plumas County Hazard Mitigation Project]

PLUMAS COUNTY HAZARD MITIGATION PLAN

Department of Health / Office of Emergency Services

Risk Factor Worksheet

Ranking	Natural Hazards	Probability	Calc.1	Impact	Calc.2	Spatial Extent	Calc.3	Warning Time	Calc.4	Duration	Calc.5	RF Factor
1	Wildfire	4	1.2	3	0.9	4	0.8	3	0.3	4	0.4	3.6
2	Severe Weather	4	1.2	2	0.6	4	0.8	1	0.1	2	0.2	2.9
3	Geologic Hazards	4	1.2	2	0.6	1	0.2	4	0.4	2	0.2	2.6
4	Flooding	2	0.6	3	0.9	2	0.4	1	0.1	4	0.4	2.4
5	Drought	2	0.6	1	0.3	3	0.6	1	0.1	4	0.4	2
6	Climate Change	2	0.6	1	0.3	4	0.8	1	0.1	1	0.1	1.9
7	Dam Failure	1	0.3	2	0.6	1	0.2	2	0.2	1	0.1	1.4

Risk Factor Conculsion	
HIGH RISK (3.0 – 4.0)	*Wildfire*
MODERATE RISK (2.0 – 2.9)	*Severe Weather, Geologic Hazards, Flooding*
LOW RISK (0.1 – 1.9)	*Drought, Climate Change, Dam Failure*

The conclusions from the example risk factor results above, were translated into three categories for a final summary of hazard risk based on *High*, *Moderate*, or *Low* risk designations. The designations values are arbitrary and can be adjusted as deemed necessary. It should be noted that although some hazards are classified as posing Low risk, their occurrence of varying or unprecedented magnitudes is still possible and will continue to be reevaluated during future updates of this plan.

D.4 Risk Factor Final Worksheet agreed upon Planning Committee

LHMP RISK FACTOR EXCEL WORKSHEET

HAZARD PRIORITIZATION / RISK FACTOR CRITERIA

MITIGATE HAZARDS

Rank	Natural Hazards	Probability (1-4)	Factor1 = (Probability Index * .30)	Impact (1-4)	Factor2 = (Impact Index * .30	Spatial Extent (1-4)	Factor3 = (Spatial Extent Index * .20)	Warning Time (1-4)	Factor4 = (Warning Time Index * .10)	Duration (1-4)	Factor5 = (Probability Index * .10)	RF Factor Total = (Add Factors 1-5)
1	Climate Change	1	0.3	1	0.3	3	0.6	1	0.1	4	0.4	1.7
2	Earthquake	3	0.9	4	1.2	4	0.8	4	0.4	3	0.3	3.6
3	Erosion	1.5	0.45	1	0.3	1	0.2	3	0.3	1.5	0.15	1.4
4	Extreme Heat	2.5	0.75	1	0.3	2.5	0.5	1	0.1	2.5	0.25	1.9
5	Flooding	2	0.6	2	0.6	2	0.4	4	0.4	2.5	0.25	2.25
6	Wildfire	2	0.6	2	0.6	2	0.4	4	0.4	3	0.3	2.3

The RF approach combines historical data, local knowledge, and consensus opinions to produce numerical values that allow identified hazards to be ranked against one another. These criteria were used to evaluate hazards and identify the highest risk hazard in the Lawndale region.

The RF approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). RF values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and duration. Each degree of risk is assigned a value ranging from 1 to 4 and a weighing factor for each category was agreed upon by the MPC. Based upon any unique concerns for the planning area, the MPC may also adjust the RF weighting scheme. To calculate the RF value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final RF value, as

D.5 Mitigation Action Implementation Plan Worksheet

Mitigation Action Worksheet

Mitigation Action Worksheet

Please complete one sheet per **NEW action/project** with as much detail as possible, using the guidance beginning on page 3.

Name of Jurisdiction: _____

Name and Title Completing Worksheet: _____

Action Number: _____

Mitigation Action/Initiative: _____

Assessing the Risk	
Hazard(s) addressed:	
Specific problem being mitigated:	
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1.
	2.
	3.
Action/Project Intended for Implementation	
Description of Selected Action/Project	
Action/Project Category	
Goals/Objectives Met	
Applies to existing and or new development, or not applicable	
Benefits (losses avoided)	
Estimated Cost	
Priority*	
Plan for Implementation	
Responsible Organization	
Local Planning Mechanism	
Potential Funding Sources	
Timeline for Completion	
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

* Refer to results of Prioritization

Prioritization

Number:
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety		
Property Protection		
Cost-Effectiveness		
Technical		
Political		
Legal		
Fiscal		
Environmental		
Social		
Administrative		
Multi-Hazard		
Timeline		
Agency Champion		
Other Community Objectives		
Total		
Priority (High/Med/Low)		

Guidance to Complete the Mitigation Action Worksheet

Assessing the Risk

Hazard(s) addressed: Please enter the hazard of concern you are mitigating.

Specific problem being mitigated: Please describe the specific problem being mitigated.

Evaluation of Potential Actions/Projects

Actions/Projects Considered: Please consider different options to mitigate the problem identified. One alternative is always to accept the current level or risk (tolerate the vulnerability/problem) by deciding to take no action at this time. If you choose to take no action, please complete the worksheet up to and including this section and this will be noted in the Plan.

Please include the name of the action considered and a brief reason as to why the action was not selected. The reasoning documents the consideration of these alternatives.

Action/Project Intended for Implementation

Description of the Selected Project: Please provide a brief description of the selected project.

Mitigation Action Type:

- Local Plans and Regulations (LPR) – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Project (SIP)- These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- Natural Systems Protection (NSP) – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- Education and Awareness Programs (EAP) – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.

Goals/Objectives: Please insert the goals and objectives (found in Section 6 of your HMP) that would be met if the action/project is implemented.

Benefits: Please describe the losses avoided when the project is implemented. This includes physical property damage; loss of function; road closing/detours; etc.

Estimated Cost:
Please provide the estimated cost or use the following ranges:
Low = < $10,000 Medium = $10,000 to $100,000 High = > $100,000

Priority: Please enter High/Medium/Low. Refer to the prioritization exercise and table.

Plan for Implementation

Potential Funding Source: Please identify the anticipated funding source, which could be "Grant funding with local cost share". Sources may include federal, state and local sources.

Timeline for Completion: Short = 1 to 5 years. Long Term= 5 years or greater. OG = On-going program.

Reporting on Progress

Please provide a status update on the selected action/project. Along with this description, please indicate if the action/project is completed or not completed.

Actions which are not complete may be dropped with a rational provided (e.g., project deemed unfeasible…). Other incomplete actions should clearly be indicated as continuing; indicate percent complete, and identify any hurdles/obstacles/reasons for change in schedule. Even actions that have had no progress to date can be identified as continuing. For any action that is not yet complete and will continue, always consider modifying the action to promote implementation.

Please note this report on progress should be done, at minimum, each year prior to the annual Planning Committee update outlined in the plan maintenance procedures in Section 7 (Plan Maintenance).

Guidance to Complete the Evaluation/Prioritization Table

Complete this table to help evaluate and prioritize each mitigation action being considered by your municipality. Please use these 14 criteria to assist in evaluating and prioritizing new mitigation actions identified. Specifically, for each new mitigation action, assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria in the provided table, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Use the numerical results of this exercise to help prioritize your actions as "Low", "Medium" or "High" priority. Your municipality may recognize other factors or considerations that affect your overall prioritization; these should be identified in narrative in the Priority field of the worksheet.

The 14 evaluation/prioritization criteria are:

1. Life Safety – How effective will the action be at protecting lives and preventing injuries?
2. Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
3. Cost-Effectiveness – Are the costs to implement the project or initiative commensurate with the benefits achieved?
4. Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
5. Political – Is there overall public support for the mitigation action? Is there the political will to support it?
6. Legal – Does the jurisdiction have the authority to implement the action?
7. Fiscal - Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
8. Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
9. Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
10. Administrative – Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
11. Multi-hazard – Does the action reduce the risk to multiple hazards?
12. Timeline - Can the action be completed in less than 5 years (within our planning horizon)?
13. Local Champion – Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?
14. Other Local Objectives – Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

D.6 Mitigation Action Reporting Form

Mitigation Action Progress Report Form

Progress Report Period	From Date:	To Date:
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	o Project completed o Project canceled o Project on schedule o Anticipated completion date:_____ o Project delayed Explain _____	

Summary of Project Progress for this Report Period

1. What was accomplished for this project during this reporting period?

_____

_____

2. What obstacles, problems, or delays did the project encounter?

_____

_____

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

_____

_____

4. Other comments

_____

_____

D.7 Annual HMP Review Questionnaire

Annual HMP Review Questionnaire

Plan Section	Questions	Yes	No	Comments
Planning Process	Have there been staffing changes that would warrant inviting different members to the planning team?			
	Are there procedures that can be done more efficiently?			
	Are there representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the team?			
	Has the committee undertaken any public outreach activities regarding the HMP or implementation of mitigation actions?			
	How can public participation be improved?			
Hazard Profiles	Has a natural and/or human caused disaster occurred in this reporting period?			
	Are there natural and/or human caused hazards that have not been addressed in this HMP and should be?			
	Are additional maps/data or new hazards studies available? If so, what have they revealed?			
Vulnerability Analysis	Do any new critical facilities or infrastructure need to be added to the asset lists?			
	How will the vulnerability analysis be affected by additional maps/data or new hazard studies?			
	Have there been changes in development patterns that could influence the effects of hazards or create additional risks?			
	Has the vulnerability analysis changed as a result of the implementation of mitigation actions?			
Mitigation Strategy	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?			
	Is the goal still applicable?			
	Should new mitigation actions be added to the Mitigation Action Plan?			
	During implementation of the mitigation actions, what has proven effective? What has proven not effective?			
	Do existing mitigation actions listed in the Mitigation Action Plan need to be reprioritized deleted, or revised?			
	Are the mitigation actions listed in the Mitigation Action Plan appropriate for available resources?			
Planning Mechanisms	Has the Mitigation Action plan been incorporated into existing planning mechanisms?			
	Has the Mitigation Action plan incorporated existing plan mechanisms?			