EXHIBIT A

LIVERMORE CALIFORNIA

THE CITY OF PLEASANTON

DUBLIN CALIFORNIA

Dublin San Ramon Services District
Water, wastewater, recycled water

TRI-VALLEY LOCAL HAZARD MITIGATION PLAN

Volume 1
Planning Area-Wide Elements

January 2024

TETRA TECH

EXHIBIT A

Tri-Valley Local Hazard Mitigation Plan

Volume 1—Planning-Area-Wide Elements

January 2024

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CONTENTS

PART 3— MITIGATION STRATEGY

Appendices

Tables

Figures

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DEFINITIONS/ACRONYMS

ABAG—Association of Bay Area Governments

Acre-Foot—An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset—An asset is any man-made or natural feature that has value, including people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Bank Erosion—Bank erosion refers to the erosion, sloughing or undercutting of a river, stream or drain. It is natural for streams to meander through erosion processes. Generally, bank erosion is a problem where development has limited meandering, where streams have been channelized, or where stream bank structures (bridges, culverts, etc.) are in places where they can cause damage to downstream areas. Stabilizing these areas can help protect watercourses from sedimentation, prevent damage to adjacent lands, control unwanted meander, and improve fish and wildlife habitat.

Base Flood—The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program (NFIP) are protected to the same degree against flooding.

Basin—A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit/Cost Analysis—A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Benefit—A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Building—A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment—A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified.

CCR—California Code of Regulations

CDBG-DR—Community Development Block Grant Disaster Recovery

CEQA—California Environmental Quality Act

CFR—Code of Federal Regulations

Community Lifeline—The services, capabilities, and physical assets that are used day-to-day to support a community's ongoing needs. When stabilized and working properly, community lifelines enable all other aspects of society to function

Community Rating System (CRS)—The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Facility—Facilities and infrastructure that are critical to the health and welfare of the population. For this plan, critical facilities are all physical assets identified as community lifelines

CRS—Community Rating System

Dam Failure—Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Dam—Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Debris Flow—Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

DFIRM—Digital Flood Insurance Rate Maps

Disaster Mitigation Act of 2000 (DMA); The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster hazard mitigation grant program were established.

DMA—Disaster Mitigation Act

Drainage Basin—A basin is the area within which all surface water- whether from rainfall, snowmelt, springs or other sources- flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought—Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

DWR—Department of Water Resources

Earthquake—An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

EPA—U.S. Environmental Protection Agency

ESA—Endangered Species Act

Exposure—Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent—The range of anticipated intensities of a hazard, usually expressed using a scientific scale.

FEMA—Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

Fire Behavior—Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency—Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

FIRM—Flood Insurance Rate Map

FIS—Flood Insurance Study

Flash Flood—A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM)—FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study—A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's Flood Insurance Rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain—Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community's floodplain as the Special Flood Hazard Area (SFHA).

Floodway—Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

FRA—Federal Responsibility Area

Freeboard—Freeboard is the margin of safety added to the base flood elevation.

Frequency—For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Geographic Information System (GIS)—GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

GIS—Geographic Information System

Goal—A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Hazard—A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazards U.S. Multi-Hazard Loss Estimation Program (Hazus)—Hazus is a GIS-based program used to support the development of risk assessments as required under the DMA. The Hazus software program assesses risk in a quantitative manner to estimate damage and losses associated with natural hazards. Hazus is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. Hazus has also been used to assess vulnerability (exposure) for other hazards.

Hazus—Hazards, United States

Hydraulics—Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology—Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity—For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory—The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide—Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Lightning—Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms.

Liquefaction—Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government—Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

LRA—Local Responsibility Area

Magnitude—Magnitude is the measure of the strength of an earthquake and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mass movement—A collective term for landslides, debris flows, sinkholes and lahars.

Mean Return Period—This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Mitigation Action—Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Mitigation—A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

NEHRP—National Earthquake Hazards Reduction Program

NFIP—National Flood Insurance Program

NIMS—National Incident Management System

NOAA—National Oceanic and Atmospheric Administration

NWS—National Weather Service

Objective—For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

OES—Office of Emergency Services

Peak Ground Acceleration—Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

PGA—Peak Ground Acceleration

PHMSA—Pipeline and Hazardous Materials Safety Administration

Preparedness—Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration—These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence—The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property—Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced: Four or more paid flood losses in excess of $1000.00; or two paid flood losses in excess of $1000.00 within any 10-year period since 197;8 or three or more paid losses that equal or exceed the current value of the insured property.

Risk Assessment—Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking—This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates are based on the methodology used to prepare the risk assessment for this plan.

Risk—Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine—Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Robert T. Stafford Act—The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 100-107) was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974 (Public Law 93-288). The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

SEMS—Standardized Emergency Management System

SFHA—Special Flood Hazard Area

Special Flood Hazard Area—The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems

SRA—State Responsibility Area

Stakeholder—Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Steep Slope—Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33 percent.

Thunderstorm—A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado—A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

USGS—U.S. Geological Survey

Vulnerability—Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damage, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed—A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire—These terms refer to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm—Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance—The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

Executive Summary

HAZARD MITIGATION OVERVIEW

Hazard mitigation is the use of policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. The Cities of Dublin, Livermore, and Pleasanton, along with the Dublin San Ramon Services District (the Tri-Valley Planning Partnership), have collaborated to develop a hazard mitigation plan to reduce risks from natural disasters that complies with federal requirements for hazard mitigation planning.

In 2010, the Tri-Valley planning partners used hazard mitigation planning tools created by the Association of Bay Area Governments (ABAG) to meet their federal hazard mitigation planning requirements. In 2017, the Tri-Valley Planning Partnership formed to prepare an updated multi-jurisdiction hazard mitigation plan that best suits local needs and capabilities. The planning partners developed a new plan from scratch, using lessons learned from the earlier ABAG planning efforts. The resulting 2018 plan was an update for each member of the Tri-Valley Planning Partnership.

Federal regulations require periodic updates of hazard mitigation plans. A jurisdiction covered by a plan that has expired is ineligible for certain federal natural disaster assistance funding. The 2023 Tri-Valley Local Hazard Mitigation Plan meets the federal update requirements while keeping the participating jurisdictions prepared to address their hazard mitigation needs in response to always changing local conditions.

PLAN DEVELOPMENT APPROACH

Organize, Review and Engage the Public

A planning team assembled for the plan update conducted outreach to invite the participation of local planning partners. A 15-member steering committee was assembled to oversee the plan update, consisting of staff from each of the planning partners, citizens, and other stakeholders in the defined planning area. Coordination with other county, state, and federal agencies involved in hazard mitigation occurred throughout the plan update process.

The planning team implemented a public involvement strategy developed by the Steering Committee. The strategy included public meetings to present the risk assessment and the draft plan, a hazard mitigation survey, a project website, and multiple media releases. The planning team and Steering Committee also reviewed the existing hazard mitigation plan, the California statewide hazard mitigation plan, and existing programs that may support hazard mitigation actions.

Assemble, Adopt and Maintain the Plan

The planning team and Steering Committee assembled a document to meet federal hazard mitigation planning requirements. A mitigation plan review crosswalk included in the hazard mitigation plan demonstrates its compliance with all requirements. The planning partners formally adopted the plan once the State of California Governor's Office of Emergency Services and FEMA Region 9 granted pre-adoption approval.

The plan includes a schedule for monitoring and evaluating plan progress periodically and producing a revised plan every five years. This maintenance strategy also includes processes for continuing public involvement and integrating with other programs that can support or enhance hazard mitigation.

RISK ASSESSMENT

Risk assessment is the process of measuring the potential loss of life resulting from natural hazards, as well as personal injury, economic injury and property damage. It is used to define the vulnerability of people, buildings, and infrastructure to natural hazards. For this update, risk assessment models were enhanced with new data and technologies. The Steering Committee used the risk assessment to rank risk and to gauge the potential impacts of each hazard of concern in the Tri-Valley planning area. Specific hazard risk rankings for each planning partner are detailed in Volume 2. The risk assessment included the following:

- Hazard identification and profiling
- Assessment of the impact of hazards on physical, social, and economic assets
- Identification of particular areas of vulnerability
- Estimates of the cost of potential damage.

Based on the risk assessment, hazards were ranked for the risk they pose to the overall planning area, as shown in Figure ES-1.

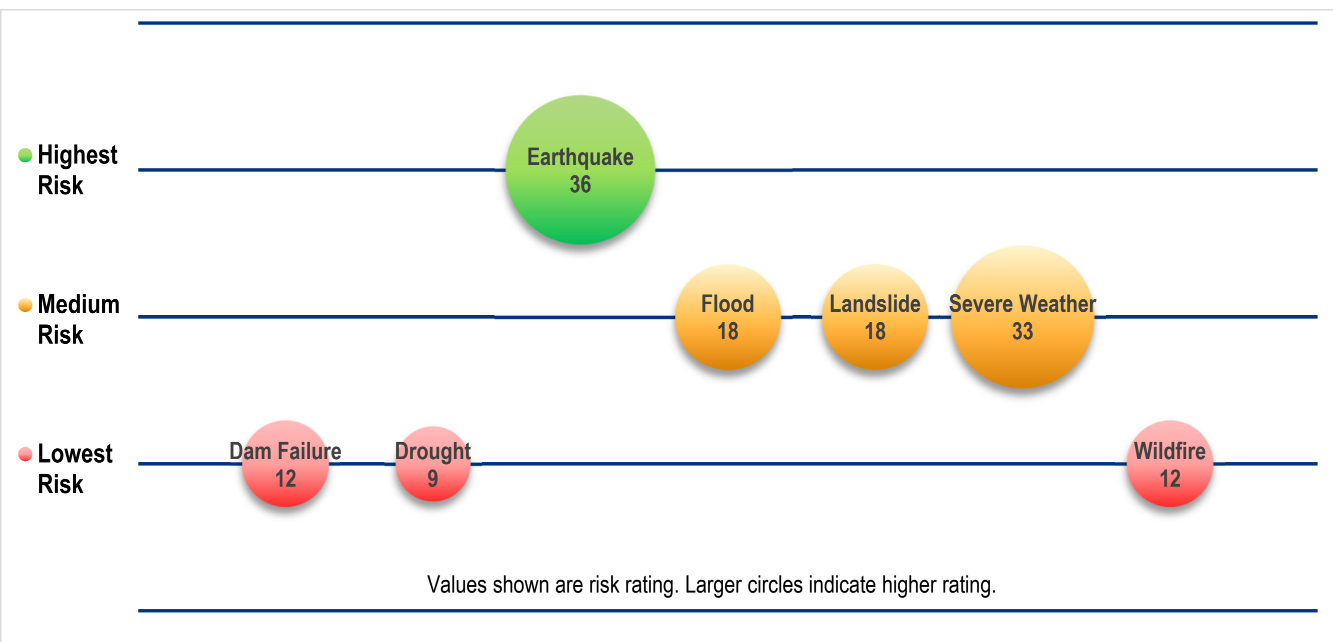


Figure ES-1. Planning-Area-Wide Hazard Risk Rating

Each planning partner also ranked hazards for its own area. Figure ES-2 summarizes all jurisdictions' numerical ratings of high, medium and low. The results indicate the following general patterns:

- The earthquake hazard was most commonly ranked as high.
- The severe weather, wildfire and landslide hazards were most commonly ranked as medium.
- The dam failure, flood and drought hazards were most commonly ranked as low.

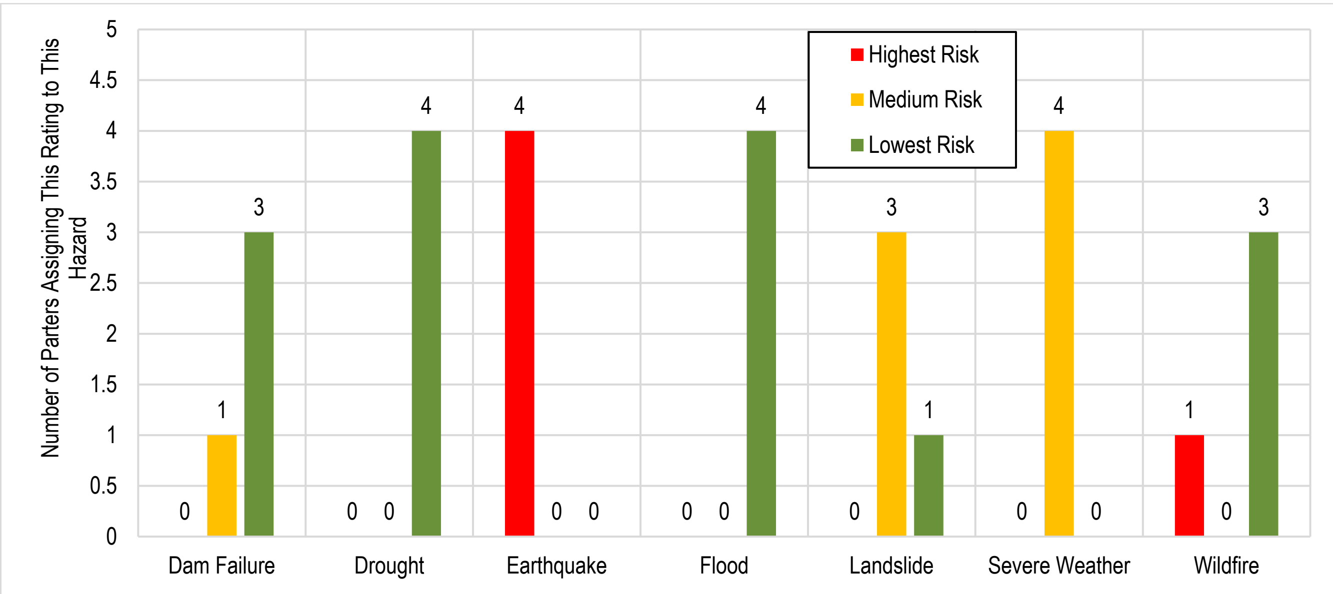


Figure ES-2. Summary of Risk Rating for Individual Planning Partners

MISSION STATEMENT, GOALS AND OBJECTIVES

The Steering Committee developed the following mission statement for the 2023 planning effort:

> Through community partnerships, establish a plan to reduce the vulnerability to hazards in order to protect the health, safety, welfare, environment and economy of the planning area.

The Steering Committee established the following goals for the plan update:

1. Ensure that hazards are identified and considered in land use decisions.
2. Improve local emergency management capability.
3. Promote community awareness, understanding, and interest in hazard mitigation policies and programs.
4. Incorporate hazard mitigation as an integrated public policy and standard practice.
5. Reduce community exposure and vulnerability to hazards where the greatest risk exists.
6. Increase resilience of infrastructure and critical facilities.
7. Promote an adaptive and resilient planning area that responds proactively to future conditions.
8. Develop and implement mitigation strategies that identify the best alternative to protect natural resources, promote equity, and use public funds in an efficient and cost-effective manner.

9. Prioritize and direct resources to increase disaster resiliency among historically underserved populations, individuals with access and functional needs, and in communities disproportionately impacted by disasters.

Each selected objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows:

1. Develop and provide updated information to improve the understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety health, property and the environment.
2. Use local general plan, zoning, and subdivision requirements to help establish resilient and sustainable communities.
3. Increase public participation in systems that provide warning and emergency communications.
4. Encourage the retrofit of vulnerable structures in the planning area.
5. Consider programs that incentivize risk reduction.
6. Reduce repetitive property losses due to hazards by updating land use, design, and construction policies.
7. Continually build linkages and promote dialog about emergency management within the public and private sectors.
8. Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of hazards.
9. Inform the public, including underrepresented and marginalized community groups, on the risk of exposure to hazards and ways to increase the public's capability to prepare for, respond to, recover from, and mitigate the impacts of these events.
10. Identify projects that simultaneously reduce risk while increasing planning area resilience and sustainability.
11. Where feasible and cost-effective, research, develop, and promote adoption of building and development laws, regulations, and ordinances exceeding the minimum levels needed for life safety.
12. Encourage hazard mitigation measures that promote and enhance natural processes, minimize adverse impacts on the ecosystem, and promote social equity.

MITIGATION ACTION PLAN

The planning partnership selected a range of mitigation actions to work toward achieving the goals set forth in this plan update. The recommended mitigation actions are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of 60 mitigation actions for implementation by individual planning partners, as presented in Volume 2 of the hazard mitigation plan.

IMPLEMENTATION

The Steering Committee developed a plan implementation and maintenance strategy that includes mid-term progress reporting, a strategy for continued public involvement, a commitment to plan integration with other relevant plans and programs, and a recommitment from the planning partners to actively maintain the plan over the five-year performance period.

Full implementation of the recommendations of this plan will require time and resources. The measure of the plan's success will be its ability to adapt to changing conditions. The Tri-Valley Planning Partnership will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan commits all planning partners to pursue actions when the benefits of a project exceed its costs. The planning partnership developed this plan with extensive public input, and public support of the actions identified in this plan will help ensure the plan's success.

EXHIBIT A

Tri-Valley Local Hazard Mitigation Plan

PART 1—PLANNING PROCESS AND COMMUNITY PROFILE

1. INTRODUCTION TO HAZARD MITIGATION PLANNING

1.1 WHY PREPARE THIS PLAN?

1.1.1 Federal Guidance

Hazard mitigation is defined as any action taken to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster. It involves long- and short-term actions implemented before, during and after disasters. Hazard mitigation activities include planning efforts, policy changes, programs, studies, improvement projects, and other steps to reduce the impacts of hazards.

The federal Disaster Mitigation Act (DMA) emphasizes planning for disasters before they occur. The DMA requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Regulations developed to fulfill the DMA's requirements are included in Title 44 of the Code of Federal Regulations (44 CFR). The long-term benefits of hazard mitigation planning include the following:

- An increased understanding of hazards in the local community
- A more sustainable and disaster-resistant community
- Financial savings through partnerships that support planning and mitigation efforts
- Focused use of limited resources on hazards that have the biggest impact on the communities
- Reduced long-term impacts and damage to human health and structures, and reduced repair costs.

The responsibility for hazard mitigation lies with not only with local, state, and federal governments, but also with private property owners and commercial and institutional interests. The DMA encourages cooperation among state and local authorities in pre-disaster planning. The enhanced planning network called for by the DMA helps local governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk-reduction projects.

The DMA also promotes sustainability in hazard mitigation. To be sustainable, hazard mitigation needs to incorporate sound management of natural resources and address hazards and mitigation in the largest possible social and economic context.

1.1.2 Local Concerns

In response to the requirements of the DMA, the cities of Dublin, Livermore and Pleasanton, California and the Dublin San Ramon Services District (DSRSD) have developed this multi-jurisdiction hazard mitigation plan. The three cities make up the incorporated area of the Alameda County portion of the Tri-Valley region, on the east side of the San Francisco Bay area. This multi-jurisdiction plan represents an update to each city's component of the *2018 Tri-Valley Local Hazard Mitigation Plan*. The three cities and the DSRSD prepared annexes for that previous hazard mitigation plan that were approved and adopted in 2018.

This *2023 Tri-Valley Local Hazard Mitigation Plan* fulfills the five-year plan update requirement for these planning partners. It identifies resources, information, and strategies for reducing risk from natural hazards in the Tri-Valley planning area. Components of the hazard mitigation plan were selected because they meet a program requirement and because they best meet the needs of the planning partners (the cities and participating special district) and their citizens. One benefit of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning under its guidance for the DMA.

The plan will help guide and coordinate mitigation activities throughout the planning area. It was developed to meet the following objectives:

- Meet or exceed requirements of the DMA.
- Enable all planning partners to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner as well as state and federal requirements.
- Create a risk assessment that focuses on local hazards of concern.
- Meet the planning requirements of the Federal Emergency Management Agency's (FEMA's) Community Rating System (CRS), allowing planning partners that participate in the CRS program to maintain or enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority projects to mitigate possible disaster impacts are funded and implemented.

1.2 WHO WILL BENEFIT FROM THIS PLAN?

All residents and businesses of the planning area are the ultimate beneficiaries of this hazard mitigation plan. The hazard mitigation plan reduces risk for those who live in, work in, and visit the planning area. It provides a viable planning framework for all foreseeable natural hazards. Participation in development of the hazard mitigation plan by key stakeholders helped ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable across the planning area, and the plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.3 CONTENTS OF THIS PLAN

This plan has been set up in two volumes so that jurisdiction-specific elements may be easily distinguished from those that apply to the whole planning area:

- **Volume 1**—Volume 1 includes all federally required elements of a disaster mitigation plan that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, planning area hazard risk assessment, and a plan maintenance strategy.
- **Volume 2**—Volume 2 includes all federally required jurisdiction-specific elements in annexes for each participating jurisdiction. It includes a description of the participation requirements established by the

Steering Committee, as well as instructions and templates that the partners used to complete their annexes.

Both volumes include elements required under federal guidelines. DMA compliance requirements are cited at the beginning of subsections as appropriate to demonstrate compliance. Appendices provided at the end of Volume 1 include information or explanations to support the main content of the plan (see table of contents for list of appendices).

All planning partners will adopt Volume 1 in its entirety, including the appendices, and at least the following parts of Volume 2: Part 1, and each partner's jurisdiction-specific annex.

2. PLAN UPDATE—WHAT HAS CHANGED

2.1 PREVIOUS PLANS

2.1.1 ABAG Planning Efforts

In 2004, ABAG led a regional effort to address hazard mitigation planning for jurisdictions in the San Francisco Bay Area. The ABAG process equipped local governments with a template and tools to complete individual planning processes for their jurisdictions, while pooling resources and eliminating redundant planning efforts. Alameda County's first annex to the ABAG hazard mitigation plan was developed and adopted in 2007. In 2010, ABAG conducted its second regional planning effort. Dublin, Livermore and Pleasanton participated in the 2010 planning process, along with Alameda County, other cities, and the Alameda County Water District including the Zone 7 Water Agency; these jurisdictions used the ABAG tools to achieve DMA compliance.

The single-jurisdiction annexes in the 2010 hazard mitigation plan, developed using the ABAG template and tools, contained the following components:

- Introduction
- Description of the local planning process
- Hazards and risk assessment
- Summary of the National Flood Insurance Program and repetitive loss properties
- Mitigation goals, activities and priorities
- Regional mitigation strategies
- Incorporation of the plan into existing planning mechanisms
- Description of the plan update process
- Exhibits to illustrate the planning process.

The Dublin Unified School District and the Livermore Valley Joint Unified School District did not participate in a ABAG hazard mitigation planning.

2.1.2 2018 Tri-Valley Hazard Mitigation Plan

In 2015, ABAG again provided tools for counties and cities in the Bay Area to revise their previous plans and annexes but decided not to revise the regional 2010 ABAG hazard mitigation plan. As a result, multiple counties and cities that participated in the previous ABAG hazard mitigation plan needed to undertake a planning process independently, or as part of a new partnership, in order to remain eligible for federal hazard mitigation assistance.

Alameda County set out to develop a stand-alone plan focusing on unincorporated areas; Dublin, Livermore, Pleasanton, and the DSRSD pooled resources to develop the 2018 multi-jurisdictional hazard mitigation plan. The following factors were the basis for the Tri-Valley hazard mitigation planning effort:

- The planning area has significant exposure to numerous natural hazards.
- Limited local resources make it difficult to be pre-emptive in risk reduction actions. Being able to leverage federal financial assistance was paramount to successful hazard mitigation in the area.
- The planning partners wanted to be proactive in preparedness for the probable impacts of natural hazards.

Based on its assessment of the identified natural hazards, the 2018 plan included 73 mitigation actions for implementation by individual planning partners that addressed the following seven hazards of concern:

- Dam failure
- Drought
- Earthquake
- Flood
- Landslide
- Severe weather
- Wildfire

2.2 WHY UPDATE?

2.2.1 Federal Eligibility

Title 44 of the Code of Federal Regulations (44 CFR) stipulates that hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. This 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. The Robert T. Stafford Act requires that jurisdictions have current hazard mitigation plans to pursue and receive federal funding.

2.2.2 Changes in Development

Hazard mitigation plan updates must be revised to reflect changes in development in the planning area since the previous plan was completed (44 CFR Section 201.6(d)(3)). The plan must describe changes in development in hazard-prone areas that increased or decreased vulnerability for each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction’s overall vulnerability, plan updates may validate the information in the previously approved plan. The intent of this requirement is to ensure that the mitigation strategy continues to address the risk and vulnerability of existing and potential development and takes into consideration possible future conditions that could impact vulnerability.

The planning area experienced an 18.1 percent increase in population from 2000 to 2010, an average growth of 1.81 percent per year. Between 2010 and 2020, the California Department of Finance estimates that the total populations of Dublin, Livermore and Pleasanton grew an additional 22.48 percent, to 241,646 (California Department of Finance 2023). Since DSRSD services Dublin, San Ramon, and surrounding areas, its population would have increased proportionally with that of the number of connections (water and wastewater). DSRSD made the necessary adjustments in delivery, service, and procedures to accommodate these increases and changes. The City of San Ramon's hazard profile is covered by the Contra Costa County Hazard Mitigation Plan (Contra Costa County 2018).

This plan update assumes that some new development triggered by the increase in population occurred in hazard areas. Because all such new development would have been regulated pursuant to local programs and codes, it is assumed that vulnerability did not increase, even if exposure did. Participating planning partners have adopted general plans, strategic plans, and emergency plans that govern land-use decisions and policymaking, as well as building codes and specialty ordinances based on state and federal mandates. A detailed analysis of development patterns in the planning area is provided in Section 4.4 and in the individual partner annexes in Volume 2.

2.2.3 Community Priorities

As noted in the annexes for each jurisdiction participating in this hazard mitigation plan (provided in Volume 2 of this plan), community priorities were reviewed for each jurisdiction to determine whether any had changed in a way that called for revisions to the hazard mitigation plan. No significant changes in community priorities were identified from the 2018 Hazard Mitigation Plan.

2.3 THE UPDATED PLAN—WHAT IS DIFFERENT?

The updated plan differs from the initial plan in a variety of ways. Table 2-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 2-1. Plan Changes Crosswalk

44 CFR Requirement	2018 Plan	Updated Plan (2023)
PLANNING PROCESS		
§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: • *1. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* • *2. An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and* • *3. Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*	The planning process was overseen by a planning team of staff from participating jurisdictions and the planning consultant, and a steering committee with representatives from stakeholder organizations in or near the planning area. The planning team maintained contact with other stakeholder agencies to apprise them of ongoing planning activities. The planning team and steering committee reviewed relevant documents and developed and implemented a strategy for public involvement. The strategy included a survey, attendance at public events, a website, and a public comment period for review of a draft version of the plan. Volume 1 Chapter 3 described the planning process for the 2018 plan. Jurisdiction-specific annexes in Volume 2 list each planning partner's specific planning resources that were reviewed as part of the planning process.	The planning process was little changed from that used for the 2018 plan. In-person attendance at public events was reduced, but a stronger internet presence was established using social media and a StoryMap website. Volume 1 Chapter 3 describes the overall planning process for the 2023 plan. Jurisdiction-specific annexes in Volume 2 list each planning partner's specific public outreach activities undertaken as part of the planning process.

44 CFR Requirement	2018 Plan	Updated Plan (2023)
RISK ASSESSMENT		
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	Volume 1 Part 2 presented a risk assessment of 10 hazards of concern: dam failure, drought, earthquake, flood, landslide, severe weather, wildfire, human caused hazards, health hazards, and climate change. These hazards were profiled as they impact the Tri-Valley planning area. Including a qualitative assessment of human caused hazards and health hazards provides a more complete picture of the hazards facing the planning area.	The risk assessment methodology was unchanged but most-current data was used in the analyses. Volume 1 Part 2 describes the risk assessment for the 2023 plan. The updated plan presents quantitative risk assessment results in graphs rather than tables to better display the relative significance of the findings.
§201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	Volume 1 Part 2 presented a risk assessment of each hazard of concern. Each hazard chapter included the following components: • Hazard profile, including maps of extent and location, historical occurrences, frequency, severity, and warning time • Secondary hazards • Climate change impacts • Exposure of people, property, critical facilities and environment • Vulnerability of people, property, critical facilities and environment • Future trends in development • Scenarios • Issues	The general presentation of hazard profiles is unchanged from the 2018 plan. Updated data was used to represent the most current information. A new analysis of social vulnerability was included, using the Centers for Disease Control and Prevention's Social Vulnerability Index (see Section 4.5.2). The confirmation of hazards to be assessed included a review of all hazards assessed in the California state hazard mitigation plan, with an explanation for why any of those are omitted from this plan.
§201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community	Vulnerability was assessed for all hazards of concern. The Hazus computer model was used for the dam failure, earthquake, and flood hazards, incorporating local data sets. Site-specific data on Steering Committee-identified critical facilities were entered into the Hazus model. Vulnerability was assessed for other hazards by applying varying damage percentages to an asset inventory extracted from Hazus.	The hazards evaluation and risk assessment methodology for this plan were unchanged, but most-current data was used in the analyses. The earthquake risk assessment included a new analysis that assessed the exposure of people and property on earthquake-sensitive soils (see Section 10.3).
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods	Dublin, Livermore and Pleasanton had no identified Repetitive Loss or Severe Repetitive Loss structures insured through the National Flood Insurance Program at the time of the 2018 plan.	There is one repetitive loss property in the current planning area. This is discussed in Section 11.2.4.
§201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined and identified "critical facilities" for the planning area, and these facilities were inventoried by exposure. Each hazard chapter provided a discussion on future development trends.	The methodology for evaluating buildings in the hazard area is unchanged. Most-current data was used in the analysis. Results are presented in graphs rather than tables to better display the relative significance of the findings.

44 CFR Requirement	2018 Plan	Updated Plan (2023)
§201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimations in terms of dollar loss were generated for all hazards of concern. These estimates were generated by Hazus for the dam failure, earthquake, and flood hazards. For the other hazards, loss estimates were generated by applying varying damage percentages to an asset inventory extracted from Hazus.	The methodology for evaluating potential dollar losses is unchanged. Most-current data was used in the analysis. Results are presented in graphs rather than tables to better display the relative significance of the findings.
§201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There was a discussion on future development trends as they pertain to each hazard of concern. This discussion looked predominantly at land use and the regulatory environment that dictated that land use.	Discussion of future development and its implications for hazard mitigation was updated with most-current information.
MITIGATION STRATEGY		
§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.	The plan contained a guiding principle, goals, objectives, and actions. The actions were jurisdiction-specific and strived to meet multiple objectives. All objectives met multiple goals and stood alone as components of the plan. Each planning partner was asked to complete a capability assessment that looked at its regulatory, technical, and financial capabilities.	The overall approach to establishing a mitigation strategy based on goals, objectives, and actions was unchanged. Unlike the 2018 plan, which included actions that apply to all planning partners as well as actions specific to each jurisdiction, the updated plan does not include area-wide mitigation actions. All actions are presented in the jurisdiction-specific annexes included in Volume 2. Jurisdiction-specific capability assessments were expanded to include a discussion of each jurisdiction's capacity to expand or improve its mitigation-related capabilities.
§201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Steering Committee developed a new overall guiding principle for the plan, and developed eight goals and 12 objectives, as described in Chapter 17. The goals and objectives were specifically for the 2018 hazard mitigation plan and were completely new at that time. They were identified based on the capabilities of the Planning Partnership.	The 2018 mission statement, goals, and objectives were carried over to this plan with minor wording revisions. One new goal was added, calling for a new focus on disaster resiliency for historically underserved populations.
§201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	Volume I, Part 3 included a hazard mitigation catalog that was developed through a facilitated process. This catalog identified actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, or increase mitigation capability. The catalog further segregated actions by scale of implementation. A table in the action plan chapter analyzed each action by mitigation type to illustrate the range of actions selected.	The catalogs were updated with the newest best practices for each hazard assessed.

44 CFR Requirement	2018 Plan	Updated Plan (2023)
§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	Dublin, Livermore and Pleasanton identified actions stating their commitment to maintain compliance and good standing under the National Flood Insurance Program.	City planning partner mitigation actions calling for ongoing NFIP commitment have been retained in the updated plan.
§201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in Section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each recommended actions was prioritized using a qualitative methodology that looked at the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project. This prioritization scheme was detailed in Chapter 19. Since this planning effort was the first for all the Tri-Valley planning partners working together on a plan, the prioritization concept was entirely different from what was applied in the ABAG planning effort. Since each planning partner was asked to review all risks and prior actions, any action that was carried over to this plan from the prior plan had the opportunity to have its priority reviewed and if necessary, changed. Therefore, every risk and action in this plan, whether new or carried over from the prior plan, was prioritized as described in the introduction section of Volume 2.	The prioritization and plan implementation approaches from the 2018 plan have been carried over to this update.
PLAN ADOPTION, IMPLEMENTATION, AND MAINTENANCE		
§201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	Volume I, Part 3 presented a plan maintenance strategy that contains additional detail to address deficiencies observed during the 2010 update process. This update includes a more defined role and vehicle for facilitating the annual review of the plan.	The same general strategy for plan maintenance is carried over from the previous plan.
§201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	Volume I, Part 3 detailed recommendations for incorporating the plan into other planning mechanisms, such as: • General plans • Emergency response plans • Capital improvement programs • Municipal codes Specific current and future plan and program integration activities were detailed in each participating jurisdiction's annex in Volume 2.	The same general strategy for plan integration with other planning mechanisms is carried over from the previous plan.
§201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	Volume I, Part 3 detailed a comprehensive strategy for continuing public involvement.	The same general strategy for ongoing public involvement is carried over from the previous plan.
§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commission, Tribal Council).	An appendix in Volume 1 contained the resolutions of all planning partners that adopted this plan.	Planning partners passed new adoption resolutions for the update plan after FEMA approval. The FEMA approval letter and adoption resolutions are included in a Volume 1 appendix.

3. Plan Update Approach

3.1 FORMATION OF THE PLANNING TEAM

Project management for this update of the Tri-Valley hazard mitigation plan was the joint responsibility of staff members from the Cities of Dublin, Livermore, and Pleasanton, and the Dublin San Ramon Services District. A contract planning consultant (Tetra Tech, Inc.) was tasked with assisting in the development, update, and implementation of the plan. The Tetra Tech project manager assumed the role of the lead planner, reporting directly to the planning team. In addition to Tetra Tech project staff, the main planning team consisted of the following members:

- Susan Frost, Special Projects Manager, City of Livermore
- Jake Potter, Associate Planner, City of Livermore
- Shweta Bonn, Senior Planner, Advanced Planning; City of Pleasanton
- Diego Mora, Assistant Planner, City of Pleasanton
- John Stefanski, Assistant to the City Manager, City of Dublin
- Aaron Johnson, GIS Analyst, Dublin San Ramon Services District

3.2 DEFINING STAKEHOLDERS

At the start of the planning process, the planning team identified a list of stakeholders to engage during the update of the Tri-Valley Hazard Mitigation Plan. “Stakeholder” was defined as any person or public or private entity that owns or operates facilities that would benefit from the mitigation actions of this plan, and/or has an authority or capability to support mitigation actions identified by this plan. Stakeholders were separated into two categories:

- **Participatory Stakeholders**—Stakeholders that actively participated in the planning process as planning partners or members of the Steering Committee.
- **Coordinating Stakeholders**—Stakeholders that were not able to commit to actively participating in the process but were kept apprised of plan development milestones or were able to provide data that was used in the plan development.

3.3 THE STEERING COMMITTEE

A Steering Committee provided guidance to the hazard mitigation plan effort and ensured that the document will be accepted by agencies and the public. For a project kickoff meeting on May 23, 2022, the planning team assembled a list of planning area candidates who could have recommendations for the plan or be impacted by its recommendations. The planning team requested these candidates' participation in the planning process. The planning team confirmed a committee of 15 primary members and three alternates, as listed in Table 3-1.

Table 3-1. Steering Committee Members

Name	Title	Jurisdiction/Agency
Shweta Bonn	Senior Planner	City of Pleasanton
Lincoln Casimere	Emergency Manager	Alameda County Fire Department
Herbert Cole	Emergency Manager	City of Livermore
Susan Frost [a]	Special Projects Coordinator	City of Livermore
Cary Fukada [b]	Citizen	CERT
Matt Fuzie	General Manager RPD	City of Livermore
Tracy Hein	Emergency Preparedness Manager	Livermore-Pleasanton Fire Department
Aaron Lacey	Deputy Chief	Livermore-Pleasanton Fire Department
Christine Martin	Assistant City Manager	City of Livermore
Franc Moufarrej	Permit Center Manager	City of Livermore
Adam Nelkie	Assistant Director of Engineering	City of Pleasanton
Aaron Johnson	GIS Analyst	Dublin San Ramon Services District
Jerry Paulson	Emergency Manager	Lawrence Livermore National Laboratory
Tricia Pontau	Associate Planner	City of Livermore
John Stefanski	Assistant to the City Manager	City of Dublin
Alternate Members		
Stephanie Egidio	Management Analyst	City of Livermore
Jake Potter	Assistant Planner	City of Livermore

a. Chair
b. Vice-Chair

Leadership roles and ground rules were established during the Steering Committee's meeting on July 11, 2022. The Steering Committee agreed to meet once a month as needed throughout the course of the plan's development. The planning team facilitated each Steering Committee meeting to address a set of objectives based on an established work plan. The Steering Committee met five times from July 2022 through April 2023. All Steering Committee meetings were open to the public and agendas and meeting notes were posted to the hazard mitigation plan website. Meeting minutes and the Steering Committee's adopted ground rules are provided in Appendix F.

The Steering Committee included key planning partner staff, citizens, and other stakeholders from within the planning area. Members combined expertise in preventive measures, property protection, natural resource protection, emergency services, structural flood control projects, public safety, and public information. They applied their expertise on behalf of all planning partners participating in the plan process.

3.4 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

Hazard mitigation planning enhances collaboration among diverse parties whose interests can be affected by hazard losses. In June 2022, the Cities of Dublin, Livermore, and Pleasanton identified eligible special districts within the planning area of the pending planning process and invited them to formally participate. All special districts were asked to identify planning points of contact to serve as planning partners and represent the interests of their district. The Dublin San Ramon Services District accepted the invitation to participate in the planning partnership.

The planning partners covered under this plan are shown in Table 3-2. Together these jurisdictions make up the Planning Partnership for the hazard mitigation plan. While all participating jurisdictions authorized the Steering Committee to carry out certain activities on their behalf, all planning partners were invited to attend and participate in all aspects of the plan update process.

Table 3-2. Municipal and Special District Planning Partners

Jurisdiction	Point of Contact	Title
Dublin	John Stefanski	Assistant to the City Manager
Livermore	Susan Frost Jake Potter	Special Projects Coordinator Associate Planner
Pleasanton	Shweta Bonn Diego Mora	Senior Planner Assistant Planner
Dublin San Ramon Services District	Aaron Johnson Jason Ching	Associate Engineer Senior Engineer

3.5 DEFINING THE PLANNING AREA

The planning area was defined to consist of the jurisdictional area of the Cities of Dublin, Livermore, and Pleasanton within Alameda County as well as the service area for the Dublin San Ramon Services District that extends into Contra Costa County. The planning area is surrounded by unincorporated Alameda County. All partners to this plan have jurisdictional authority within this planning area. A map showing the geographic boundary of the defined planning area for this plan update is provided in Chapter 4, along with a description of planning area characteristics.

For the risk assessment in this hazard mitigation plan, risks to population and the general building stock were evaluated only within the city limits of the three municipal planning partners. Those risks are not relevant to the Dublin San Ramon Services District, which does not have the same regulatory authorities as cities in terms of mitigating risks to people and development.

3.6 COORDINATION WITH STAKEHOLDERS AND AGENCIES

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)). The planning team accomplished this task as follows:

- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee and comment on the draft plan.
- **Agency Notification**—The following agencies were invited to participate in the plan development process from the beginning and were kept apprised of plan development milestones. Many of the organizations listed assist at-risk and socially vulnerable populations, including those with developmental disabilities, those with access and functional needs, at-risk youth and seniors, those with limited access to childcare, and those who have suffered through or are currently experiencing homelessness. These agencies were advised of the planning efforts and invited to comment on the draft plan.
  - ➢ Alameda County Fire Department, Emergency Management Division
  - ➢ Alameda County Office of Emergency Services

- Alameda County Voluntary Organizations Active in Disaster (VOAD)—VOAD is a humanitarian association of independent voluntary organizations active in emergency disaster relief with a mission to provide efficient services to all disaster victims and eliminate the duplications of services (ALCOVOAD n.d.).
- Alameda County Emergency Managers Association
- American Red Cross Bay Area Chapter (ARC)—ARC works in communities to provide relief following emergencies and disasters
- Association of Bay Area Governments, Resilience Program Coordinator
- Bay Area Rapid Transit
- California Department of Water Resources, National Flood Insurance Program Coordinator
- California Governor’s Office of Emergency Services (Cal OES)
- Contra Costa County Office of Emergency Services
- East Bay Parks and Recreation District
- FEMA Region 9, Lead Community Planner
- Lawrence Livermore National Laboratory
- Livermore Area Recreation & Park District (LARPD) (includes senior groups)
- Los Positas College (academia)
- East Bay Innovations (access and functional needs)
- Livermore-Pleasanton Fire Department
- Pleasanton Chamber of Commerce
- San Ramon Valley Fire District
- Stanford Health Care – Valley Care (medical care)
- Zone 7 Water Agency
- Livermore’s Multi Services Center (unhoused, non-English speakers)
- Quest Science Center (youth and disadvantaged youth)

These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process. They supported the effort by attending meetings or providing feedback on issues.

- **Pre-Adoption Review**— All the agencies listed above were provided an opportunity to review and comment on this plan, primarily through the hazard mitigation plan website (see Section 3.8.1). All were sent an e-mail message informing them that draft portions of the plan were available for review.

Special involvement in and assistance with the planning process was provided by the following federal and state agencies:

- FEMA Region 9 provided updated planning guidance, provided summary and detailed data for the planning area from the National Flood Insurance Program (NFIP) (including repetitive loss information), and conducted plan review.
- The U.S. Geological Survey (USGS) provided earthquake event mapping to support the earthquake risk assessment.
- Cal OES facilitated FEMA review, provided updated planning guidance, and reviewed the draft and final versions of the plan prior to FEMA review.
- The California Department of Forestry and Fire Protection (CAL FIRE) provided fire severity mapping to support the wildfire risk assessment.
- The California Department of Water Resources provided information on NFIP compliance for local cities.

The following sections identify agencies and organizations maintaining close partnerships with the cities of Dublin, Livermore, and Pleasanton, as well as the Dublin San Ramon Services District to provide opportunities for members of underserved and socially vulnerable populations to participate in the planning process and comment during its progress and on the draft plan.

3.6.1 City of Dublin

The City of Dublin provides targeted outreach to its senior population, which has been identified by the city as an at-risk or socially vulnerable population, through the following programs:

- **Meals on Wheels**—Dublin seniors aged 60 and older who are home-bound and unable to cook have access to nutritious meals at little to no cost.
- **Diabetes Support Group**—The Alameda County Public Health Department offers a course on how to manage diabetes and monitor blood sugar as a free local service.
- **Senior Health Screening and Foot Care**—Free senior health screenings that include blood tests, diabetes tests, health education services and many other resources are offered quarterly by the Senior Support Program of the Tri-Valley for Alameda County residents.
- **Computer and Wi-Fi Access**—Unlimited access to the internet through desktop computers and wi-fi is available at no cost through the Dublin Senior Center for seniors who do not have access to reliable internet connection.
- **Alameda County VOAD—**VOAD is a humanitarian association of independent voluntary organizations active in emergency disaster relief, with a mission to provide efficient services to all disaster victims and eliminate the duplications of services (ALCOVOAD n.d.).

3.6.2 City of Livermore

The City of Livermore maintains an ongoing partnership with the following agencies to provide up-to-date information to at-risk communities:

- **Livermore Area Recreation & Park District (LARPD)**—Provides services and programs to adults and seniors aged 50 and older, such as a Senior Lunch Program (60+) and 50+ Service and Support Groups. LARPD's mission is to improve the quality of life for Livermore's older adults and their families by educating and advocating for health and social services while providing recreation, socialization, and meaningful volunteer opportunities to encourage active and healthy lives (LARPD n.d.).
- **East Bay Innovations (EBI)**—EBI offers services supporting over 500 individuals with disabilities to live as independently as possible in their own homes, be successfully employed, and feel a sense of membership in their community (East Bay Innovations n.d.).
- **Abode Services—**Abode's mission is to end homelessness by assisting low-income, unhoused people, including those with special needs, to secure stable, supportive housing, and to be advocates for the removal of the causes of homelessness.
- **Alameda County VOAD—**VOAD is a humanitarian association of independent voluntary organizations active in emergency disaster relief with a mission to provide efficient services to all disaster victims and eliminate the duplications of services (ALCOVOAD n.d.).

The City has conducted the following activities to supplement outreach to socially vulnerable populations:

- August 26, 2023—The City of Livermore attended the "Weather Wonders" youth outreach event hosted by the Quest Science Center to showcase this Plan.
- The City of Livermore has distributed a copy of this Plan to Livermore's Multi Service Center, which provides services to those experiencing homelessness, non-English speakers, and other at-risk and socially vulnerable groups.

3.6.3 City of Pleasanton

The City of Pleasanton hosts a number of ongoing programs for senior citizens, who have been identified by the city as an at-risk or socially vulnerable population. The following are examples of these programs:

- **Pleasanton Rides**—Provides safe, reliable, and affordable transportation for seniors aged 70 and older.
- **Open Heart Kitchen**—Provides free lunch for seniors aged 60 and older.
- **Meals on Wheels**—Provides meals for seniors aged 60 and older with annual registration.
- **Alameda County VOAD—**VOAD is a humanitarian association of independent voluntary organizations active in emergency disaster relief with a mission to provide efficient services to all disaster victims and eliminate the duplications of services (ALCOVOAD n.d.).

In addition to these programs, a number of financial assistance programs are available for the senior population, including emergency loans and grants for seniors experiencing extreme financial hardship (Wiesner Senior Fund), a 20 percent discount on water bills, and a fee assistance program for senior recreation activities.

3.6.4 Dublin San Ramon Services District

Since the DSRSD covers most of the City of Dublin, DSRSD collaborates and works closely with the City in its outreach efforts to businesses, community organizations, and at-risk and socially vulnerable communities such as seniors and older adults in the Tri-Valley planning area.

3.7 REVIEW OF EXISTING PROGRAMS

Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3)). In addition, the following programs can affect mitigation within the planning area:

- California Fire Code
- 2022 California Building Code
- California State Hazard Mitigation Forum
- Five-year and biennial capital improvement programs
- Local emergency operations plans
- Local general plans, including housing and safety elements
- Local strategic plans
- Local zoning ordinances
- Climate action plans.

An assessment of all planning partners' planning and regulatory; permitting; fiscal; administrative and technical; and education and outreach capabilities to implement hazard mitigation actions is presented in the jurisdiction-specific annexes in Volume 2. Chapter 1 provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation actions.

3.8 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). This section details the outreach to, and involvement of, the many agencies, departments, organizations, non-profit organizations, districts, authorities and other entities that have a stake in managing hazard risk and mitigation, commonly referred to as stakeholders.

3.8.1 Strategy

The strategy for involving the public in this plan emphasized the following elements:

- Include members of the public on the Steering Committee.
- Engage the public and organizations that are listed in Section 3.6 by providing updates and an opportunity to comment on a draft of the plan.
- Use a survey to determine if the public's perception of risk and support of hazard mitigation has changed since the initial planning process.
- Attempt to reach as many planning area residents as possible using multiple media.
- Identify and involve planning area stakeholders.
- Develop a StoryMap of the planning area for public access (https://experience.arcgis.com/experience/809c8425c55a4e31b35884794aaa1060/?draft=true). The map provides information on hazards based on specific locations. It also has the ability to send an email requesting information.

Diligent efforts were made to ensure broad regional, county, and local representation in this planning process. Stakeholder outreach was performed early and throughout the planning process. In addition to mass media notification efforts, identified stakeholders were invited via email and social media posts to attend meetings and provide input on draft documents. Information and input provided by these stakeholders has been included throughout this plan where appropriate, and all were given an opportunity to comment on the draft plan.

Outreach efforts reflecting a whole community approach were conducted collaboratively across all four jurisdictions to ensure members of local businesses, academia, private organizations, and marginalized communities were provided the opportunity to have a voice in the planning process. The following private organizations were partnered with to drive public outreach efforts:

- Dublin Chamber of Commerce
- Livermore Valley Chamber of Commerce
- Pleasanton Chamber of Commerce

An emphasis was placed on including representatives from marginalized, at-risk, and socially vulnerable communities in the planning process through the following methods by each jurisdiction:

- **City of Dublin—**Due to the City of Dublin's regular partnership and collaboration with their senior community, seniors in Dublin were the primary focus of outreach activities at the Dublin Senior Center.
- **City of Livermore—**The planning team collaborated with the Livermore Multi Service Center to involve at-risk seniors and unsheltered people in the planning process through the distribution of this Plan to the Center.
- **City of Pleasanton—**Outreach was conducted through social media outlets, the Pleasanton Community Page, and the Pleasanton city website to promote involvement in the planning process, especially for the local senior community.
- **DSRSD—**The District collaborates with the City of Dublin on its outreach and public involvement strategies as explained in Section 3.6.

The sections below describe Steering Committee and planning team efforts toward public outreach throughout the development and review of the hazard mitigation plan.

Website

At the beginning of the plan development process, a planning partnership website was created on the City of Livermore's Planning Department web page to keep the public posted on plan development milestones and to solicit relevant input (see Figure 3-1).

The site's address (https://www.livermoreca.gov/departments/community-development/planning/hazard-mitigation) was publicized in all press releases, mailings, and public meetings. Information on the plan development process, the Steering Committee, the survey and phased drafts of the plan was made available to the public on the site throughout the process. The planning partners intend to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

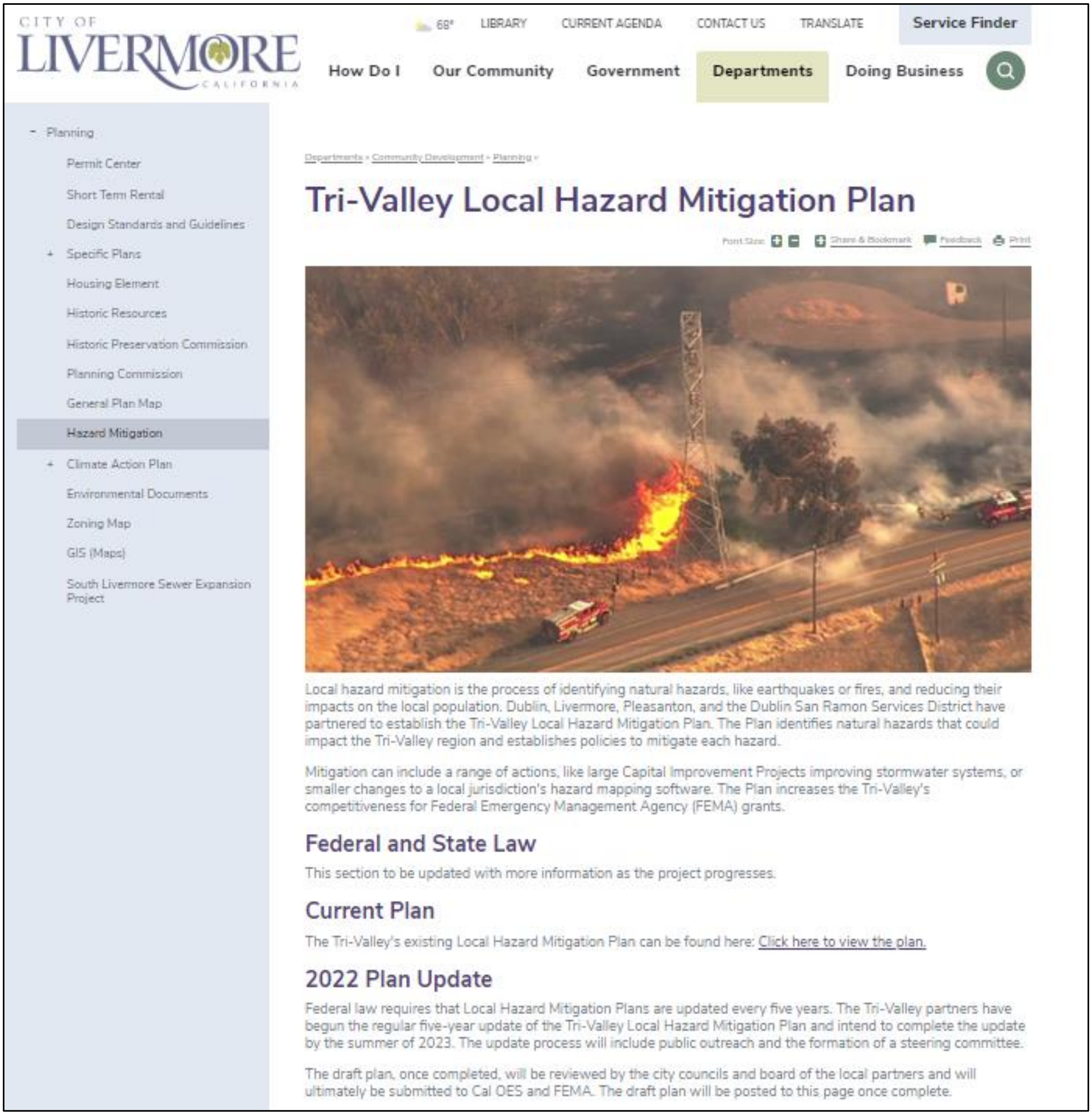
Hazard Mitigation Survey

A hazard mitigation plan survey (see Figure 3-2) was developed for this planning process.

The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its questions helped guide the Steering Committee in selecting mitigation strategies.

The survey was made available on the hazard mitigation plan website and was distributed to community members in the planning area as follows:

- Via social media outlets, including Facebook, Twitter and Nextdoor
- At virtual public meetings via web link and QR code



CITY OF LIVERMORE CALIFORNIA

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  - Historic Preservation Commission
  - Planning Commission
  - General Plan Map
  - Hazard Mitigation
  - + Climate Action Plan
  - Environmental Documents
  - Zoning Map
  - GIS (Maps)
  - South Livermore Sewer Expansion Project

Departments » Community Development » Planning »

Tri-Valley Local Hazard Mitigation Plan

Font Size: Share & Bookmark Feedback Print

Local hazard mitigation is the process of identifying natural hazards, like earthquakes or fires, and reducing their impacts on the local population. Dublin, Livermore, Pleasanton, and the Dublin San Ramon Services District have partnered to establish the Tri-Valley Local Hazard Mitigation Plan. The Plan identifies natural hazards that could impact the Tri-Valley region and establishes policies to mitigate each hazard.

Mitigation can include a range of actions, like large Capital Improvement Projects improving stormwater systems, or smaller changes to a local jurisdiction's hazard mapping software. The Plan increases the Tri-Valley's competitiveness for Federal Emergency Management Agency (FEMA) grants.

Federal and State Law

This section to be updated with more information as the project progresses.

Current Plan

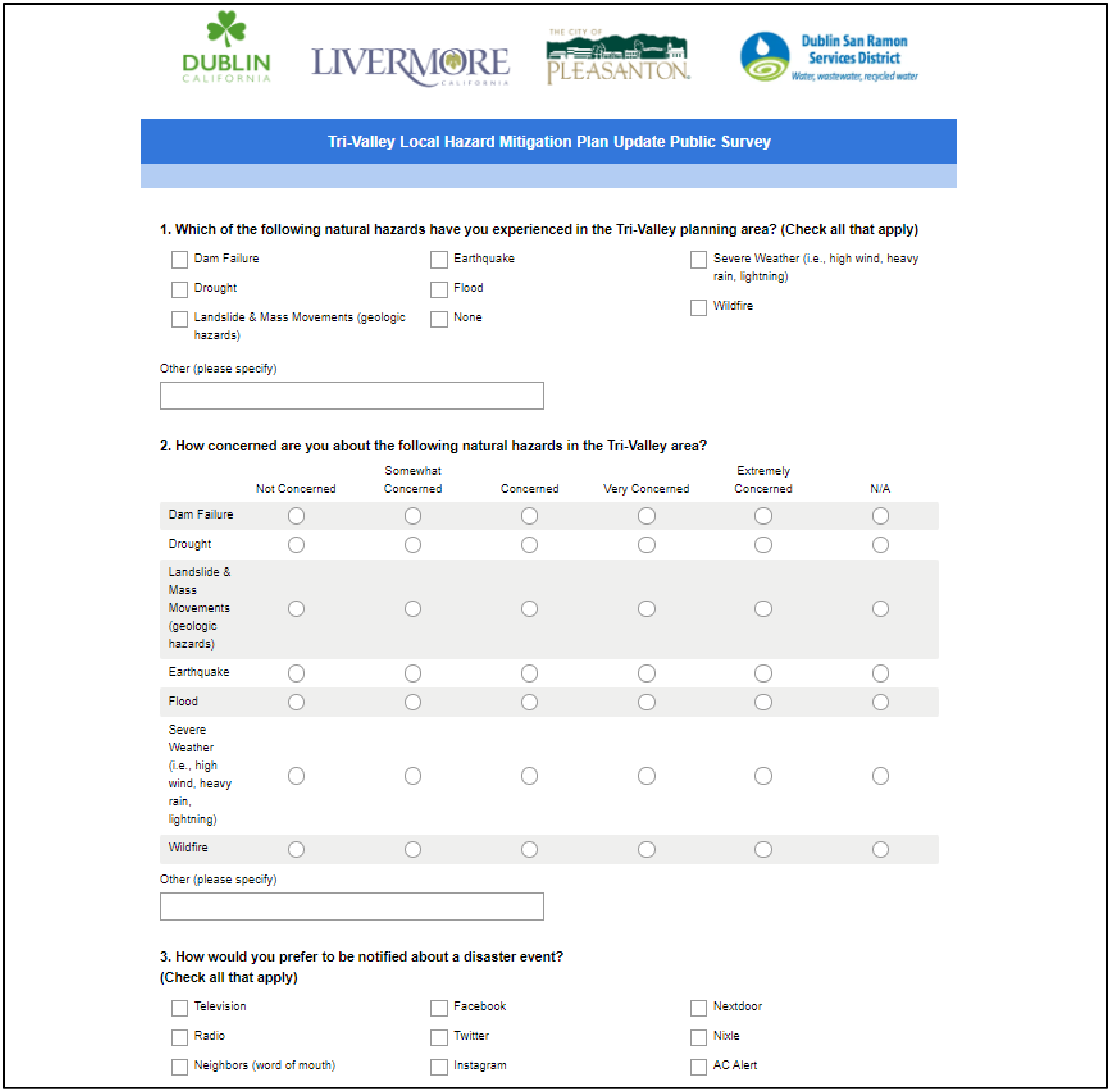
The Tri-Valley's existing Local Hazard Mitigation Plan can be found here: Click here to view the plan.

2022 Plan Update

Federal law requires that Local Hazard Mitigation Plans are updated every five years. The Tri-Valley partners have begun the regular five-year update of the Tri-Valley Local Hazard Mitigation Plan and intend to complete the update by the summer of 2023. The update process will include public outreach and the formation of a steering committee.

The draft plan, once completed, will be reviewed by the city councils and board of the local partners and will ultimately be submitted to Cal OES and FEMA. The draft plan will be posted to this page once complete.

Figure 3-1. Hazard Mitigation Plan Web Site Homepage



DUBLIN CALIFORNIA   LIVERMORE CALIFORNIA   THE CITY OF PLEASANTON   Dublin San Ramon Services District Water, wastewater, recycled water

Tri-Valley Local Hazard Mitigation Plan Update Public Survey

1. Which of the following natural hazards have you experienced in the Tri-Valley planning area? (Check all that apply)

- ☐ Dam Failure
- ☐ Drought
- ☐ Landslide & Mass Movements (geologic hazards)
- ☐ Earthquake
- ☐ Flood
- ☐ None
- ☐ Severe Weather (i.e., high wind, heavy rain, lightning)
- ☐ Wildfire

Other (please specify)

2. How concerned are you about the following natural hazards in the Tri-Valley area?

	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned	N/A
Dam Failure	○	○	○	○	○	○
Drought	○	○	○	○	○	○
Landslide & Mass Movements (geologic hazards)	○	○	○	○	○	○
Earthquake	○	○	○	○	○	○
Flood	○	○	○	○	○	○
Severe Weather (i.e., high wind, heavy rain, lightning)	○	○	○	○	○	○
Wildfire	○	○	○	○	○	○

Other (please specify)

3. How would you prefer to be notified about a disaster event? (Check all that apply)

- ☐ Television
- ☐ Radio
- ☐ Neighbors (word of mouth)
- ☐ Facebook
- ☐ Twitter
- ☐ Instagram
- ☐ Nextdoor
- ☐ Nixle
- ☐ AC Alert

Figure 3-2. Hazard Mitigation Survey

StoryMap

An online StoryMap was created to communicate the variety and severity of hazards in the Tri-Valley planning area (see Figure 3-3). During the update process, the StoryMap was released to the public and promoted through social media, the project website, and during Steering Committee meetings, which were open to the public. It includes risk assessment results for hazards of concern, an interactive hazard mapping tool, and a report function to produce hazard exposure summaries for a specified address or area.

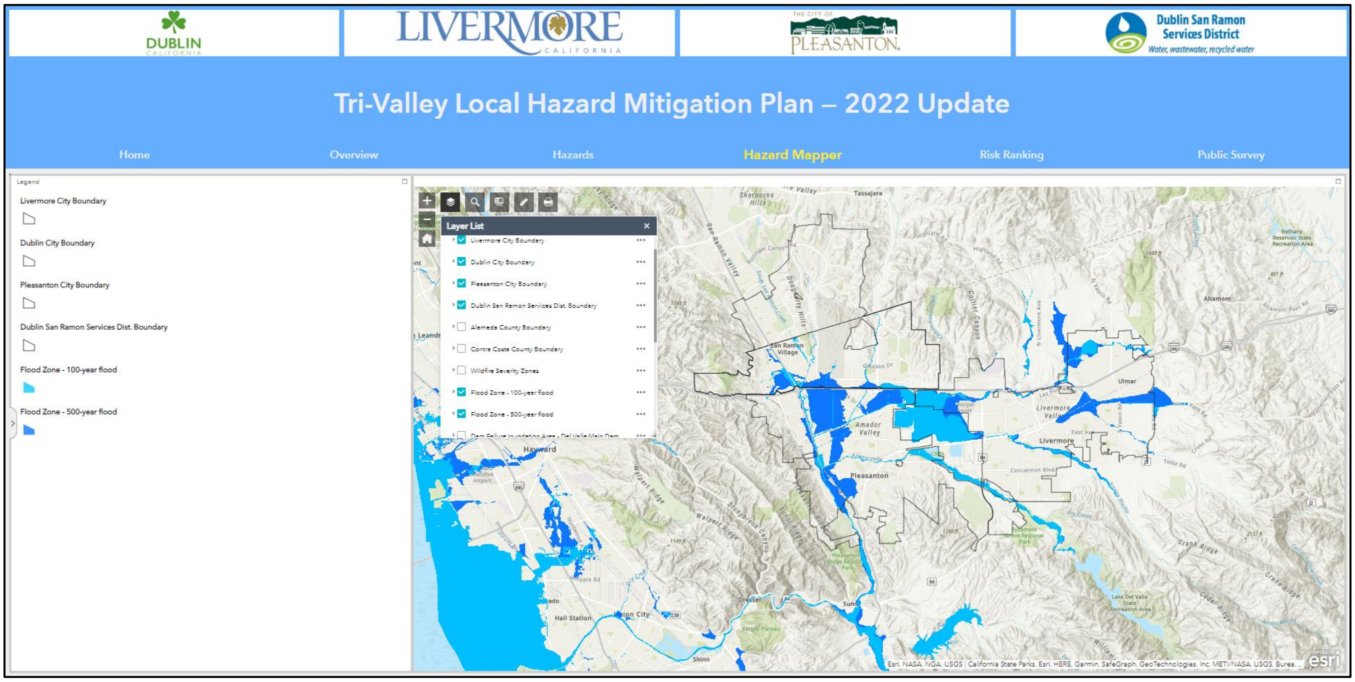


Figure 3-3. Tri-Valley StoryMap

Public Comment

A 14-day public comment period, from May 8 to 22, 2023, provided the public an opportunity to comment on the draft plan update prior to its submittal to Cal OES. The principal mechanism for public comment on the draft plan was a virtual public comment form. Additionally, a public meeting held in conjunction with a Steering Committee meeting on May 15, 2023, allowed an opportunity to provide comment on the draft plan update. At the public meeting, a 30-minute presentation was given, followed by a period for questions and answers by those in attendance. Comments received on the draft plan are available upon request.

The draft Hazard Mitigation Plan was widely distributed for comment for a 14-day public comment period, including agencies identified in Section 3.6. Outreach efforts, including those to socially vulnerable communities, are described in Section 3.6. During that time, none of the planning partners received any comments. Because there were no comments submitted, no associated demographic data was available.

Social Media

The planning partners posted announcements about the plan update on their social media platforms including Facebook, Twitter, Instagram, and Nextdoor (Figure 3-4).

Print, Email, and Other Outreach

Planning partners distributed press releases and performed email outreach over the course of the plan's development as key milestones were achieved. Press releases and resulting press coverage included the following:

- September 22, 2022—Dublin Patch: Announcement of commencement of the planning project and invitation to the public to take the hazard awareness survey.
- September 2022—The plan update was promoted at the Livermore/Pleasanton CERT meeting and a subsequent flyer was emailed to all CERT members.

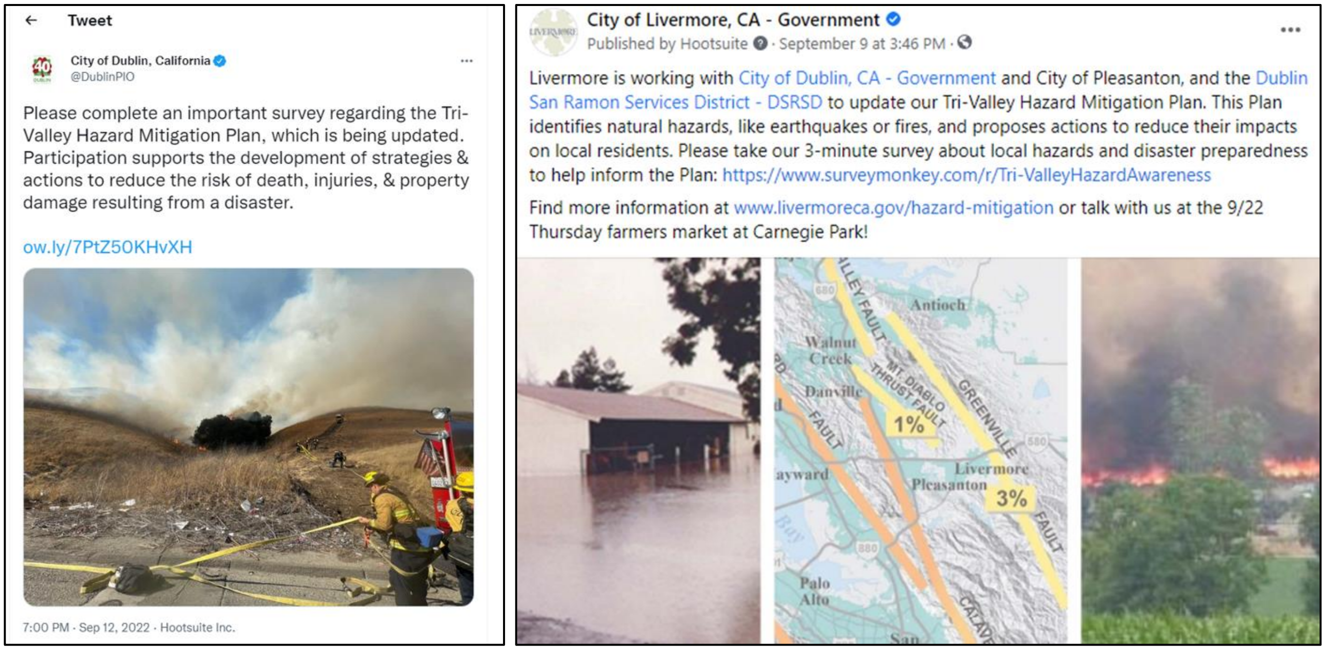


Figure 3-4. Social Media Public Outreach

3.8.2 Public Involvement Results

Survey Response

Detailed analysis of the survey findings is presented in Appendix A; a summary is as follows:

- 585 surveys were completed.
- Surveys were received from residents of each participating planning partner.
- Survey respondents ranked drought as the hazard of greatest concern, followed by wildfire and earthquake.
- More than 80 percent of respondents reported having experienced a drought, over 69 percent reported having experienced an earthquake, and nearly 55 percent reported having experienced a severe weather event.
- Most respondents (78.38 percent) felt that they were somewhat prepared to deal with a hazard event and more than 60 percent keep an emergency kit with spare food and water.
- Nearly 66 percent of respondents would consider retrofitting their home to withstand hazard events if they received an insurance discount, while about 50 percent would do so if they received free government technical assistance. Another 40 percent would do retrofits if they had a building permit fee waiver.

Survey results were provided to the Steering Committee for use in support of confirming the guiding principle, goals, objectives and county-wide actions for this plan update. Additionally, the survey results were included in the toolkit provided to each planning partner through the jurisdictional annex process described in Volume 2. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public’s perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.

- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

3.9 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

A summary of Planning Partnership activities, including Steering Committee meetings held during development of this hazard mitigation plan, is included in Table 3-3.

Table 3-3. Plan Development Chronology/Milestones

Date	Event	Description	Attendance
2022			
3/9	Support Contractor Secured	Contract executed with Tetra Tech, Inc. to facilitate the plan update process	N/A
5/23	Planning Team Meeting #1	Planning Process	10
6/6	Planning Team Meeting #2	Planning Process	10
6/10	Jurisdictional Annex Process Phase 1	Planning partners begin the jurisdiction annex update process with the team, profile, trends, and previous plan status updates	N/A
6/20	Planning Team Meeting #3	Planning Process	10
7/5	Planning Team Meeting #4	Planning Process	10
7/8	Jurisdictional Annex Process Phase 2	Planning partners continue the jurisdictional annex update process with the capability assessment, integration review, and information sources updates	N/A
7/11	Steering Committee Meeting #1	• Project overview • Steering Committee's role • Hazards of concern • Review of mission statement, goals and objectives • Public involvement strategy	21
7/18	Planning Team Meeting #5	Planning Process	7
8/1	Planning Team Meeting #6	Planning Process	6
8/1	Steering Committee Meeting #2	• Approve ground rules • Approve mission statement, goals and objectives • Approve hazard of concern • Approve community lifelines • Public involvement strategy	16
8/14	Public Outreach	Hazard awareness survey open and promotion started	N/A
8/29	Planning Team Meeting #7	Planning Process	9
9/26	Planning Team Meeting #8	Planning Process	9
10/3	Steering Committee Meeting #3	• Social vulnerability discussion • Discuss hazards of concern and risk assessment • Outreach and engagement progress	15
10/24	Planning Team Meeting #9	Planning Process	7
11/8	Jurisdictional Annex Workshop	Workshop for planning partners to assist in development of Phase 3 of the jurisdictional annex process	22
11/21	Planning Team Meeting #10	Planning Process	7
12/5	Steering Committee Meeting #4	• Accepted social vulnerability definition • Outreach and engagement update	12
2023			
1/9	Planning Team Meeting #11	Planning Process	10
1/30	Planning Team Meeting #12	Planning Process	9
1/31	Public Outreach	Hazard awareness survey closed	585
2/27	Planning Team Meeting #13	Planning Process	7
3/13	Planning Team Meeting #14	Planning Process	9
3/27	Planning Team Meeting #15	Planning Process	5
5/8	Public Comment Period Begins	Public involvement strategy	N/A
5/15	Steering Committee Meeting #5 and Public Meeting	• Draft plan overview • Public comment period	16
5/22	Public Comment Period ends	Public involvement strategy	N/A
6/15	Plan submittal	Pre-adoption review draft of the plan submitted to Cal OES.	N/A
12/15	Approval	Final plan approval issued by FEMA Region 9	N/A

4. COMMUNITY PROFILE

4.1 GEOGRAPHIC OVERVIEW

The Tri-Valley planning area is in north-central Alameda County in the San Francisco Bay area, east of San Francisco and north of San Jose. The cities of Dublin, Livermore and Pleasanton are located along Interstate 580, which runs east-west through the county. The City of Dublin is north of the intersection of Interstates 580 and 680 and is generally bounded by the City of San Ramon to the north, Castro Valley to the west, the City of Pleasanton to the south, and the City of Livermore to the east. The City of Livermore is north and south of Interstate 580. The Livermore Valley is edged to the north, south, and east by rolling hills, with the cities of Pleasanton and Dublin to the west. The City of Pleasanton extends south of Interstate 580 along Interstate 680, bounded by the City of Dublin on the north, the City of Livermore to the east, the Sunol Valley to the south, and the steep, rugged Pleasanton and main ridges on the west. Figure 4-1 shows the 66.2-square-mile planning area.

4.2 HISTORICAL OVERVIEW

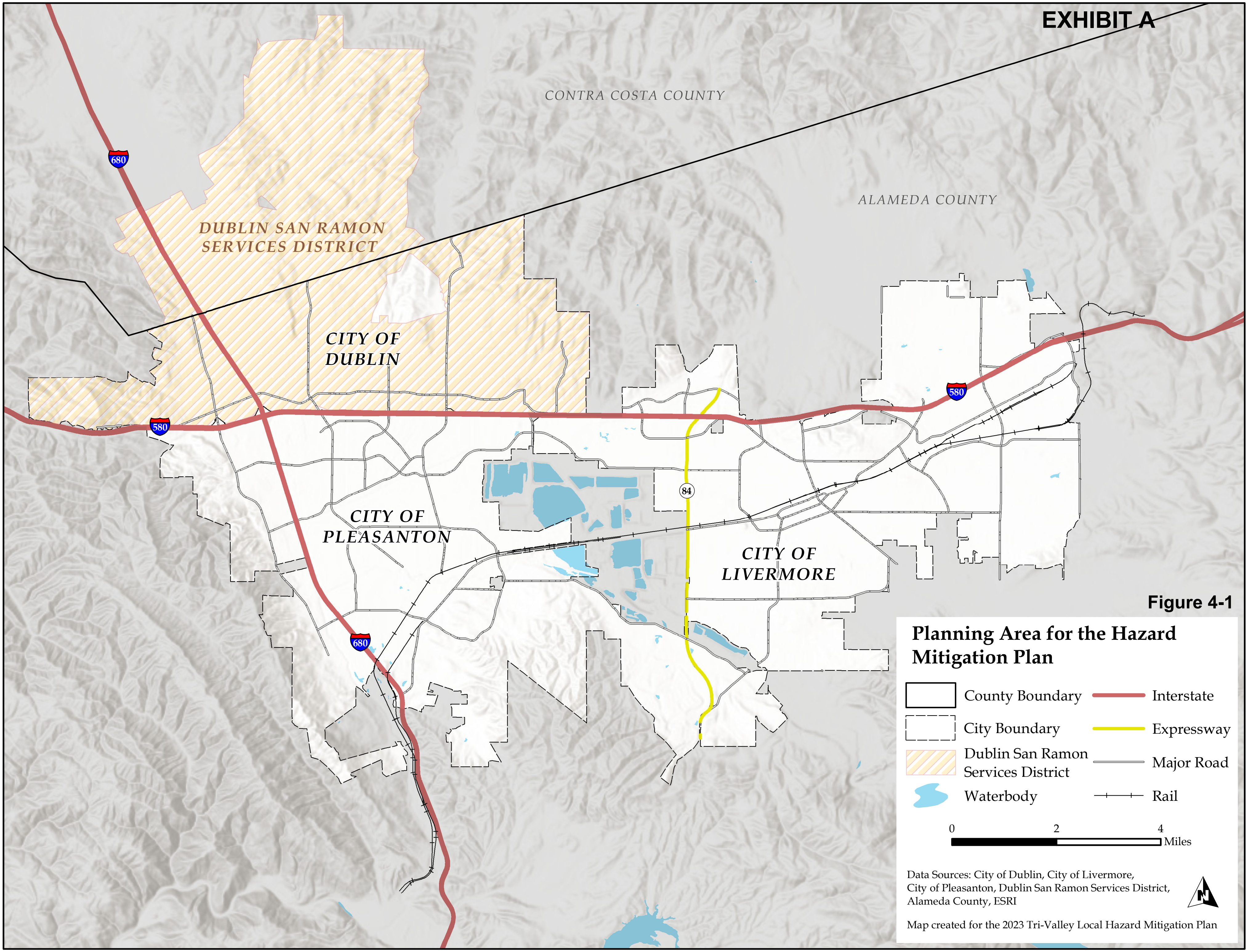
For thousands of years until the arrival of Spanish settlers in the late 1700s, the Ohlone people, also referred to as Costanoans (the Spanish word for “coast”), lived in and around the Bay Area. Living in small villages, they survived on the abundance of natural resources, including acorns from oak trees and shellfish in the bay. Mission San Jose was founded on June 11, 1797, by Father Fermín Francisco de Lasuén. It was the 14th of the 21 Spanish missions in what is now the western United States. The missionaries required the Indians to move to the mission, and this disruption, as well as new diseases the Spanish brought, destroyed the Indian way of life even before the influx of gold seekers in the mid-1800s.

The Amador-Livermore Valley was first sighted by a Spanish solder in 1772 while on an expedition searching for new mission sites. After 1822, Mexico succeeded Spain in jurisdiction over Alta California. Beginning in 1839, the former mission lands were secularized and broken up into large ranchos as the result of grants to citizens by Mexico. It was a half-century after the initial discovery that Jose Amador, in 1826, brought the first settlement to the valley and Spanish families were awarded large tracts of land.

California became part of the United States after the Mexican War of 1846–1847. The territory was formally ceded in the treaty of Guadalupe Hidalgo in 1848 and was admitted as a state in 1850. Pressure from the United States was a major factor leading to the disintegration of Mexican control in California. The first American settler in the tri-valley area arrived in 1850 and settlement continued. The area was on one of the main routes to the gold fields and became a mercantile stopover for miners on their way to those fields.

Ranchers and thoroughbred horse breeders, also came to the area, attracted to the favorable climate and abundance of water, and were followed by dairy farms, hop fields, and vineyards. The Central Pacific Railroad was completed in 1869, resulting in the establishment of more towns.

EXHIBIT A


CONTRA COSTA COUNTY
ALAMEDA COUNTY
DUBLIN SAN RAMON SERVICES DISTRICT
CITY OF DUBLIN
CITY OF PLEASANTON
CITY OF LIVERMORE
680
580
84
Figure 4-1
Planning Area for the Hazard Mitigation Plan
County Boundary
City Boundary
Dublin San Ramon Services District
Waterbody
Interstate
Expressway
Major Road
Rail
0
2
4
Miles
Data Sources: City of Dublin, City of Livermore, City of Pleasanton, Dublin San Ramon Services District, Alameda County, ESRI
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

In 1925, the section of the Lincoln Highway through the area (by 1874 known as Dublin Road) was incorporated into the U.S. Highway system as U.S. Highway 50. In 1928, it was also designated State Route 84. By 1953, U.S. Highway 50 had become a divided four-lane road; Interstate 680 was completed in 1967. By 1973, U.S. Highway 50 had become Interstate 580. Prior to the 1950s, small agricultural towns history and economy were integrated with those of the agricultural areas around them. Since the 1950s, urbanization of the area has grown across former agricultural land, and urban development now dominates the area (Corbett 2005).

Over the last two decades, the Tri-Valley has experienced an influx of people and jobs, growing at a faster rate than the Bay Area as a whole. In 2011, the West Dublin/Pleasanton BART (Bay Area Rapid Transit) station opened, providing another commute option between San Francisco and the Tri-Valley (Bay Area Council Economic Institute n.d.).

4.3 PHYSICAL SETTING

4.3.1 Topography and Geology

The planning area is in the east-central part of the California Coast Range Province that is characterized by elongated ranges and narrow valleys parallel to the coast. It lies in a depression within the Diablo Range where there are three valleys: Amador Valley, Livermore Valley, and San Ramon Valley. The Livermore and Amador Valleys, which are adjacent in an east-west orientation, make up the major part of the basin. San Ramon is a smaller valley that trends northwest from the northwest edge of Amador Valley. Elevations in the planning area range from approximately 300 feet above sea level at the drainage exit of Amador Valley southwest of Pleasanton, to approximately 700 feet above sea level along Livermore Valley’s eastern margin. The mean elevation above sea level is 486 feet in the City of Livermore and 354 feet in the City of Dublin. North and east of the Tri-Valley area, the Diablo Range rises to elevations between approximately 1,000 and 2,000 feet above sea level, with Mount Diablo reaching an elevation of 3,849 feet above sea level.

Geologic conditions are controlled by the planning area’s location along the complex boundary between the North American and Pacific Plates and the interaction of these two plates. The Pacific Plate moves northwestward relative to the North American Plate at a rate of about 5 centimeters per year. Much of this relative movement at the latitude of the San Francisco Bay Area is accommodated primarily by strike-slip motion along a number of major faults, including the San Gregorio, San Andreas, Hayward, Calaveras, and Greenville faults. Countless other faults in the region accommodate relative motion between major faults and relieve compression stress along the plate boundary.

4.3.2 Hydrology

The Tri-Valley area consists of sub-watersheds of the Alameda Creek Watershed. Arroyo Las Positas, Arroyo Seco, and Arroyo Mocho drain the northeastern and southeastern hills, and Arroyo del Valle drains the southern hills. These drainages converge and flow through the central Tri-Valley area, collecting the flow of Cayetano, Collier, Cottonwood, Tassajara, and Alamo Creeks from the northern hills. These streams join San Ramon Creek, which flows south through the San Ramon Valley and exits the basin along Arroyo de la Laguna. Figure 4-2 shows the entire Alameda Creek Watershed and major water bodies around the Tri-Valley area.

Source: (Alameda Creek Alliance n.d.)

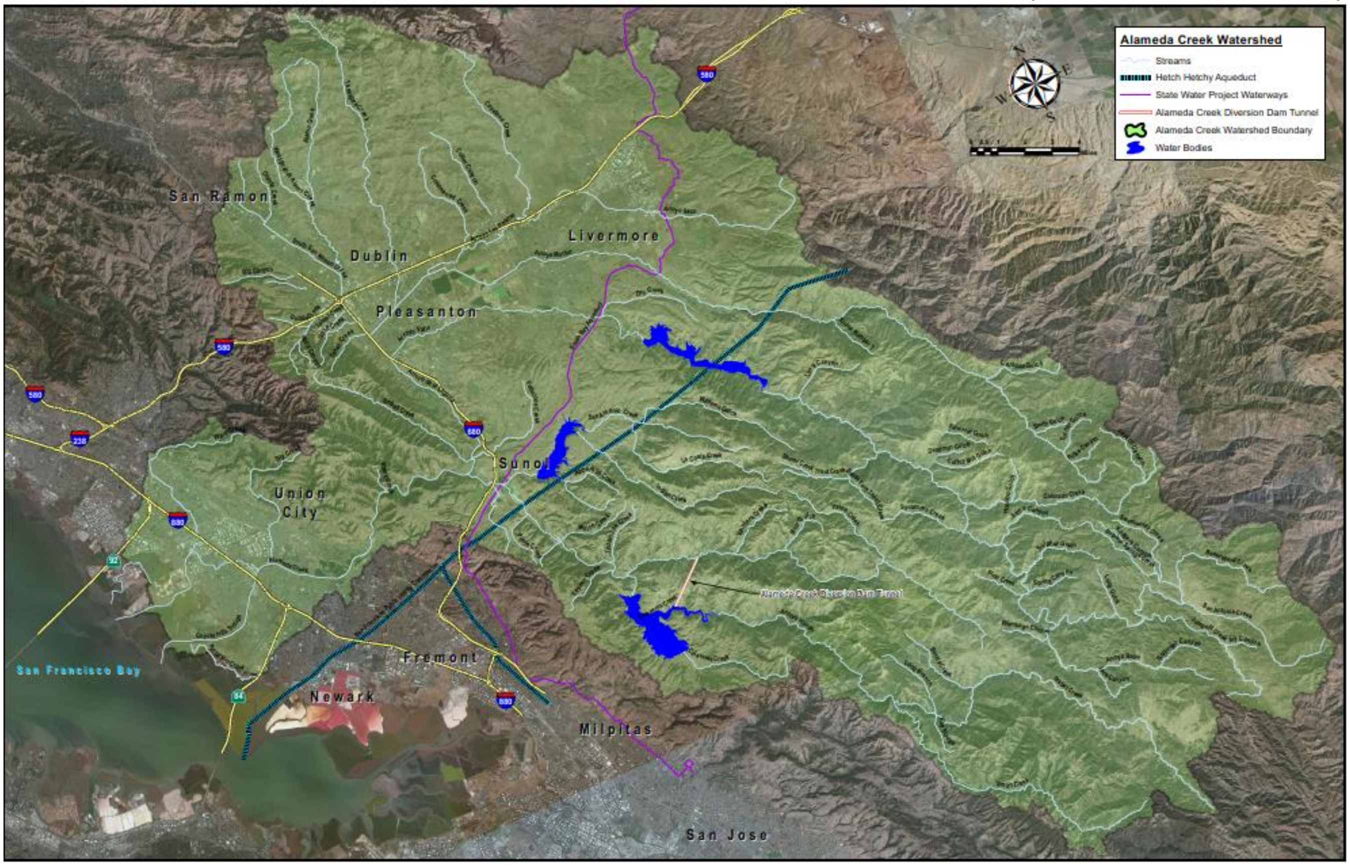


Figure 4-2. Watersheds and Water Bodies in the Planning Area

4.3.3 Climate

The climate of the planning area is moderated by its proximity to the San Francisco Bay, with average annual temperatures ranging from 45.7 degrees Fahrenheit (ºF) to 73.6 ºF. Climate records from the NOAA National Weather Service Forecast Office describe the region's climate as Mediterranean type. This classification is characterized by sharply contrasting wet and dry seasons, with the wet season from November through March bringing more than 80 percent of the total annual precipitation. Rainfall is sparse from May through September.

Mean precipitation in June, July and August in Livermore normally totals only 0.11 inches. Wet seasons are cool but mild, with mean monthly temperatures of 48.3 °F in January to 53.9 °F in March. Dry season weather is very consistent, with warm sunny days and average temperatures reaching 72.8 °F in June, July, August, and September.

Average temperature and precipitation across the planning area by month are shown in Figure 4-3. The total annual average precipitation is 13.38 inches. Annual average maximum and minimum temperatures are 48.3 ºF and 72.8 ºF, respectively.

In the past several years California experienced significant drought. However, in the winter of 2022 – 2023 much of the state was beset by multiple atmospheric rivers bringing substantial precipitation – rain and snow – that contributed to flooding and landslide issues in various parts of the state.

Source: (National Weather Service 2023)

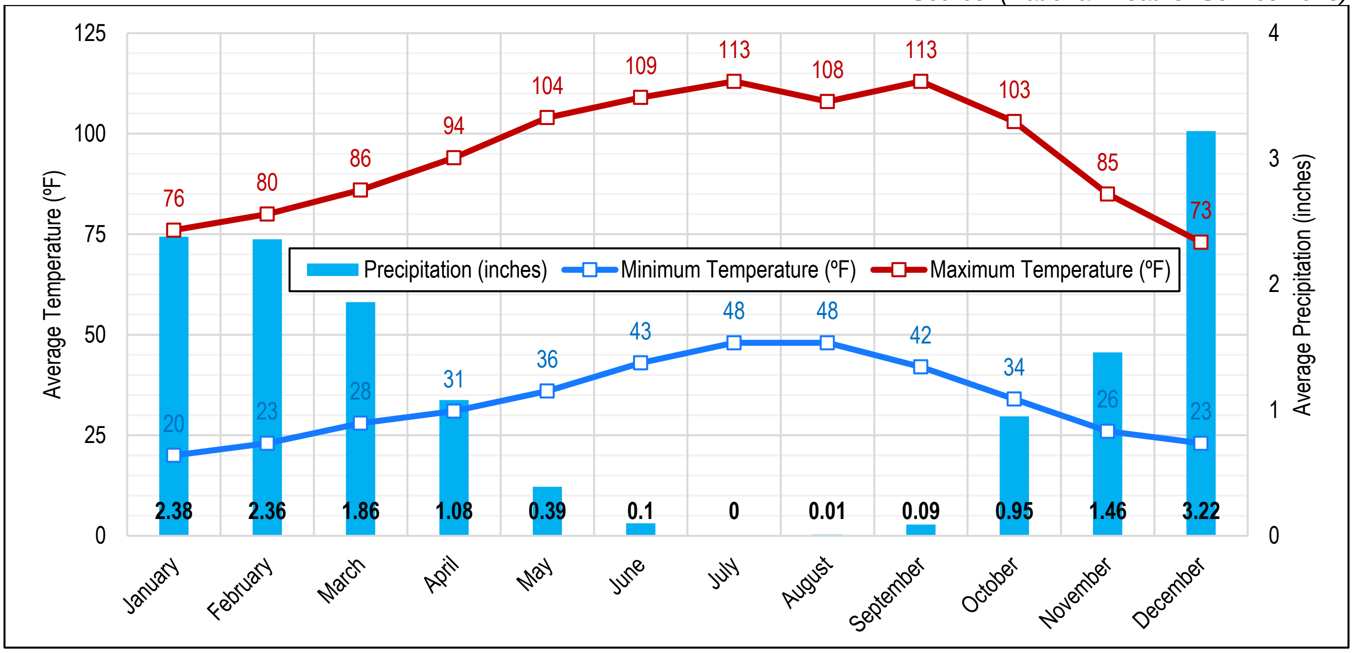


Figure 4-3. Normal Precipitation and Temperatures in Planning Area, 2000-2023

4.4 DEVELOPMENT PROFILE

4.4.1 Land Use

Dublin

The City of Dublin, located north of Interstate 580, covers 15.51 square miles, or 9,923.6 acres. As of 2017, the city accommodates 20,931 housing units. The City has defined the following planning areas:

- The Primary Planning Area consists of the original city boundaries and annexations completed through 1991. It covers roughly 3,100 acres.
- The Eastern Extended Planning Area is east of the Primary Planning Area and south and east of the U.S. Army's Parks Reserve Forces Training Area (Camp Parks). It covers roughly 4,300 acres.
- The Western Extended Planning Areas is west of the Primary Planning Area. It consists of 3,200 acres, mostly outside Dublin's urban limit line, which encompasses the city areas with access to city utilities and road maintenance services.
- The Dublin Crossing Planning Area, a portion of Camp Parks, covers 189 acres in the center of the city where existing buildings are scheduled for demolition to be replaced with a residential mixed-use project.

The city's land use includes a mixture of public open space, commercial/industrial, and residential. Development guidelines for the Eastern Extended Planning Area consider visually sensitive ridge lands and biologically sensitive habitat areas to preserve key elements of the area's physical character. A development elevation cap keeps growth within the 770-foot elevation that is the highest serviceable elevation for water service. Development is allowed in only a small portion of the Western Extended Planning Area; that area is out of view from the major ridgelines so it can be developed without disrupting scenic values (City of Dublin 2022).

Livermore

The City of Livermore, on the eastern side of the Tri-Valley planning area, covers approximately 24 square miles. As of 2019, the city accommodates 32,883 housing units. Single-family residential development is the predominant land use within the city limits, with residential subdivisions scattered throughout the city. Other land uses are agriculture, open space and parks, industry, retail and office space, and community facilities. The city has a defined urban growth boundary to protect agricultural uses and natural resources outside the city from future urban development (City of Livermore 2022).

Pleasanton

The City of Pleasanton covers approximately 24 square miles, with additional areas designated for future land use. A 42-square-mile sphere-of-influence area represents the probable ultimate physical boundary and service area of the city. If all residential land shown on the General Plan Map is built out, Pleasanton will contain approximately 29,000 housing units by 2025. City land use policy allows for well-planned neighborhoods and a separation between residential and non-residential uses. As of 2019, there were 77 residential neighborhoods and 17 commercial, office, and industrial development sub-areas. The City's growth management ordinance regulates the location and rate of new residential growth (City of Pleasanton 2019).

Dublin San Ramon Services District

The DSRSD was formed in 1953 as the Parks Community Services District. Its name transformed over the years. Today, the DSRSD is a water retailer for the City of Dublin area and wastewater collection and treatment for Dublin and San Ramon. Under contract, it also treats wastewater collected by the City of Pleasanton. From its origins, the District has grown in proportion to the growth in population and businesses in the Dublin area (DSRSD 2023).

4.4.2 Building Count, Occupancy Class and Estimated Replacement Value

Table 4-1 presents planning area building counts by building occupancy class. Table 4-2 summarizes estimated replacement value for building structures and contents. For the DSRSD, buildings listed include only critical facilities owned by the district.

Table 4-1. Planning Area Building Counts by Occupancy Class

	Number of Buildings							
	Agricultural	Commercial	Education	Government	Industrial	Religion	Residential	Total
Dublin	15	453	182	247	42	20	14,550	**15,509**
Livermore	1	1,189	496	518	381	95	28,213	**30,893**
Pleasanton	0	1,414	246	20	154	40	21,779	**23,653**
DSRSD	0	0	0	2	0	0	0	**2**
Total	**16**	**3,056**	**924**	**787**	**577**	**155**	**64,542**	**70,057**

Based on GIS data provided to Tetra Tech in May 2022 by the Cities of Dublin, Livermore, and Pleasanton and DSRSD

Table 4-2. Planning Area Replacement Value

	Estimated Replacement Value		
	Structure	Contents	Total
Dublin	$12,356,612,767	$8,098,062,522	**$20,454,675,289**
Livermore	$16,693,865,603	$13,105,030,879	**$29,798,896,482**
Pleasanton	$16,903,633,696	$12,445,602,543	**$29,349,236,239**
DSRSD	$14,629,000	$202,944,505	**$16,129,000**
Total	$45,968,741,066	$33,851,640,449	$79,618,937,010

4.4.3 Community Lifelines

The Community Lifeline Concept

Community lifelines, as defined by FEMA, are the most fundamental functions of a community. Lifelines are all the services, capabilities, and physical assets that are used day-to-day to support a community's ongoing needs. When stabilized and working properly, community lifelines enable all other aspects of society to function. The following are the seven basic community lifelines (in alphabetical order) and multiple components of each, as defined by FEMA (FEMA 2019):

- Communications
  - Infrastructure
  - Responder communications
  - Alerts, warnings, and messages
  - Finance
  - 911 and dispatch
- Energy
  - Power grid
  - Fuel
- Food, water, shelter
  - Food
  - Water
  - Shelter
  - Agriculture
- Hazardous material
  - Facilities
  - Hazmat, pollutants, contaminants
- Health and medical
  - Medical care
  - Public health
  - Patient movement
  - Medical supply chain
  - Fatality management
- Safety and security
  - Law enforcement/security
  - Fire service
  - Search and rescue
  - Government service
  - Community safety
- Transportation
  - Highway/roadway/motor vehicle
  - Mass transit
  - Railway
  - Aviation
  - Maritime

FEMA further defines subcomponents for each of the above components—nearly 100 altogether. These subcomponents include physical facilities as well as public and private services, capabilities, activities, and systems. The essential subcomponents that make up community lifelines range from police stations to farm animals, from public records to the food supply chain, and from medical treatment to banking services.

Lifelines Identified for This Plan’s Risk Assessment

It is an essential element of hazard mitigation planning to identify the community lifelines whose function can be negatively impacted by hazard events and to develop mitigation actions that will minimize the potential for such impacts. For this hazard mitigation plan, the assessment of community lifelines focuses on physical assets—the critical facilities and infrastructure that can be geographically located within mapped hazard areas and for which quantitative estimates can be made of current value and potential loss. These are referred to as critical facilities throughout the plan. Across the planning area, 1,161 such facilities were identified by each of the planning partners for analysis, geographically distributed as follows:

- Dublin—101 facilities
- Livermore—507 facilities
- Pleasanton—502 facilities
- Dublin San Ramon Services District—51 facilities

Figure 4-4 and Figure 4-5 show the general locations of these critical facilities in the planning area. Figure 4-6 summarizes counts of identified physical community lifeline assets in the planning area by category, based on the best data available at the time of this plan. This information is subject to change as new information about such structures becomes available during the performance period for this plan.

4.4.4 Development Trends

The planning area municipal partners have adopted general and economic development strategic plans to guide future growth, both local and area-wide, and ensure the orderly development of the communities. Development forecasts and development trends assist in providing a long-term vision for the planning area’s future and a strategy for achieving the desired vision. This plan aligns with these development programs and provides vital information on the risk associated with natural hazards in the planning area to support wise land use in the future.

Tracking building permit volume can be a way of looking at the potential increase in exposure within the planning area. Whether a permit is issued for new construction or improvement to existing construction, the permit volume can be associated with an increase in exposed value. The number of residential building permits reported in the planning area has fluctuated significantly from a low of 227 permits in 2007 to a high of 965 permits in 2014. The number of permits stayed steady through 2018, then consistently dropped through 2021. In 2021, the City of Dublin issued residential building permits for 131 buildings, which was significantly higher than the City of Livermore, with 89, and the City of Pleasanton, with 25.

Figure 4-7 shows the trends in residential development projects in the planning area since 2005. Additional city-specific development trend information is provided in the city-specific annexes in Volume 2 of this plan.

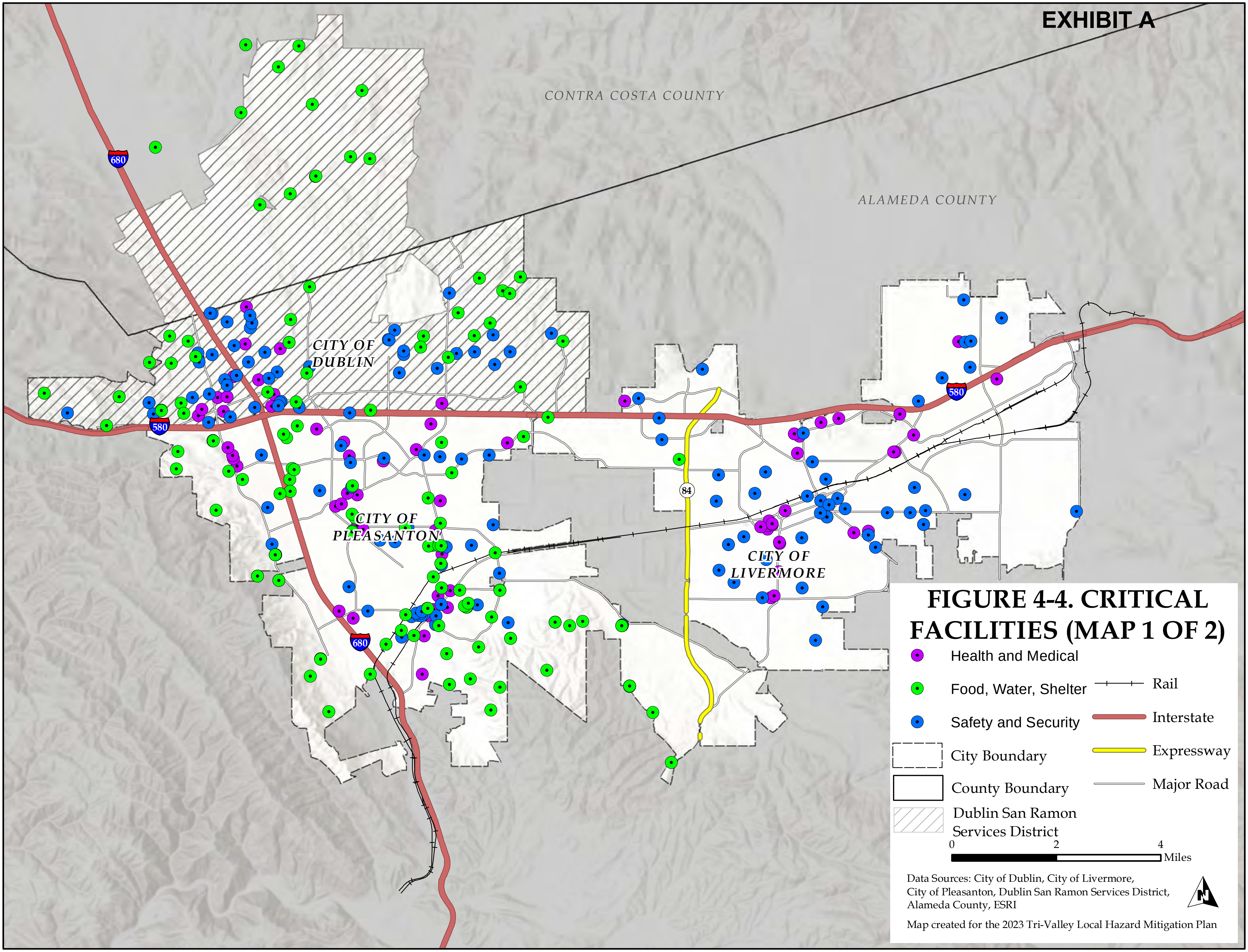
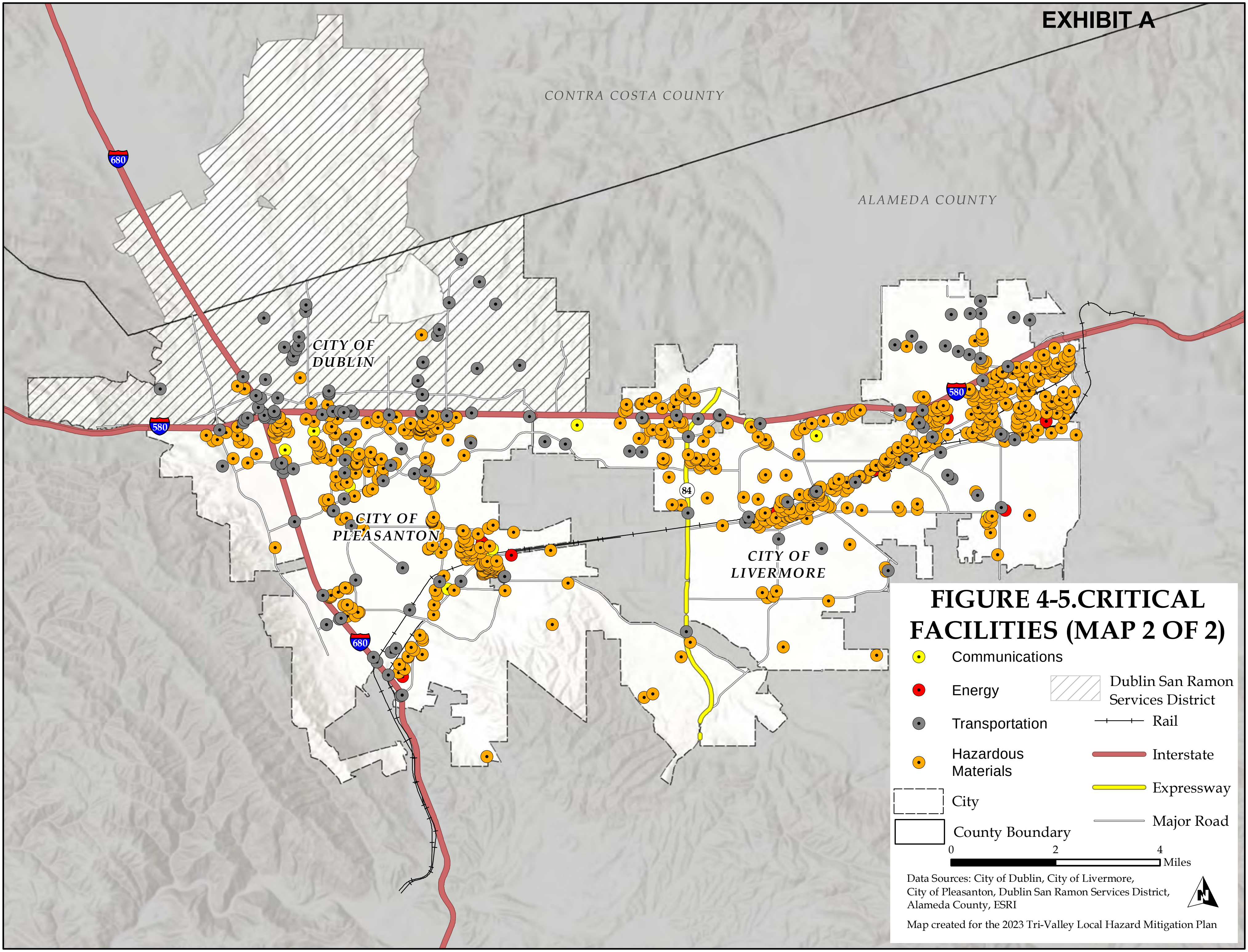


EXHIBIT A
CONTRA COSTA COUNTY
ALAMEDA COUNTY
CITY OF DUBLIN
CITY OF PLEASANTON
CITY OF LIVERMORE
680
580
84
FIGURE 4-4. CRITICAL FACILITIES (MAP 1 OF 2)
Health and Medical
Food, Water, Shelter
Safety and Security
City Boundary
County Boundary
Dublin San Ramon Services District
Rail
Interstate
Expressway
Major Road
0
2
4
Miles
Data Sources: City of Dublin, City of Livermore, City of Pleasanton, Dublin San Ramon Services District, Alameda County, ESRI
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

EXHIBIT A


CONTRA COSTA COUNTY
ALAMEDA COUNTY
CITY OF
DUBLIN
CITY OF
PLEASANTON
CITY OF
LIVERMORE
680
580
84
FIGURE 4-5.CRITICAL
FACILITIES (MAP 2 OF 2)
Communications
Energy
Transportation
Hazardous
Materials
City
County Boundary
Dublin San Ramon
Services District
Rail
Interstate
Expressway
Major Road
0
2
4
Miles
Data Sources: City of Dublin, City of Livermore,
City of Pleasanton, Dublin San Ramon Services District,
Alameda County, ESRI
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

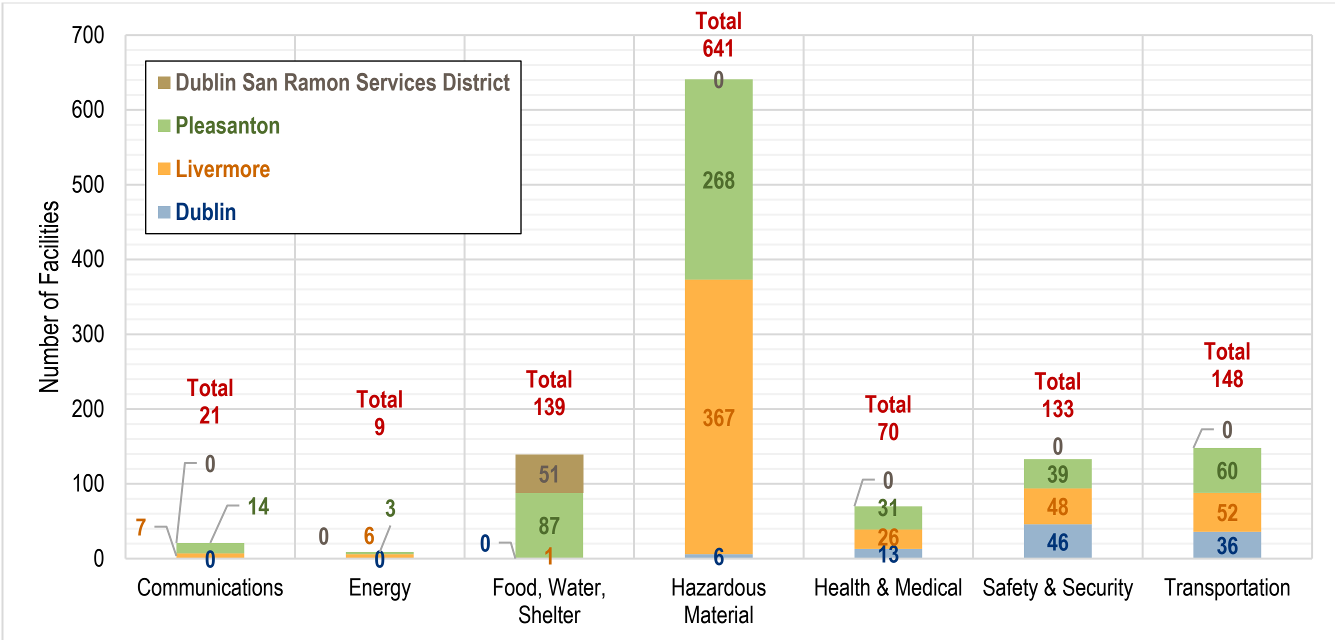
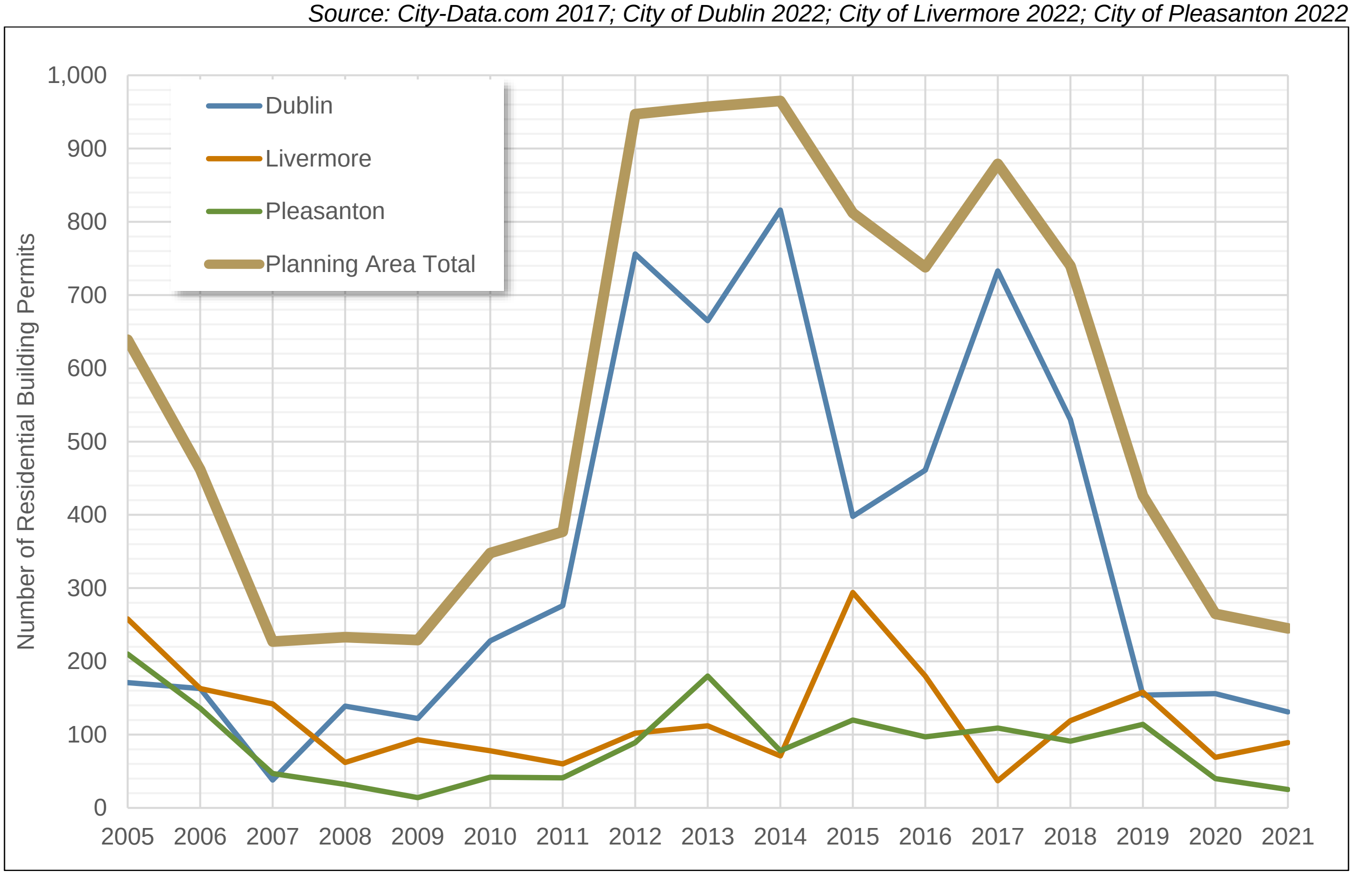


Figure 4-6. Planning Area Critical Facilities by Jurisdiction and Category

Source: City-Data.com 2017; City of Dublin 2022; City of Livermore 2022; City of Pleasanton 2022



DSRSD does not have permit authority

Figure 4-7. Residential Building Permit Trends, 2005 to 2021

The municipal partners will incorporate this hazard mitigation plan in their general plans by reference. This will ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan. The planning partners intend to pursue the following:

- Discourage development within vulnerable areas, areas with the potential for high population density, and Special Flood Hazard Areas.
- Encourage higher regulatory standards at the local level.

Future development is expected to focus on infill as identified through current land use practices. Dublin, Livermore and Pleasanton are largely built out, and with sustainability practices and urban growth boundaries in place, there is little opportunity for new growth.

4.5 DEMOGRAPHICS

4.5.1 Population Characteristics

Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. The California Department of Finance estimated the planning area population at 236,690 as of January 1, 2022.

Population changes are useful socio-economic indicators. A growing population generally indicates a growing economy, while a decreasing population signifies economic decline. Table 4-3 shows population for each city in the planning area from 2010 to 2022 (California Department of Finance 2023). The population of the planning area increased 20 percent from 2010 to 2022, with Dublin gaining 26,896 residents, Livermore gaining 5,181, and Pleasanton gaining 7,324.

Table 4-3. Annual Population Data

	Population			
	Dublin*	Livermore	Pleasanton	Tri-Valley Planning Area
2010	46,036	80,968	70,285	**197,289**
2011	46,408	81,948	70,813	**199,169**
2012	46,956	82,772	71,117	**200,845**
2013	50,079	83,768	71,153	**205,000**
2014	53,512	85,049	71,990	**210,551**
2015	56,014	86,368	73,776	**216,158**
2016	57,349	88,138	74,982	**220,469**
2017	59,686	89,648	75,916	**225,250**
2018	61,488	90,392	78,244	**230,124**
2019	63,890	90,769	78,840	**233,499**
2020	74,211	87,694	79,741	**241,646**
2021	73,209	87,388	78,924	**239,521**
2022	72,932	86,149	77,609	**236,690**

Source: (California Department of Finance 2023)

DSRSD provides service to 26,237 potable water accounts, 473 recycled water accounts and 25,301 single-family residential wastewater tax roll assessments (excludes commercial, industrial and institutional accounts), with a current staff of 131. The District distributes drinking water to approximately 100,400 people and provides wastewater collection and treatment for approximately 168,600 people in Dublin, southern San Ramon and the city of Pleasanton.

Figure 4-8 shows the overall planning area and Alameda County population change from 1980 to 2020. Between 1980 and 2020, Alameda County's population grew by 52.15 percent and the planning area's population increased by 189.37 percent. Much of the growth in the planning area was between 1980 and 2000, though double-digit growth continues. Local growth still exceeds that of the county.

Source: (California Department of Finance 2023)

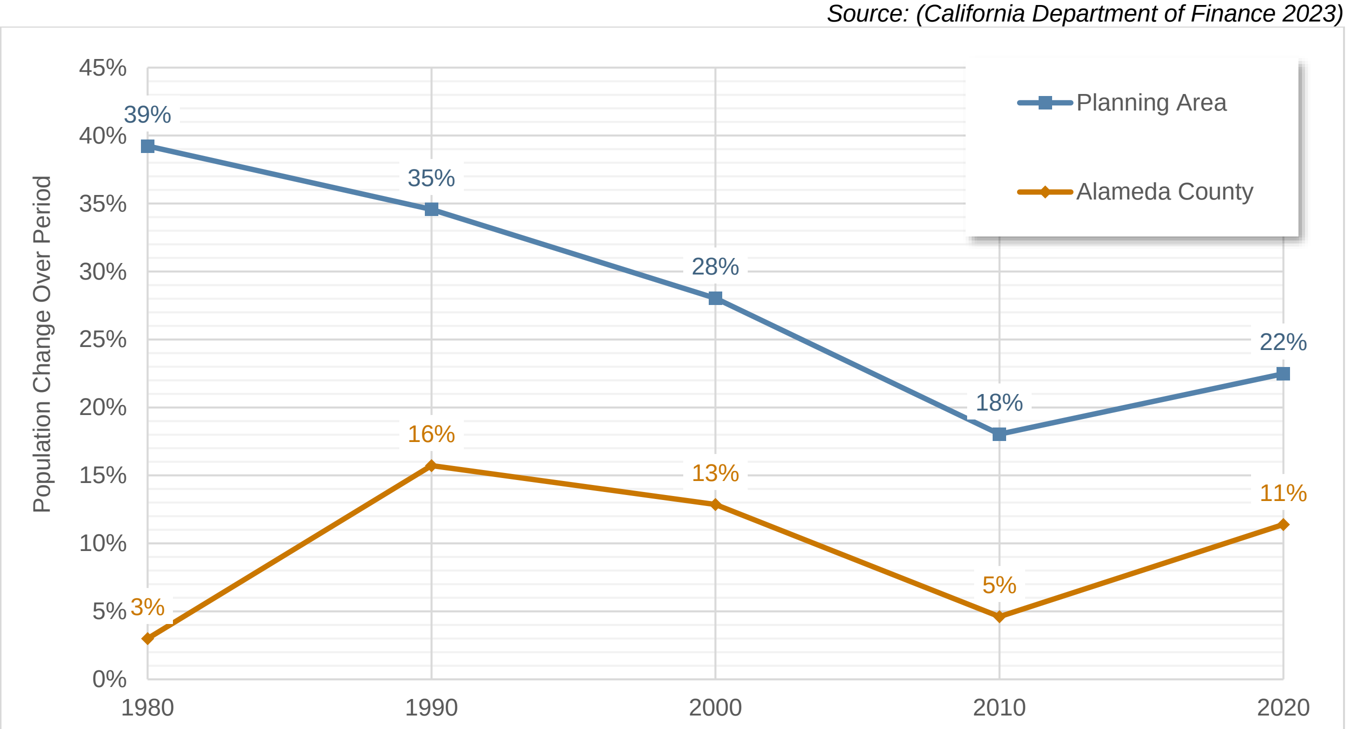


Figure 4-8. Alameda County vs. Planning Area Population Growth

4.5.2 Socially Vulnerable Groups

In general, the socially vulnerable populations are at greater risk from hazard events because of decreased resources or physical abilities. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would help to extend focused public outreach and education to these most vulnerable citizens.

Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty accessing information or evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need individualized medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The overall age distribution for the planning area is shown in Figure 4-9. Based on the U.S. Census 2021 American Community Survey (ACS) 1-year estimates, 12.5 percent of the planning area's population is 65 or older, compared to Alameda County's average of 13.9 percent. The Census data also show that 4.28 percent of the under-65 population has disabilities of some kind and 4.1 percent of the entire population have an income below the poverty line. It is also estimated that 24.5 percent of the population is 18 or younger, compared to Alameda County's average of 20.6 percent (U.S. Census 2022).

Race, Ethnicity and Language

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. According to the U.S. Census 2021 ACS 1-year estimates, the racial composition of the planning area is predominantly white (41.47 percent) and Asian (37.43 percent), with 1.93 percent Black or African American. Figure 4-10 shows the racial distribution in the planning area. Census data also indicate that 16.3 percent of individuals in the planning area are Hispanic or Latino (of any race) and that 32.27 percent of the planning area population is foreign-born.

Individuals with Disabilities and Others with Access and Functional Needs

The 2021 U.S. Census estimates that 42.5 million non-institutionalized people with disabilities and others with access and functional needs live in the U.S. This equates to about one-in-eight persons. This population is more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their needs is paramount to life safety efforts. Knowing the percentage of population with a disability or access and functional need will allow emergency management personnel and first responders to have personnel available who can provide services needed by this population. According to the 2021 ACS 1-year estimates, there are 19,360 individuals with some form of disability, access, or functional need within the planning area (U.S. Census 2022).

Source: (U.S. Census 2022)

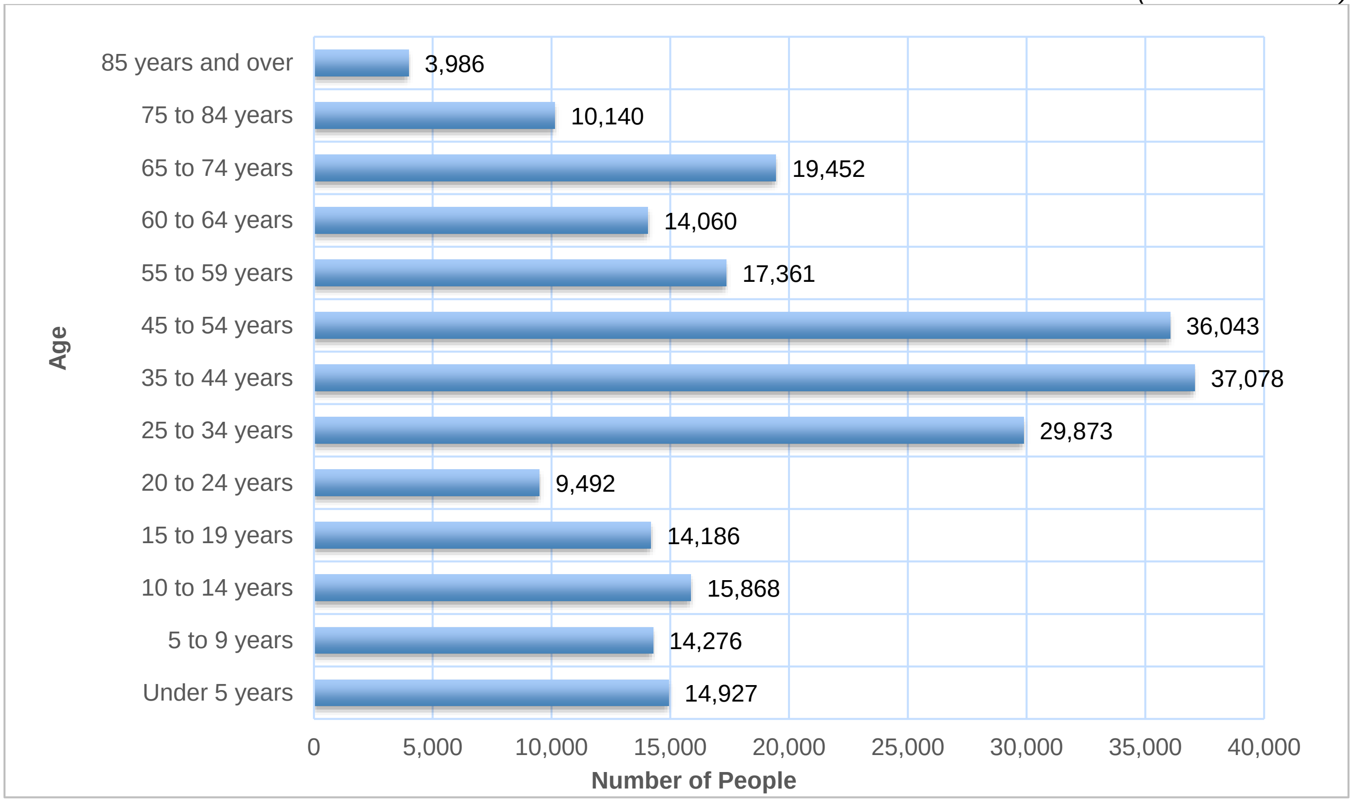


Figure 4-9. Planning Area Age Distribution

Source: (U.S. Census 2022)

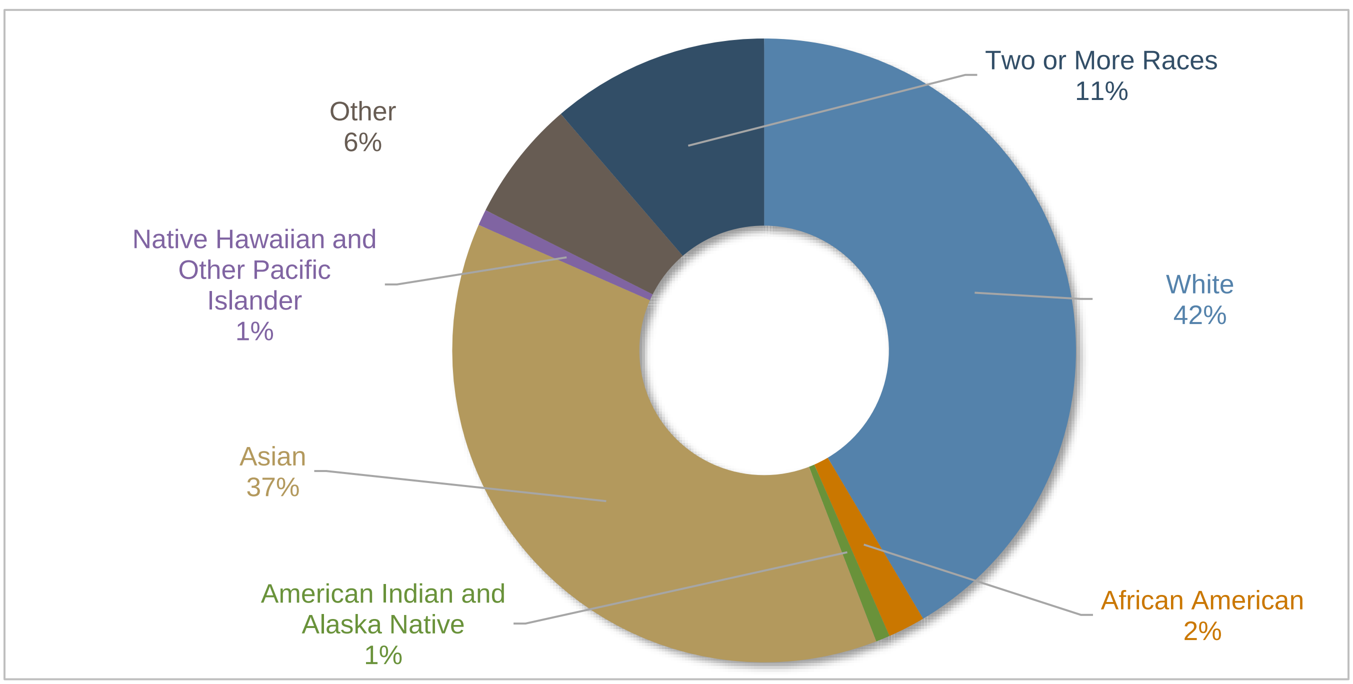


Figure 4-10. Planning Area Race Distribution

Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This expectation means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the economically disadvantaged typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the economically disadvantaged often live in older houses and apartment complexes, which are more likely to be made of unreinforced masonry, a building type that is particularly susceptible to damage during earthquakes.

Residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people’s decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on 2021 ACS 1-year estimates, average per capita income in the planning area in 2021 was $69,438 and the median household income was $160,198. As defined by the U.S. Census Bureau, the poverty threshold in 2021 was $27,479 for a household with two adults and two children, and $13,788 for one person (unrelated individual) (U.S. Census 2023)

2021 ACS 1-year estimates showed that roughly 15.4 percent of households in the planning area receive an income between $150,000 and $199,999 per year and about 39.6 percent of household incomes are above $200,000 annually. About 4.2 percent of the households in the planning area make less than $25,000 per year.

The Social Vulnerability Index

The Centers for Disease Control and Prevention’s Social Vulnerability Index (SVI) uses 16 U.S. census variables to help local officials identify communities that may need support before, during, or after disasters. Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss.

This planning effort aligns the social vulnerability threshold with that used in the State of California Hazard Mitigation Plan. High vulnerability is defined by using the overall summary ranking value greater than 0.70. A GIS analysis found that no Census tracts within the Tri-Valley planning area have an SVI of 0.7 or greater. The highest SVI value among the 44 planning area Census tracts is 0.54, and 39 of the Census tracts have an SVI less than 0.3. For this reason, the risk assessment in this plan provides qualitative discussions of how each hazard can affect socially vulnerable populations, but no quantitative analysis is provided of socially vulnerable populations at risk.

4.6 ECONOMY

4.6.1 Large Local Employers

The planning area benefits from a variety of business activity. Major businesses with headquarters in Dublin include Ross Stores, Challenge Dairy, Tria Beauty and DeSilva Gates Construction. Technology firms in Dublin include Micro Dental Laboratories, Callidues Cloud, Carl Zeiss Meditec, and Epicor. Top employers in City of Livermore include Lawrence Livermore National Laboratory, Valley Care Health System Lifestyle Rx Fitness Center, Livermore Valley Joint Unified School District, Comcast Cable, and Sandia National Laboratory, and Form Factor, Inc., Gillig Bus, and Tesla warehouse. Top employers in City of Pleasanton include Kaiser Permanente, Safeway, Oracle, Workday Inc., Pleasanton Unified School District, Macy's, and Valley Care Medical Center.

4.6.2 Employment by Sector

Figure 4-11 shows the planning area breakdown of employment by U.S. Census-defined industry types from 2021 ACS 1-year estimates. Professional, scientific, and management, and administrative and waste management services has the highest percentage of employees with 26.7 percent. Followed by educational services, and health care and social assistance with 21.37 percent.

Source: (U.S. Census 2022)

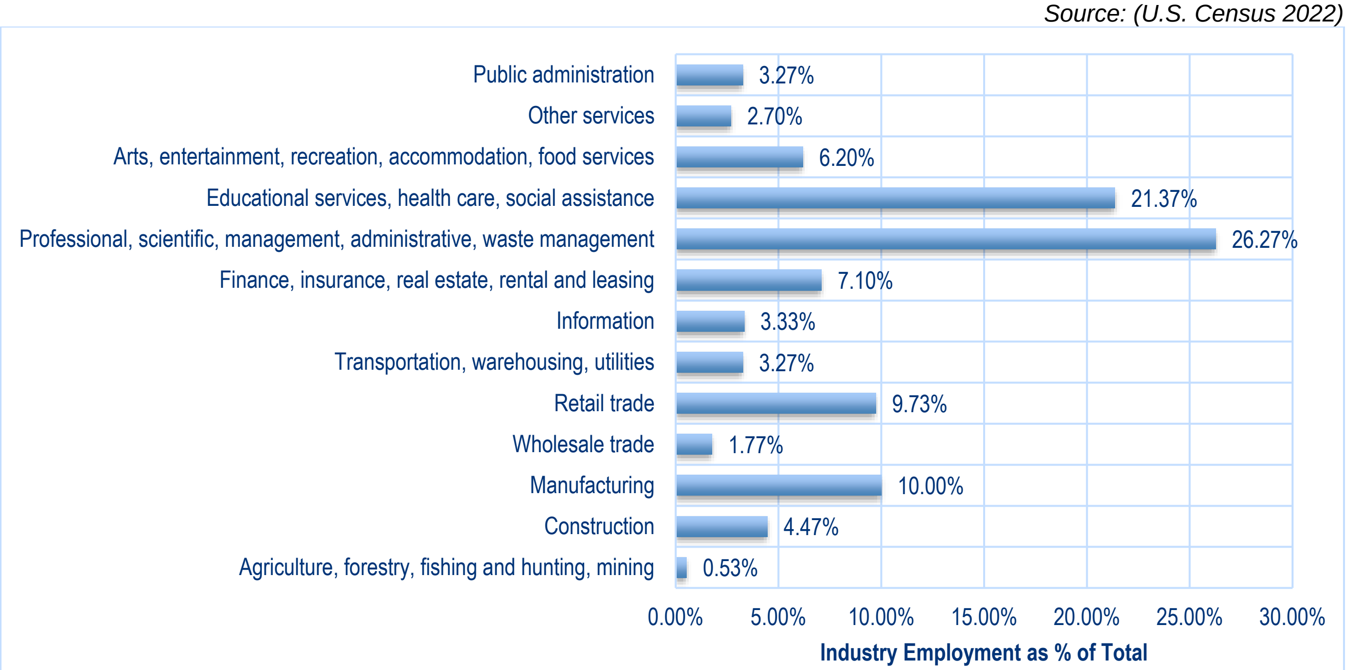


Figure 4-11. Industry in the Planning Area by Population Employed

4.6.3 Employment by Occupations

According to the 2021 ACS 1-year estimates, about 68 percent of the planning area's population 16 years and over is in the labor force. Figure 4-12 shows the distribution of workers by occupation category.

4.6.4 Unemployment

Figure 4-13 compares California and planning area unemployment trends from 2016 through 2022. Unemployment in the planning area has remained lower than the state average, and is lowest in 2022, at about 2.5 percent. Unemployment rates jumped significantly at the beginning of the COVID-19 pandemic in 2020, but have now been on the decline in both the state and the planning area.

Source: (U.S. Census 2022)

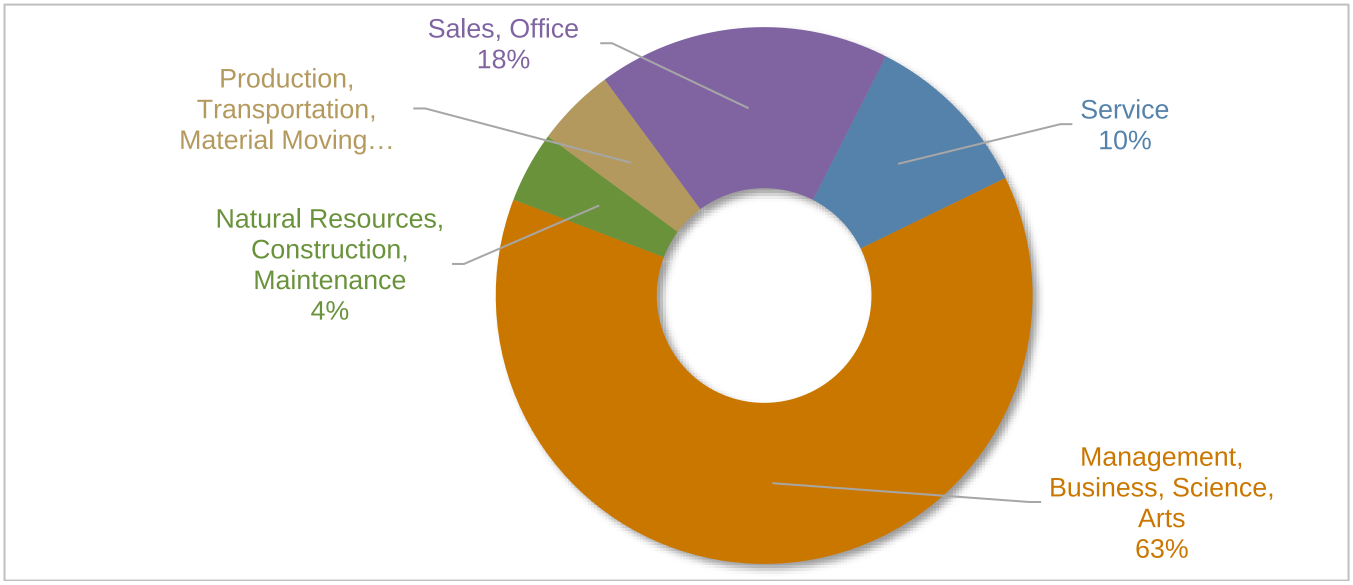


Figure 4-12. Occupations in the Planning Area

Source: CA EDD, 2022

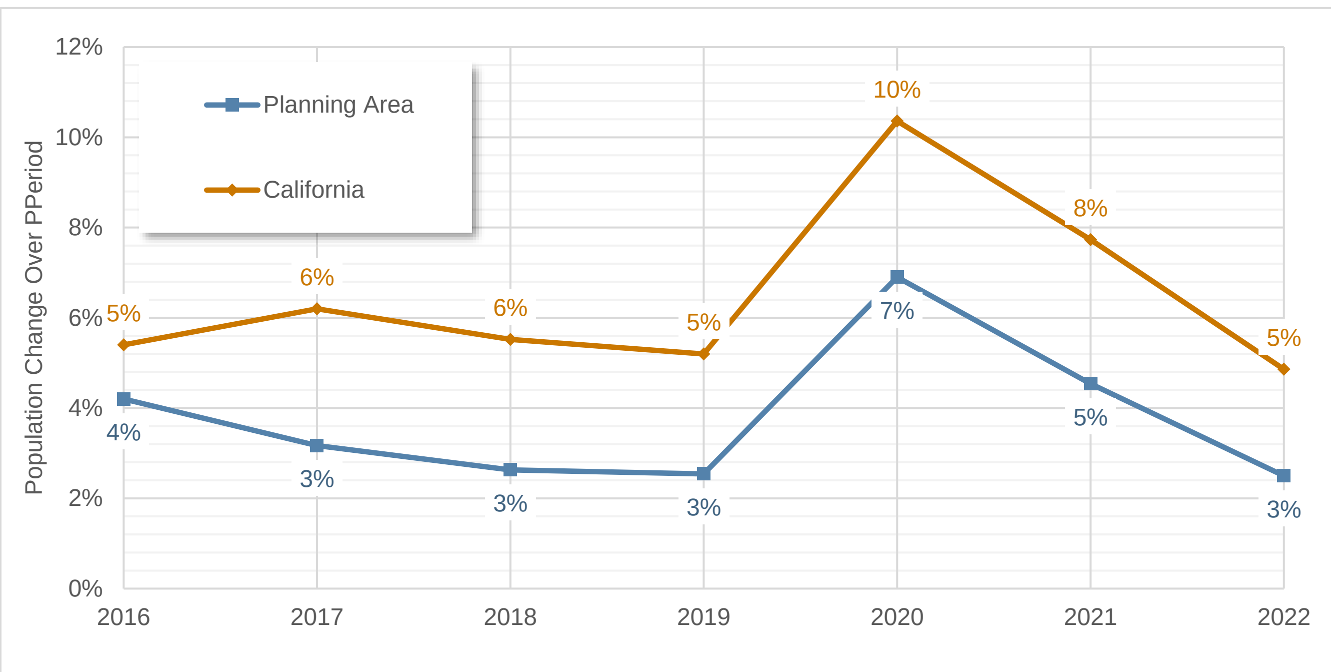


Figure 4-13. California State and Planning Area Unemployment Rate

The 2021 ACS 1-year estimates show that over 68 percent of the employed population 16 years and older in the planning area, or 129,137 individuals, commute to work. Of those, 47.17 percent drove alone (by car, truck or van) to work, and 7.27 percent carpooled (by car, truck or van). The mean travel time to work in the planning area is about 29 minutes (U.S. Census 2022).

5. HAZARDS OF CONCERN

Defining the hazards that present the greatest risk to the planning area is the first step in assessing overall risk to the community. The planning team and Steering Committee reviewed available information to determine what types of hazards may affect the planning area, how often they can occur, and their potential severity. This effort defined hazards of concern, for which individual risk assessments are presented in this hazard mitigation plan.

5.1 MAJOR PAST HAZARD EVENTS

A list of federal disaster declarations that affected the planning area offers an indication of the types of hazards most likely to pose risks to the community. Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Since 1953, 20 presidential disaster declarations have been issued for Alameda County, which includes the cities of Dublin, Livermore, and Pleasanton and DSRSD, as listed in Table 5-1.

Table 5-1. Presidential Disaster Declarations

Type of Event	FEMA Disaster Number	Declaration Date
Severe Winter Storms, Flooding, Landslides, and Mudslides	DR-4683	January 14, 2023
COVID-19 Pandemic	DR-4482	March 22, 2020
Severe Winter Storms, Flooding, Mudslides	DR-4308	April 1, 2017
Severe Winter Storms, Flooding, Mudslides	DR-4305	March 16, 2017
Severe Winter Storms, Flooding, Mudslides	DR-4301	February 14, 2017
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1646	June 5, 2006
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1628	February 3, 2006
Severe Winter Storms, Flooding	DR-1203	February 9, 1998
Severe Winter Storms, Flooding	DR-1155	January 4, 1997
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1046	March 12, 1995
Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1044	January 10, 1995
Oakland Hills Fire	DR-919	October 22, 1991
Severe Freeze	DR-894	February 11, 1991
Loma Prieta Earthquake	DR-845	October 17, 1989
Severe Storms, Flooding	DR-758	February 12, 1986
Coastal Storms, Floods, Slides, Tornadoes	DR-677	January 21, 1983
Severe Storms, Flood, Mudslides, High Tide	DR-651	January 7, 1982
Drought	EM-3023	January 20, 1977

Type of Event	FEMA Disaster Number	Declaration Date
Forest, Brush Fires	DR-295	September 29, 1970
Severe Storms, Flooding	DR-283	February 16, 1970

Source: (FEMA 2017); (FEMA 2022)

Review of these events helps identify targets for risk reduction and ways to increase a community's capability to mitigate damage from large-scale events in the future. Still, many natural hazard events do not trigger federal disaster declaration protocol but have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for hazards of concern.

5.2 HAZARDS IDENTIFIED FOR ASSESSMENT IN THIS PLAN

The Steering Committee considered the full range of natural and human-caused hazards assessed in the 2023 State of California Hazard Mitigation Plan (draft) that could affect the planning area and then listed hazards that present the greatest concerns for the Tri-Valley planning area (see Table 5-2).

Table 5-2. Tri-Valley Hazard Comparison with California State Hazards

Hazard Assessed in 2023 California State Hazard Mitigation Plan (Draft)	Where Addressed in 2023 Tri-Valley Hazard Mitigation Plan	Comment
Air pollution	Wildfire	This hazard is included in the discussion of wildfire
Civil disorder	Human-caused hazards	This hazard is included in a combined discussion of human-caused hazards (referred to as civil unrest)
Cyber threats	Human-caused hazards	This hazard is included in a combined discussion of human-caused hazards
Dam failure	Dam failure	This hazard aligns with the state
Drought	Drought	This hazard aligns with the state
Earthquake	Earthquake	This hazard aligns with the state
Electromagnetic pulse attack	Human-caused hazards	This hazard is included in a combined discussion of terrorism (under human-caused hazards)
Energy shortage	Not included	This hazard is a concern for the planning area, but it is dealt with through other planning mechanisms
Epidemic/pandemic/vector-borne disease	Public health emergency	This hazard is included in a combined discussion of public health emergencies
Extreme cold or freeze	Not included	This hazard is not a concern for the planning area
Extreme heat	Severe weather	This hazard is included in a combined discussion of severe weather hazards
Geomagnetic storm (space weather)	Severe weather	This hazard is included in a combined discussion of severe weather hazards
Hazardous materials release	Human-caused hazards	This hazard is included in a combined discussion of human-caused hazards
Invasive and nuisance species	Not included	This hazard is not a concern for the planning area
Landslide, debris flow, and other mass movements	Landslide	This hazard aligns with the state
Levee failure	Not included	This hazard is not a concern for the planning area
Natural gas pipeline hazards	Human-caused hazards	This hazard is included in a combined discussion of human-caused hazards
Oil spills	Not included	This hazard is not a concern for the planning area
Other potential causes of long-term electrical outage	Not included	This hazard is not a concern for the planning area

Hazard Assessed in 2023 California State Hazard Mitigation Plan (Draft)	Where Addressed in 2023 Tri-Valley Hazard Mitigation Plan	Comment
Public safety power shutoff	Severe weather	This hazard is discussed in connection with the severe weather hazard
Radiological accidents	Human-caused hazards	This hazard is mentioned in connection with hazardous materials incidents
Riverine, stream and alluvial flood	Flood	The flood chapter addresses stormwater runoff floods, riverine floods and flash floods
Sea-level rise, coastal flooding and erosion	Climate change	This hazard is included in a combined discussion of hazards and factors relating to climate change
Severe wind, weather, and storms	Severe weather	This hazard is included in a combined discussion of severe weather hazards
Snow avalanche	Not included	This hazard is not a concern for the planning area
Subsidence	Not included	This hazard is not a concern for the planning area
Terrorism	Human-caused hazards	This hazard is included in a combined discussion of human-caused hazards
Transportation accidents resulting in explosions or toxic releases	Human-caused hazards	This hazard is included in a combined discussion of severe weather hazards
Tree mortality	Climate change	This hazard is briefly mentioned in a combined discussion of climate change
Tsunami and seiche	Not included	The planning area does not border the ocean or contain any large bodies of water
Urban structural fire	Not included	This hazard is a concern for the planning area, but it is dealt with in other planning mechanisms
Volcano	Not included	This hazard is not a concern for the planning area
Well stimulation and hydraulic fracturing	Not included	This hazard is not occurring in the planning area
Wildfire	Wildfire	This hazard aligns with the state

The process incorporated a review of local hazard planning documents as well as information on the frequency of, magnitude of, and costs associated with hazards that have struck the planning area or could do so. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Based on the review, this plan presents complete risk assessment for the following hazards of concern (presented in alphabetical order; the order of listing does not indicate the hazards' relative severity):

- Climate change
- Dam failure
- Drought
- Earthquake
- Flood
- Landslide
- Severe weather
- Wildfire

In addition to the hazards of concern for which full risk assessments were performed, the following hazards of interest were identified for inclusion in this plan:

- Active threats
- Civil unrest
- Cyber threats
- Hazardous materials incidents
- Pipeline and utility failure
- Public health emergency
- Terrorism
- Transportation accidents

These hazards are of interest because they present risk to the planning area. However, no methodologies are currently available to perform risk assessments on them that are equivalent to those used for the natural hazards of concern addressed in detail in this plan.

6. RELEVANT LAWS, ORDINANCES AND PROGRAMS

Existing regulations, agencies and programs at the federal, state, and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Information presented in this section can be used to review local capabilities to implement the action plan this hazard mitigation plan presents. Individual review by each planning partner of existing local plans, studies, reports, and technical information is presented in the annexes in Volume 2.

6.1 RELEVANT FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

State and federal regulations and programs that need to be considered in hazard mitigation are constantly evolving. For this plan, a review was performed to determined which regulations and programs are currently most relevant to hazard mitigation planning. The findings are summarized in Table 6-1 and Table 6-2. Short descriptions of each program are provided in Appendix B.

Table 6-1. Summary of Relevant Federal Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Americans with Disabilities Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Bureau of Land Management	Wildfire Hazard	The Bureau funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands.
Civil Rights Act of 1964	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Clean Water Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Community Development Block Grant Disaster Resilience Program	Action Plan Funding	This is a potential alternative source of funding for actions identified in this plan.
Community Rating System	Flood Hazard	This voluntary program encourages floodplain management activities that exceed the minimum National Flood Insurance Program requirements.
Disaster Mitigation Act	Hazard Mitigation Planning	This is the current federal legislation addressing hazard mitigation planning.
Emergency Relief for Federally Owned Roads Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Emergency Watershed Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Endangered Species Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Federal Energy Regulatory Commission Dam Safety Program	Dam Failure Hazard	This program cooperates with a large number of federal and state agencies to ensure and promote dam safety.
Federal Wildfire Management Policy and Healthy Forests Restoration Act	Wildfire Hazard	These documents mandate community-based collaboration to reduce risks from wildfire.
National Dam Safety Act	Dam Failure Hazard	This act requires a periodic engineering analysis of most dams in the country
National Environmental Policy Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
National Fire Plan (2001)	Wildfire Hazard	This plan calls for joint risk reduction planning and implementation by federal, state and local agencies.
National Flood Insurance Program (NFIP)	Flood Hazard	This program makes federally backed flood insurance available to homeowners, renters, and business owners in exchange for communities enacting floodplain regulations
National Incident Management System (NIMS)	Action Plan Development	Adoption of this system for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards is a prerequisite for federal preparedness grants and awards
National Landslide Preparedness Act	Risk Assessment of Landslide Hazard	This act authorized a national landslide hazards reduction program and a 3D elevation program, providing tools and data to assess the landside hazard.
Presidential Executive Order 11988 (Floodplain Management)	Flood Hazard	This order requires federal agencies to avoid long and short-term adverse impacts associated with modification of floodplains
Presidential Executive Order 11990 (Protection of Wetlands)	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable presidential executive orders.
U.S. Army Corps of Engineers Dam Safety Program	Dam Failure Hazard	This program is responsible for safety inspections of dams that meet size and storage limitations specified in the National Dam Safety Act.
U.S. Army Corps of Engineers Flood Hazard Management	Flood Hazard, Action Plan Implementation, Action Plan Funding	The Corps of Engineers offers multiple funding and technical assistance programs available for flood hazard mitigation actions
U.S. Fire Administration	Wildfire Hazard	This agency provides leadership, advocacy, coordination, and support for fire agencies and organizations.
U.S. Fish and Wildlife Service	Wildfire Hazard	This service's fire management strategy employs prescribed fire throughout the National Wildlife Refuge System to maintain ecological communities.

Table 6-2. Summary of Relevant State Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
AB 9: Fire safety: Wildfires: Fire Adapted Communities	Wildfire Hazard	Establishes the Regional Forest and Fire Capacity Program to support regional leadership to build local and regional capacity and develop, prioritize, and implement strategies and projects that create fire-adapted communities and landscapes by improving watershed health, forest health, community wildfire preparedness, and fire resilience.
AB 32: The California Global Warming Solutions Act	Action Plan Development	Establishes a state goal of reducing greenhouse gas emissions.
AB 38: Fire safety: Low-Cost Retrofits: Regional Capacity Review: Wildfire Mitigation	Wildfire Hazard	Directs the California Natural Resources Agency to review the regional capacity of each county that contains a very high fire hazard severity zone and establishes a comprehensive wildfire mitigation and assistance program.
AB 70: Flood Liability	Flood Hazard	A city or county may be required to partially compensate for property damage caused by a flood if it unreasonably approves new development in areas protected by a state flood control project
AB 162: Flood Planning	Flood Hazard	Cities and counties must address flood-related matters in the land use, conservation, and safety and housing elements of their general plans.
AB 267: California Environmental Quality Act: Exemption: Prescribed Fire, Thinning, and Fuel Reduction Projects.	Wildfire Hazard	Extends to January 1, 2026, the exemption from requirements of the California Environmental Quality Act for prescribed fire, thinning, or fuel reduction projects on federal lands to reduce the risk of high-severity wildfire that had been reviewed under the National Environmental Policy Act.
AB 380: Forestry: Priority Fuel Reduction Projects	Wildfire Hazard	Requires the Department of Forestry and Fire Protection to identify priority fuel reduction projects annually and exempts the identified priority fuel reduction projects from certain legal requirements.
AB 431: Forestry: Timber Harvesting Plans: Defensible Space: Exemptions	Wildfire Hazard	Extends to January 1, 2026, the exemption from a requirement to complete a timber harvest plan for maintaining defensible space between 150 feet and 300 feet from a habitable structure.
AB 497: Forestry and Fire Protection: Local Assistance Grant Program: Fire Prevention Activities: Street and Road Vegetation Management	Wildfire Hazard	Appropriates funds for local assistance grants for fire prevention activities with priority for projects that manage vegetation along streets and roads to prevent the ignition of wildfire.
AB 575: Civil Liability: Prescribed Burning Activities: Gross Negligence	Wildfire Hazard	Provides that a private entity engaging in a prescribed burning activity that is supervised by a person certified as burn boss is liable for damages to a third party only if the prescribed burning activity was carried out in a grossly negligent manner.
AB 642: Wildfires	Wildfire Hazard	Makes changes to support cultural and prescribed fire, including the creation of a Cultural Burning Liaison at the Department of Forestry and Fire Protection, and requires a proposal for creating a prescribed fire training center.
AB 747: General Plans—Safety Element	Hazard Mitigation Planning	The safety elements of cities' and counties' general plans must address evacuation routes and include any new information on flood and fire hazards and climate adaptation and resiliency strategies.
AB 800: Wildfires: local general plans: safety elements: fire hazard severity zones.	Wildfire Hazard	Establishes provisions for wildfire hazard mapping and applications for that mapping in General Plan Safety Elements.
AB 1255: Fire prevention: Department of Forestry and Fire Protection: Grant Programs	Wildfire Hazard	Requires the Natural Resources Agency to develop a guidance document that describes goals, approaches, opportunities, and best practices in each region of the state for ecologically appropriate, habitat-specific fire risk reduction. Requires consultation with counties related to the Department of Forestry and Fire Protection's local fire prevention grant program.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
AB 1295: Residential development Agreements: Very High-Risk Fire Areas	Wildfire Hazard	Prohibits the legislative body of a city or county from entering into a residential development agreement for property in a very high fire risk area as designated by a local agency or a fire hazard severity zone classified by the director of CAL FIRE.
AB 1439: Property Insurance Discounts	Wildfire Hazard	Requires residential or commercial property insurance policies to include a discount if a local government where the insured property is located funds a local wildfire protection or mitigation program.
AB 1500: Safe Drinking Water, Wildfire Prevention, Drought Preparation, Flood Protection, Extreme Heat Mitigation, and Workforce Development Bond Act of 2022.	Drought, Flood, Extreme Heat and Wildfire Hazards	Authorizes, upon voter approval, the issuance of bonds to finance projects for safe drinking water, wildfire prevention, drought preparation, flood protection, extreme heat mitigation, and workforce development programs.
AB 2140: General Plans—Safety Element	Hazard Mitigation Planning	Enables state and federal disaster assistance and mitigation funding to communities with compliant hazard mitigation plans.
AB 2800: Climate Change—Infrastructure Planning	Action Plan Development	Requires state agencies to take into account the impacts of climate change when developing state infrastructure.
Alquist-Priolo Earthquake Fault Zoning Act	Earthquake Hazard	Restricts construction of buildings used for human occupancy on the surface trace of active faults.
Board of Forestry and Fire Protection Fire Safe Regulations	Wildfire Hazard	The Fire Safe Regulations set the floor for fire safety standards for perimeters and access to residential, commercial, and industrial building construction.
California Department of Forestry and Fire Protection (CAL FIRE)	Wildfire Hazard	CAL FIRE has responsibility for wildfires in areas that are not under the jurisdiction of the Forest Service or a local fire organization.
California Department of Parks and Recreation	Wildfire Hazard	State Parks Resources Management Division has wildfire protection resources available to suppress fires on State Park lands.
California Department of Water Resources	Flood Hazard	Department of Water Resources is the state coordinating agency for floodplain management.
California Division of Safety of Dams	Dam Failure Hazard	Division of Safety of Dams monitors the dam safety program at the state level and maintains a working list of dams in the state.
California Environmental Quality Act	Action Plan Implementation	Establishes a protocol of analysis and public disclosure of the potential environmental impacts of development projects. Any project action identified in this plan will seek full California Environmental Quality Act compliance upon implementation.
California Fire Alliance	Wildfire Hazard	The alliance works with communities at risk from wildfires to facilitate the development of community fire loss mitigation plans.
California Fire Plan	Wildfire Hazard	This plan's goal is to reduce costs and losses from wildfire through pre-fire management and through successful initial response.
California Fire Safe Council	Wildfire Hazard	This council facilitates the distribution of National Fire Plan grants for wildfire risk reduction and education.
California Fire Service and Rescue Emergency Mutual Aid Plan	Wildfire Hazard	This plan provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support.
California General Planning Law	Hazard Mitigation Planning	This law requires every county and city to adopt a comprehensive long-range plan for community development, and related laws call for integration of hazard mitigation plans with general plans.
California Multi-Hazard Mitigation Plan	Hazard Mitigation Planning	Local hazard mitigation plans must be consistent with their state's hazard mitigation plan.
California Residential Mitigation Program	Earthquake Hazard	This program helps homeowners with seismic retrofits to lessen the potential for damage to their houses during an earthquake.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
California State Building Code	Action Plan Implementation	Local communities must adopt and enforce building codes, which include measures to improve buildings' ability to withstand hazard events.
Disadvantaged and Low-Income Communities Investments	Action Plan Funding	This is a potential source of funding for actions located in disadvantaged or low-income communities.
Division of the State Architect's AB 300 List of Seismically At-Risk Schools	Earthquake Hazard, Action Plan Development	The Division of the State Architect recommends that local school districts conduct detailed seismic evaluations of seismically at-risk schools identified in the inventory that was required by AB 300.
Governor's Executive Order S-13-08 (Climate Impacts)	Action Plan Implementation	This order includes guidance on planning for climate change in designated coastal and floodplain areas for new projects.
Office of the State Fire Marshal	Wildfire Hazard	This office has a wide variety of fire safety and training responsibilities.
Senate Bill 12: Local government: planning and zoning: wildfires.	Wildfire Hazard	Requires safety elements to be reviewed and updated as necessary to include a retrofit strategy to reduce the risk of property loss and damage during wildfires. Requires the planning agency to submit the adopted strategy to the Office of Planning and Research for inclusion in a central clearinghouse.
Senate Bill 92: Dam Emergency Action Plans; Public Resources Portion of Biennial Budget Bill	Dam Failure Hazard	This bill requires dams (except for low-risk dams) to have emergency action plans that are updated every 10 years and inundation maps updated every 10 years, or sooner if specific circumstances change.
Senate Bill 97: Guidelines for Greenhouse Gas Emissions	Action Plan Implementation	This bill establishes that greenhouse gas emissions and the effects of greenhouse gas emissions are appropriate subjects for California Environmental Quality Act analysis.
Senate Bill 99: General Plans: Safety Element: Emergency Evacuation Routes	Action Plan Implementation	This bill requires the safety element to include information to identify residential developments in hazard areas that do not have at least two emergency evacuation routes.
Senate Bill 379: General Plans: Safety Element—Climate Adaptation	Action Plan Implementation	This bill requires cities and counties to include climate adaptation and resiliency strategies in the safety element of their general plans.
Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements	Action Plan Implementation	Under this bill, review and revision of general plan safety elements are required to address only flooding and fires (not climate adaptation and resilience), and environmental justice is required to be included in general plans.
Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts	Wildfire Hazard	This bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.
Standardized Emergency Management System	Action Plan Implementation	Local governments must use this system to be eligible for state funding of response-related personnel costs.
Western Governors Association Ten-Year Comprehensive Strategy	Wildfire Hazard	This strategy implementation plan prepared by federal and Western state agencies outlines measures to restore fire-adapted ecosystems and reduce hazardous fuels.

6.2 LOCAL PLANS, REPORTS AND CODES

Plans, reports and other technical information were identified and provided directly by participating jurisdictions and stakeholders or were identified through independent research by the planning consultant. These documents were reviewed to identify the following:

- Existing jurisdictional capabilities.

- Needs and opportunities to develop or enhance capabilities, which may be identified within the local mitigation strategies.
- Mitigation-related goals or objectives, considered during the development of the overall goals and objectives.
- Proposed, in-progress, or potential mitigation projects and actions to be incorporated into the updated jurisdictional mitigation strategies.

The following local regulations, codes, ordinances, and plans were reviewed in order to develop complementary and mutually supportive goals, objectives, and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms:

- General plans (land use, housing, safety, and open space elements)
- Building codes
- Zoning and subdivision ordinances
- National Flood Insurance Program flood damage prevention ordinances
- Stormwater management plans
- Emergency management and response plans
- Land use and open space plans
- Climate action plans
- Community wildfire protection plans

6.3 LOCAL CAPABILITY ASSESSMENT

All participating jurisdictions compiled an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of a jurisdiction's mission, programs, and policies, and evaluates its capacity to carry them out. This assessment identifies potential gaps in the jurisdiction's capabilities.

The planning partnership views all core jurisdictional capabilities as fully adaptable to meet a jurisdiction's needs. Every code can be amended, and every plan can be updated. Such adaptability is itself considered to be an overarching capability. If the capability assessment identified an opportunity to add a missing core capability or expand an existing one, then doing so has been selected as an action in the jurisdiction's action plan, which is included in the individual annexes presented in Volume 2 of this plan.

Capability assessments for each planning partner are presented in the jurisdictional annexes in Volume 2. The sections below describe the specific capabilities evaluated under the assessment.

6.3.1 Legal and Regulatory Capabilities

Jurisdictions have the ability to develop policies and programs and to implement rules and regulations to protect and serve community members. Local policies are typically identified in a variety of community plans, implemented via a local ordinance, and enforced through a governmental body.

Jurisdictions regulate land use through the adoption and enforcement of zoning, subdivision, and land development ordinances, building codes, building permit ordinances, floodplain, and stormwater management ordinances. When effectively prepared and administered, these regulations can lead to hazard mitigation.

6.3.2 Fiscal Capabilities

Assessing a jurisdiction's fiscal capability provides an understanding of the ability to fulfill the financial needs associated with hazard mitigation projects. This assessment identifies both outside resources, such as grant-funding eligibility, and local jurisdictional authority to generate internal financial capability, such as through impact fees.

6.3.3 Administrative and Technical Capabilities

Legal, regulatory, and fiscal capabilities provide the backbone for successfully developing a mitigation strategy; however, without appropriate personnel, the strategy may not be implemented. Administrative and technical capabilities focus on the availability of personnel resources responsible for implementing all the facets of hazard mitigation. These resources include technical experts, such as engineers and scientists, as well as personnel with capabilities that may be found in multiple departments, such as grant writers.

6.3.4 National Flood Insurance Program Compliance

Flooding is the costliest natural hazard in the United States and, with the promulgation of recent federal regulation, homeowners throughout the country are experiencing increasingly high flood insurance premiums. Community participation in the National Flood Insurance Program (NFIP) opens up opportunity for additional grant funding associated specifically with flooding issues. Assessment of the jurisdiction's current NFIP status and compliance provides planners with a greater understanding of the local flood management program, opportunities for improvement, and available grant funding opportunities.

6.3.5 Public Outreach Capability

Regular engagement with the public on issues regarding hazard mitigation provides an opportunity to directly interface with community members. Assessing this outreach and education capability illustrates the connection between the government and community members, which opens a two-way dialogue that can result in a more resilient community based on education and public engagement.

6.3.6 Participation in Other Programs

Other programs, such as the Community Rating System, StormReady, and Firewise USA, can enhance a jurisdiction's ability to mitigate, prepare for, and respond to natural hazards. These programs indicate a jurisdiction's desire to go beyond minimum requirements set forth by local, state, and federal regulations in order to create a more resilient community. These programs complement each other by focusing on communication, mitigation, and community preparedness to save lives and minimize the impact of natural hazards on a community.

6.3.7 Development and Permitting Capability

Identifying previous and future development trends is achieved through a comprehensive review of permitting since completion of the previous plan and in anticipation of future development. Tracking previous and future growth in potential hazard areas provides an overview of increased exposure to a hazard within a community.

6.3.8 Adaptive Capacity

An adaptive capacity assessment evaluates a jurisdiction's ability to anticipate impacts from future conditions. By looking at public support, technical adaptive capacity, and other factors, jurisdictions identify their core capability for resilience against issues such as climate change. The adaptive capacity assessment provides jurisdictions with an opportunity to identify areas for improvement by ranking their capacity high, medium, or low.

6.3.9 Integration Opportunity

The assessment looked for opportunities to integrate this mitigation plan with the legal/regulatory capabilities identified. Capabilities were identified as integration opportunities if they can support or enhance the actions identified in this plan or be supported or enhanced by components of this plan. Planning partners considered actions to implement this integration as described in their jurisdictional annexes.

6.4 OPPORTUNITIES FOR INTEGRATION AND EXPANSION

The Tri-Valley planning partners have a high degree of core capability for funding, administrative, and technical functions, and public outreach with its existing plans and programs. These capabilities represent opportunities for future integration with this hazard mitigation plan. All four jurisdictions in the Tri-Valley planning area have begun this integration process with the concurrent planning efforts for this hazard mitigation plan and the ongoing implementation and update of their general plans, specific integration for each planning partner is located in their respective annex in Volume 2. The planning partners are fully committed to implementing and incorporating the information learned during the update process in an emergency management plan integration process. This hazard mitigation plan includes information that can be used for future updates such as those listed in Table 6-3 identifies how this hazard mitigation plan incorporates information from other plans and programs and how its findings may be integrated into future updates of those plans and programs.

Table 6-3. Integration of Hazard Mitigation Plan With Other Plans and Programs

Plan or Program	Integration With Hazard Mitigation Plan Update
[All jurisdictions] General Plan	Livermore—Review safety elements to ensure compliance with current guidance incorporating information and data learned during the update process Pleasanton—Review safety element to ensure compliance with current guidelines incorporating information and data learned during the update process Dublin—Review safety element to ensure compliance with current guidelines incorporating information and data learned during the update process DSRSD—Make appropriate updates as indicated into master plan incorporating information and data learned during the update process

Plan or Program	Integration With Hazard Mitigation Plan Update
[All jurisdictions] Climate Action Plan	Livermore—Incorporate data and findings from hazard mitigation plan to update plans and programs related to climate based on new information learned from this hazard mitigation plan update Pleasanton—Incorporate data and findings from hazard mitigation plan to update plans and programs related to climate based on new information learned from this hazard mitigation plan update Dublin—Incorporate data and findings from hazard mitigation plan to update plans and programs related to climate based on new information learned from this hazard mitigation plan update DSRSD—Update the District plan to be consistent with the changing climate conditions based on new information learned from this hazard mitigation plan update
Resilience Plan	Incorporate relevant hazard mitigation plan action items into resiliency plans
Emergency Response and Operation Plan	Livermore—Incorporate hazard risk ranking information to update emergency response and training and exercise plans Pleasanton—Incorporate hazard risk ranking information to update emergency response and training and exercise plans Dublin—Incorporate hazard risk ranking information to update emergency response and training and exercise plans; currently in process of updating the City's EOP and emergency management efforts DSRSD—Update related Emergency Action Plans (EAP) based on finding from the risk ranking assessment; currently updating the District's emergency management plans and responses
Capital Improvement Plan (CIP)	Livermore—Update CIP to include hazard mitigation plan related action items Pleasanton—Update CIP to include hazard mitigation plan related action items Dublin—Update CIP to include hazard mitigation plan related action items DSRSD—Update CIP to include hazard mitigation plan related action items
Municipal Codes	Livermore—Review and update existing codes and regulation (building, zoning, and planning) and incorporate possible related action items for future action Pleasanton—Review and update existing codes and regulation (building, zoning, and planning) and incorporate possible related action items for future action Dublin—Review and update existing codes and regulation (building, zoning, and planning) and incorporate possible related action items for future action DSRSD—Not applicable (special district)
Community Design Guidelines	Livermore—Update city guidelines as warranted based upon any new information or data gained while conducting hazard mitigation plan update Pleasanton—Update city guidelines as warranted based upon any new information or data gained while conducting hazard mitigation plan update Dublin—Update city guidelines as warranted based upon any new information or data gained while conducting hazard mitigation plan update DSRSD—Not applicable (special district)
Water Efficient Landscape Design Guidelines	Livermore—Make necessary regulation changes and updates based on changing climate and information derived from hazard mitigation plan update Pleasanton—Make necessary regulation changes and updates based on changing climate and information derived from hazard mitigation plan update Dublin—Make necessary regulation changes and updates based on changing climate and information derived from hazard mitigation plan update DSRSD—Collaborate with municipalities in service area to update landscape design and watering guidance
Stormwater Management Programs	Livermore—As an NFIP/CRS community, make any necessary updated changes in plans and programs based on information derived from the flooding information in the hazard mitigation plan Pleasanton—As an NFIP/CRS community, make any necessary updated changes in plans and programs based on information derived from the flooding information in the hazard mitigation plan Dublin—Make any necessary updated changes in plans and programs based on information derived from the flooding information in the hazard mitigation plan DSRSD—Update related EAPs and collaborate with municipalities in the service area on stormwater-related programs based on information derived from hazard mitigation plan update

Plan or Program	Integration With Hazard Mitigation Plan Update
Water System Vulnerability Assessments	Livermore—Work with Public Works Department to ensure assessments are consistent with ever-changing water availability and the security of water delivery program Pleasanton—Work with Public Works Department to ensure assessments are consistent with ever-changing water availability and the security of water delivery program Dublin—Collaborate with DSRSD on water deliver program and system security DSRSD—Work with service area municipalities, including Dublin, on the delivery and security of the water system
Master Fire Protection Plans	Livermore—Continue work with the Livermore Pleasanton Fire Department (LPFD) to ensure the protection, prevention and suppression plans are current and that the LPFD collaborates with the building department on building plan reviews to be consisted with the current state building code Pleasanton— Continue work with the LPFD to ensure the protection, prevention and suppression plans are current and that the LPFD collaborates with the building department on building plan reviews to be consisted with the current state building code Dublin—Continue work with the Alameda County Fire Department (ACFD) to ensure protection, prevention, and suppression plans are current and that the ACFD collaborates with the planning department on plan reviews to be consistent with the current state building code DSRSD—Not applicable (special water district)

EXHIBIT A

Tri-Valley Local Hazard Mitigation Plan

PART 2—RISK ASSESSMENT

7. RISK ASSESSMENT METHODOLOGY

The risk assessments in this plan describe the risks associated with each identified hazard of concern. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - A summary of past events that have impacted the planning area
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity descriptions
  - Warning time likely to be available for response.
- **Determine exposure to each hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and Hazus were used for this assessment for the dam failure, earthquake, flood, and tsunami hazards. Outputs similar to those from Hazus were generated for other hazards, using data generated through GIS.

The risk assessments performed for this plan evaluated risk for all participating incorporated areas. The assessments did not extend to the portion of the Dublin San Ramon Services District outside the three cities, because the District does not have the same regulatory authorities as cities in terms of mitigating risks to people and development.

7.1 RISK ASSESSMENT TOOLS

7.1.1 Mapping

National, state, and local databases were reviewed to locate spatially based data relevant to this planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent and location of identified hazards when such data was available. These maps are included in the hazard profile chapters of this document and the jurisdiction-specific annexes in Volume 2. Information regarding the data sources and methodologies employed in these mapping efforts is located in Appendix C.

7.1.2 Hazus

Overview

FEMA developed the standardized GIS-based software program Hazards U.S. (Hazus) to estimate losses caused by earthquakes, hurricanes and floods and identify areas that face the highest risk and potential for loss. Hazus is used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facilities, and transportation and utility infrastructure, and multiple models to estimate potential losses from natural disasters. The program maps and calculates hazard data and damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that they can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

For flood-related hazards, Hazus calculates losses to structures due to inundation based on depth of flooding and type of structure. Using historical flood insurance claim data, Hazus estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. The Hazus analysis also estimates the quantity of debris that would be caused by the flooding.

For earthquake, once the location and size of a hypothetical earthquake are identified, Hazus estimates the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up.

Levels of Detail for Evaluation

Hazus provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. Level 2 estimates of losses require detailed information on local geology, hydrology, hydraulics, building inventory, utilities, and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

7.2 RISK ASSESSMENT APPROACH

7.2.1 Hazard Profile Development

Hazard profiles were developed through web-based research and review of previously developed reports and plans, including community general plans and state and local hazard mitigation plans. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others.

7.2.2 Exposure and Vulnerability

The risk assessment for this plan determined exposure and vulnerability to identified hazards of concern for the overall planning area and individual cities. The approach used for each hazard is described below.

Flood, Dam Failure, and Earthquake

Exposure and vulnerability to flood, dam failure, and earthquake were evaluated using Hazus as follows:

- **Flood**—A Level 2 user-defined analysis was performed for general building stock in flood zones and for critical facilities. Current flood mapping for the planning area was used to delineate flood hazard areas and estimate potential losses from the 1-percent-annual-chance and 0.2-percent-annual-chance flood events. To estimate damage that would result from a flood, Hazus uses pre-defined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data and known property replacement cost values, dollar-value estimates of damage were generated.
- **Dam Failure**—A Level 2 user-defined analysis was performed for general building stock and critical facilities located in the dam failure hazard area. A depth grid was generated using a combined dam failure inundation area and uploaded into the Hazus riverine flood model. By inputting depth data and known property replacement cost values, dollar-value estimates of damage were generated.
- **Earthquake**—A Level 2 analysis was performed to assess earthquake exposure and vulnerability for the following scenario events:
  - A Magnitude 6.86 event on the Calaveras North Fault
  - A Magnitude 6.86 event on the Greenville North Fault
  - A Magnitude 7.05 event on the Hayward Fault (the USGS scenario representing this event is called the HayWired scenario)
  - A Magnitude 6.5 event on the Las Positas Fault
  - A Magnitude 6.5 event on the Mount Diablo Thrust South Fault

All Other Assessed Hazards

Historical datasets were not adequate to model future losses for most of the hazards of concern. However, areas and inventory susceptible to some of the hazards of concern were mapped by other means, and exposure was evaluated. A qualitative analysis was conducted for other hazards using the best available data and professional judgment.

7.3 SOURCES OF DATA USED IN MODELING

7.3.1 Building and Cost Data

Replacement cost values and detailed structure information derived from parcel and tax assessor data provided by Alameda County were loaded into Hazus. When available, an updated inventory was used in place of the Hazus defaults for critical facilities.

Replacement cost is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in the 2022 edition of *RS Means Square Foot Costs*. It is calculated using the RS Means square foot cost for a structure, which is based on the Hazus occupancy class (i.e., multi-family residential or commercial retail trade), multiplied by the square footage of the structure from the tax assessor data. The construction class and number of stories for single-family residential structures also factor into determining the square-foot costs.

7.3.2 Hazus Data Inputs

The following hazard datasets were used for the Hazus Level 2 analysis conducted for the risk assessment:

- **Flood**—The effective Digital Flood Insurance Rate Map (DFIRM) for the planning area was used to delineate flood hazard areas and estimate potential losses from the 1-percent-annual-chance and 0.2-percent-annual-chance flood events.
- **Dam Failure**—Dam failure inundation areas were downloaded from the California Department of Water Resources for the Del Valle and Patterson Dams.
- **Earthquake**—Earthquake shake maps prepared by the USGS were used for the analysis of this hazard. Data from the California Geological Survey on National Earthquake Hazard Reduction Program soil types and liquefaction zones were also integrated into the Hazus model.

7.3.3 Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others. Data sources for specific hazards were as follows:

- **Landslide**—Susceptibility to deep-seated landslides data were provided by the California Geological Survey. Areas categorized as very high susceptibility, high susceptibility, and medium susceptibility were used in the exposure analysis.
- **Wildfire**— Wildfire hazard severity zones from the California Department of Forestry and Fire Protection were used in the exposure analysis.

7.3.4 Data Source Summary

Table 7-1 summarizes the data sources used for the risk assessment for this plan.

Table 7-1. Risk Assessment Data Sources

Data	Source	Date	Format
Parcels (included county tax assessor information such as use code, year built, and building square footage)	Alameda County, City of Pleasanton, City of Dublin	2022	Digital (GIS)
Building Outlines	City of Livermore, City of Pleasanton, City of Dublin	2022	Digital (GIS)
Building replacement (square foot) costs	RS Means	2022	Digital (pdf)
California State dam breach inundation maps (inundation boundaries and depth grids)	California Department of Water Resources	2019	Digital (GIS)
ShakeMap – Calaveras (No) M6.86	USGS	2017	Digital (GIS)
ShakeMap – Greenville (No) M6.86	USGS	2017	Digital (GIS)
ShakeMap – HayWired M7.05	USGS	2018	Digital (GIS)
ShakeMap – Las Positas M6.5	USGS	2017	Digital (GIS)
ShakeMap – Mount Diablo Thrust South M6.5	USGS	2017	Digital (GIS)
National Earthquake Hazards Reduction Program soil mapping (VsMapV3_Geology)	California Department of Conservation	2015	Digital (GIS)
Liquefaction Susceptibility	USGS	Unknown	Digital (GIS)
Digital Flood Insurance Rate Map (DFIRM) – Alameda County effective 12/21/2018	FEMA	2018	Digital (GIS)
Susceptibility to deep-seated landslides	California Geological Survey	2011	Digital (GIS)
Police Stations/Law Enforcement	City of Pleasanton, Alameda County, Hazus	Provided 2022	Digital (GIS)
Fire Stations/Firefighting Resources	City of Pleasanton, City of Livermore, Alameda County Fire	Provided 2022	Digital (GIS)
Schools	City of Pleasanton, Alameda County	Provided 2022	Digital (GIS)
Historic/Cultural Resources	City of Livermore, City of Dublin	Provided 2022	Digital (GIS)
Public Facilities	City of Pleasanton	Provided 2022	Digital (GIS)
Senior Centers	City of Dublin	Provided 2022	Digital (GIS)
Potable Water Facilities	Dublin San Ramon Services District	Provided 2022	Digital (GIS)
Water Utilities	City of Pleasanton, City of Livermore	Provided 2022	Digital (GIS)
Wastewater Treatment Plants	CA State Geoportal	Downloaded 2022	Digital (GIS)
Dublin San Ramon Services District Wastewater Facilities	Dublin San Ramon Services District	Provided 2022	Digital (GIS)
Sewer System Utilities	City of Pleasanton, City of Livermore	Provided 2022	Digital (GIS)
Recycled Water Facilities	Dublin San Ramon Services District	Provided 2022	Digital (GIS)
Community Shelters	City of Pleasanton	Provided 2022	Digital (GIS)
Hospitals	Alameda County	Provided 2022	Digital (GIS)
Medical Facilities	Hazus	Downloaded 2022	Digital (GIS)
Veterans Health Medical Facilities	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
Pharmacies	Open Street Map	Downloaded 2022	Digital (GIS)
EMS Stations	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
Health Facilities	California Department of Public Health	Downloaded 2022	Digital (GIS)

Data	Source	Date	Format
California Power Plants	CA State Geoportal, Alameda County	Downloaded 2022	Digital (GIS)
Natural Gas Stations	CA Energy Commission	Downloaded 2022	Digital (GIS)
National Gas Pipelines	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
Wireless Facilities	Homeland Infrastructure Foundation-Level Data, Alameda County, City of Dublin	Downloaded and Provided 2022	Digital (GIS)
Broadcast Facilities (TV and Radio)	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
Banks	Homeland Infrastructure Foundation-Level Data	Downloaded 2022	Digital (GIS)
Highways	City of Livermore, City of Dublin	Provided 2022	Digital (GIS)
Local Streets	City of Livermore, City of Dublin	Provided 2022	Digital (GIS)
Railroad Facilities	California Transportation, City of Dublin	Downloaded and Provided 2022	Digital (GIS)
Airports	California Transportation, Alameda County	Downloaded and Provided 2022	Digital (GIS)
Bus Facilities	City of Dublin, City of Livermore, California Sate Geoportal	Downloaded and Provided 2022	Digital (GIS)
Port Facilities	Homeland Infrastructure Foundation-Level Data, California Transportation	Downloaded 2022	Digital (GIS)
Bridges	California Transportation, City of Livermore, City of Dublin	Downloaded and Provided 2022	Digital (GIS)
Hazardous Materials Facilities	City of Livermore, EPA	Downloaded and Provided 2022	Digital (GIS)

7.4 LIMITATIONS

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event
- The uncertain spatial accuracy of the dam inundation area data.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, the planning partners will collect additional data to assist in estimating potential losses associated with other hazards.

8. DAM FAILURE

8.1 GENERAL BACKGROUND

8.1.1 Definition

A dam is an artificial barrier that can store water, wastewater, or liquid-borne materials for many reasons—flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control. Many dams fulfill a combination of these functions. In California, dams are regulated by the State of California Division of Safety of Dams. Additional regulatory oversight of dams is described in Appendix B. The California Water Code defines a dam as any artificial barrier, together with appurtenant works, that does or may impound or divert water, and that meets either of the following conditions:

- Is 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier (or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse) to the maximum possible water storage elevation
- Has an impounding capacity of 50 acre-feet or more

Dams can be classified according to their purpose, the construction material or methods used, their slope or cross-section, the way they resist the force of the water pressure, or the means used for controlling seepage. Materials used to construct dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, plastic, rubber, and combinations of these.

8.1.2 Causes of Dam Failure

Partial or full failure of dams has the potential to cause massive destruction to the ecosystems and communities located downstream. Partial or full failure can occur as a result of one or a combination of the following reasons (Federal Emergency Management Agency 2016):

- Overtopping caused by floods that exceed the dam capacity (inadequate spillway capacity)
- Prolonged periods of rainfall and flooding
- Deliberate acts of sabotage (terrorism)
- Structural failure of materials used in dam construction
- Movement and/or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate or negligent operation, maintenance, and upkeep

- Failure of upstream dams on the same waterway
- Earthquake (liquefaction/landslides).

Many dam failures in the United States have been secondary results of other disasters. The most common causes are earthquakes, landslides, extreme storms, equipment malfunction, structural damage, foundation failures, and sabotage. Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

8.1.3 Residual Risk

Dams present a flood risk called “residual risk” that represents flooding that can occur even without a failure at the dam. A storm event that is more severe than the design-storm can result in overtopping, inundation upstream of the dam, or failure of the dam or spillway, potentially resulting in rapid water release (FEMA 2018).

8.1.4 Downstream Hazard Potential Classifications

California’s Division of Safety of Dams has developed a classification system for the downstream hazard potential of state-jurisdiction dams, as shown on Table 8-1. This system is modified from federal guidelines, which recommend three-tier classification. The California system adds a fourth hazard classification of “extremely high.”

Table 8-1. State of California Downstream Hazard Potential Classification

Downstream Hazard Potential Classification	Potential Downstream Impacts on Life and Property
Low	No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner’s property.
Significant	No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
High	Expected to cause loss of at least one human life
Extremely High	Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

S*ource:* (California Employment Development Department 2021)

8.1.5 Planning Requirements

State of California

All dams whose inundation areas may impact the planning area have emergency action plans (EAPs) on file. The EAPs must include the following (Cal OES 2022):

- Emergency notification flow charts
- Information on a four-step response process
- Description of agencies’ roles and actions in response to an emergency incident
- Description of actions to be taken in advance of an emergency
- Inundation maps
- Additional information such as revision records and distribution lists.

After the EAPs are approved by the state, the law requires dam owners to send the approved EAPs to relevant stakeholders. Local public agencies can then adopt emergency procedures that incorporate the information in the EAP in a manner that conforms to local needs and includes methods and procedures for alerting and warning the public and other response and preparedness related items (Cal OES 2022):

Federal Energy Regulatory Commission

Dams under the jurisdiction of the Federal Energy Regulatory Commission (FERC) also have specified planning requirements. FERC has the largest dam safety program in the United States. It cooperates with many federal and state agencies to ensure and promote dam safety and, more recently, homeland security. FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans are designed to serve as an early warning system if there is a potential for, or a sudden release of water from, a dam failure or accident to the dam. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows and procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that in emergency situations everyone knows what to do, thus saving lives and minimizing property damage.

8.1.6 Secondary Hazards

Dam failure can cause severe downstream flooding depending on the magnitude of the failure. Other potential secondary hazards of dam failure include landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat.

8.2 HAZARD PROFILE

8.2.1 Past Events

No dam failures have been recorded in the planning area. However, according to the *2018 State of California Multi-Hazard Mitigation Plan*, there have been a small number of dam failures elsewhere in the state in the past 50 years. The most catastrophic event in the state was the failure of the St. Francis Dam in Los Angeles County, which failed in 1928 and killed an estimated 450 people. According to the *2021 Alameda County Local Hazard Mitigation Plan*, there have been three failures in the county:

- **1905 Piedmont #1 Dam Failure**—An earthen dam built in Oakland in 1903 had an outlet pipe sheared off from its core wall. This was a minor incident; no deaths occurred as a result.
- **1918 Calaveras Dam Failure**—The San Francisco Public Utilities Commission-owned Calaveras Dam, located in Alameda County, failed during construction in 1918. A landslide damaged the upstream shell of the dam and destroyed the dam's outlet tower.
- **2015 Rubber Dam 3 Failure**—In 2015, the inflatable dam on Alameda Creek (Rubber Dam 3) failed due to vandalism, releasing nearly 50 million gallons of water from the community's water into the San Francisco Bay. The water was supposed to go into the Niles Cone Groundwater Basin where residents and businesses from the Cities of Newark, Union City and Fremont could access drinking water.

There is a possibility that the planning area experienced the direct or indirect impacts of these events, though no specific information on local impact is available.

8.2.2 Location

Dams With Potential to Affect Planning Area

According to the California Division of Safety of Dams, as of September 2021, there were 23 dams in Alameda County, of which 18 were classified as high or extremely high hazard. Of these, the Del Valle and Patterson Dams have the potential to impact the planning area if a failure were to occur.

Del Valle Dam

The Del Valle Dam, located outside the planning area in unincorporated Alameda County on Arroyo Del Valle, a tributary of Alameda Creek, was completed in 1968 by the California Department of Water Resources. The dam is outside the planning area, about 5 miles southeast of central Livermore. This earth dam receives stormwater runoff from an area of approximately 150 square miles. The maximum spillway peak discharge is 7,000 cfs. Construction of the dam created Lake Del Valle, which provides water storage, Alameda Creek flood control, and regulatory storage for a portion of water delivered through the South Bay Aqueduct. The dam is in satisfactory condition as of September 2017, which means it has no recognized safety deficiencies. It is the only flood control dam in the Livermore Valley. The dam has a storage capacity of 77,100 acre-feet of water (California Department of Water Resources 2021b). Table 8-2 provides information on the Del Valle Dam.

Table 8-2. Del Valle Dam Characteristics

Hazard Class[a]	Extremely High
Water Course	Arroyo Valle
Owner	California Department of Water Resources
Year Built	1968
Dam Type	Earth
Crest Length (feet)	880
Height (feet)	222
Storage Capacity (acre-feet)	77,100
Drainage area (sq. mi.)	146
Inundation Area (sq. mi.)	97.98

a. Hazard classification as defined in Table 8-1.
Source: (California Department of Water Resources 2021b)

Patterson Dam

The Patterson Dam is listed as high hazard and is owned by the California Department of Water Resources. It was built in 1962 and was constructed as part of the California State Water Project. It is maintained and operated by the California Department of Water Resources. The Project is also operated to improve water quality in the Delta, control Feather River flood waters, provide recreation, and enhance fish and wildlife. Table 8-3 provides information on the Patterson Dam. The dam is outside the planning area, less than a mile east of the eastern city limit of Livermore in unincorporated Alameda County.

Table 8-3. Patterson Dam Characteristics

Hazard Class[a]	High
Water Course	Off stream
Owner	California Department of Water Resources
Year Built	1962
Dam Type	Earth
Crest Length (feet)	1,275
Height (feet)	39
Storage Capacity (acre-feet)	104
Drainage area (sq. mi.)	0
Inundation Area (sq. mi.)	Information not available

a. Hazard classification as defined in Table 8-1.
Source: (California Department of Water Resources 2021b)

Mapped Inundation Areas

Dam failure inundation mapping in support of emergency action planning is available for the Del Valle and Patterson dams. The combination of the inundation areas for the two dams was used for the risk assessment of the dam failure hazard in this plan. Figure 8-1 shows the combined inundation area.

8.2.3 Frequency

Dam failures are infrequent and usually coincide with the events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. There is a “residual risk” associated with dams; residual risk is the risk that remains after safeguards have been implemented. The residual risk is associated with events beyond those that the facility was designed to withstand. However, the probability of occurrence of any type of dam failure event is considered to be low in today’s regulatory and dam safety oversight environment.

8.2.4 Severity

The Patterson Dam is rated by the state as a high hazard dam, which means that its failure is likely to result in the loss of at least one life. The Del Valle Dam is rated as extremely high hazard, which means that its failure would likely cause considerable loss of human life or would inundate an area with a population of 1,000 or more. Based on the modeling of the combined inundation areas, dam inundation flood depths can range from shallow (3 feet or less) to deep (10 feet or more).

8.2.5 Warning Time

Warning time for dam failure depends on the cause of the failure. In events of extreme precipitation, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, it is possible that there would be no warning time. A dam’s structural type also affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections formed during dam construction are forced apart by the escaping water. The time for breach formation ranges from a few minutes to a few hours. Alameda County and the Cities of Dublin, Livermore and Pleasanton have established protocols for emergency warning and response through adopted emergency operations plans. These protocols are tied to the emergency action plans created by the dam owners.

EXHIBIT A

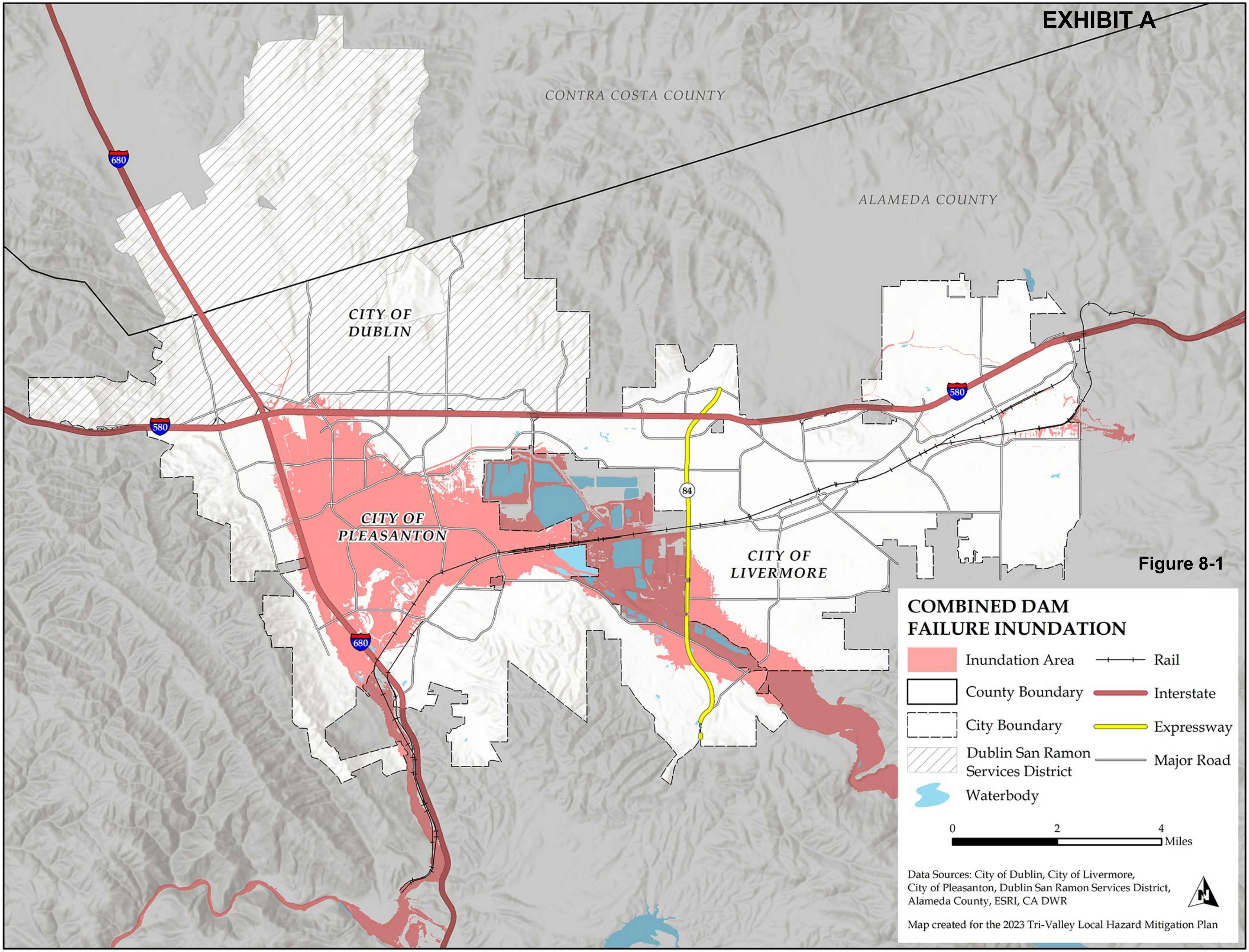


Figure 8-1

8.3 EXPOSURE

8.3.1 Population

All populations living in a dam failure inundation zone are exposed to the risk of a dam failure. Figure 8-2 shows the estimated population living in the evaluated inundation area compared to total population for each planning area city. The exposed population represents 16.9 percent of the total planning area population.

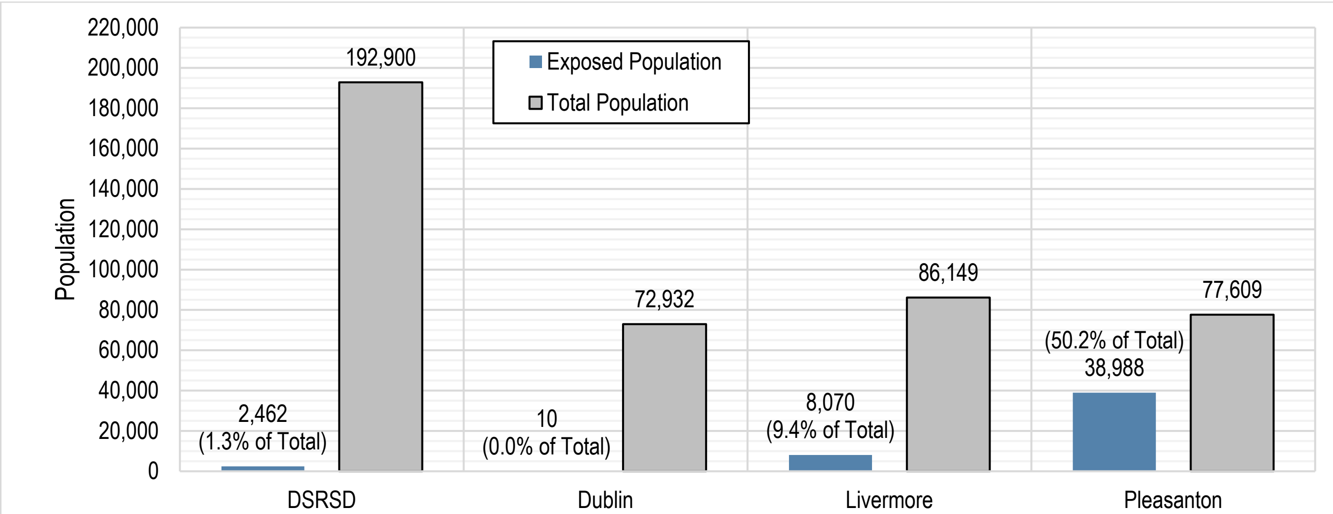


Figure 8-2. Population Exposed to Dam Failure and Total Population, by Jurisdiction

8.3.2 Property

Figure 8-3 summarizes the number and value of planning area buildings within the mapped dam failure inundation zone. Figure 8-4 shows the estimated exposed total value as a percentage of the total replacement value in each city and in the overall planning area. Figure 8-5 shows the distribution by occupancy class of buildings in the inundation area.

8.3.3 Critical Facilities

GIS analysis determined that 299 of the planning area's 1,161 critical facilities (26 percent) are in the evaluated inundation area. Figure 8-6 shows the distribution of exposed critical facilities by category and jurisdiction.

8.3.4 Environment

The environment would be exposed to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways. This could result in destruction of downstream habitat and could have detrimental effects on many species of animals, especially endangered species such as salmon. The extent of the vulnerability of the environment is the same as the exposure of the environment.

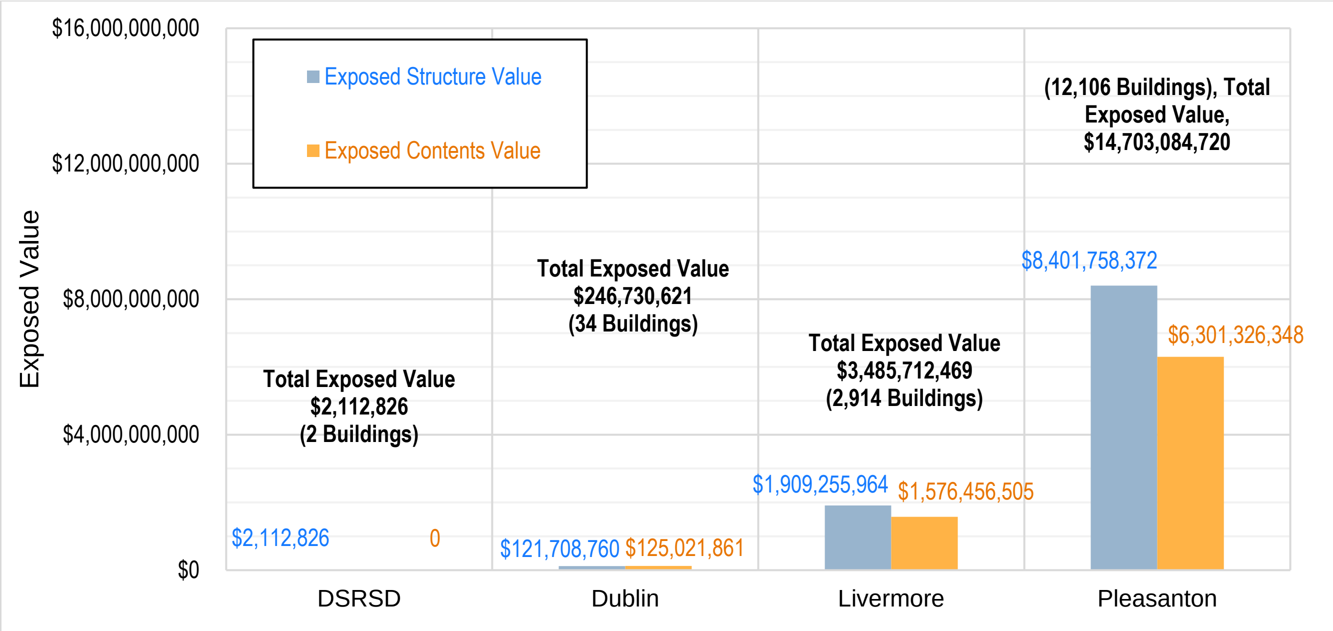


Figure 8-3. Number and Exposed Value of Buildings in Dam Failure Inundation Area

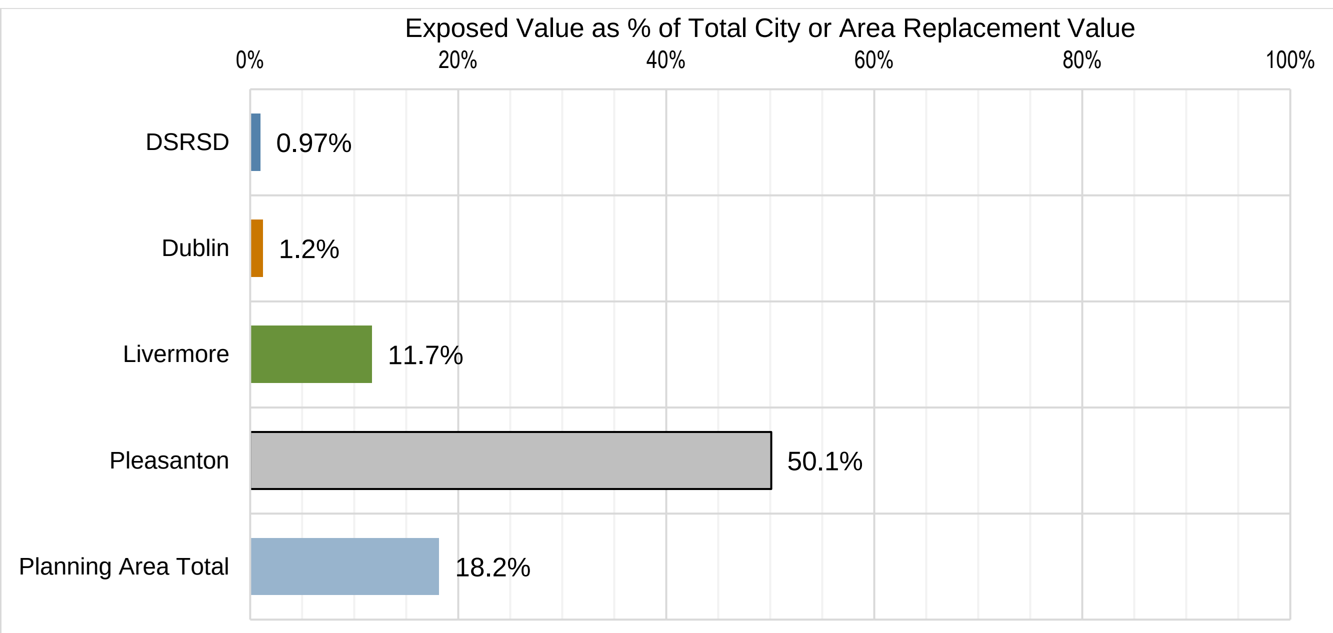


Figure 8-4. Total Value in Dam Failure Inundation Area as % of Total Replacement Value, by Jurisdiction

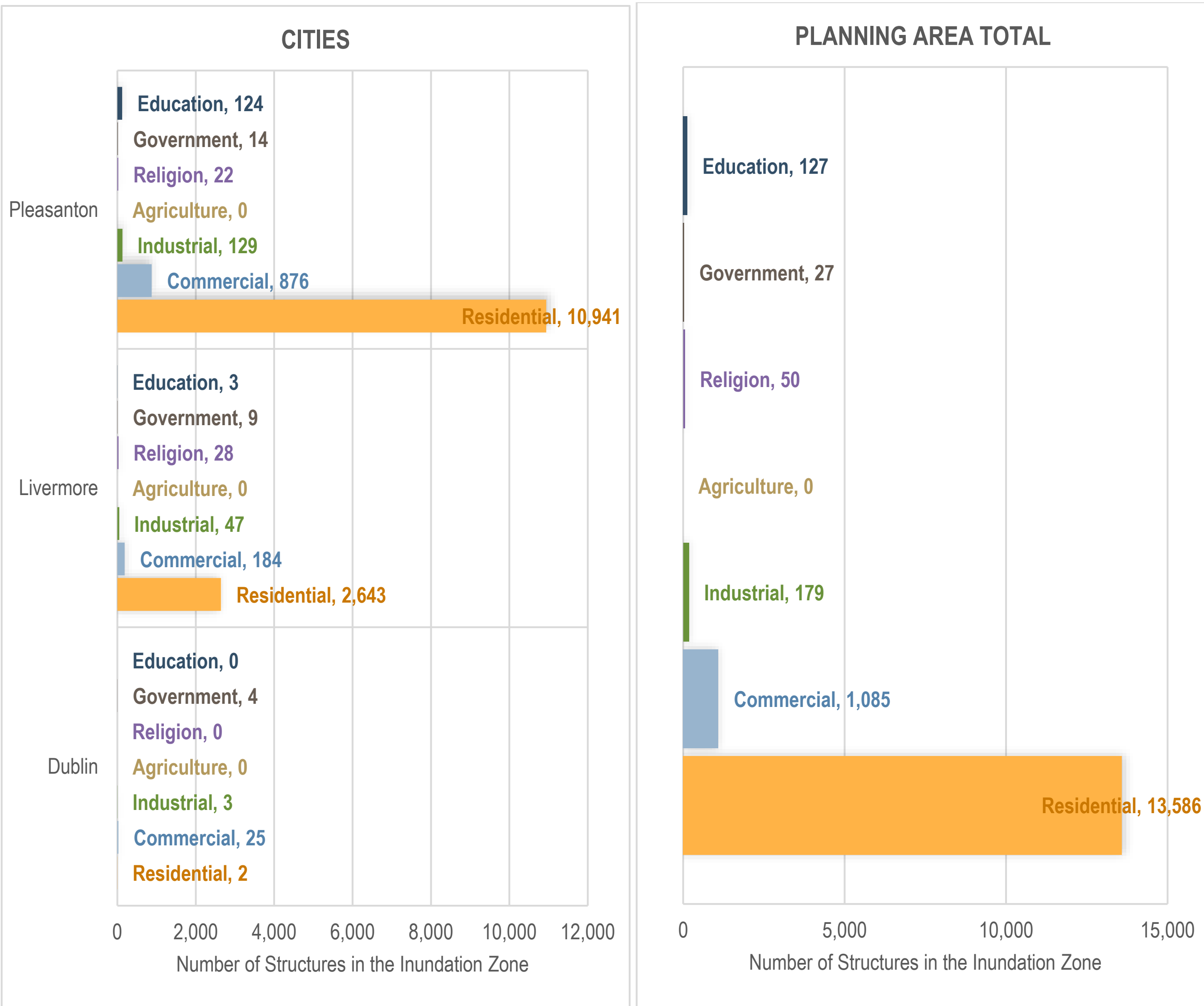


Figure 8-5. Number of Structures within the Dam Failure Inundation Zone, by Occupancy Class

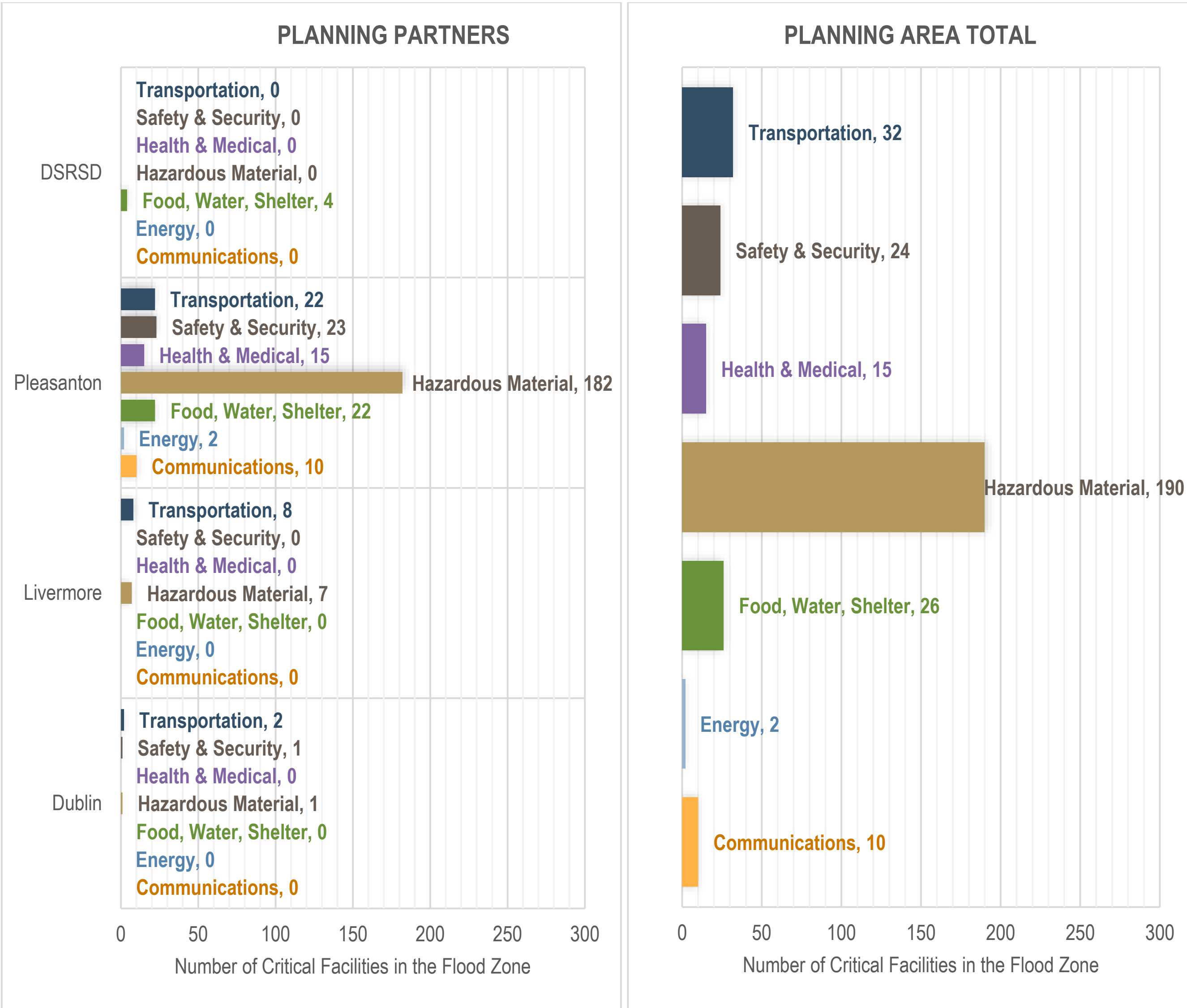


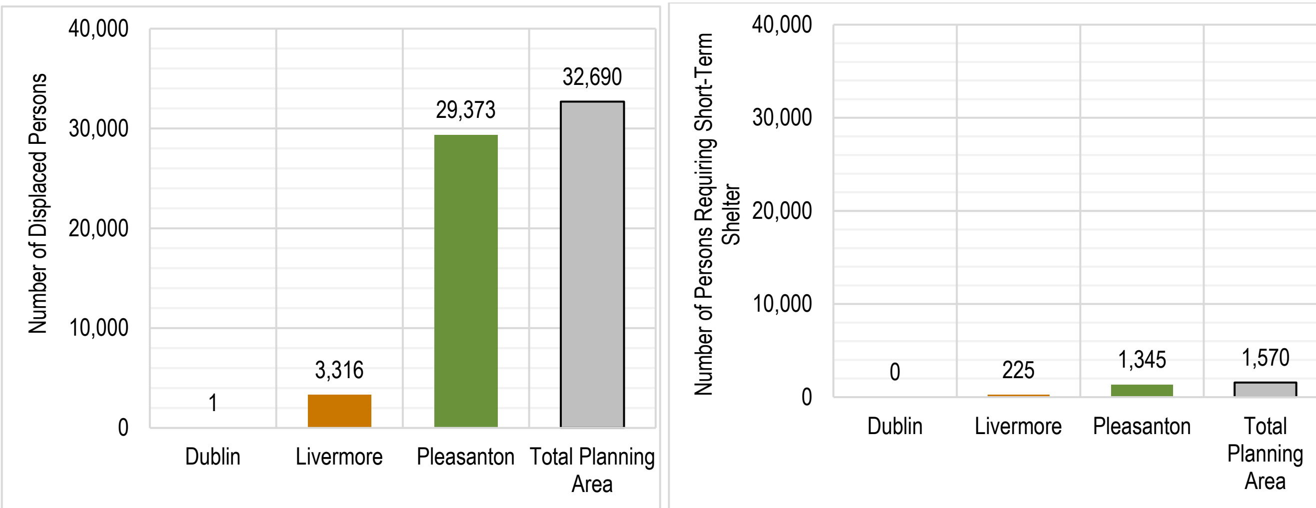
Figure 8-6. Critical Facilities within the Dam Failure Inundation Area, by Jurisdiction

8.4 VULNERABILITY

8.4.1 Population

Displacement and Shelter Requirements

Impacts on population in the planning area were estimated for the evaluated dam failure inundation area. Estimates for each city and the total planning area are presented in Figure 8-7. Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area before floodwaters arrive. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television, radio emergency warning system, siren, cell phone alert or in-person contact.



DSRSD does not have any responsibility for sheltering

Figure 8-7. Estimated Persons Displaced or Requiring Short-Term Shelter Due to Dam Failure

Vulnerable Populations

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. Socially vulnerable populations include the very young, the elderly, and those experiencing poverty. In the cities of Dublin, Livermore, and Pleasanton, socially vulnerable communities specifically include local senior populations (Livermore Senior Center, Dublin Senior Center, and Pleasanton Senior Center), the unhoused, and individuals with disabilities. These socially vulnerable populations are most susceptible based on many factors, including their physical and financial ability to react or respond during a hazard and the ability to be self-sustaining for prolonged periods of time after an incident because of limited ability to stockpile supplies. Socially vulnerable populations may live in areas with substantial population density, inhibiting their ability to escape from the inundation area to safety in enough time. At-risk communities such as those with disabilities or the local senior population may face difficulty evacuating from the senior centers in Dublin, Pleasanton, and Livermore. Vulnerable populations may also lack adequate warning from television, radio emergency warning systems, or alert and warning messages released on social media due to a lack of access to these tools caused by disparities in economic opportunity and socioeconomic status. The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living in areas of potential inundation. DSRSD overlies the City of Dublin and a small portion of the City of Pleasanton. Socially vulnerable population within Dublin would be the same as that for DSRSD. Dublin and DSRSD collaborate on programs for the affected vulnerable populations.

An especially vulnerable population is found among those experiencing homelessness. Not only do those experiencing homelessness face an inequitable lack of access to resources and basic needs, they also face an exceptional risk of injury due to common shelter locations. Those experiencing homelessness often set up shelter under bridges near or along waterways, presenting an exceptional threat to their lives in the event of dam failure and subsequent flooding.

8.4.2 Property

Vulnerable properties are those closest to the dam failure inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. It is estimated that there could be up to $5.0 billion of loss from a dam failure affecting the planning area. This represents 27.0 percent of the total exposure within the inundation area, or 6.3 percent of the total assessed value of the planning area. Figure 8-8 summarizes the loss estimates for dam failure by damage type and jurisdiction. The estimated number of buildings that would be impacted is shown in Figure 8-9. The risk assessment also estimated the amount of debris that would be generated by a dam failure in the planning area, as summarized in Figure 8-10.

8.4.3 Critical Facilities

Hazus estimated damage to critical facilities in the dam failure inundation zones as shown in Figure 8-11. Typical vulnerabilities of affected critical facilities include the following:

- Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues and significant disruption to travel. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge.
- Utilities such as overhead power lines, cable, and phone lines in the inundation zone could be vulnerable. If phone lines were lost, significant communication issues may occur in the planning area due to limited cell phone reception in many areas.
- Emergency response would be hindered due to the loss of transportation routes the inundation zone.
- Some protective-function facilities in the safety and security category located in the inundation zone could be lost.
- Recovery time to restore many critical functions after an event may be lengthy.

8.4.4 Environment

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce foreign elements into local waterways, resulting in destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species. The extent of the vulnerability of the environment is the same as the exposure of the environment.

8.5 FUTURE TRENDS IN DEVELOPMENT

All land use decision-making is guided by the goals, policies and implementation measures contained in the land use elements of Dublin, Livermore and Pleasanton’s general plans. The Dublin general plan’s seismic safety element, Livermore general plan’s public safety element, and Pleasanton’s general plan’s public safety element establish standards and plans for protecting the community from hazards. Most of the areas vulnerable to the worst impacts from a dam failure correspond to the flood hazard areas. Flood-related policies in the general plans will help to reduce the risk associated with the dam failure hazard for all future development in the planning area.

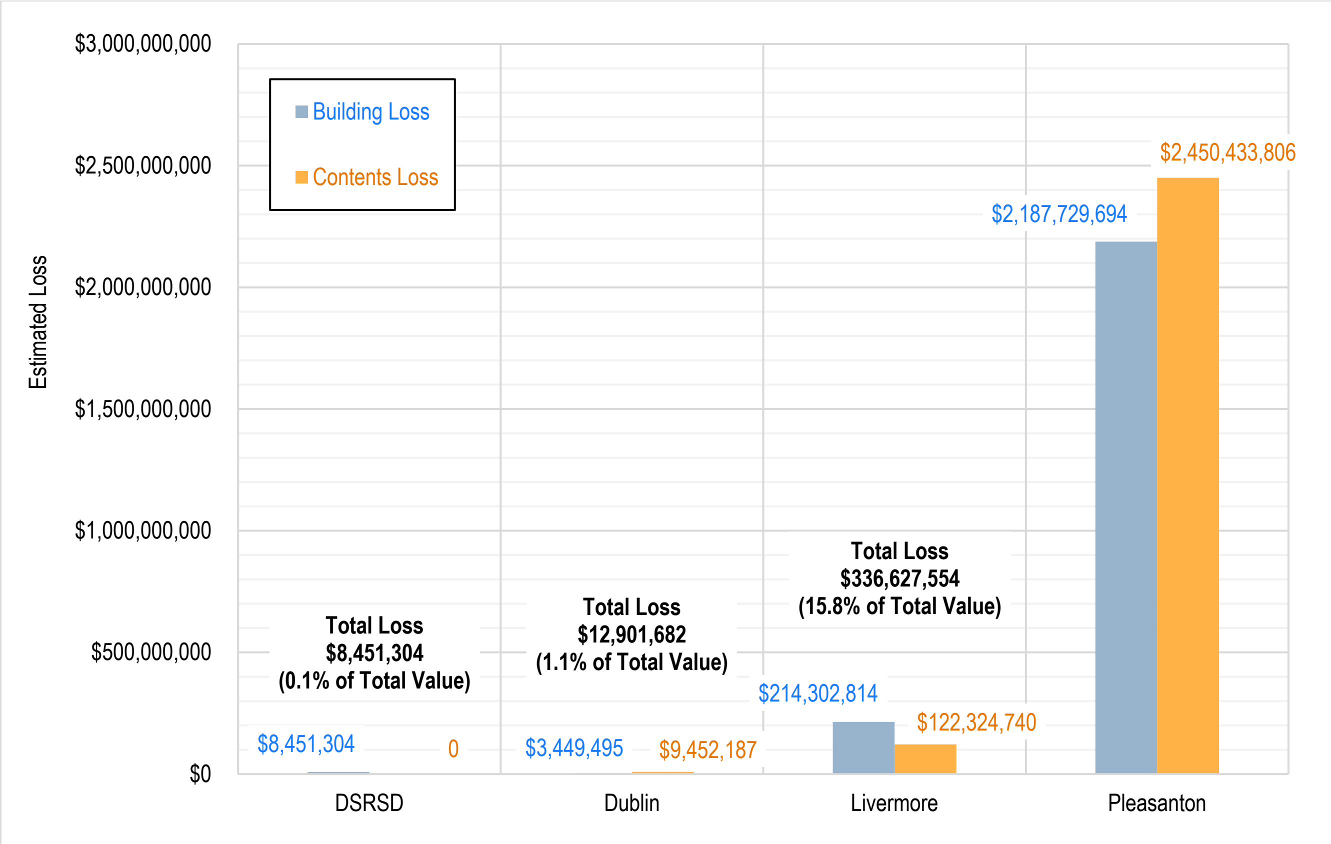
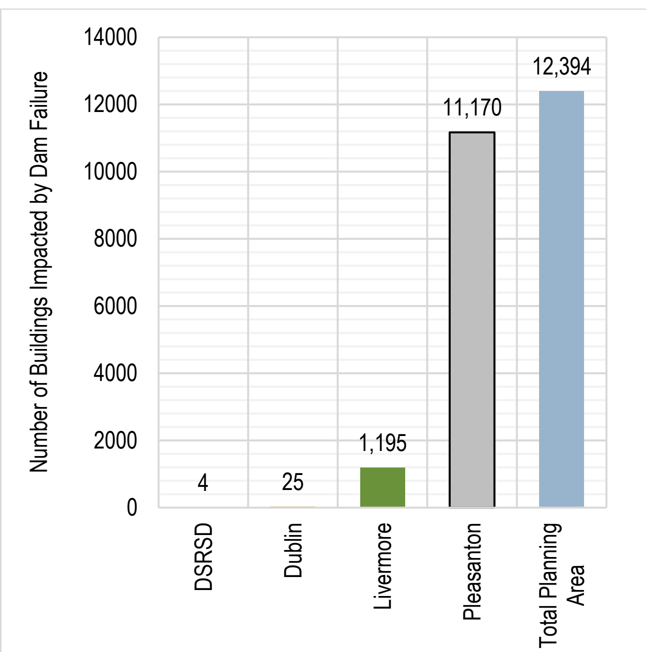


Figure 8-8. Loss Estimates for Dam Failure



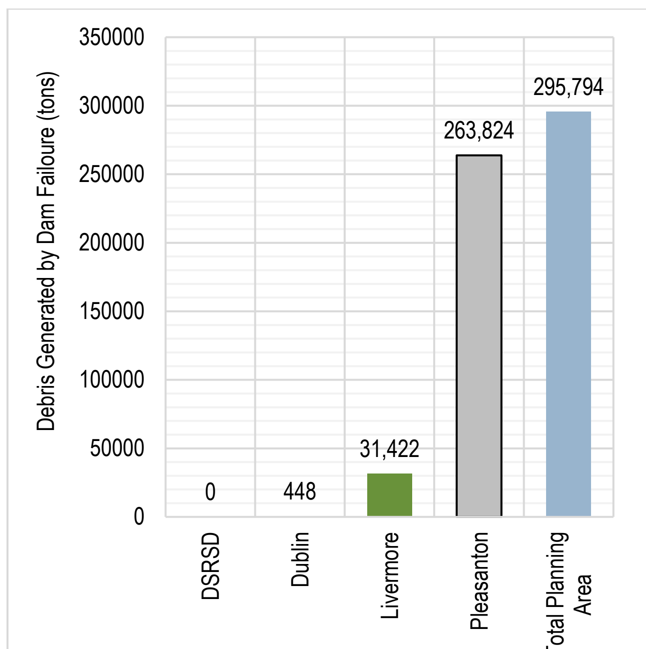


Figure 8-9. Number of Buildings Impacted by Dam Failure

Figure 8-10. Estimated Structural Debris Generated by Dam Failure

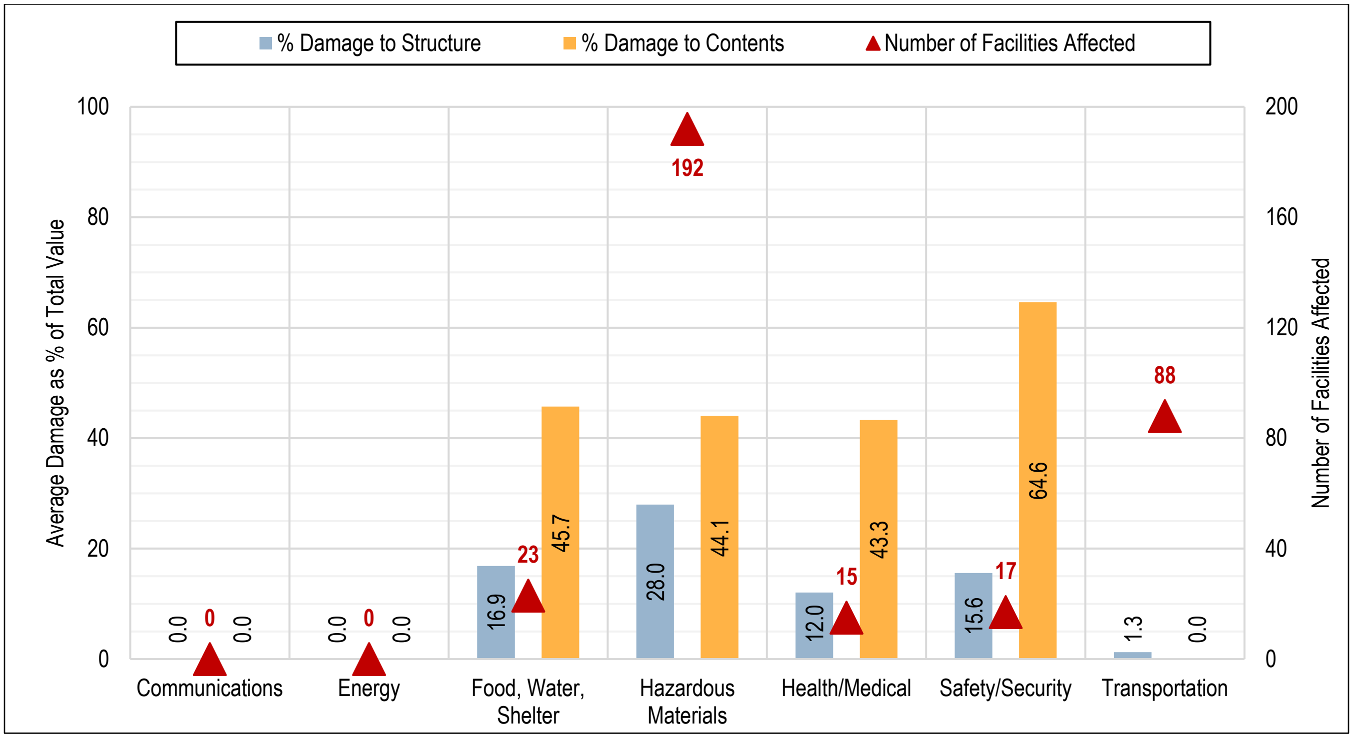


Figure 8-11. Estimated Damage to Critical Facilities from Dam Failure

8.6 SCENARIO

An earthquake within the region could lead to liquefaction of soils around the dams. This could occur without warning during any time of the day. A human-caused failure such as a terrorist attack also could trigger a catastrophic failure of a dam that impacts the planning area. The worst-case scenario for the dam failure hazard would be a full failure of the Del Valle Dam. Such a failure would result in a large portion of Pleasanton being inundated and a smaller portion of Dublin and Livermore. Critical facilities located in the dam inundation area would likely experience failure, resulting in a severe disruption of essential services.

8.7 ISSUES

The most significant issue associated with dam failure involves the properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas. There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather, which limits their predictability and compounds the hazard. Other important issues associated with dam failure include the following:

- Federally regulated dams have an adequate level of oversight and sophistication in the development of emergency action plans for public notification in the unlikely event of failure. However, the protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.

- Mapping for federally regulated dams is already required and available; however, mapping that estimates inundation depths is needed for dams that are not federally regulated, in order to better assess the risk associated with failure of these facilities.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. For dams that are not federally regulated, mapping of failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to downstream community officials and emergency managers. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness actions.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.

9. DROUGHT

9.1 GENERAL BACKGROUND

Drought is a significant decrease in water supply relative to what is needed to sufficiently meet typical demand in each location. It is a normal phase in the Mediterranean climate cycle, originating from a deficiency of precipitation over an extended period, usually a season or more. This leads to a water shortage for some activity, group, or environmental sector. Drought is generally defined based on five ways of measuring it (National Drought Mitigation Center 2022a):

- **Meteorological drought**—Based on measurements such as precipitation deficit compared to normal or expected precipitation. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of global weather systems.
- **Agricultural drought**—Based on impacts due to reduced precipitation and water supply (e.g., crop loss, herd culling, etc.)
- **Hydrological drought**—Based on measurements of stream flows, groundwater, and reservoir levels relative to normal conditions
- **Socioeconomic drought**—Based on direct and indirect socio-economic impacts on society and the economy. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply. If a community has stored enough water to meet its needs in the event of a shortage of rainfall, then it may not experience socioeconomic drought even though its geographic area experiences meteorological drought.
- **Ecological drought**—Defined as a prolonged and widespread deficit in naturally available water supplies, including changes in natural and managed hydrology, that create multiple stresses across ecosystems.

9.1.1 Monitoring and Categorizing Drought

National Oceanic and Atmospheric Administration Drought Indices

The National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure the impacts and severity of meteorological, agricultural, and hydrological drought and to map their extent and locations:

- The ***Crop Moisture Index*** measures short-term drought weekly to assess impacts on agriculture.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale.

- The ***Palmer Drought Severity Index*** is based on long-term weather patterns. The intensity of drought in a given month is dependent on current weather plus the cumulative patterns of previous months. Weather patterns can change quickly, and the Palmer Drought Severity Index can respond fairly rapidly.
- The ***Palmer Hydrological Drought Index*** quantifies hydrological effects (reservoir levels, groundwater levels, etc.), which take longer to develop and last longer. This index responds more slowly to changing conditions than the Palmer Drought Index.
- The ***Standardized Precipitation Index*** considers only precipitation. A value of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The Standardized Precipitation Index is computed for time scales ranging from one month to 24 months.

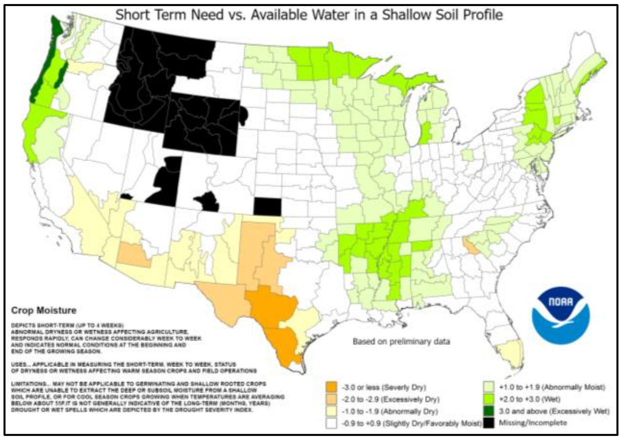
Each of these indices is meaningful for different sectors of society and the economy. For example, an urbanized areas that uses water from reservoirs would be sensitive to hydrological drought characterized by the Palmer Hydrological Drought Index, while unirrigated grazing land would be sensitive to meteorological drought characterized by the Crop Moisture Index. Maps of these indices show drought conditions nationwide at a given point in time. They are not necessarily indicators of any given area's long-term susceptibility to drought. Recent examples of these maps are shown on Figure 9-1.

U.S. Drought Monitor

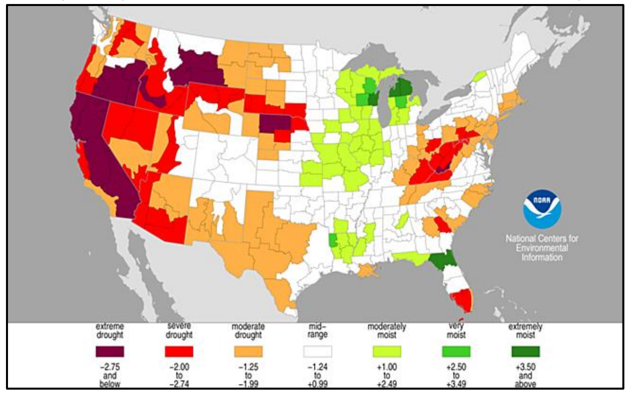
The U.S. Drought Monitor (USDM) is a map that is updated weekly to show the location and intensity of drought across the country. The USDM uses a five-category system (U.S. Drought Monitor 2022):

- D0—Abnormally Dry
  - Short-term dryness slowing planting, growth of crops
  - Some lingering water deficits
  - Pastures or crops not fully recovered
- D1—Moderate Drought
  - Some damage to crops, pastures
  - Some water shortages developing
  - Voluntary water-use restrictions requested
- D2—Severe Drought
  - Crop or pasture loss likely
  - Water shortages common
  - Water restrictions imposed
- D3—Extreme Drought
  - Major crop/pasture losses
  - Widespread water shortages or restrictions
- D4—Exceptional Drought
  - Exceptional and widespread crop/pasture losses
  - Shortages of water creating water emergencies

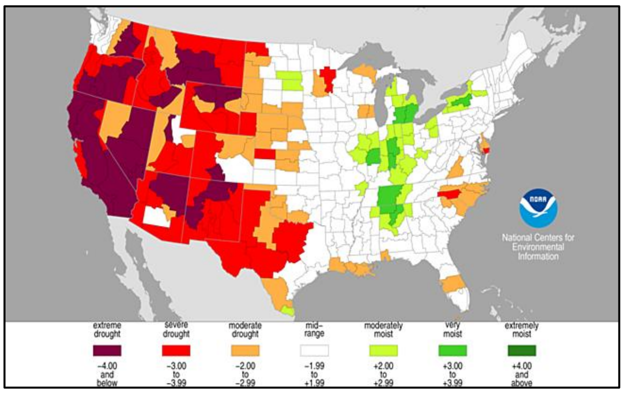
Sources: National Weather Service, 2022; National Centers for Environmental Information, 2022



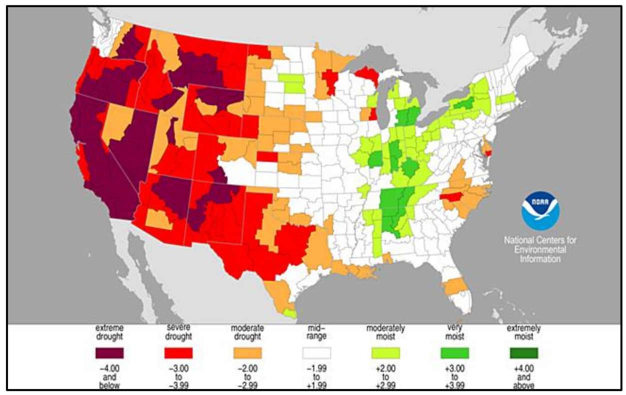
Crop Moisture Index (Week Ending April 23, 2022)



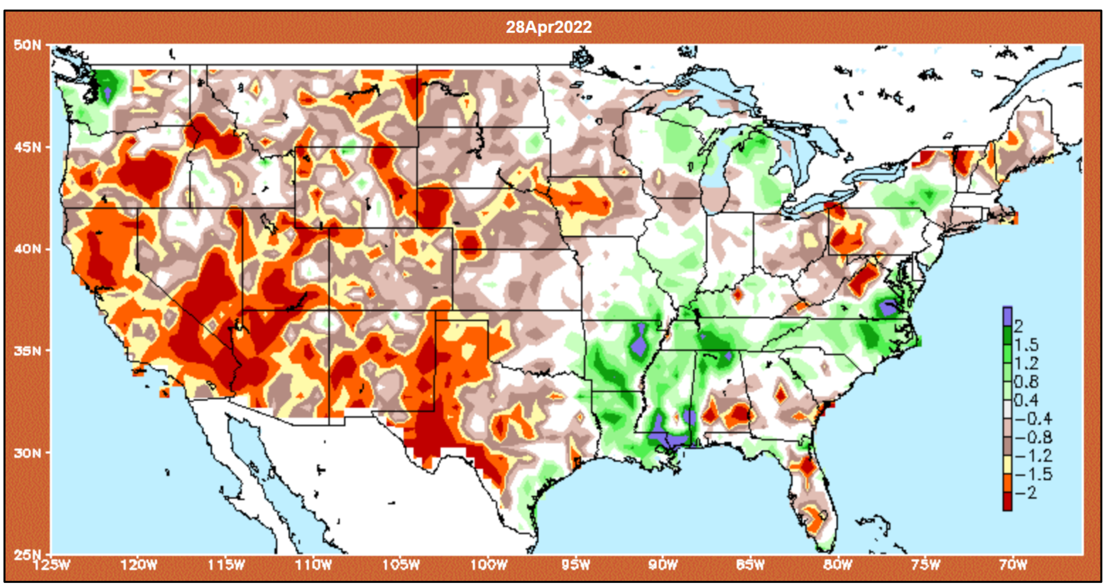
Palmer Z Index Short-Term Drought Conditions (March 2022)



Palmer Modified Index (March 2022)



Palmer Hydrological Drought Index (March 2022)



Standardized Precipitation Index (24-Months Ending April 2022)

Figure 9-1. Standard National Drought and Precipitation Indices

The USDM categories show experts' assessments of conditions related to drought. These experts check variables including temperature, soil moisture, stream flow, water levels in reservoirs and lakes, snow cover, and meltwater runoff. They also check whether areas are showing drought impacts such as water shortages and business interruptions. Associated statistics show what proportion of various geographic areas are in each category of dryness or drought, and how many people are affected. U.S. Drought Monitor data go back to 2000.

9.1.2 Drought Impacts

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to structures, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- **Economic Impacts**—These impacts of drought cost people (or businesses) money. Farmers' crops are destroyed; low water supply necessitates spending on irrigation system modifications, drilling of new wells, and/or trucking in water; water-related businesses (such as sales of boats and fishing equipment) may experience reduced revenue.
- **Environmental Impacts**—Plants and animals depend on water. When a drought occurs, their food supply can shrink, and their habitat can be damaged.
- **Social Impacts**—Social impacts include public safety, health, conflicts between people when there is not enough water to go around, and changes in lifestyle.

The demand that society places on water systems and supplies—such as expanding populations, irrigation, and environmental needs—contributes to drought impacts. Drought can lead to difficult decisions regarding the allocation of water, as well as stringent water use restrictions, water quality problems, and inadequate water supplies for fire suppression. There are also issues such as growing conflicts between agricultural uses of surface water and in-stream uses, surface water and groundwater interrelationships, and the effects of growing water demand on uses of water.

Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand. The impacts of drought vary between sectors of the community in both timing and severity:

- **Water supply—**The water supply sector encompasses urban and rural drinking water systems that are affected when a drought depletes surface and groundwater supplies due to reduced runoff and recharge from precipitation.
- **Agriculture and commerce—**Impacts on agriculture and associated commerce include the reduction of crop yield and livestock sizes due to insufficient water supply for crop irrigation and maintenance of ground cover for grazing.
- **Environment, public health, and safety—**Impacts on the environmental, public health, and safety sectors include wildfires that are both detrimental to the forest ecosystem and hazardous to the public. The impacts also includes the desiccation of streams, resulting in the reduction of in-stream habitats for native species.

9.1.3 California Drought Response

During critically dry years, the California State Water Resources Control Board can mandate conservation by water users and agencies to address statewide water shortages. Table 9-1 lists State Drought Management Program stages mandated to water right holders.

Table 9-1. State Drought Management Program

Drought Stage	State Mandated Customer Demand Reduction	Rate Impacts
Stage 0 or 1	<10%	Normal rates
Stage 2	10 to 15%	Normal rates; Drought surcharge
Stage 3	15 to 20%	Normal rates; Drought surcharge
Stage 4	>20%	Normal rates, Drought surcharge

9.1.4 Secondary Hazards

The secondary impact most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. In addition, lack of sufficient water resources can stress trees and other vegetation, making them more vulnerable to infestation from pests, which in turn, can make them more vulnerable to ignition. Prolonged droughts can impact underground aquifers, thus impacting groundwater supplies. Algae blooms can occur in surface water reservoirs that are stressed by drought impacts.

9.2 HAZARD PROFILE

9.2.1 Local Water Supply

Water Supply System

The Zone 7 Water Agency (Zone 7), a water wholesaler, provides treated drinking water to four major retailers in the planning area that serve approximately 240,000 people and businesses. Figure 9-2 summarizes the quantities of water managed by Zone 7. The wholesale water has three sources: South Bay Aqueduct that originates from the California State Water Project; Lake Del Valle storage reservoir that is approximately 10 miles from Livermore; and groundwater from local wells (Zone 7 Water Agency 2020).

The following retail water purveyors in the Tri-Valley planning purchase water from Zone 7:

- **Dublin San Ramon Services District—**Dublin San Ramon Services District is a public agency that distributes water and recycled water, and collects, treats and disposes of wastewater for 193,400 people in Dublin, southern San Ramon, Dougherty Valley, and Pleasanton. It provides water services only to Dougherty Valley and the City of Dublin (Dublin San Ramon Services District 2021).
- **City of Livermore—**Livermore Municipal Water purchases potable water from Zone 7 Water agency and provides water to more than 28,000 Livermore residents in addition to significant industrial and commercial areas. The balance of residents are served by the California Water Service Company, or Cal Water (City of Livermore n.d.).
- **City of Pleasanton—**The City of Pleasanton Utilities Division provides potable water to Pleasanton residents and businesses. The City purchases approximately 80 percent of the water from the Zone 7 Water Agency; the remaining 20 percent comes from local groundwater pumped from City-owned and operated wells (City of Pleasanton 2020).

Source: (Zone 7 Water Agency 2020)

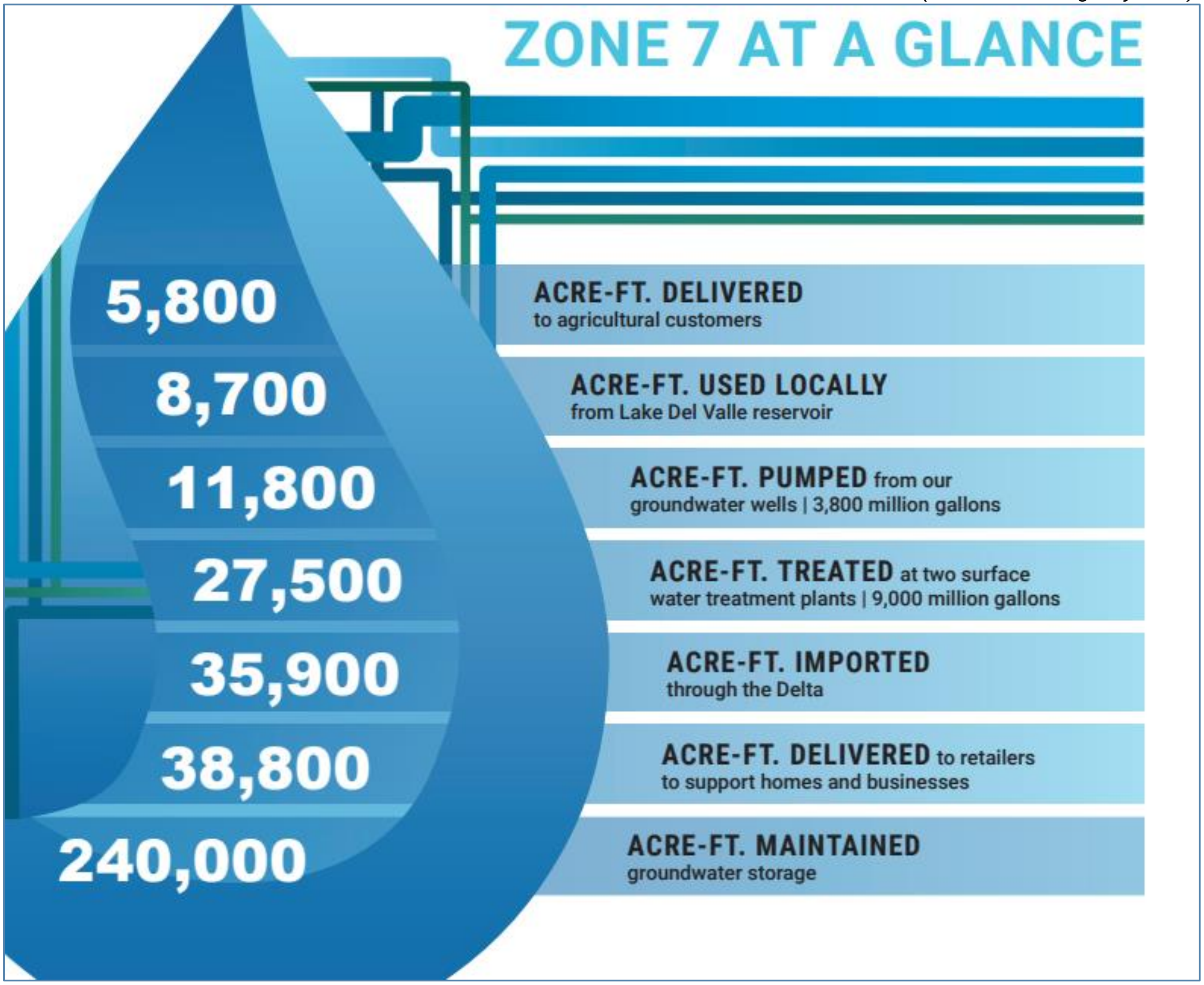


Figure 9-2. Zone 7 Water Agency Supply and Use, Fiscal Year 2019-2020

Water Supply Strategy

Zone 7 includes a water supply strategy in its *2020 Urban Water Management Plan* to meet its planning objectives for water supply reliability, cost, water quality, environmental protection and risk. It evaluates a range of water supply and water conservation options and recommended a strategy that includes desalination, recycled water, conservation, groundwater management and off-site banking/transfers.

Zone 7 has projected water supply and demand through 2045 for normal-year, single-dry-year, and multiple-dry-year conditions. Table 9-2 shows that under normal hydrologic conditions, Zone 7's supplies are adequate to meet projected demand through 2045. Surplus supplies are stored as carryover, used to recharge the Main Basin, and stored in the Kern County groundwater banks. The supplies shown below in the table are representative of expected normal conditions or normal operational targets (Zone 7 Water Agency 2021).

Table 9-2. Projected Normal Year Water Supply and Demand Comparison

Supply/Demand	Projections (by year) (acre-feet per year)				
	2025	2030	2035	2040	2045 (opt)
Supply Component					
State Water Project Table A	47,000	46,000	45,000	43,500	43,50
Yuba Accord	0	0	0	0	0
Turnback Pool	0	0	0	0	0
State Water Project - Carryover	10,000	10,000	10,000	10,000	10,000
Arroyo Valle	5,500	5,500	5,500	5,500	5,500
Main Basin	9,200	9,200	9,200	9,200	9,200
Semitropic	0	0	0	0	0
Cawelo	0	0	0	0	0
BARDP/Potable Reuse	0	5,000	5,000	5,000	5,000
Sites Reservoir Project	0	10,000	10,000	10,000	10,000
Transfers	5,000	5,000	0	0	0
Chain of Lakes	0	0	0	0	0
TOTAL SUPPLY	**76,700**	**90,700**	**84,700**	**83,200**	**83,200**
Demand Component					
Retail Demand	43,000	43,200	43,400	43,700	43,700
Untreated Water Demand	5,500	7,800	8,300	8,300	8,300
Direct Retail Demand	800	800	800	800	800
Losses	1,000	1,000	1,300	2,500	2,500
TOTAL DEMAND	**50,300**	**52,800**	**53,800**	**55,300**	**55,300**
Supply & Demand Comparison					
Supply Totals	76,700	90,700	84,700	83,200	83,200
Demand Totals	50,300	52,800	53,800	55,300	55,300
Difference	26,400	37,900	30,900	27,900	27,900

Source: (Zone 7 Water Agency 2021)

Zone 7 Water Management Plan

Zone 7's *2020 Urban Water Management Plan* was developed to address a water supply shortage up to 50 percent. Zone 7 has sufficient supply to meet demand in most years, but shortages can occur as a result of dry weather or an extended interruption of imported supplies. Voluntary water restrictions may also be initiated by an executive order from the governor due to state-level water conditions. Table 9-3 shows the six water shortage stages, which align with the State's standard stages (Zone 7 Water Agency 2021). Since Zone 7 is a wholesale water agency, it has not adopted ordinances that set or enforce consumption limits at the customer level.

Local Retail Water Purveyors

Local retail water purveyors in the Tri-Valley planning area (Dublin San Ramon Services District, Livermore Municipal Water, California Water Service Company, and City of Pleasanton Utilities Division) have prepared for water supply interruptions with water shortage contingency plans. The plans consist of four stages of water conservation and give guidelines to residential and commercial users' conservation action ideas. These plans also include per capita allotment, penalties and customer incentives for conservation.

Table 9-3. Water Shortage Contingency Plan Levels

Shortage Level	Percent Shortage Range	Water Shortage Condition	Shortage Response Actions
1	Up to 10%	• Agency has adequate supply and seeks to preserve water resources for the future; or • Assessment shows that water supply is not able to meet normal demands by up to 10%; or • Definable event has reduced water supply by up to 10%.	• Public outreach to support voluntary conservation. • Ask retailers for voluntary demand reduction, as needed.
2	Up to 20%	• Assessment leads to a reasonable conclusion that water supplies may not adequately meet normal demands in the current or upcoming years; or • Assessment shows that water supply is not able to meet normal demands by up to 20%; or • Definable event has reduced water supply by up to 20%.	• Expand public outreach to support conservation. • Ask retailers for voluntary or mandatory demand reduction, as needed. Only the latter will be enforced.
3	Up to 30%	• Previous water conservation target has not been met; or • Assessment shows that water supply is not able to meet normal demands by up to 30%; or • Definable event has reduced water supply by up to 30%.	• Intensify public outreach to support conservation. • Ask retailers for mandatory demand reduction.
4	Up to 40%	• Previous water conservation target has not been met; or • Assessment shows that water supply is not able to meet normal demands by up to 40%; or • Definable event has reduced water supply by up to 40%.	• Intensify public outreach to support conservation. • Ask retailers for mandatory demand reduction.
5	Up to 50%	• Previous water conservation target has not been met; or • Assessment shows that water supply is not able to meet normal demands by up to 50%; or • Definable event has reduced water supply by up to 50%.	• Intensify public outreach to support conservation. • Ask retailers for mandatory demand reduction.
6	>50%	• Previous water conservation target has not been met; or • Assessment shows that water supply is not able to meet normal demands by more than 50%; or • Definable event has reduced water supply by more than 50%.	• Intensify public outreach to support conservation. • Ask retailers for mandatory demand reduction.

Source: (Zone 7 Water Agency 2021)

9.2.2 Past Events

In California, droughts typically occur after two or three years of below-average rainfall for the period from November to March, when about 75 percent of the State's average annual precipitation falls. December, January, and February are when approximately 50 percent of the rainfall occurs in California.

Drought has affected nearly every county in California at one time, causing more than $5.1 billion in damage. They are a cyclic part of the climate of the State and occur at any time of the year, with an average recurrence interval in Alameda County at least every decade (Cal OES 2018) (Alameda County 2021). This section provides information regarding drought events that occurred in California and Alameda County.

State of California

State Records

The California Department of Water Resources has state hydrologic data back to the early 1900s. The hydrologic data show multi-year droughts from 1912 to 1913, 1918 to 1920 and 1922 to 1924, and 1928 to 1934 (Department of Water Resources 2022). Since then, five prolonged periods of drought occurred in California:

- **2020 to Present Drought**— At the time of this plan update, California was in its third year of another multi-year drought. By July of 2021, a state of emergency had been declared in 50 counties, including Alameda County, and the governor appealed to residents to collectively reduce water usage by 15 percent that year. A few months later the governor authorized the State Water Board to ban wasteful water uses, and made plans to invest $5.2 billion over the next three years in drought response and water resilience efforts, seeing this drought as the worst in over a century. The first few months of 2022 were especially remarkable in terms of weather conditions, being the driest January, February, and March on record in California (California Drought Action 2022).
- **2012 to 2017 Drought**—California's drought has set several records for the state. The period from 2012 to 2014 ranked as the driest three consecutive years for statewide precipitation. Calendar year 2014 set new climate records for statewide average temperatures and for record-low water allocations from State Water Project and federal Central Valley Project contractors. Calendar year 2013 set minimum annual precipitation records for many communities. The state has detailed executive orders and regulations concerning water conservation and management. Total impacts of the drought cannot be determined until after its conclusion. Based on a wet winter, Governor Brown declared an end to the drought emergency on April 7, 2017, in Executive Order B-40-17, except in four counties (Fresno, Kings Tulare, and Tuolumne) (California Water Boards 2017).
- **2007 to 2009 Drought**—The Governor issued an Executive Order that proclaimed a statewide drought emergency on June 4, 2008, after spring 2008 was the driest spring on record and low snowmelt runoff. On February 27, 2009, the Governor proclaimed a state of emergency for the entire state as the severe drought conditions continued widespread impacts and the largest court-ordered water restriction in state history (at the time).
- **1987 to 1992 Drought** —California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected, the Sierra Nevadas in Northern California and the Central Valley counties were also affected. During this drought, only 56 percent of average runoff for the Sacramento Valley was received, totaling just 10 million acre-feet. In 1991, the State Water Project sharply decreased deliveries to water suppliers including the San Francisco Bay Area. By February 1991, all 58 counties in California were suffering from drought conditions, and urban areas as well as rural and agricultural areas were impacted.
- **1976 to 1977 Drought**—California had one of its most severe droughts due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California, with the previous winter recorded as the fourth driest in California's hydrological history. The cumulative impact led to widespread water shortages and severe water conservation measures throughout the state. Only 37 percent of the average Sacramento Valley runoff was received, with just 6.6 million acre-feet recorded. Over $2.6 billion in crop damage was recorded in 31 counties. Alameda County was included in FEMA-3023-EM-CA declaration on January 20, 1977.

Figure 9-3 shows the history of statewide drought since 2000.

California | Drought.gov

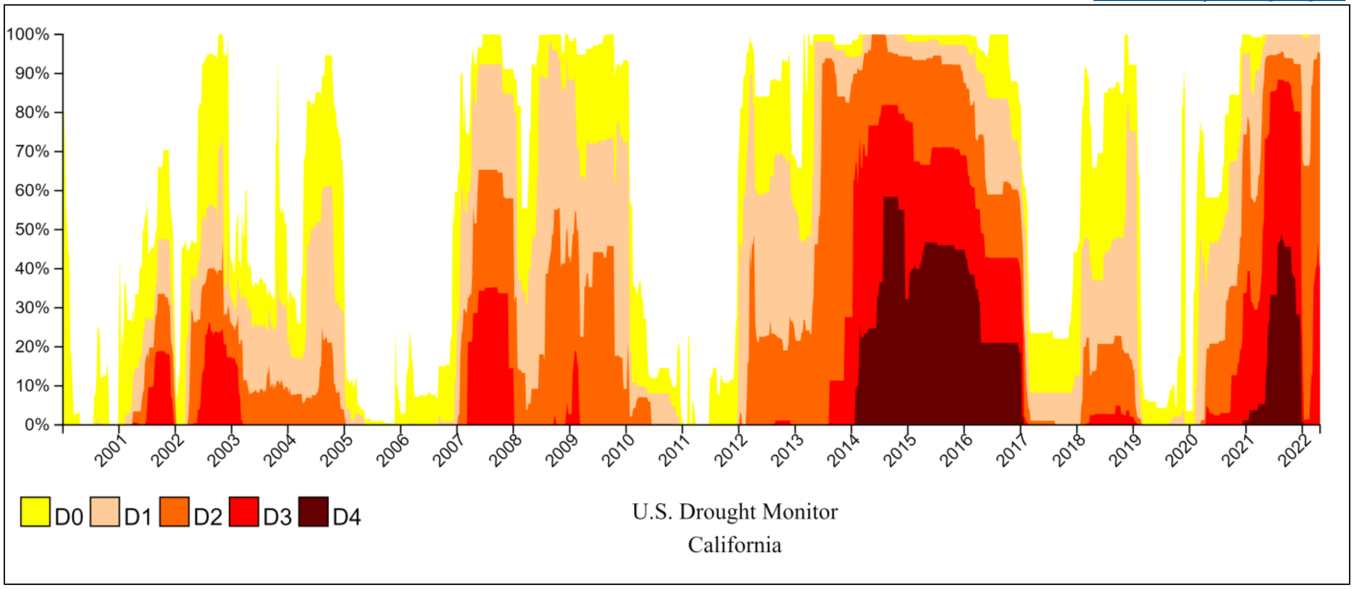


Figure 9-3. Records of Statewide Drought in California Since 2000

FEMA Drought Declarations

Between 1954 and 2021, the State of California experienced one FEMA-declared major disaster (DR) or emergency (EM) classified as a drought: Declaration EM-3023, a drought emergency issued in 1977 and applying to all California counties, including Alameda County (FEMA 2022).

Alameda County

County Drought Records

The following drought events impacted Alameda County:

- **2020 to Present**—This is an ongoing event with state of emergency declarations in 50 counties, including Alameda County.
- **2007 to 2009**—This event affected the entire state, particularly the central coast. It was a three year drought due to below average rainfall, low snowmelt runoff, and the largest court ordered water restriction in state history. The dry conditions damaged crops, deteriorated water quality, and caused extreme fire danger. California proclaimed a state disaster in 2008 and 2009. Damages included $300 million in agricultural revenue loss and potential $3 billion in economic losses over time.
- **1987 to 1992**—This event affected the entire state.
- **1976 to 1977**—This event affected the entire state with the exception of southwestern deserts. These were the two driest years in California's history. The drought was most severe in the northern two-thirds of the State. California proclaimed a statewide disaster that did not include Alameda County, but the federal disaster declaration in 1977 did include Alameda County. Damage totaled $2.664 billion ($888.5 million in 1976 and $1.775 billion in 1977).
- **1959 to 1962**—This event affected the entire state.

- **1943 to 1951**—This event affected the entire state.
- **1928 to 1937**—This event affected the entire state.
- **1922 to 1926**—This event affected the entire state with the exception of central Sierra Nevada.
- **1917 to 1921**—This event affected the entire state with the exception of central Sierra Nevada and the north coast.

U.S. Department of Agriculture Drought Declarations

Agriculture-related disasters and disaster declarations are common in the United States. The U.S. Department of Agriculture (USDA) Farm Service Agency provides assistance for natural disaster losses resulting from drought, flood, fire, freeze, tornadoes, pest infestation, and other natural disasters. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses. Between 2012 and June 2022, Alameda County and Contra Costa County were included in 16 and 15 drought-related USDA disaster declarations, respectively (USDA 2022):

- S5146 in 2022
- S4916 in 2021
- S4697 in 2020
- S4144 and S4163 in 2017
- S3952 in 2016
- S3784 and S3943 (not Contra Costa) in 2015
- S3626, S3637, S3743, and 3797 (not Alameda) in 2014
- S3547 (not Contra Costa), S3558 and S3569 in 2013
- S3248 and S3379 in 2012.

Local Impacts of the Ongoing (2020-Present) Drought

The Cities of Dublin, Livermore, and Pleasanton all initiated water shortage contingency plans during the most recent drought. Each city carried out public education campaigns about water conservation and took steps to conserve water. Zone 7 and its retailers maintain a website for Tri-Valley residents with information on water-wise gardening www.trivalleywaterwise.com (Water-Wise Gardening Tri-Valley 2022). The following sections describe examples of how local proprietors dealt with drought.

Zone 7

At the beginning of September of 2021, the Zone 7 Board of Directors unanimously agreed at a special meeting to declare a Drought Emergency and a Stage 2 Water Shortage Emergency. Included in this declaration was a 15 percent water conservation mandate for all its retailers, which had been preceded by a voluntary 10 percent conservation goal earlier in the year. Zone 7 declared a local drought emergency in order to accelerate the construction of projects that will improve the dependability of its water supply. This includes the Valley Pump Station, which had been scheduled to be completed in the summer of 2023 but was moved up to be finished in the summer of 2022 (Zone 7 Water Agency 2021).

Dublin San Ramon Services District and City of Dublin

In September 2021, the Dublin San Ramon Services District, which provides water service to Dublin and parts of the neighboring town of San Ramon, declared a Stage 2 Water Shortage Emergency. This included restrictions on the use of water for landscaping and irrigation, washing homes and vehicles, construction work, and other activities. The District also carried out public outreach and education campaigns about water conservation. (Dublin San Ramon Services District 2021).

City of Livermore

The City of Livermore City Council declared a Stage 2 Water Shortage Emergency in September 2021, establishing limitations on the use of water for landscaping and irrigation, washing homes and vehicles, and construction work (City of Livermore n.d.). The City of Livermore Water Shortage Contingency Plan, last updated in 2020 includes water conservation strategies in response to shortages.

In February 2022, 1 percent less water was consumed in Livermore compared to February 2020 (City of Livermore n.d.). In September 2021, the City Council set a water conservation goal of 15 percent less water consumption than 2020, and that conservation record was exceeded. In December 2021, Livermore used 22 percent less water than in December 2020.

City of Pleasanton

The City of Pleasanton declared a local drought emergency and Stage 2 Water Shortage in October 2021, aiming for a 15 percent reduction in water usage compared to 2020 and using many of the same measures as other communities and agencies (limitations on water use for landscaping, construction activities, etc.) (City of Pleasanton n.d.).

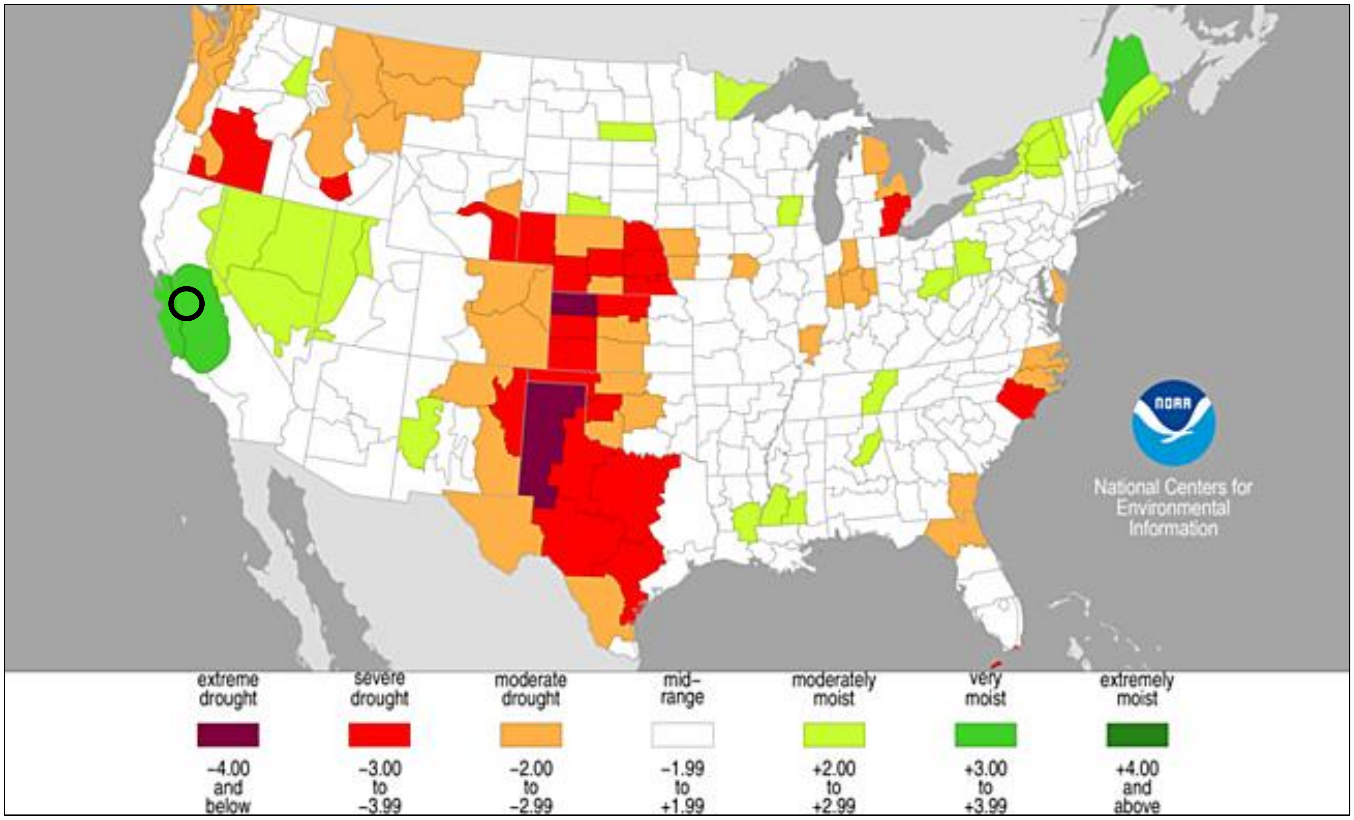
9.2.3 Location

If a drought is occurring in Alameda County or neighboring Contra Costa County, then the planning area is most likely being impacted as well. The entire planning area is susceptible to droughts and impacts brought on by such events. Figure 9-4 illustrates the drought in January 2023; source NCEI -NOAA. The planning area is outlined in a black circle near the Bay Area in a black circle. Figure 9-5 illustrates drought conditions in the planning area (outlined in a black ring) in June 2023.

9.2.4 Frequency

Drought has a high probability in the planning area:

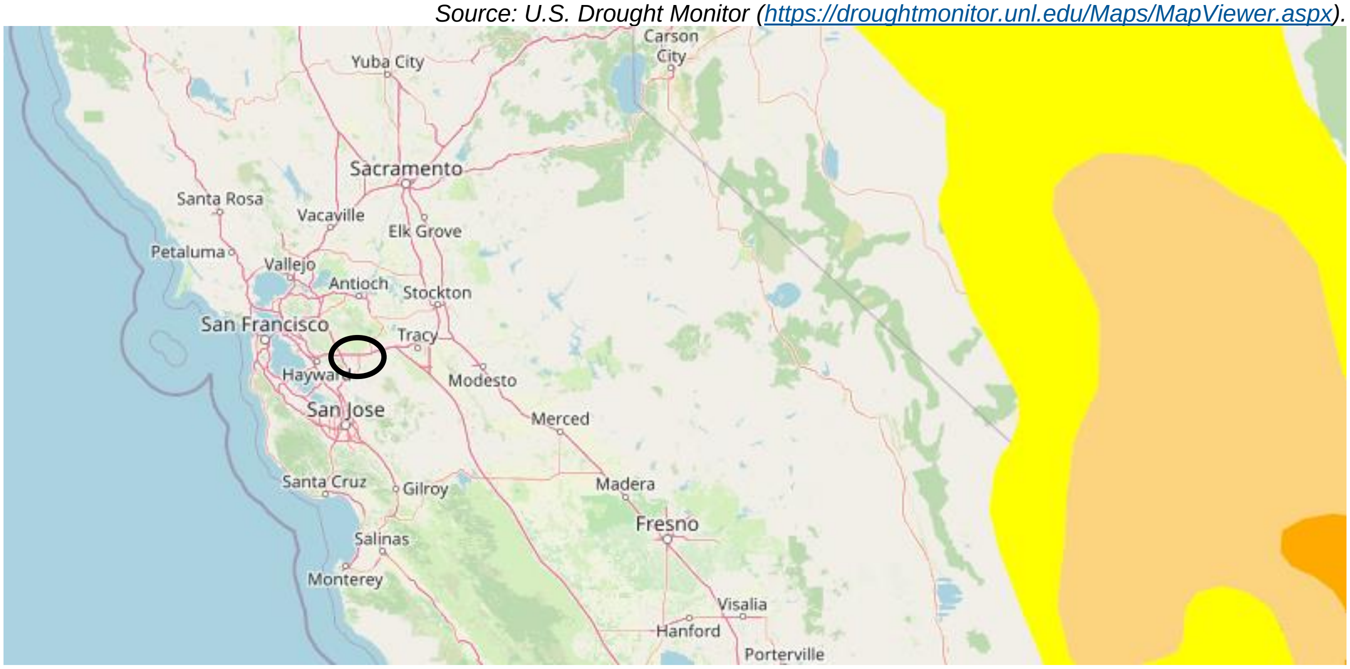
- From January 2000 through March 2023, the USDM rating was D1 or higher during 550 weeks in some part of Alameda County and 545 weeks in some part of Contra Costa County, out of 1,213 weeks—roughly one out of every two weeks (see Figure 9-6).
- Alameda and Contra Costa Counties were included in U.S. Department of Agriculture (USDA) drought disaster declarations in nine of the past 11 years (USDA, 2022).
- The planning area has experienced three significant multi-year droughts in the last 40 years (1982 to 2022), amounting to a severe multi-year drought every six to seven years on average.



The black circle identifies the planning area

Figure 9-4. Palmer Drought Severity Index, January 2023

Source: U.S. Drought Monitor (https://droughtmonitor.unl.edu/Maps/MapViewer.aspx).



The black circle identifies the planning area

Figure 9-5. U.S. Drought Monitor Map of Planning Area Drought Conditions, June 2023

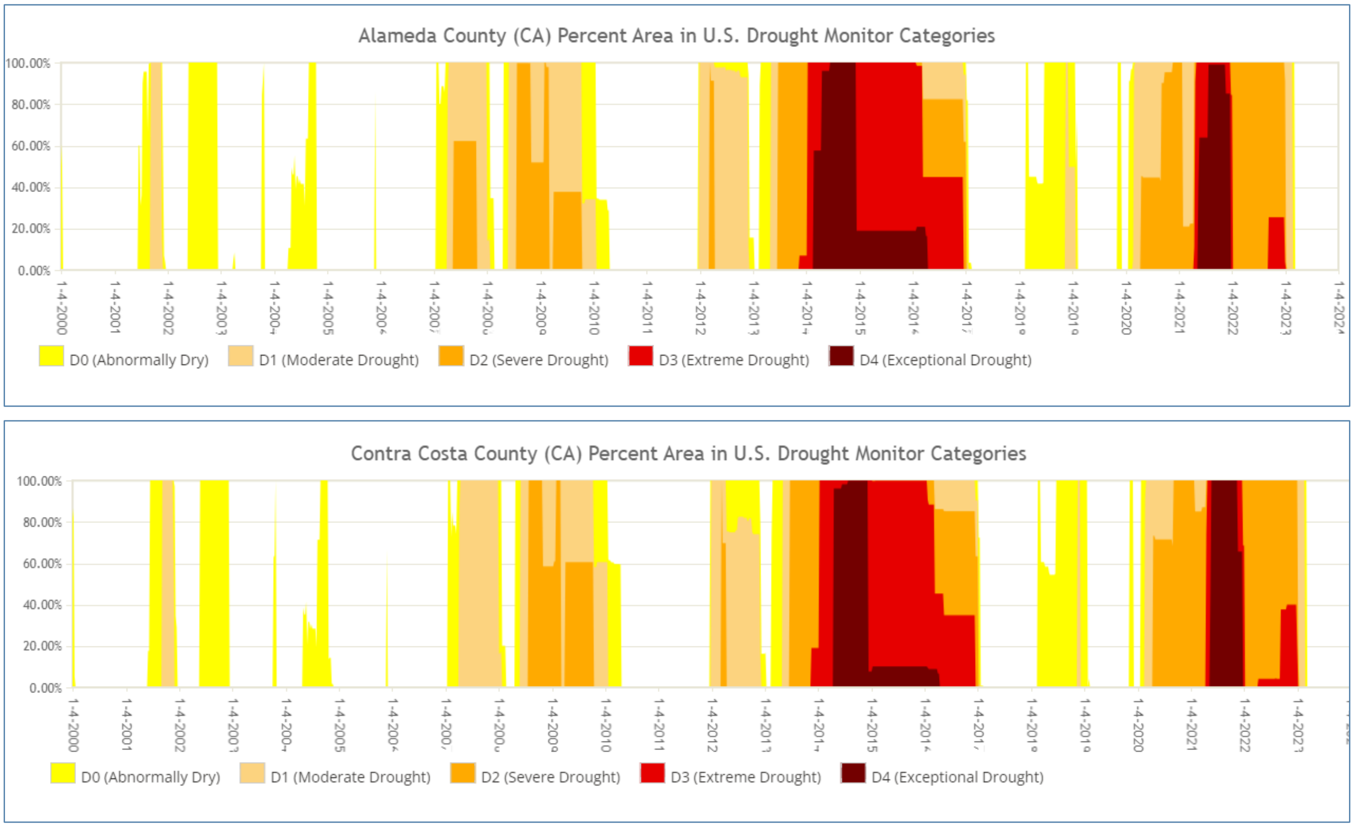


Figure 9-6. Percent of Alameda and Contra Cosa Counties Affected by Each USDM Rating, 2000 – 2023

9.2.5 Severity

The severity of any given drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts.

U.S. Drought Monitor Ratings

Alameda County has a history of severe droughts. As shown in Figure 9-6, at least part of the county has experienced extreme (D3) or exceptional (D4) droughts more than once since 2000.

Drought Impact Reporter

The National Drought Mitigation Center (NDMC) developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: on-line, drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media, and members of relevant government agencies. The database is being populated beginning with the most recent impacts and working backward in time.

The Drought Impact Reporter contains information on 201 impacts from droughts that specifically affected Alameda County from 2006 through May 5, 2022 (National Drought Mitigation Center 2022). The following are the categories and reported number of impacts (some impacts are assigned to more than one category):

- Agriculture—45
- Business and Industry—12
- Energy—6
- Fire—19
- Plants and Wildlife—40
- Relief, Response, and Restrictions—128
- Society and Public Health—69
- Tourism and Recreation—9
- Water Supply and Quality—138

9.2.6 Warning Time

Predicting drought depends on the ability to forecast precipitation and temperature. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Determination of when drought begins is based on impacts on water users and assessments of available water supply, including water stored in reservoirs or groundwater basins. Different water agencies have different criteria for defining drought. Some issue drought watch or drought warning announcements.

9.3 EXPOSURE

All people, property and environments within the planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions.

9.4 VULNERABILITY

9.4.1 Population

The entire population of the planning area is vulnerable to drought events. Drought conditions can affect people’s health and safety, including health problems related to low water flows and poor water quality, and health problems related to dust. Droughts can also lead to the loss of human life (National Centers for Environmental Information 2021). Other possible impacts include recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and hygiene; compromised food and nutrition; and increased incidence of illness and disease (Centers for Disease Control and Prevention 2020).

The local at-risk senior population in the Tri-Valley planning area may be greatly affected by these potential impacts in Dublin, Livermore, Pleasanton, and areas served by DSRSD, especially in the event of water-borne pathogens entering the local water supply. Drought conditions causing shortages of water for human consumption may amplify these effects on local at-risk communities, such as seniors and homeless persons, among others. While seniors may be readily identified because of participation at senior centers, the homeless population can be transient. Local law enforcement (Livermore Police, Pleasanton Police, and in Dublin Alameda County Sheriff) are sometime familiar with places where the homeless population congregates. These law enforcement agencies patrol these areas in the normal course of their routines and interact with them as necessitated.

Droughts can also lead to reduced local firefighting capabilities. Vulnerable populations who rely on rainfall catchment for residential water supply may be especially impacted if they do not have the physical or financial ability to obtain imported water to refill dry catchment tanks. How and to what degree drought affects the planning area's vulnerable populations does vary depending on scope and severity.

Alameda County, the Cities of Dublin, Livermore and Pleasanton, regional water purveyors, and other regional stakeholders have spent considerable effort to protect life, safety, and health during times of consecutive dry years, such as the current drought. Provisions and measures have been taken to analyze and account for anticipated water shortages. With the actions implemented by the Cities of Dublin, Livermore and Pleasanton and the coordination with Alameda County, the planning area has the ability to minimize and reduce impacts on residents and water consumers in the planning area. No significant life or health impacts as a result of drought are anticipated in the planning area.

9.4.2 Property

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can have significant impacts on other types of property such as landscaped areas and economically important natural resources. Drought causes the most significant economic impacts on industries that use water or depend on water for their business, most notably agriculture and related sectors (forestry, fisheries, and waterborne activities), power plants, and oil refineries. In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion.

Drought can lead to other losses because so many sectors are affected—losses that include reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease.

9.4.3 Critical Facilities

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility features such as landscaping may not be maintained due to limited water resources, but the risk to critical facility core functions is low.

9.4.4 Environment

Groundwater and Streams

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams, especially during the summer when there is little or no precipitation. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest. Where stream flows are reduced, development that relies on surface water may seek to establish new groundwater wells, which could further increase groundwater depletion.

Other Potential Losses

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Wildlife habitat may be degraded through the loss of wetlands, lakes, and vegetation. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Drying up or dying off of forests could reduce ecological values.

Some of these effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

9.5 FUTURE TRENDS IN DEVELOPMENT

Land use planning is directed by general plans adopted under California's General Planning Law. Municipal planning partners are encouraged to establish general plans with policies directing land use and dealing with issues of water supply and the protection of water resources. These plans provide the capability at the local municipal level to protect future development from the impacts of drought. Dublin, Livermore and Pleasanton reviewed their general plans under the capability assessments performed for this effort. Deficiencies identified by these reviews can be identified as mitigation actions to increase the capability to deal with future trends in development.

9.6 SCENARIO

Continuation or exacerbation of the current drought across California—an extreme, multiyear drought with record-breaking rates of low precipitation and high temperatures—is the worst-case scenario for the planning area. Low precipitation and high temperatures intensify the possibility of wildfires throughout the planning area, increasing the need for water, when water is already in limited supply. Surrounding regions, also in drought conditions, could increase their demand for the water supplies also relied upon in the planning area, causing social and political conflicts. The high-density population of the Bay Area increases the likelihood of such conflicts, despite the existence of the Bay Area Water Supply and Conservation Agency *Water Conservation Implementation Plan*. The longer drought conditions last in the planning area, the more impacted the local economy becomes; water-dependent industries especially will experience setbacks.

9.7 ISSUES

The planning team has identified the following drought-related issues:

- Identification of the availability and reliability of new water supplies
- Monitoring of the implementation and benefits of the long-term reliable water supply strategy projects, Bay Area Water Supply and Conservation Agency *Water Conservation Implementation Plan* projects, and water system upgrades
- Application of alternative techniques (groundwater recharge, water recycle, local capture and reuse, desalination, and transfer) to stabilize and offset Sierra Nevada snowpack water supply shortfalls

- Regular occurrence of drought or multiyear droughts that may limit the planning area's ability to successfully recover from or prepare for more occurrences-particularly noteworthy due to longevity of the current ongoing drought.
- The probability of increased drought frequencies and durations due to climate change
- The promotion of active water conservation even during non-drought periods.

10. EARTHQUAKE

10.1 GENERAL BACKGROUND

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

10.1.1 Earthquake Location

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter.

10.1.2 Earthquake Geology

Tectonic Plates

The Earth's crust, which is the rigid outermost shell of the planet, is broken into seven or eight major tectonic plates (depending on how they are defined) and many minor plates. Where the plates meet, they move in one of three ways along their mutual boundary: convergent (two plates moving together), divergent (two plates moving apart), or transform (two plates moving parallel to one another). Earthquakes, volcanic activity, mountain-building, and oceanic trench formation occur along these plate boundaries. Subduction is a geological process that takes place at convergent boundaries of tectonic plate, in which one plate moves under another. Regions where this process occurs are known as subduction zones, and they have the potential to generate highly damaging earthquakes.

California is seismically active because of movement of the North American Plate, east of the San Andreas Fault, and the Pacific Plate to the west, which includes the state's coastal communities. The transform (parallel) movement of these tectonic plates against one another creates stresses that build as the rocks are gradually deformed. The rock deformation, or strain, is stored in the rocks as elastic strain energy. When the strength of the rock is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves produces the ground shaking in earthquakes.

The sliding movement of earth on either side of a fault is called fault rupture. Fault rupture begins below the ground surface at the earthquake hypocenter, typically between 3 and 10 miles below the ground surface in California. If an earthquake is large enough, the fault rupture will travel to the ground surface, potentially destroying structures built across its path.

Faults

Geologists have found that earthquakes reoccur along faults, which are zones of weakness in the earth's crust. When a fault experiences an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake can still occur. In fact, relieving stress along one part of a fault may increase it in another part.

Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. "Active" faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). "Potentially active" faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years).

Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. The majority of the seismic hazards are on well-known active faults. However, inactive faults, where no displacements have been recorded, also have the potential to reactivate or experience displacement along a branch sometime in the future. An example of a fault zone that has been reactivated is the Foothills Fault Zone. The zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the zone near Oroville, California (now known as the Cleveland Hills Fault). The State Division of Mines and Geology indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems.

10.1.3 Earthquake-Related Hazards

According to the U.S. Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect people's normal activities. This includes the following:

- **Surface Faulting**—Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- **Ground Motion (shaking)**—The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- **Landslid**e—A movement of surface material down a slope.
- **Liquefaction**—A process by which water-saturated sediment temporarily loses strength and acts as a fluid. Earthquake shaking can cause this effect.
- **Tectonic Deformation**—A change in the original shape of a material due to stress and strain.
- **Tsunami**—A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or violent underwater volcanic eruptions.

10.1.4 Earthquake Classifications

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as magnitude; or by the impact on people and structures, measured as intensity.

Magnitude

An earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude is commonly expressed by ratings on the moment magnitude scale (M_W), the most common scale used today (Michigan Tech 2023). This scale is based on the total moment release of the earthquake (the product of the distance a fault moved and the force required to move it). The scale is as follows:

- Great—Mw > 8
- Major—Mw = 7.0 – 7.9
- Strong—Mw = 6.0 – 6.9
- Moderate—Mw = 5.0 – 5.9
- Light—Mw = 4.0 – 4.9
- Minor—Mw = 3.0 – 3.9
- Micro—Mw < 3

Intensity

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale as well as the perceived shaking and damage potential for structures are shown in Table 10-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking throughout the region, depending on the distance from the earthquake, rock and soil conditions, and variations in the propagation of seismic waves from the earthquake. A shake map shows the range of ground shaking immediately following an earthquake.

Table 10-1. Mercalli Scale and Peak Ground Acceleration Comparison

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

a. PGA = peak ground acceleration. Measured in percent of g, where g is the acceleration of gravity

10.1.5 Ground Motion

Earthquake hazard assessment is based on expected ground motion. During an earthquake when the ground is shaking, it also experiences acceleration. The peak acceleration is the largest increase in velocity recorded by a particular station during an earthquake. Estimates are developed of the annual probability that certain ground motion accelerations will be exceeded; the annual probabilities can then be summed over a time period of interest.

The most commonly mapped ground motion parameters are horizontal and vertical peak ground accelerations (PGA) for a given soil type. PGA is a measure of how hard the earth shakes, or accelerates, in a given geographic area. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. PGA is measured in g (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g). These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (e.g., single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (e.g., apartment buildings, factories, high-rises, bridges). Table 10-1 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

10.1.6 USGS Earthquake Mapping Programs

ShakeMaps

The USGS Earthquake Hazards Program produces maps called ShakeMaps that map ground motion and shaking intensity following significant earthquakes. ShakeMaps focus on the ground shaking caused by the earthquake, rather than on characteristics of the earthquake source, such as magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust.

A ShakeMap shows the extent and variation of ground shaking immediately across the surrounding region following significant earthquakes. Such mapping is derived from peak ground motion amplitudes recorded on seismic sensors, with interpolation where data are lacking based on estimated amplitudes. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. In addition to the maps of recorded events, the USGS creates the following:

- Scenario ShakeMaps of hypothetical earthquakes of an assumed magnitude on known faults
- Probabilistic ShakeMaps, based on predicted shaking from all possible earthquakes over a 10,000-year period. In a probabilistic map, information from millions of scenario maps are combined to make a forecast for the future. The maps indicate the ground motion at any given point that has a given probability of being exceeded in a given timeframe, such as a 100-year (1-percent-annual chance) event.

National Seismic Hazard Map

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown, et al. 2001). The USGS updated the National Seismic Hazard Maps in 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2018 map, shown in Figure 10-1, represents the best available data as determined by the USGS.

Source: (USGS 2021)

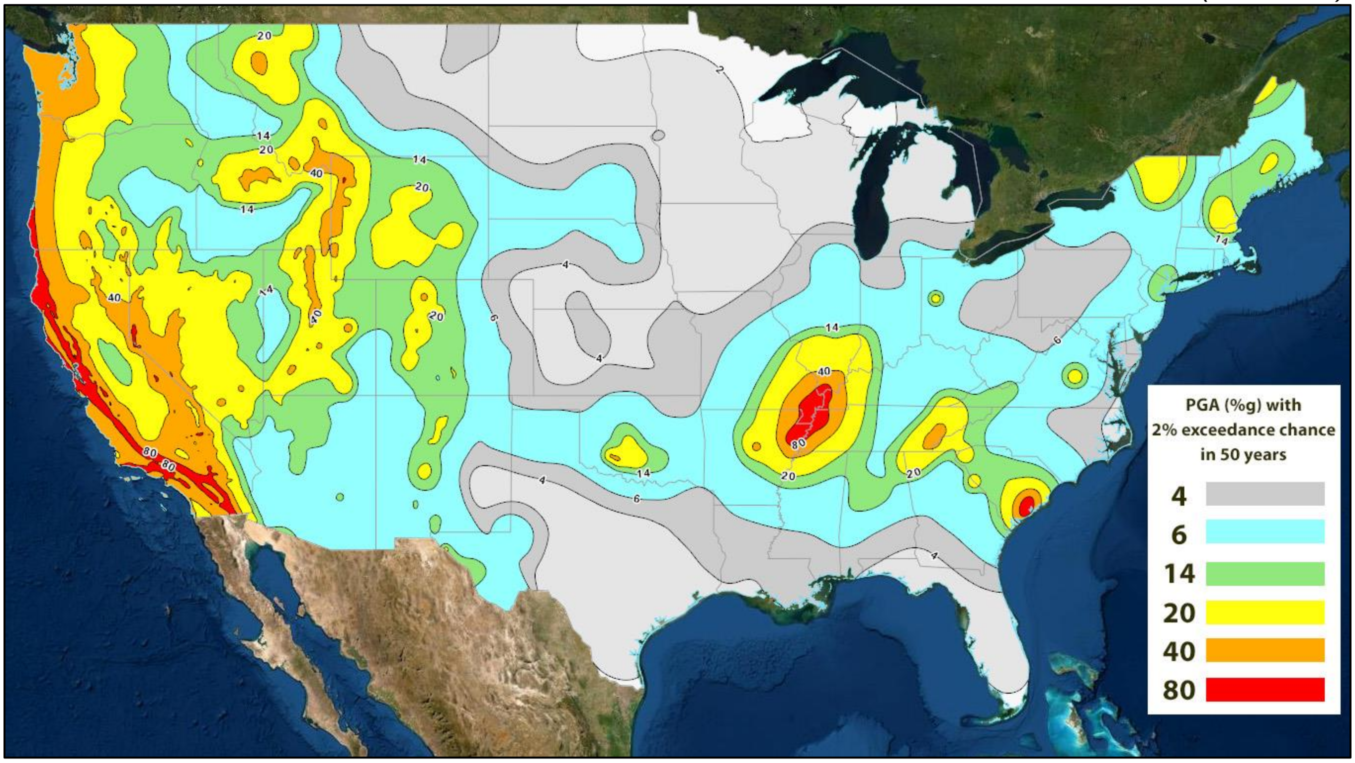


Figure 10-1. Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years

10.1.7 Liquefaction and Soil Types

Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. NEHRP soil types define the locations that will be significantly impacted by an earthquake. Table 10-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E and F. In general, these areas are also most susceptible to liquefaction. The areas that are most commonly affected by ground shaking have NEHRP Soils D, E and F.

10.1.8 Secondary Hazards

Earthquakes can cause disastrous landslides, often as a result of loss of cohesion in clay-rich soils. Earthen dams and levees are highly susceptible to seismic events, with the potential to fail following earthquakes. Earthquakes can also trigger tsunamis. Fires can result from gas lines or power lines that are broken or downed during the earthquake. It may be difficult to control a fire, particularly if the water lines feeding fire hydrants are also broken.

Table 10-2. NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

10.2 HAZARD PROFILE

10.2.1 Past Events

The last significant (> 6.0 M) seismic event in the Tri-Valley vicinity was the 2014 Magnitude-6.0 earthquake that originated 6 miles southwest of Napa. The previous large event was the 1989 M-7.1 Loma Prieta Earthquake that originated 10 miles northeast of Santa Cruz. No significant seismic events in the planning area vicinity have been recorded since these two events. Other significant earthquakes in California include the 1906 earthquake in San Francisco, the 1971 San Fernando Earthquake, and the 1994 Northridge earthquake. Recent earthquakes of magnitude of 4.0 or greater near the planning area are listed in Table 10-3. Figure 10-2 shows the locations of those with a magnitude of 5.0 or greater.

Table 10-3. Recent Earthquakes Magnitude 4.0 or Larger Near Planning Area

Date	Magnitude	Epicenter Location
10/25/2022	5.1	9.3 miles (15km) southeast of Alum Rock, California
9/14/2022	4.4	1.86 miles (3km) north of Santa Rosa, California
10/15/2019	4.5	0.62 miles (1km) southeast of Pleasant Hill, California
07/16/2019	4.3	7.47 miles (12km) southwest of Byron, California
01/04/2018	4.4	1.24 miles (2km) southeast of Berkely, California
8/24/2014, South Napa Earthquake	6.0	South Napa
10/31/2007, Alum Rock Earthquake	5.6	San Francisco Bay area, California
5/14/2002, Gilroy Earthquake	5	Northern California
9/3/2000, Yountville Earthquake	5	Northern California
8/12/1998, San Juan Bautista Earthquake	5.2	Central California
4/18/1990, Northern California	5.4	Near Aromas, Northern California
10/18/1989, Loma Prieta Earthquake	7.1	10 miles northeast of Santa Cruz
8/8/1989, Santa Cruz County Earthquake	5.2	Central California
6/27/1989	5.3	Northern California
6/13/1988	5.3	San Francisco Bay area, California
2/20/1988	5.1	Central California
3/31/1986	5.6	Northern California
1/26/1986	5.4	Central California

Source: (USGS 2023)

California has been included in 13 FEMA major disaster (DR) or emergency (EM) declarations for earthquake events; however, Alameda County was included in only one: DR-845 for the October 17, 1989 Loma Prieta Earthquake; this declaration applied to the Counties of Alameda, Contra Costa, Marin, Monterey, Sacramento, San Benito, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, and Solano (FEMA 2017).

Source: (USGS 2023)

Figure 10-2. Recent Earthquakes Magnitude 5.0 or Larger Near Planning Area

10.2.2 Location

Fault Locations

The planning area is located in a seismically active region, with exposure to major regional faults: Calaveras, Greenville, Hayward, Mount Diablo, and San Andreas. The primary seismic hazard is potential ground shaking. Figure 10-3 shows the location of these fault lines and the probability of a major earthquake on each.

Calaveras Fault

The Calaveras Fault is a major branch of the San Andreas Fault, located east of the Hayward Fault. It extends 76 miles from the San Andreas Fault near Hollister to Danville at its northern end. The Calaveras Fault is one of the most geologically active and complex faults in the San Francisco Bay Area (USGS 2017). The probability of a M-6.7 or greater earthquake along the Calaveras Fault within the next 30 years is 26 percent.

Greenville

The Greenville Fault is in the eastern Bay Area in Contra Costa and Alameda Counties. This dextral strike-slip fault zone borders the eastern side of Livermore Valley and is considered to be part of the larger San Andreas fault system in the central Coast Ranges. The fault zone extends from northwest of Livermore Valley along the Marsh Creek and Clayton Faults toward Clayton Valley.

Hayward Fault

The Hayward Fault is a 45-mile-long, right lateral slip fault that runs parallel to the San Andreas Fault through densely populated areas on the East Bay. The Hayward Fault is increasingly becoming a hazard priority in the Bay Area because of its increased chance for activity and its proximity to critical infrastructure and multiple highly populated areas. The probability of a M-6.7 or greater earthquake along the Hayward Fault within the next 30 years is 33 percent (USGS 2016).

Mount Diablo

The Mount Diablo thrust fault is in the vicinity of Mount Diablo in Contra Costa County. The fault lies between the Calaveras Fault, the Greenville Fault, and the Concord Fault, all right-lateral strike slip faults, and appears to transfer movement from the Calaveras and Greenville Faults to the Concord Fault, while continuing to uplift Mount Diablo.

San Andreas Fault

The San Andreas Fault extends 810 miles from the East Pacific rise in the Gulf of California through the Mendocino fracture zone off the shore of northern California. The fault is estimated to be 28 million years old. It is an example of a transform boundary exposed on a continent. The fault forms the tectonic boundary between the Pacific Plate and the North American Plate, and its motion is right-lateral strike-slip. The San Andreas Fault is typically referenced in three segments. The southern segment extends from its origin at the East Pacific Rise to Parkfield, California, in Monterey County. The central segment extends from Parkfield to Hollister, California. The northern segment extends northwest from Hollister, through the Bay Area, to its ultimate junction with the Mendocino fracture zone and the Cascadia subduction zone in the Pacific Ocean. The probability of a M-6.7 or greater earthquake along the San Andreas Fault within the next 30 years is 22 percent (USGS 2016).

Source: USGS, 2016c

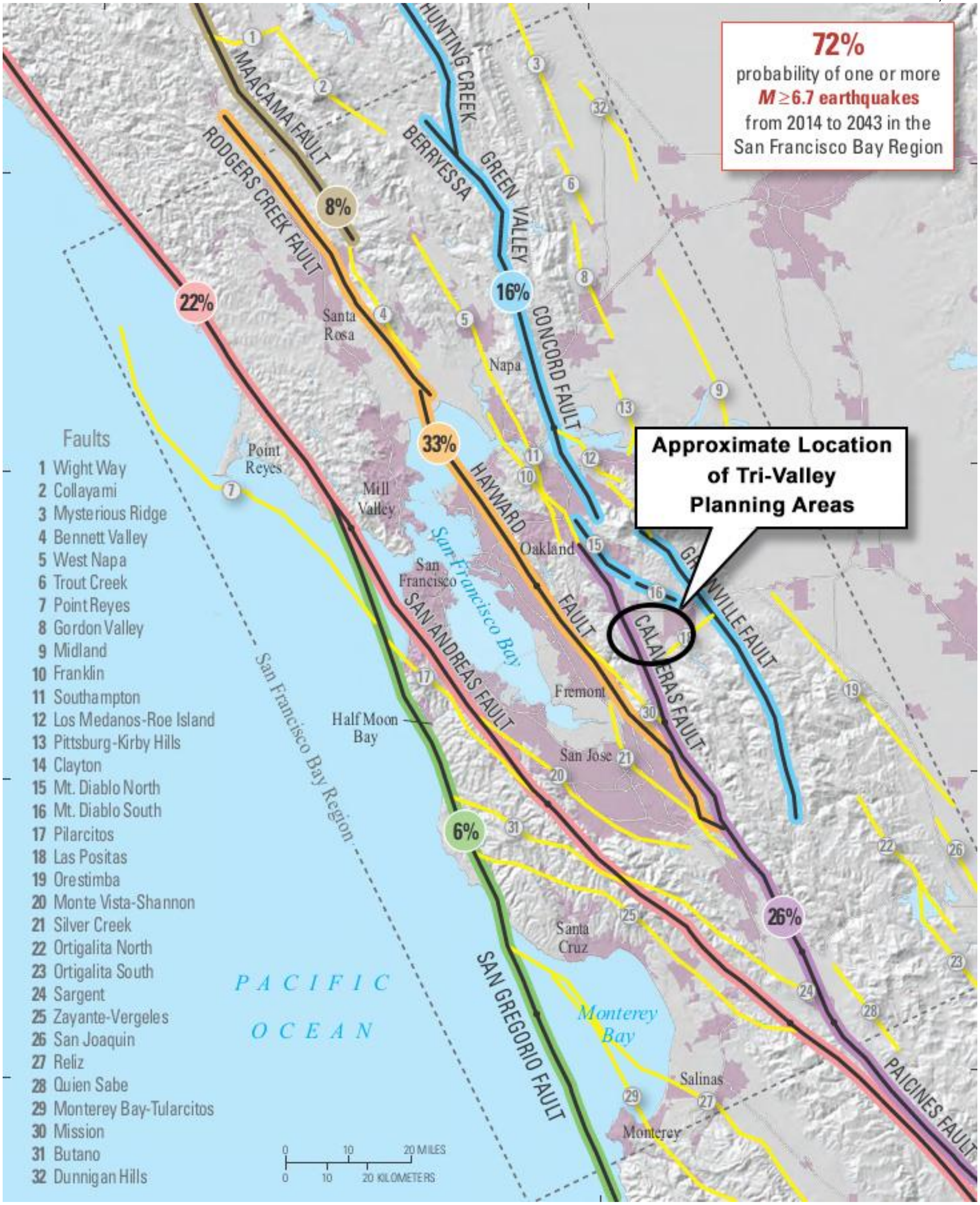


Figure 10-3. Significant Known Faults in the Bay Area

NEHRP Soil Type and Liquefaction Mapping

Figure 10-4 shows NEHRP soil classifications in San Mateo County. Figure 10-5 shows areas that have moderate, high or very high susceptibility to liquefaction.

Alquist-Priolo Zone Maps

California's Alquist-Priolo Zone Maps provide regulatory zones for potential surface fault rupture where fault lines intersect with future development and populated areas. The purpose of these maps is to assist in the geologic investigation before construction begins to ensure that the resulting structure will not be located on an active fault. The Tri-Valley planning area is located in a designated Alquist-Priolo Zone (California DOC 2023).

Alquist-Priolo maps were referenced, but not specifically used, in the assessment of risk for this plan. This plan assumes that the studies conducted and information provided by the State of California are the best available data for surface rupture risk and could not be improved through a separate assessment for this plan. Alquist-Priolo maps are available to the public on the California Department of Conservation website.

10.2.3 Frequency

California experiences hundreds of earthquakes each year, most with minimal damage and magnitudes below 3.0 on the Richter Scale. Earthquakes that cause moderate damage to structures occur several times a year. According to the USGS, a strong earthquake measuring greater than 5.0 occurs every 2 to 3 years and major earthquakes of more than 7.0 occur once a decade.

Both the San Andreas and the Hayward Faults have the potential for major to great events. The USGS estimated in 2016 that there is a 72 percent probability of at least one 6.7 or greater magnitude earthquake before 2043 that could cause widespread damage in the San Francisco Bay area (USGS 2016). The 2013 *State of California Multi-Hazard Mitigation Plan* cites projections that there is more than a 99-percent probability of a Magnitude-6.7 earthquake in California in the next 30 years and a 94-percent probability of a Magnitude-7.0 earthquake in California in the next 30 years. Probabilities for earthquakes on major fault lines in the San Francisco Bay Area were estimated by the USGS in a 2016 report, as summarized in Table 10-4.

Table 10-4. Earthquake Probabilities for the San Francisco Bay Area, 2014-2043

Fault	Probability of One or More ≥6.7 Quake, 2014-2043	Fault	Probability of One or More ≥6.7 Quake, 2014-2043
Hunting Creek	16%	Maacama	8%
Green Valley	16%	Rodgers Creek Fault	33%
Concord	16%	Hayward	33%
Greenville	16%	San Andreas	22%
Berryessa	16%	San Gregorio	6%
Calaveras	26%		

Source: (USGS 2016)

EXHIBIT A

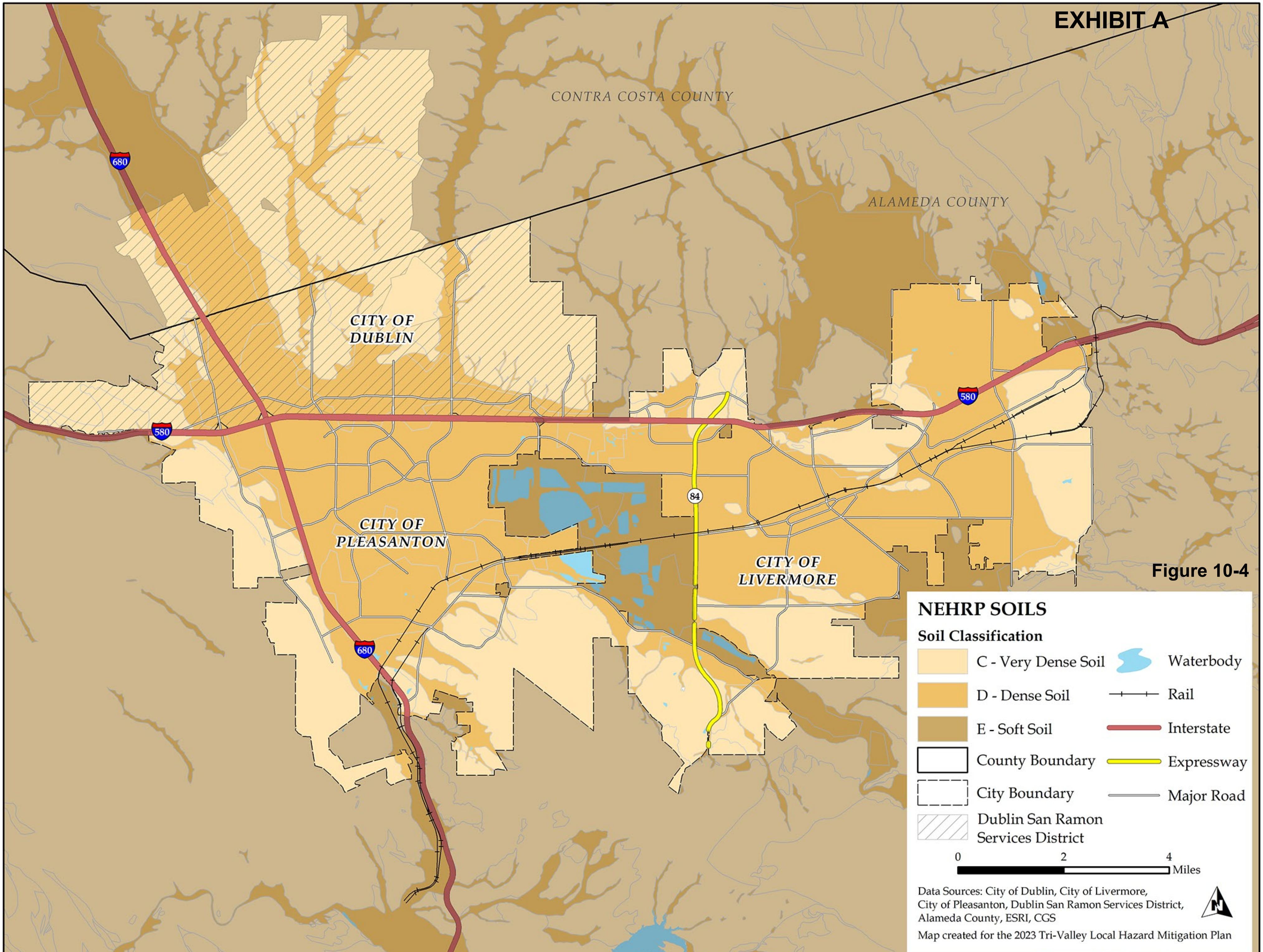
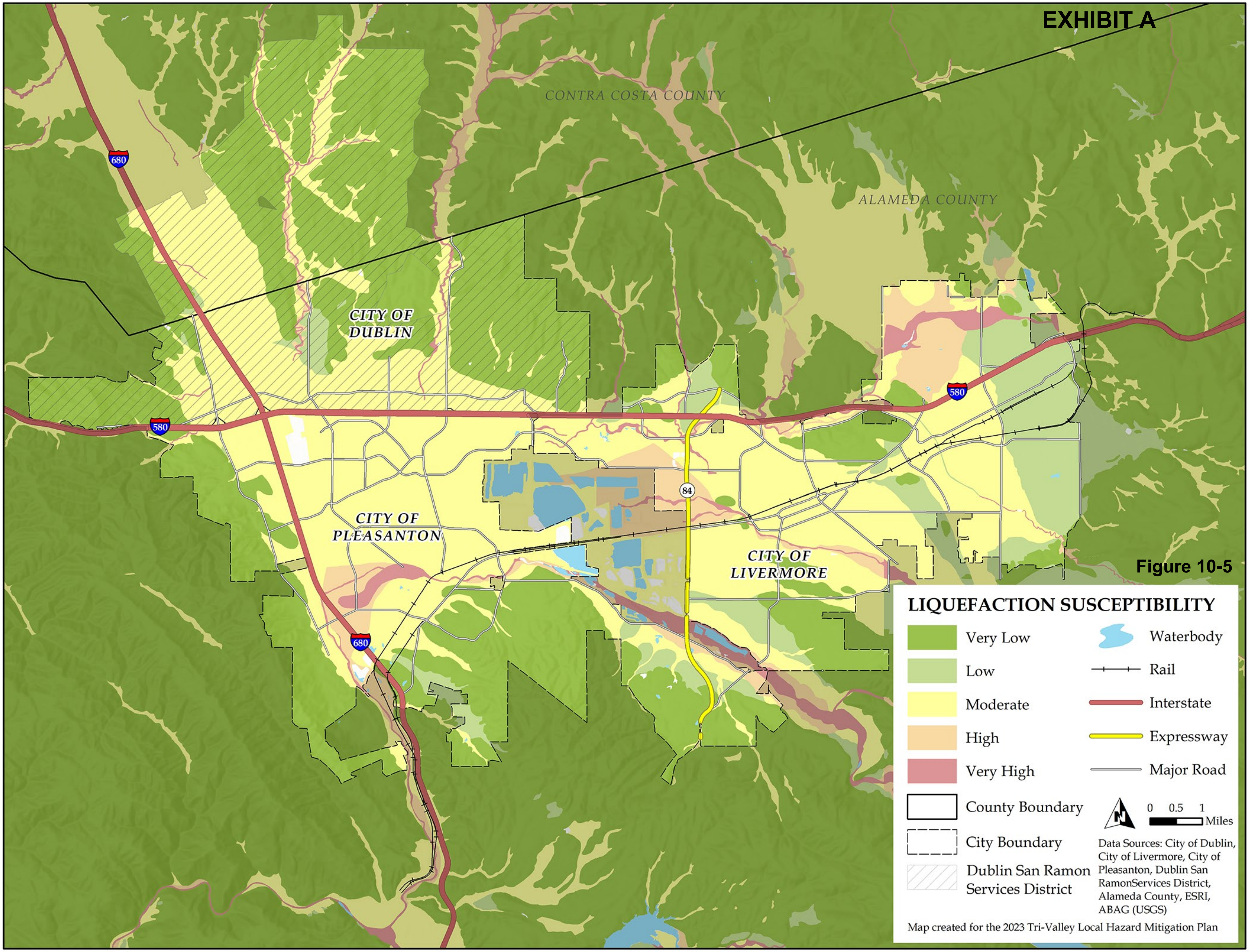


Figure 10-4

EXHIBIT A



CONTRA COSTA COUNTY
ALAMEDA COUNTY
CITY OF DUBLIN
CITY OF PLEASANTON
CITY OF LIVERMORE
680
580
84
Figure 10-5
LIQUEFACTION SUSCEPTIBILITY
Very Low
Low
Moderate
High
Very High
County Boundary
City Boundary
Dublin San Ramon Services District
Waterbody
Rail
Interstate
Expressway
Major Road
0 0.5 1 Miles
Data Sources: City of Dublin, City of Livermore, City of Pleasanton, Dublin San RamonServices District, Alameda County, ESRI, ABAG (USGS)
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

10.2.4 Severity

Earthquakes can last from a few seconds to over five minutes; they may also occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides or releases of hazardous material, compounding their disastrous effects.

The USGS has created ground motion maps based on current information about several fault zones. These maps show the PGA that has a certain probability (2 percent or 10 percent) of being exceeded in a 50-year period. The PGA is measured in numbers of g's (the acceleration associated with gravity). Figure 10-6 shows the PGAs with a 10 percent exceedance chance in 50 years in the planning area.

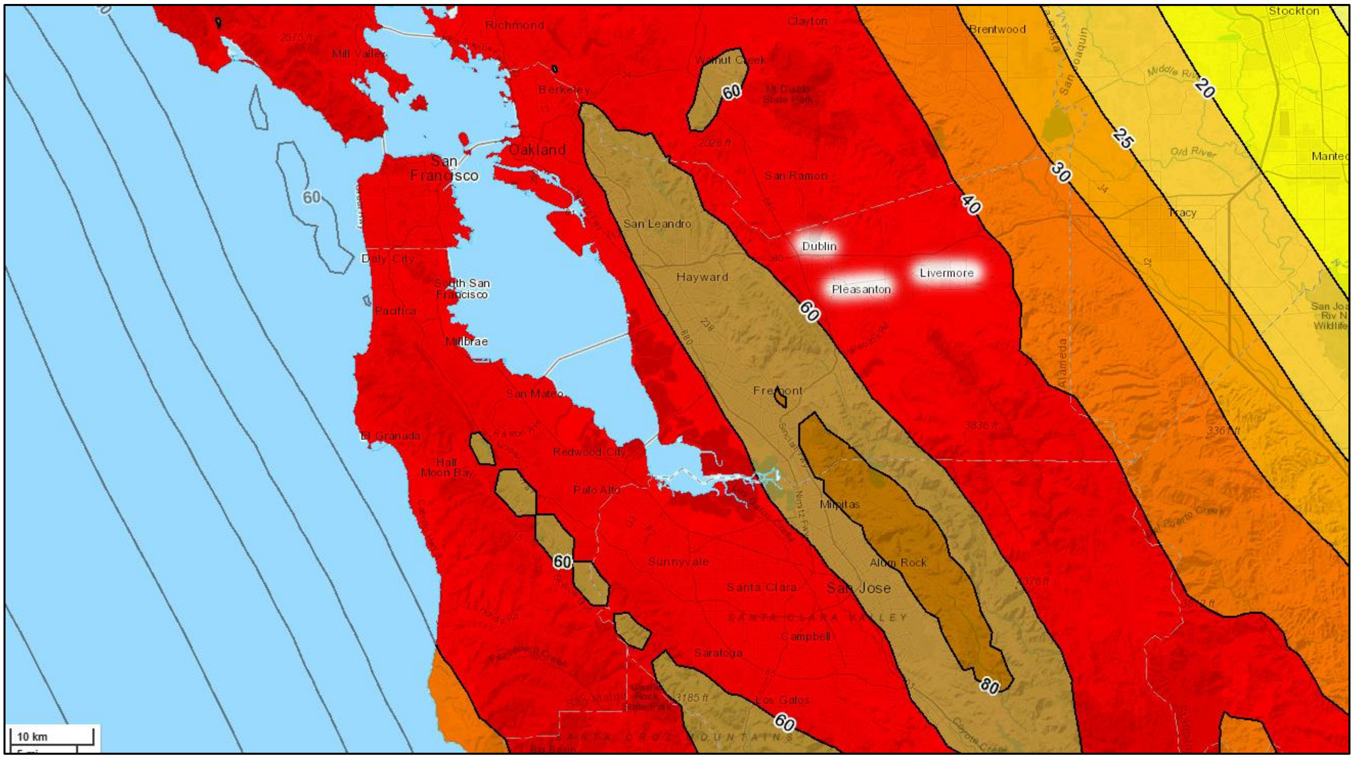


Figure 10-6. PGA (as %g) with 10-Percent Probability of Exceedance in 50 Years

10.2.5 Warning Time

There is no current reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems would give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short, but it could allow for someone to get under a desk, step away from a hazardous material, or shut down a computer system. For example, MyShake is a global smartphone seismic network for early warning that can keep users informed about earthquakes. It monitors for earthquakes using data from smartphone sensors.

10.3 EXPOSURE

10.3.1 Population

The entire population of the planning area (236,690) is potentially exposed to direct damage from earthquakes or indirect impacts such as business interruption, road closures, and loss of function of utilities. Figure 10-7 shows the estimated population of each planning area city living on NEHRP D soils, which make buildings more susceptible to damage from earthquakes, compared to total population. There are estimated to be 159,481 people in the total planning area living in these higher-risk areas, about 67 percent of the total population.

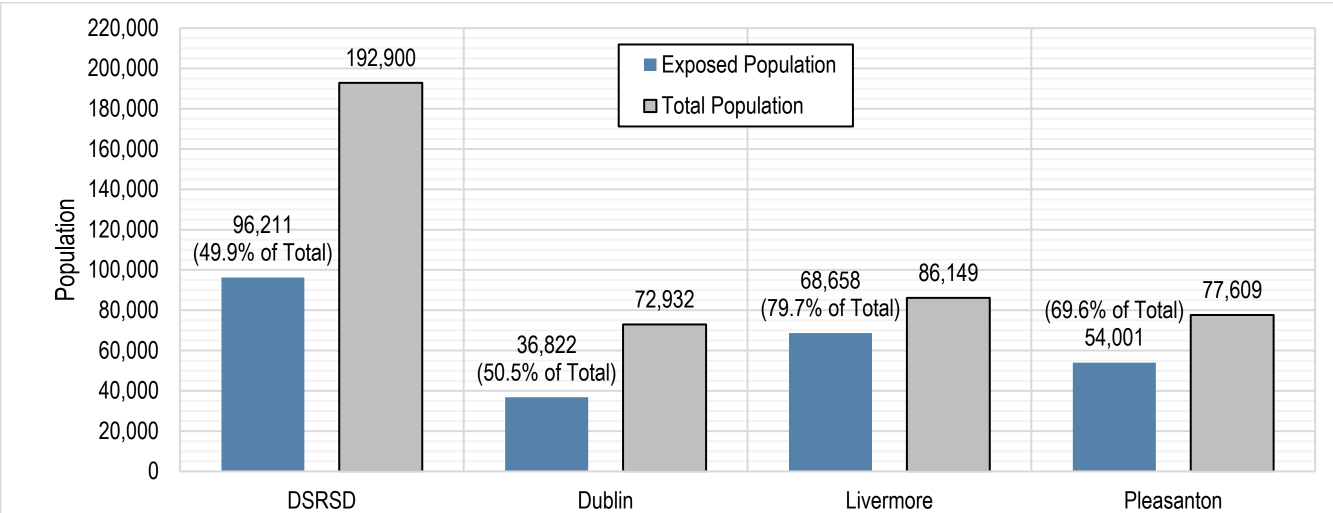


Figure 10-7. Population Living on NEHRP D Soils and Total Population, by Jurisdiction

10.3.2 Property

Figure 10-8 summarizes the number and value of buildings on NEHRP D soils in the planning area. Figure 10-9 shows the exposed total value as a percentage of the total replacement value in each city and in the overall planning area. Figure 10-10 shows the distribution by occupancy class of buildings on NEHRP D soils.

10.3.3 Critical Facilities

Critical facilities constructed on NEHRP Type D soils are particularly at risk from seismic events. Figure 10-11 shows the number of critical facilities on these soils, by category and jurisdiction. The total count of critical facilities on NEHRP Type D soils (905) represents 78 percent of the planning area total of 1,161.

10.3.4 Environment

The entire planning area is exposed to the earthquake hazard, including all natural resources, habitat, and wildlife.

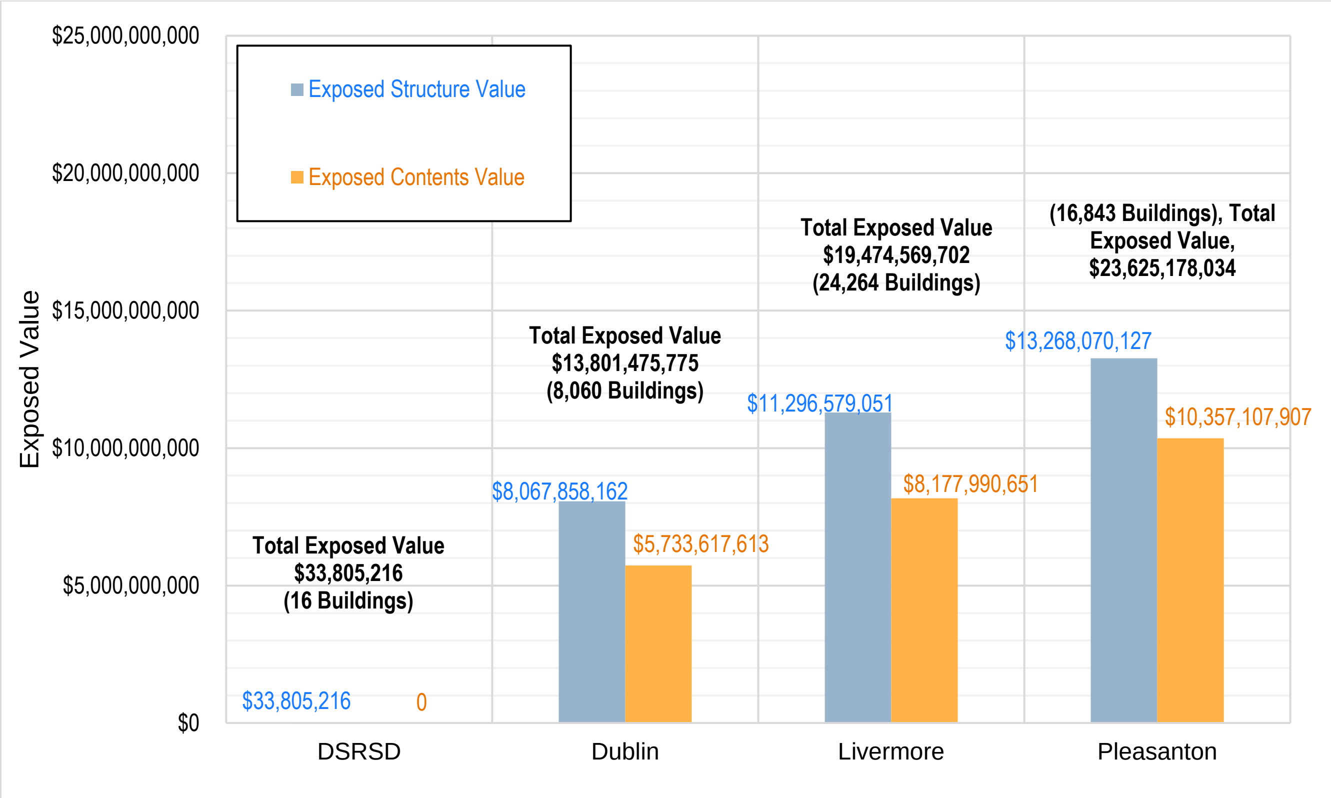


Figure 10-8. Number and Exposed Value of Buildings on NEHRP D Soils

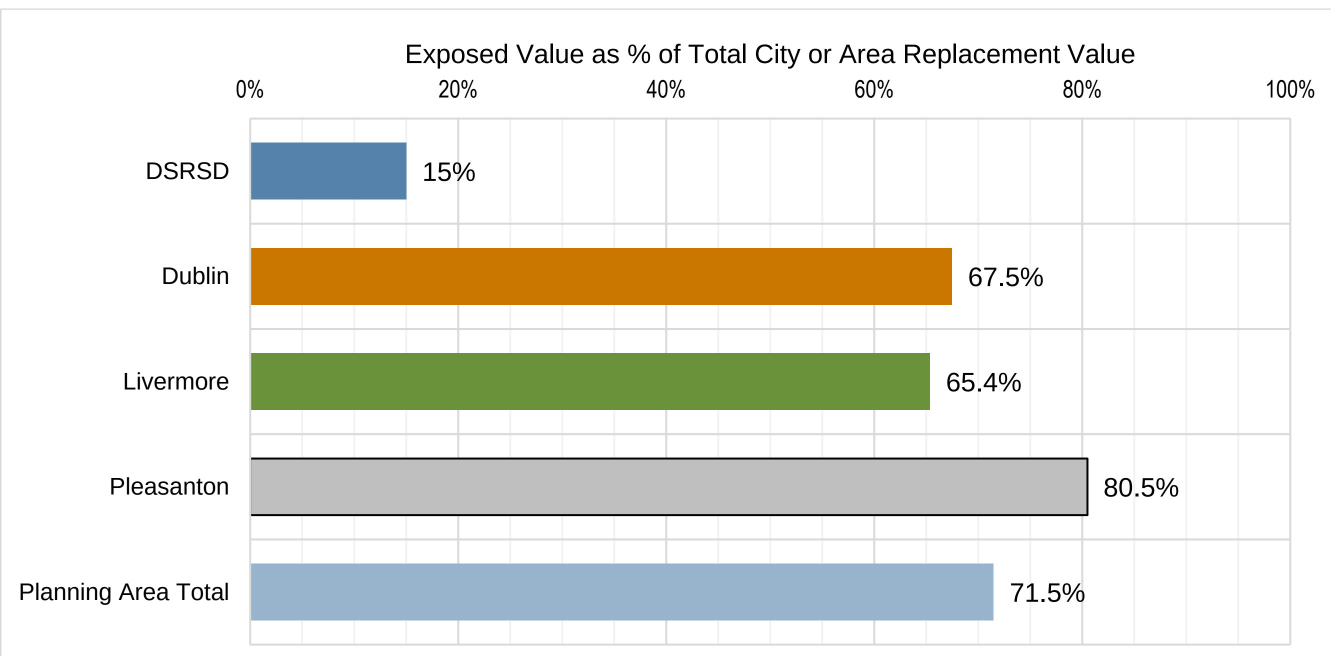


Figure 10-9. Total Value on NEHRP D Soils as Percent of Total Replacement Value, by Jurisdiction

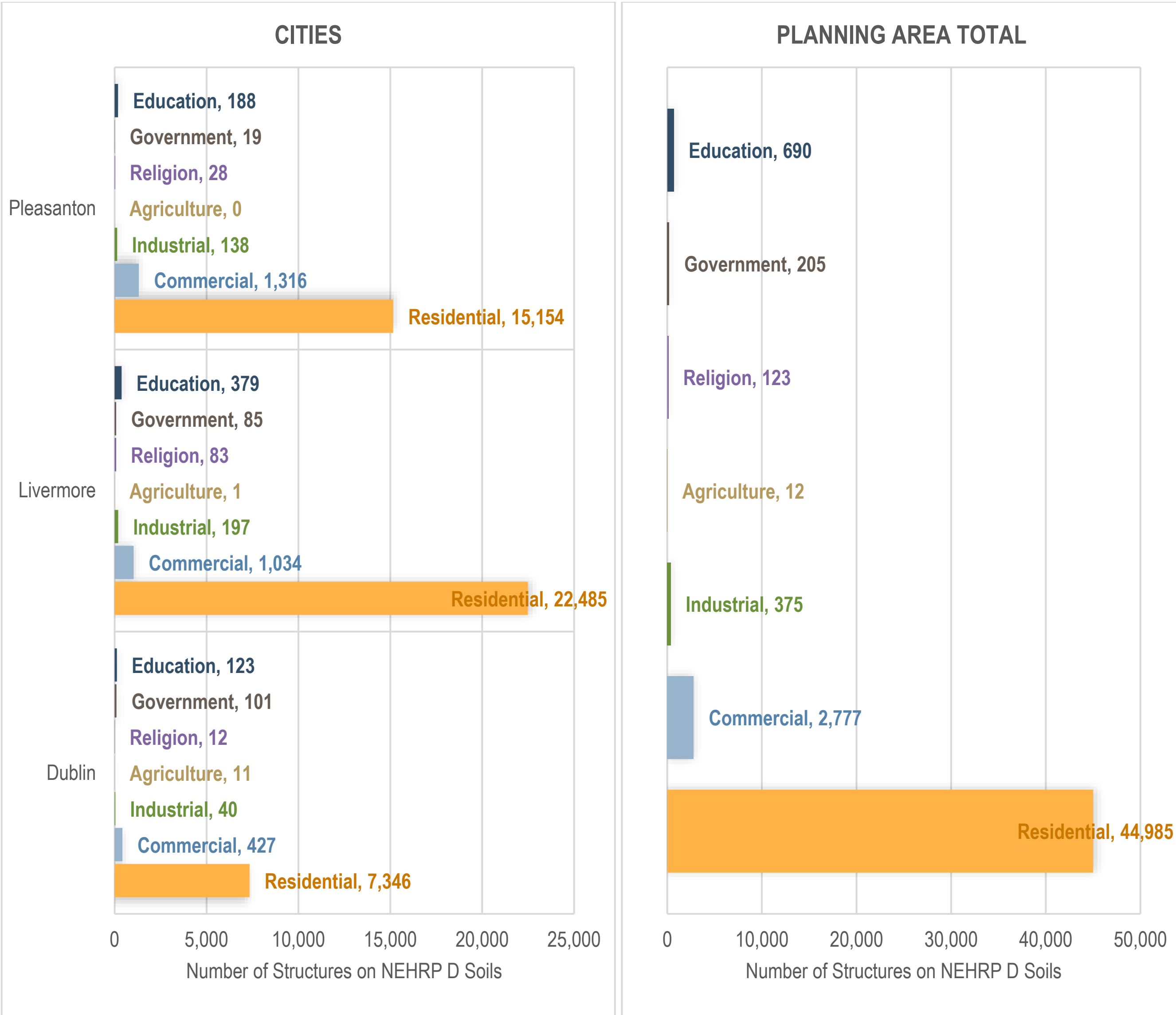


Figure 10-10. Number of Structures on NEHRP D Soils, by Occupancy Class

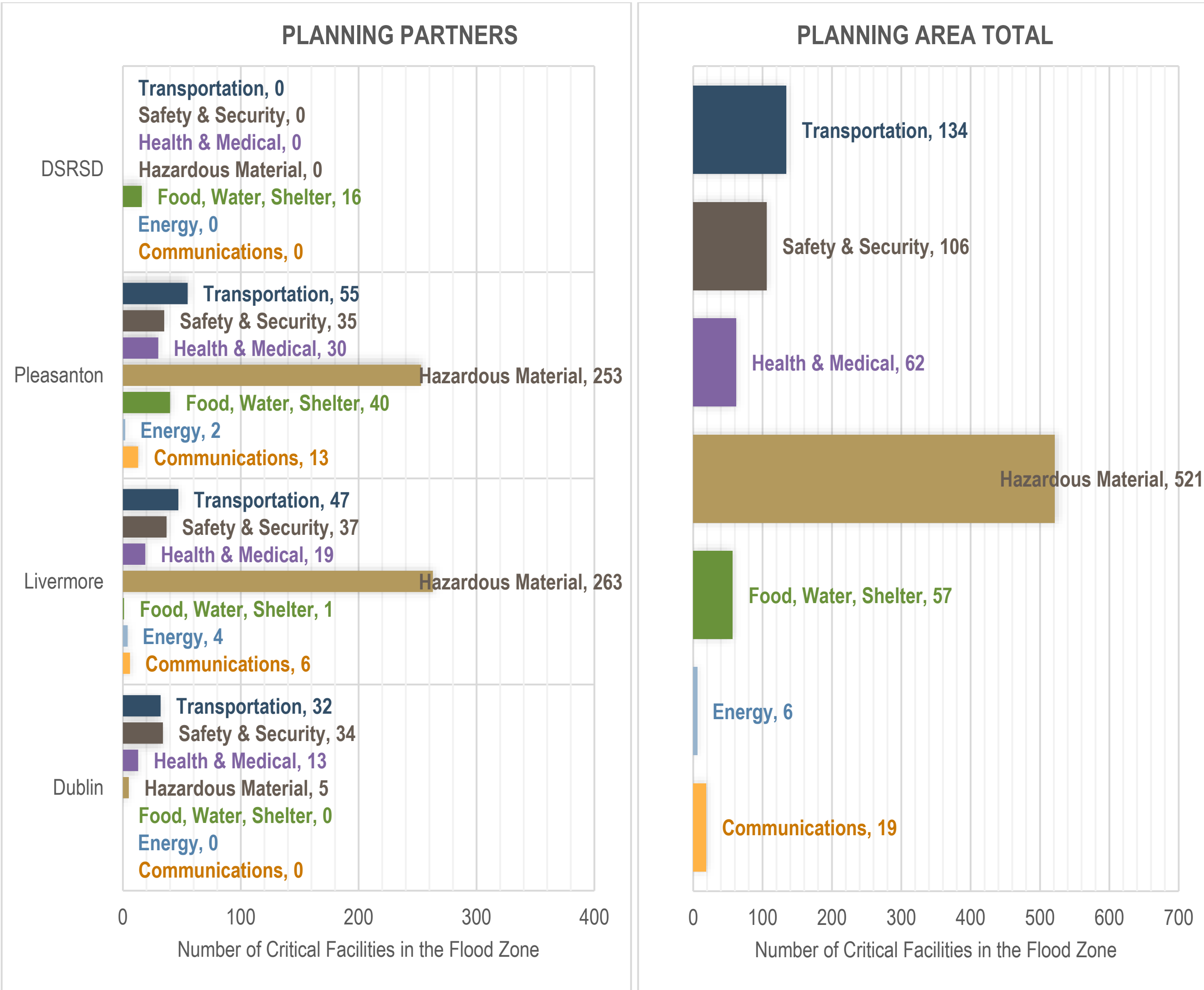


Figure 10-11. Critical Facilities on NEHRP D Soils, by Category and Jurisdiction

10.4 VULNERABILITY

Earthquake vulnerability data for the risk assessment was generated using a Hazus Level 2 (user-defined) analysis for the events listed in Table 10-5. Results are summarized in the sections below.

Table 10-5. Earthquakes Modeled for Risk Assessment

Fault Scenario	Magnitude	Epicenter Depth	Epicenter Location	PGA
Calaveras (North)	6.86	5.8 miles	Central San Ramon	Figure 10-12
Greenville	6.86	7.0 miles	5.4 miles northeast of Central Livermore	Figure 10-13
HayWired[a]	7.05	5.0 miles	9 miles northwest of Dublin	Figure 10-14
Las Positas	6.5	6.0 miles	2.5 miles southeast of Central Livermore	Figure 10-15
Mount Diablo Thrust South	6.5	5.6 miles	10 miles northeast of Central San Ramon	Figure 10-16

a. “HayWired” is the name used by the USGS for an earthquake scenario featuring an event on the Hayward fault with a magnitude of 7.0. (U.S. Geological Survey 2018)

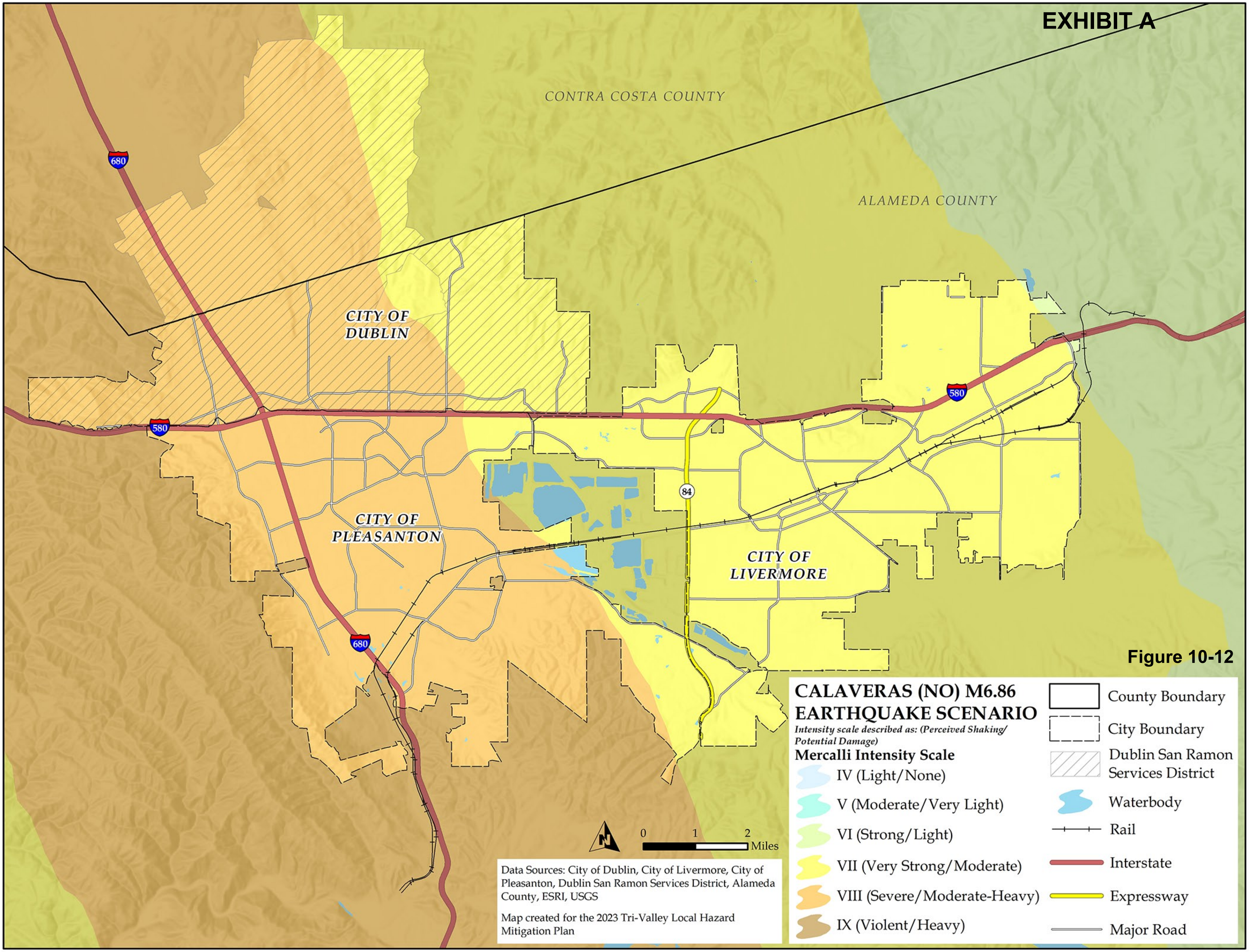


EXHIBIT A
CONTRA COSTA COUNTY
ALAMEDA COUNTY
CITY OF DUBLIN
CITY OF PLEASANTON
CITY OF LIVERMORE
680
580
84
Figure 10-12
CALAVERAS (NO) M6.86 EARTHQUAKE SCENARIO
Intensity scale described as: (Perceived Shaking/ Potential Damage)
Mercalli Intensity Scale
IV (Light/None)
V (Moderate/Very Light)
VI (Strong/Light)
VII (Very Strong/Moderate)
VIII (Severe/Moderate-Heavy)
IX (Violent/Heavy)
County Boundary
City Boundary
Dublin San Ramon Services District
Waterbody
Rail
Interstate
Expressway
Major Road
0 1 2 Miles
N
Data Sources: City of Dublin, City of Livermore, City of Pleasanton, Dublin San Ramon Services District, Alameda County, ESRI, USGS
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

EXHIBIT A

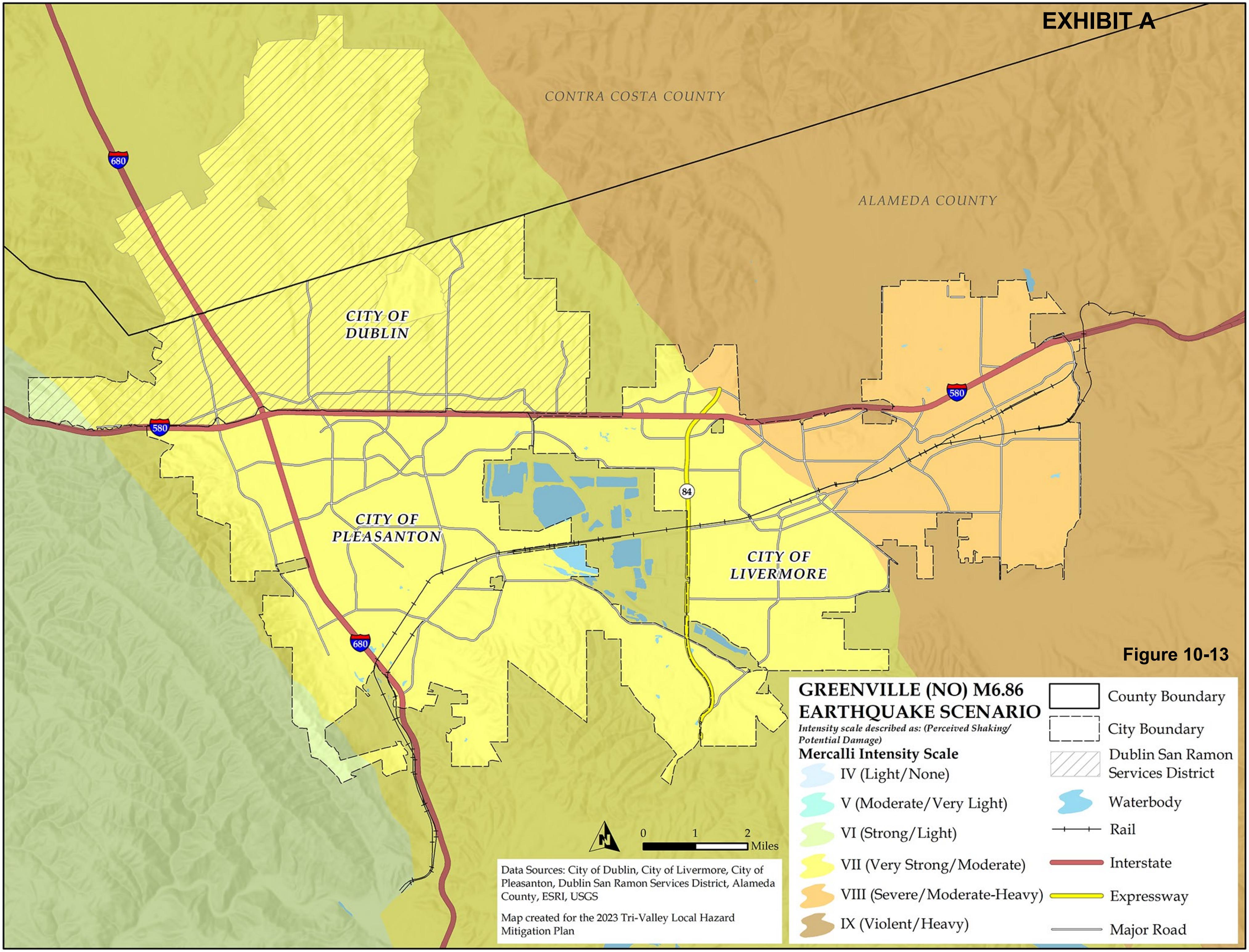


Figure 10-13

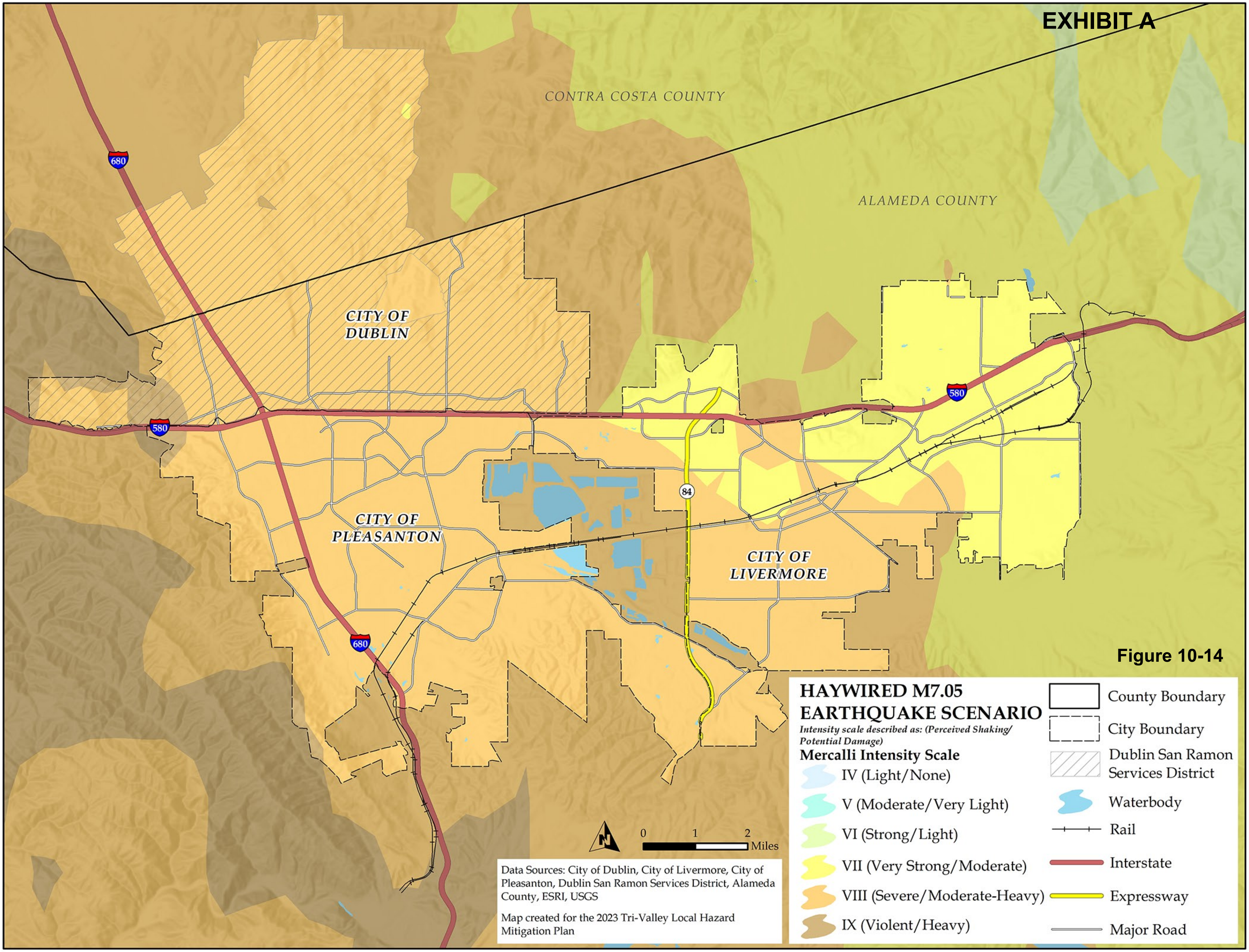


EXHIBIT A
CONTRA COSTA COUNTY
ALAMEDA COUNTY
CITY OF DUBLIN
CITY OF PLEASANTON
CITY OF LIVERMORE
680
580
84
Figure 10-14
HAYWIRED M7.05 EARTHQUAKE SCENARIO
Intensity scale described as: (Perceived Shaking/ Potential Damage)
Mercalli Intensity Scale
IV (Light/None)
V (Moderate/Very Light)
VI (Strong/Light)
VII (Very Strong/Moderate)
VIII (Severe/Moderate-Heavy)
IX (Violent/Heavy)
County Boundary
City Boundary
Dublin San Ramon Services District
Waterbody
Rail
Interstate
Expressway
Major Road
0 1 2 Miles
Data Sources: City of Dublin, City of Livermore, City of Pleasanton, Dublin San Ramon Services District, Alameda County, ESRI, USGS
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

EXHIBIT A

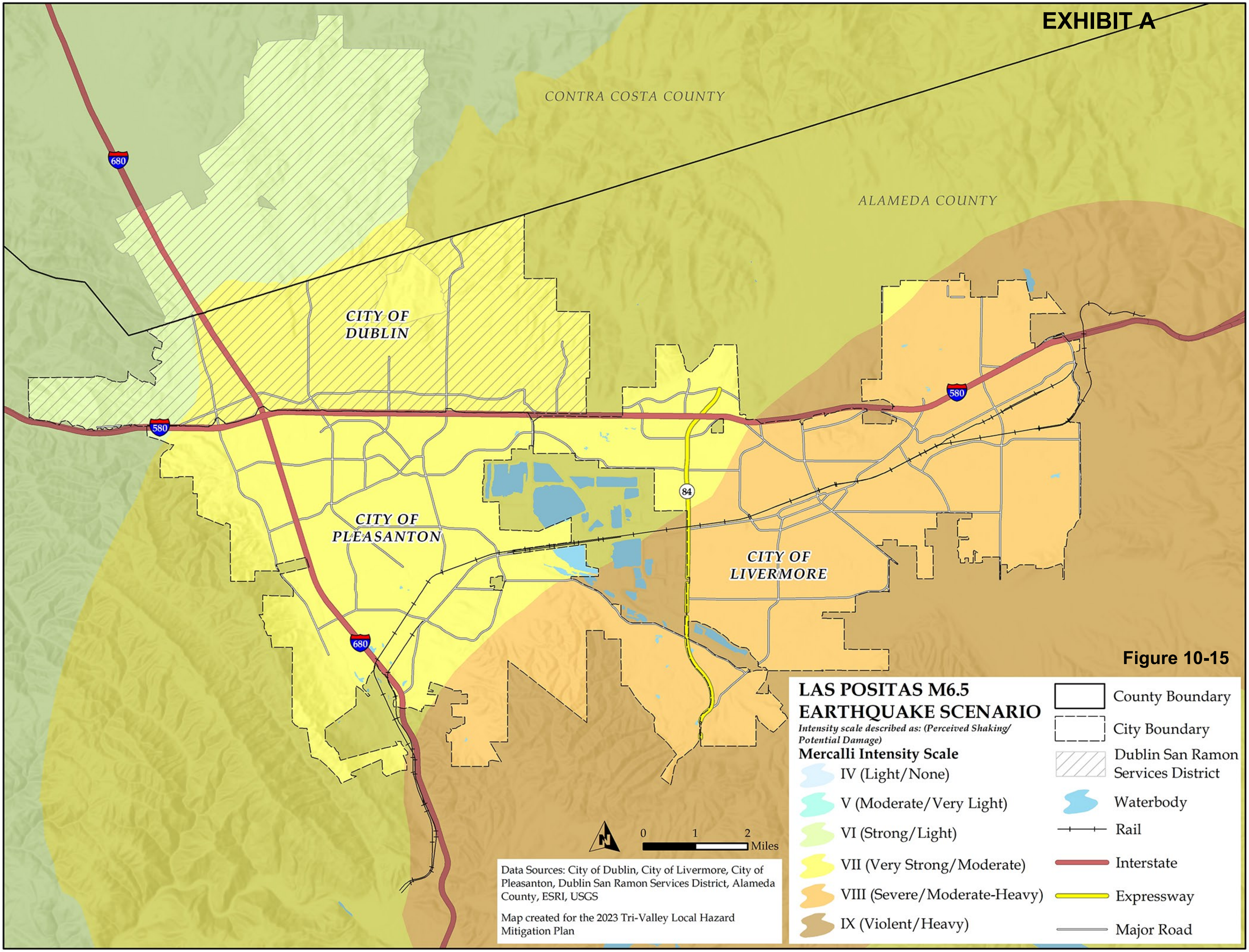


Figure 10-15

EXHIBIT A

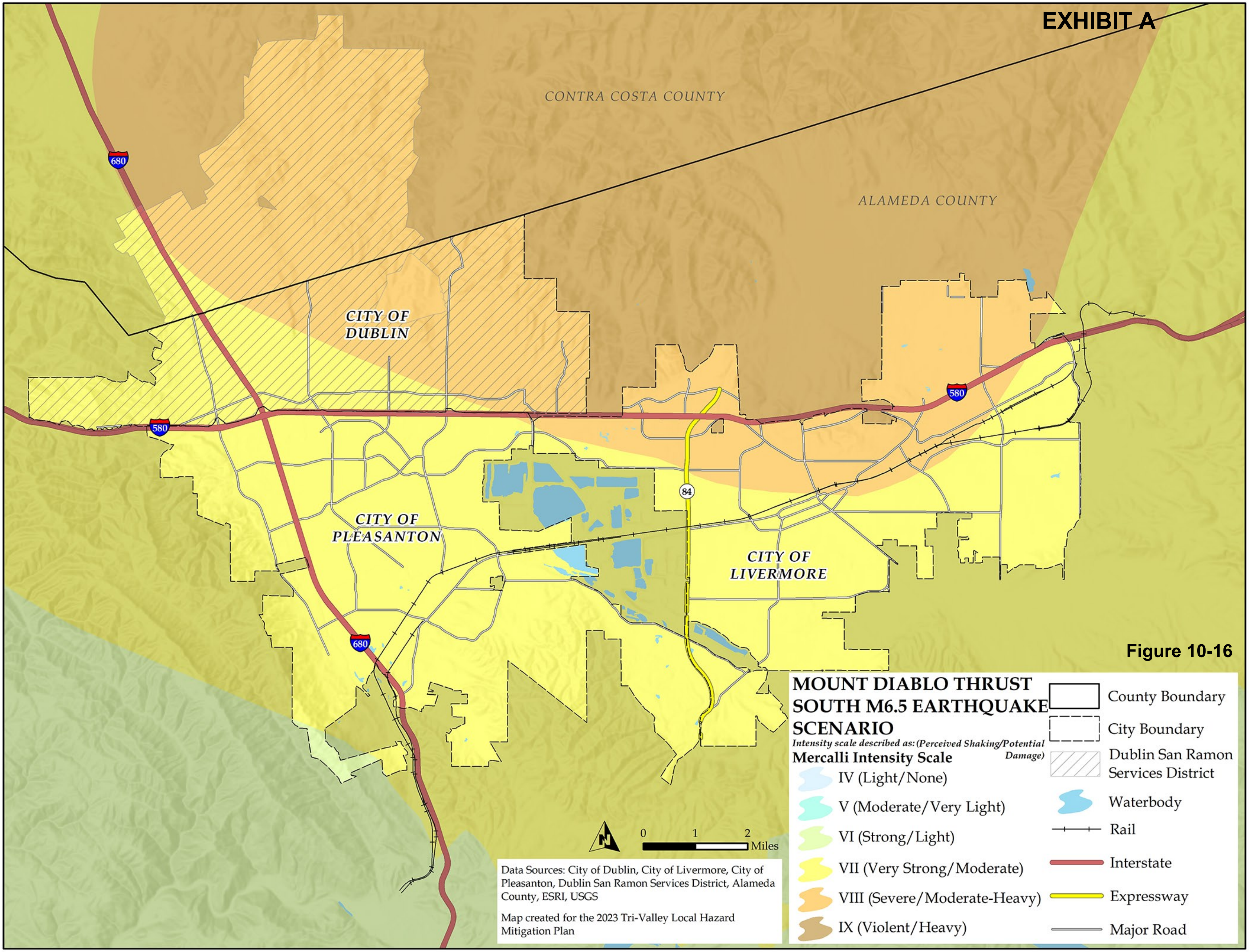


Figure 10-16

10.4.1 Population

Displacement and Shelter Requirements

Impacts on persons and households in the planning area were estimated in Hazus for the five earthquake scenarios. Estimates for each city and the total planning area are presented in Figure 10-17 and Figure 10-18. DSRSD does not have responsibility for sheltering or evacuation for displaced people.

Vulnerable Populations

While all people located in the NEHRP Class D and E Soils areas are considered exposed and potentially vulnerable, socially vulnerable populations include the very young, the elderly, and those of lower economic status. These socially vulnerable populations are most susceptible based on many factors, including their physical and financial ability to react or respond during a hazard and the ability to be self-sustaining for prolonged periods of time after an incident because of limited ability to stockpile supplies. Socially vulnerable populations may live in structures that do not conform to seismic building codes; therefore, homes will sustain more damage during an event. Local senior and disabled populations within the cities of Dublin, Livermore, and Pleasanton and those served by DSRSD may be especially vulnerable to earthquake events due to mobility challenges or reliance on medical devices such as oxygen supply tanks. Those experiencing homelessness are also especially vulnerable due to their lack of stable shelter and depending on their location, may be threatened by bridge or other structural collapse. Those who are economically challenged and inhabit structures that are not building code compliant or marginally structurally sound might have economic challenges performing repairs following an earthquake.

Additionally, emergency and urgent care medical facilities in the planning area could be impacted by a substantial earthquake. These facilities include Kaiser Permanente, Stanford Health Care, Veterans Health Care Livermore Division, Stanford Childrens Health, Axis Community Health, and others.

10.4.2 Property

Loss Potential

Property losses were estimated through the Hazus analysis for the five scenario events. Figure 10-19 summarizes the results for the overall planning area for structural loss, representing damage to building structures, and non-structural loss, representing the value of lost contents and inventory, relocation, income loss, rental loss, and wage loss. Figure 10-20 through Figure 10-22 show the results for each planning area city.

Debris Estimates

The Hazus analysis also estimated the amount of earthquake-caused debris in the planning area for the five scenario events, as summarized in Figure 10-23.

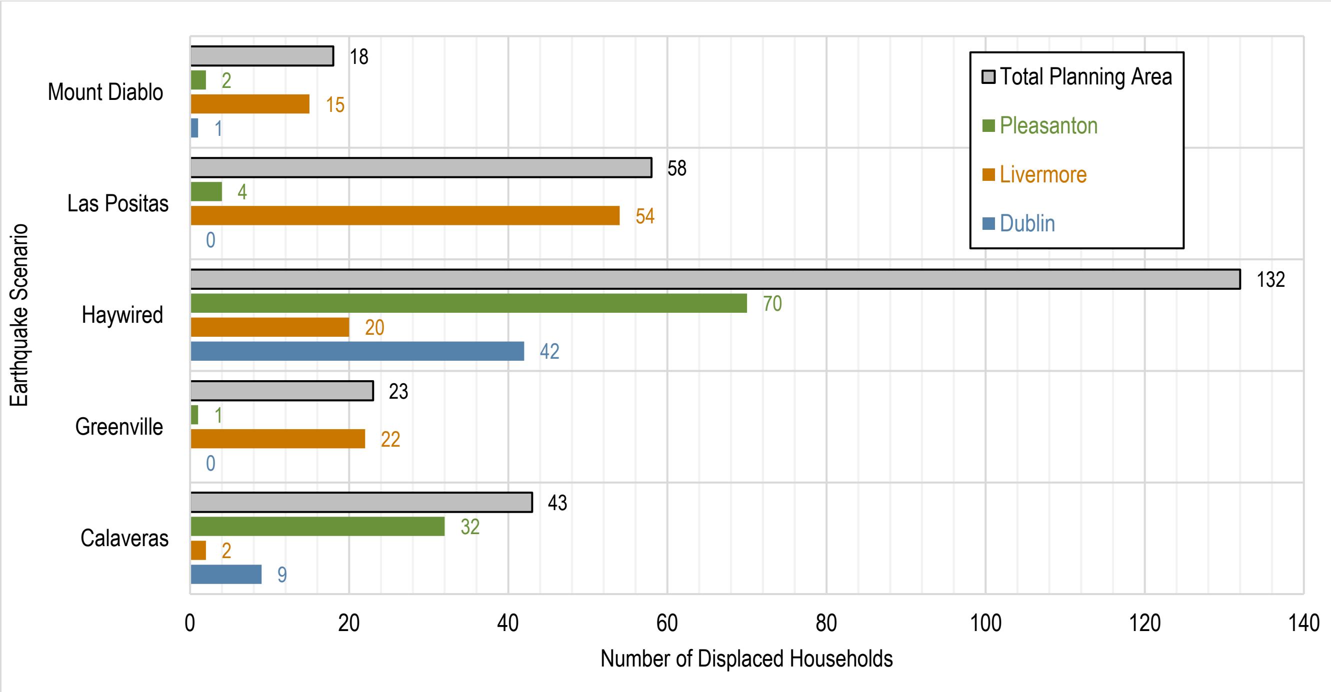


Figure 10-17. Estimated Number of Displaced Households Due to Earthquake

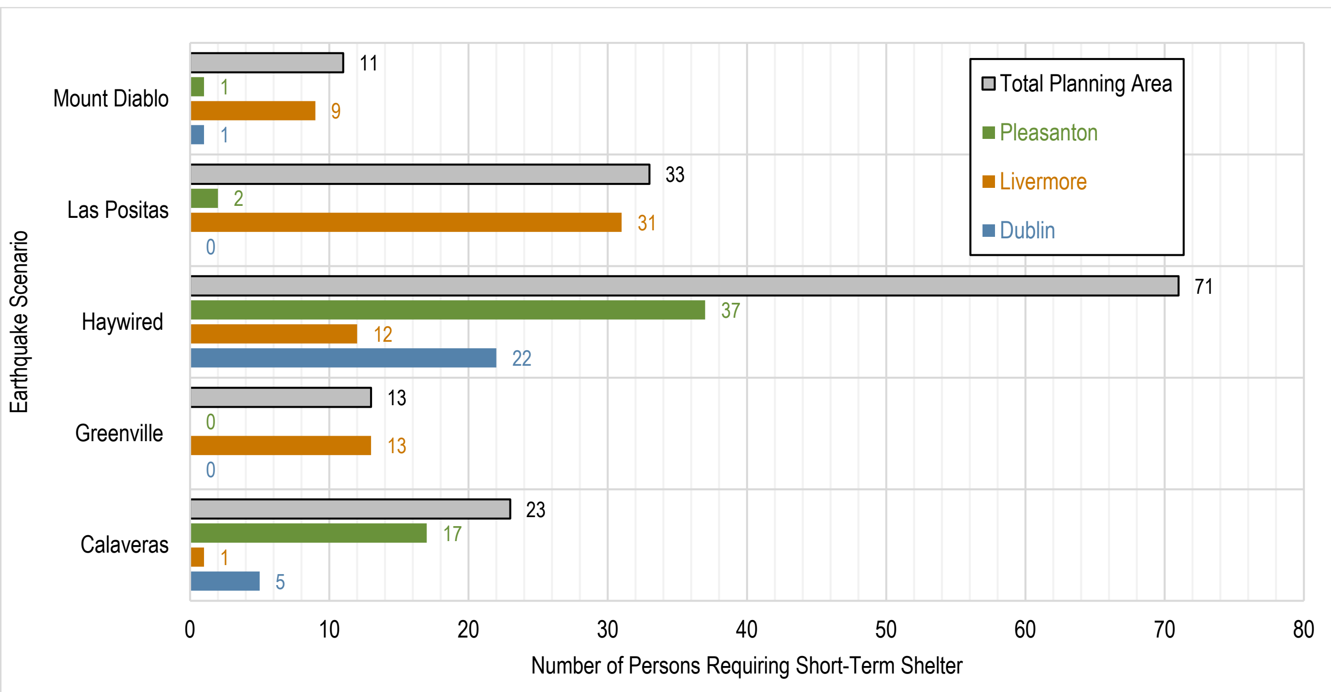


Figure 10-18. Estimated Number of Persons Requiring Short-Term Shelter Due to Earthquake

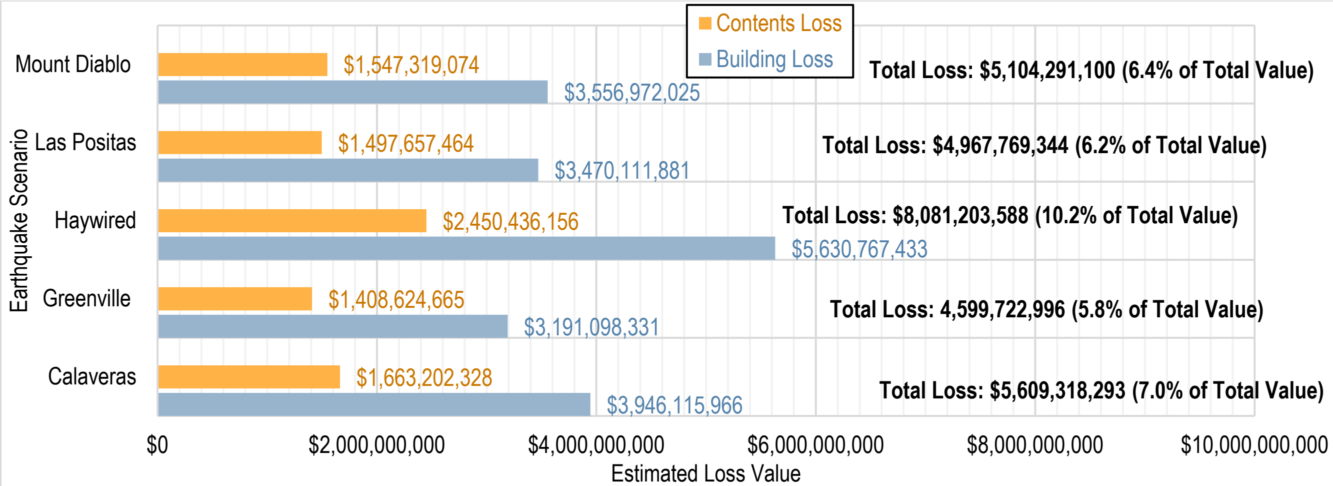


Figure 10-19. Loss Estimates for Earthquake, Total Planning Area

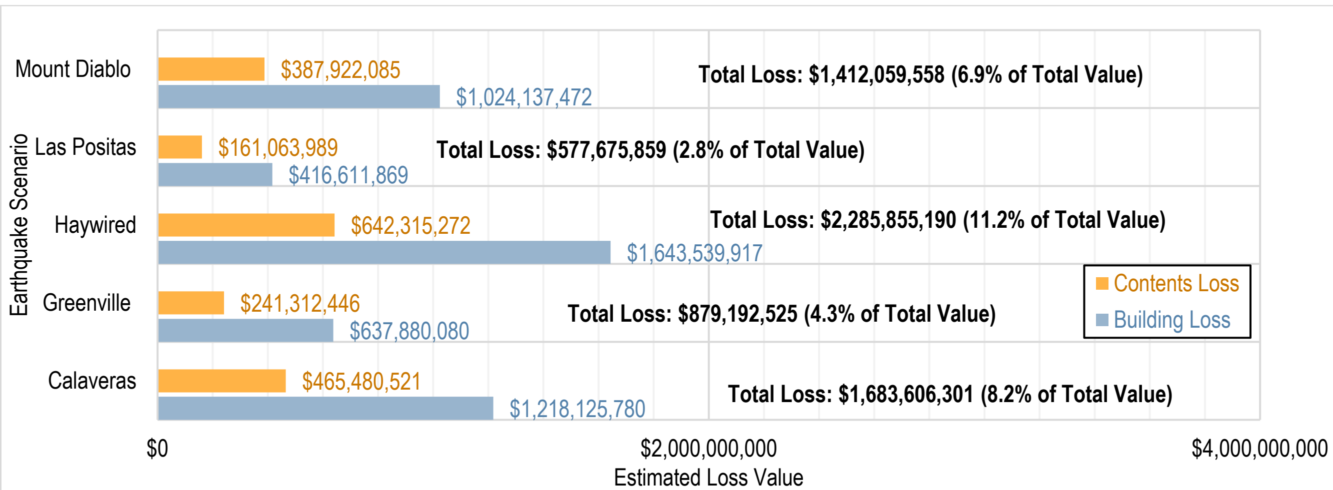


Figure 10-20. Loss Estimates for Earthquake, City of Dublin

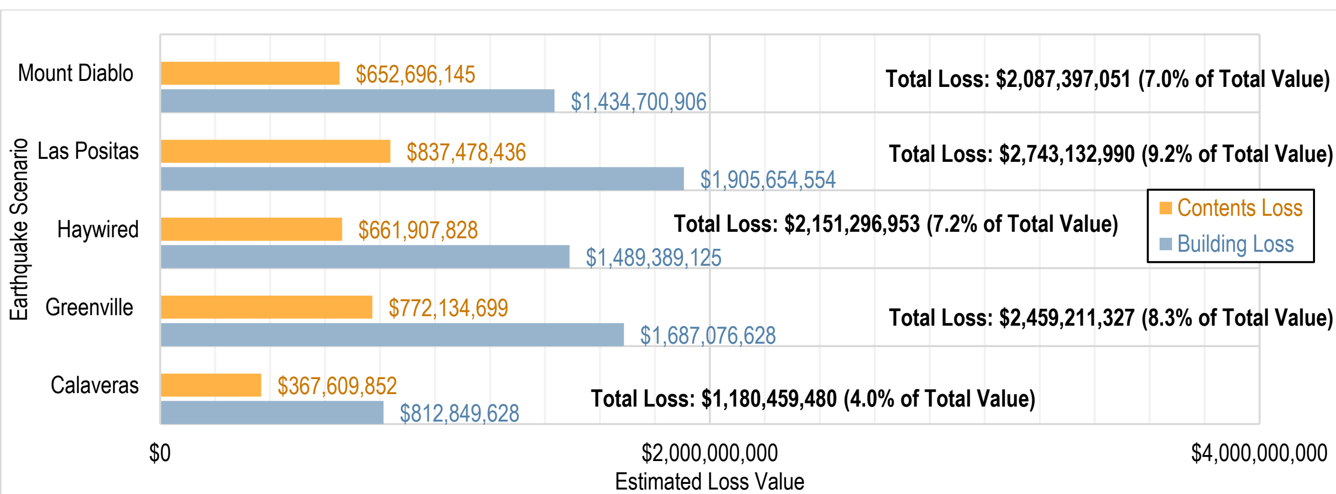


Figure 10-21. Loss Estimates for Earthquake, City of Livermore

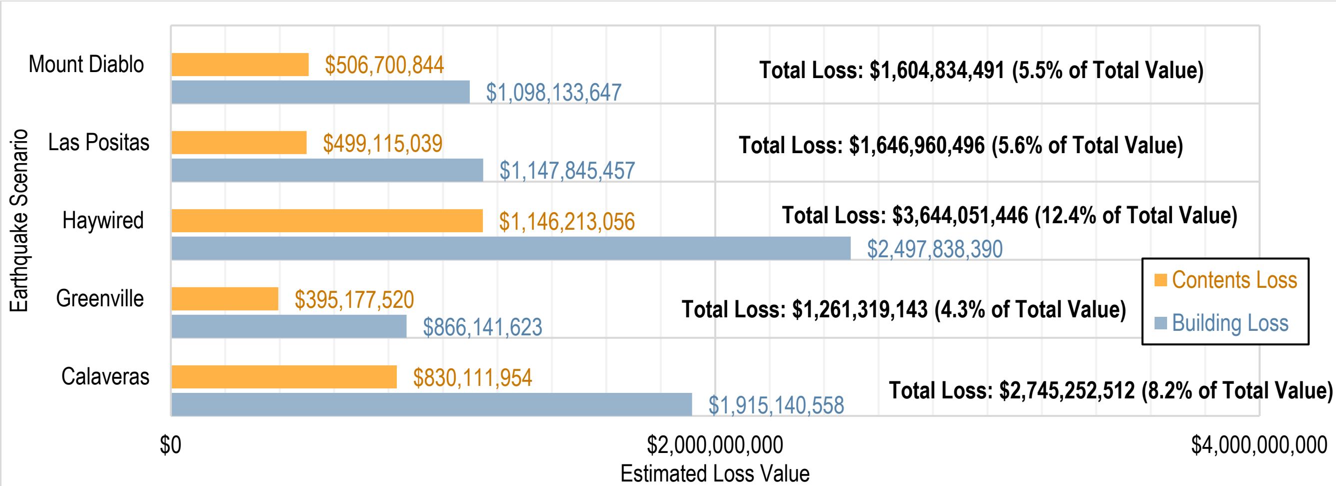


Figure 10-22. Loss Estimates for Earthquake, City of Pleasanton

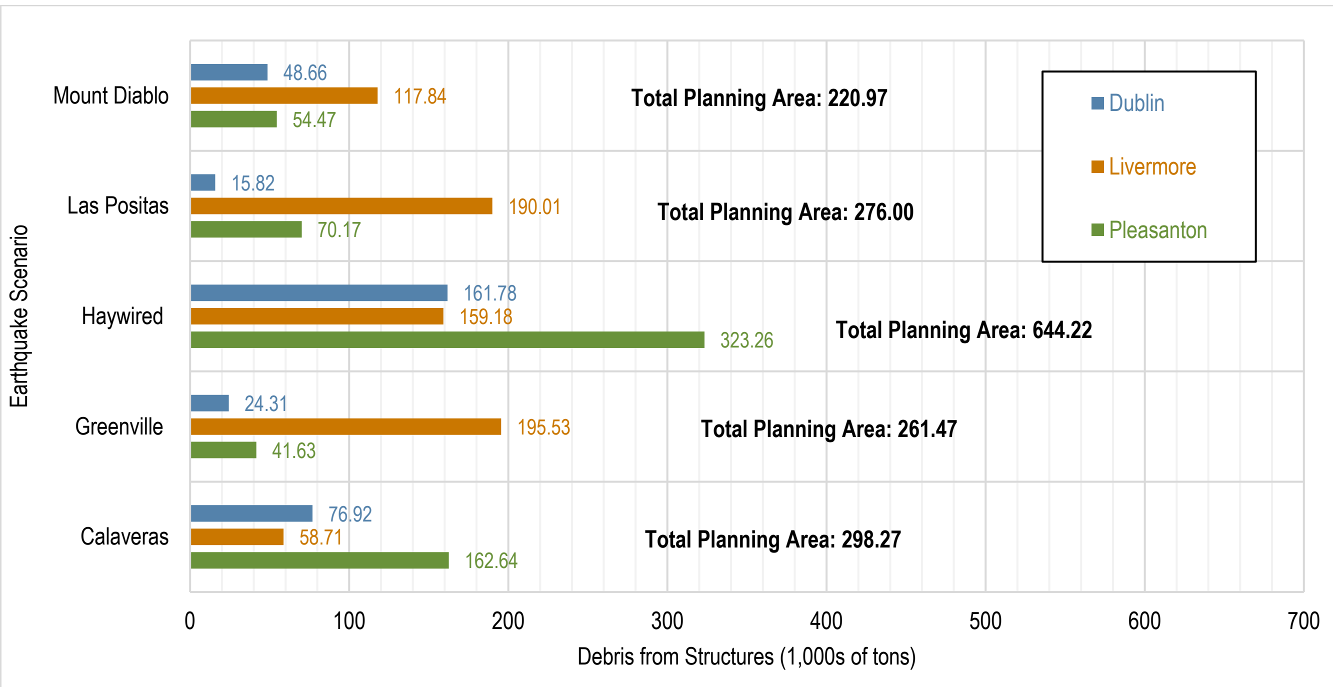


Figure 10-23. Estimated Earthquake-Caused Debris

Building Age

Table 10-6 identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development. Using these time periods, the planning team used Hazus to identify the number of structures in the planning area by date of construction. The number of structures does not reflect the number of total housing units, as many multi-family units are reported as one structure. Approximately 36 percent of the planning area's structures were constructed after the Building Code was amended in 1994 to include seismic safety provisions. Approximately 1 percent were built before 1933 when there were no building permits, inspections, or seismic standards.

Table 10-6. Age of Structures in Planning Area

Time Period	Number of Current Structures Built in Period	Significance of Time Frame
Pre-1933	971	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
1933-1940	253	In 1940, the first strong motion recording was made.
1941-1960	4.047	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
1961-1975	20.629	In 1975, significant improvements were made to lateral force requirements.
1976-1994	18,746	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1994 – present	25,409	Seismic code is currently enforced.
Total	**70,055**	

10.4.3 Critical Facilities

Level of Damage

Hazus classifies the vulnerability of critical facilities to earthquake damage in five categories: no damage, slight damage, moderate damage, extensive damage, or complete damage. The model was used to assign a vulnerability category to each critical facility in the planning area. Figure 10-24 through Figure 10-28 show the results for the evaluated events as the average estimated probability for all facilities in each category.

Time to Return to Functionality

Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as probability of being functional at specified time increments: 1, 3, 7, 14, 30 and 90 days after the event. For example, Hazus may estimate that a facility has 5 percent chance of being fully functional at Day 3, and a 95 percent chance of being fully functional at Day 90. Critical facilities were analyzed for the assessed earthquake scenarios. Figure 10-29 through Figure 10-33 show the results as the average estimated probability for all facilities in each category.

10.4.4 Environment

The environment vulnerable to earthquake hazard is the same as the environment exposed to the hazard.

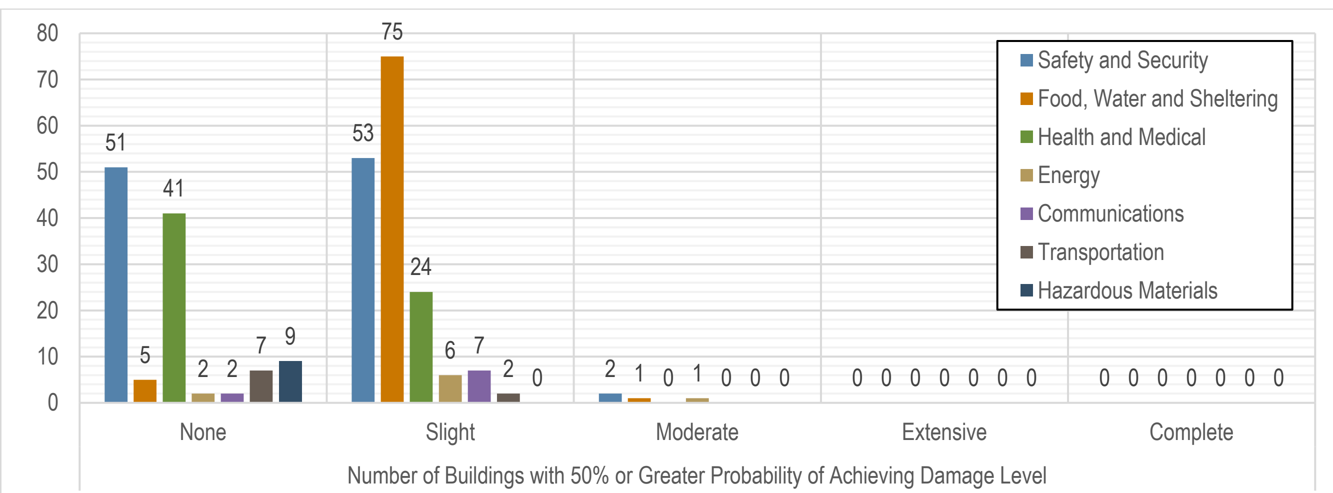


Figure 10-24. Critical Facility Damage Potential, Calaveras Fault Scenario

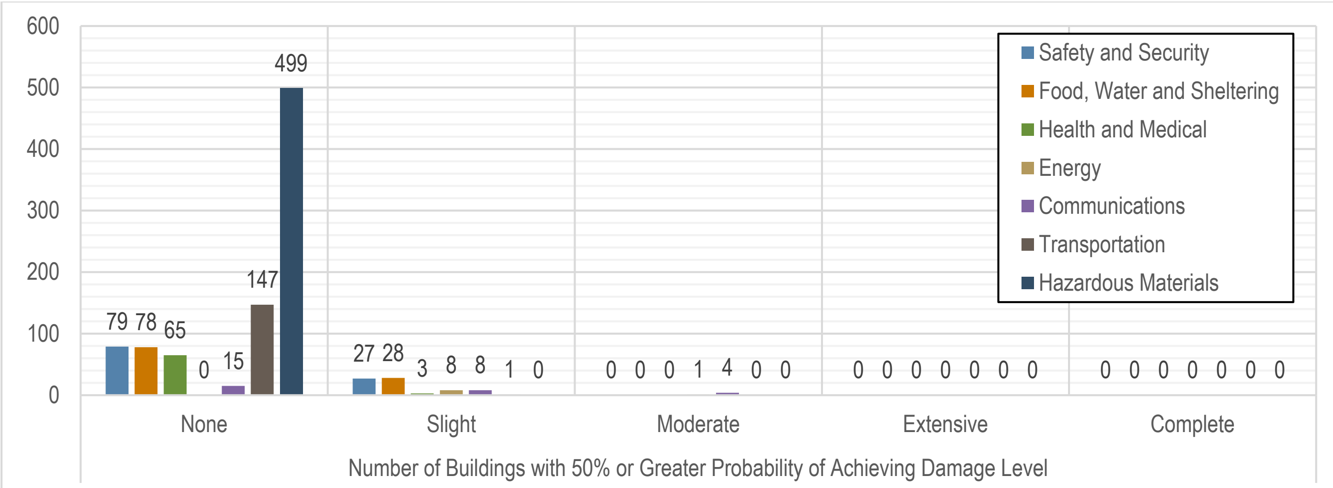


Figure 10-25. Critical Facility Damage Potential, Greenville Fault Scenario

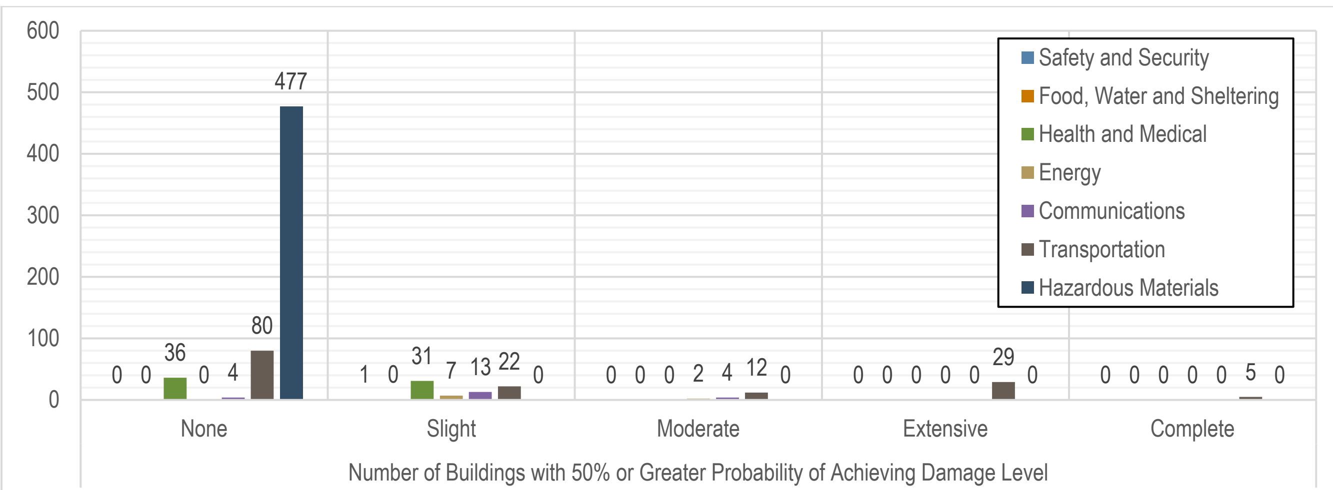


Figure 10-26. Critical Facility Damage Potential, HayWired Fault Scenario

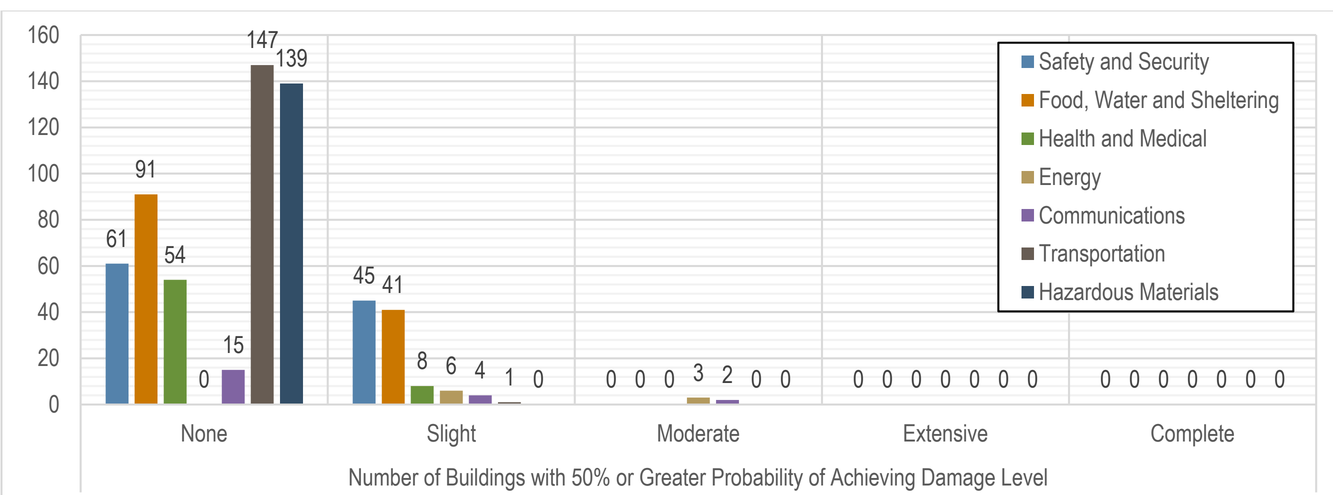


Figure 10-27. Critical Facility Damage Potential, Las Positas Fault Scenario

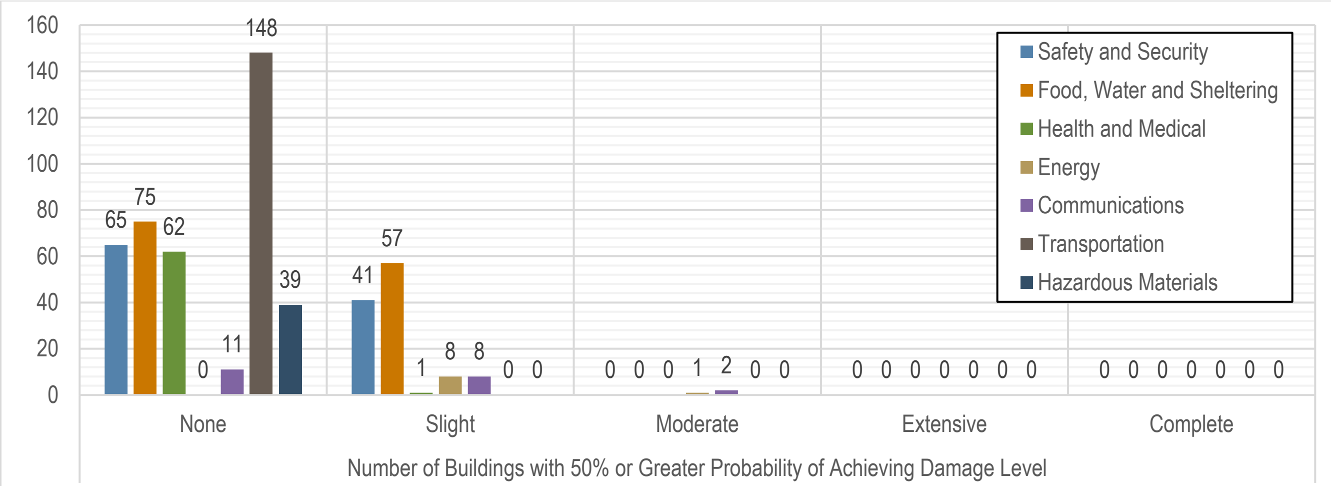


Figure 10-28. Critical Facility Damage Potential, Mt. Diablo Fault Scenario

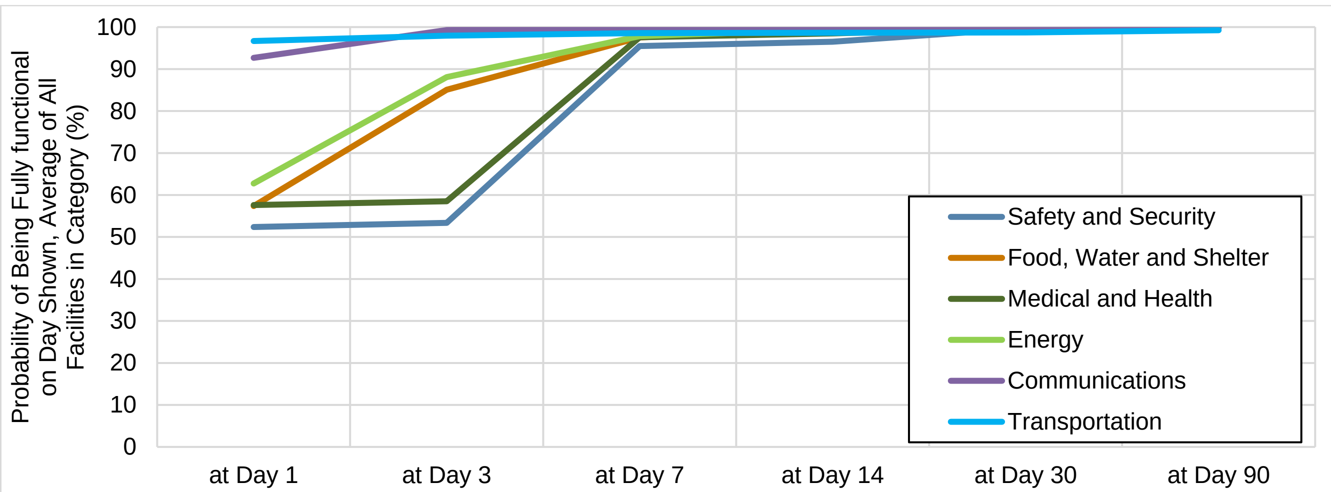


Figure 10-29. Critical Facility Functionality, Calaveras Fault Scenario

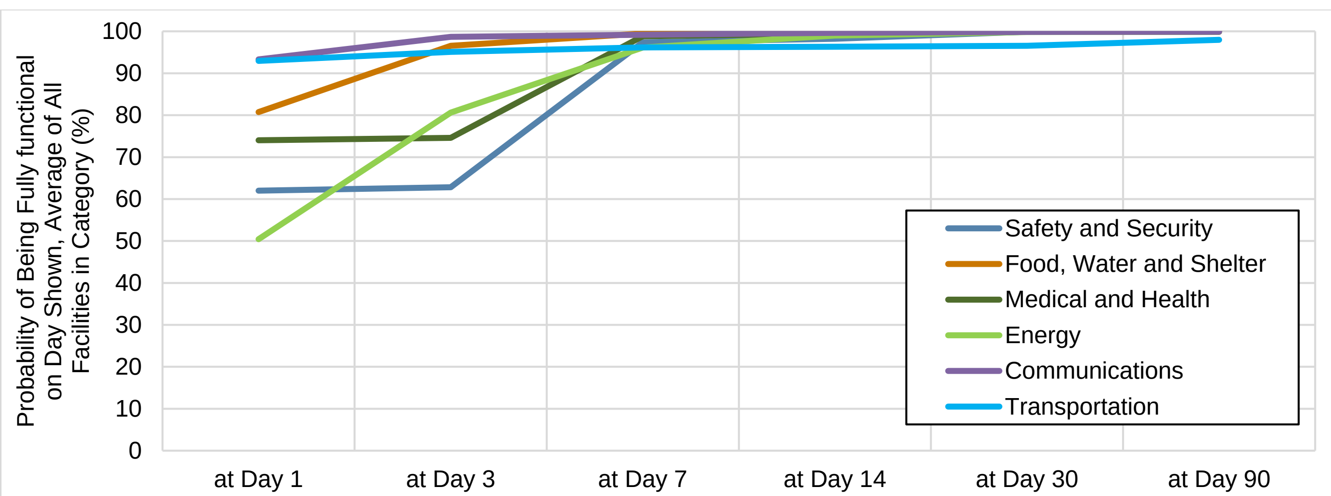


Figure 10-30. Critical Facility Functionality, Greenville Fault Scenario

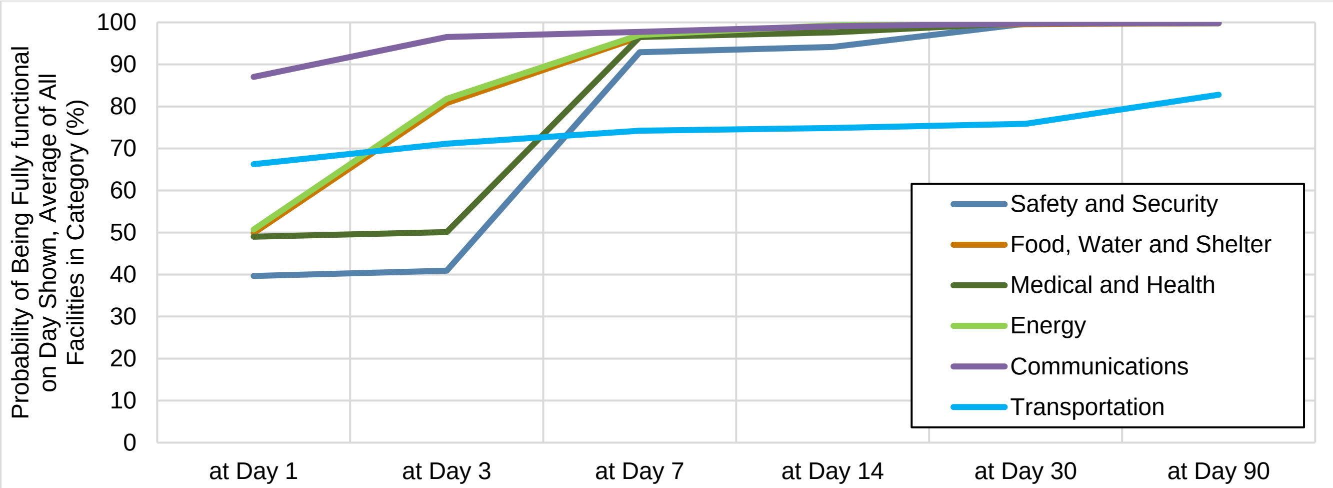


Figure 10-31. Critical Facility Functionality, HayWired Fault Scenario

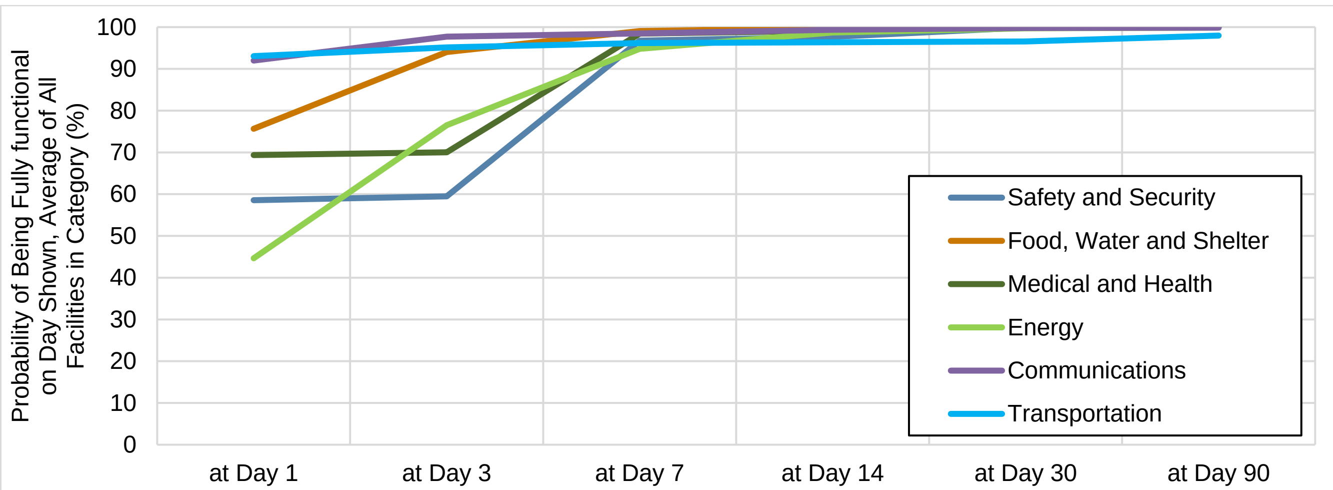


Figure 10-32. Critical Facility Functionality, Las Positas Fault Scenario

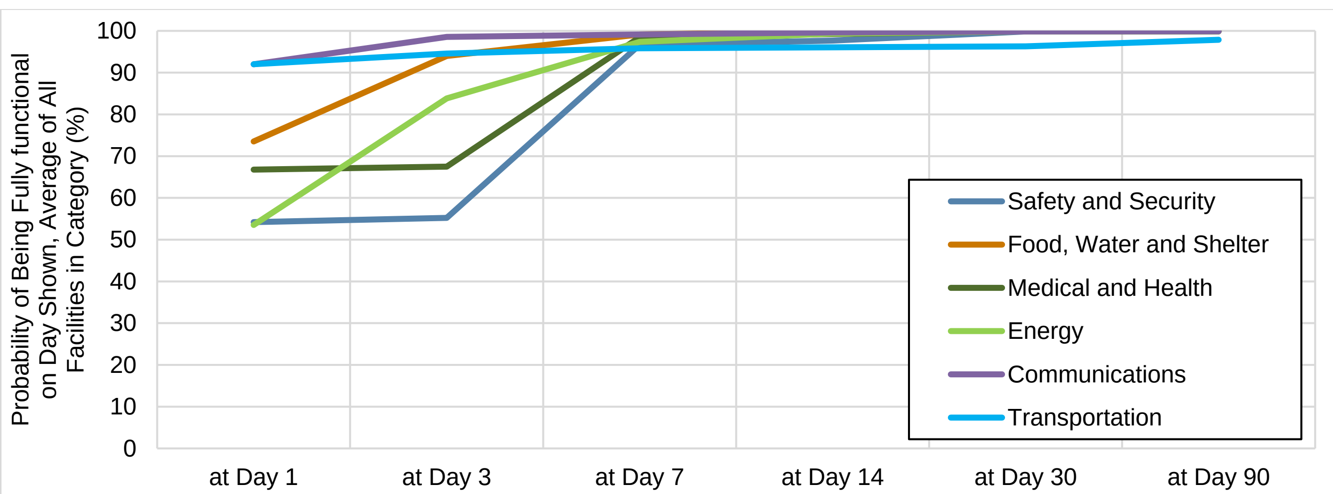


Figure 10-33. Critical Facility Functionality, Mt. Diablo Fault Scenario

10.5 FUTURE TRENDS IN DEVELOPMENT

Land use in the planning area will be directed by general plans adopted under California's General Planning Law. The safety elements of the general plans establish standards and plans for the protection of the cities from hazards. The information in this plan provides a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The geologic hazard portions of the planning area are heavily regulated under California's General Planning Law. The International Building Code establishes provisions to address seismic risk.

10.6 SCENARIO

With the abundance of fault exposure in the Bay Area, the potential scenarios for earthquake activity are many. An earthquake does not have to occur within the planning area to have a significant impact on the people, property and economy of the planning area.

Any seismic activity of 6.0 or greater on faults within the planning area would have significant impacts throughout the planning area. Potential warning systems could give approximately 40 seconds notice that a major earthquake is about to occur. This would not provide adequate time for preparation. Earthquakes of this magnitude or higher would lead to massive structural failure of property on NEHRP C, D, E, and F soils. Dams and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. These events could cause secondary hazards, including landslides and mudslides that would further damage structures. Soil liquefaction would occur in water-saturated sands, silts or gravelly soils.

10.7 ISSUES

Important issues associated with an earthquake include the following:

- More information is needed on the exposure and performance of soft-story construction within the planning area.
- Based on the modeling of critical facility performance performed for this plan, a high number of facilities in the planning area are expected to have complete or extensive damage from scenario events. These facilities are prime targets for structural retrofits.
- Critical facility owner should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in this plan.
- Geotechnical standards should be established that take into account the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- There are a few dams that could affect a portion of the planning area. Dam failure warning and evacuation plans and procedures should be reviewed and updated to reflect the dams' risk potential associated with earthquake activity in the region.
- Earthquakes could trigger other natural hazard events such as dam failures and landslides, which could severely impact the planning area.
- A worst-case scenario would be the occurrence of a large seismic event during a flood or high-water event. Dam failures would happen at multiple locations, increasing the impacts of the individual events.

- Citizens are expected to be self-sufficient for up to three days after a major earthquake without government response agencies, utilities, private-sector services, and infrastructure components. Education programs are currently in place to facilitate development of individual, family, neighborhood, and business earthquake preparedness. Government alone can never make this region fully prepared. It takes individuals, families, and communities working in concert with one another to be fully prepared for disaster.
- After a major seismic event, the Tri-Valley planning area is likely to experience disruptions in the flow of goods and services resulting from the destruction of major transportation infrastructure across the broader region.

11. FLOOD

11.1 GENERAL BACKGROUND

11.1.1 Types of Flooding Affecting the Planning Area

Flooding in the planning area typically occurs during the rainy season, between November and April. Three types of flooding primarily affect the planning area: stormwater flooding, riverine flooding and flash floods.

Stormwater Runoff Flooding

Urban drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent flooding on streets and in other urban areas. These closed conveyance systems channel water away from an urban area to surrounding streams, bypassing natural processes of water filtration through the ground, containment, and evaporation of excess water. Urban drainage systems can play a role in flooding in two ways:

- Because drainage systems reduce the amount of time surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in the area.
- If stormwater runoff exceeds the capacity of the drainage system, then stormwater runoff flooding can result throughout the system's service area.

Stormwater runoff flooding can occur in areas other than delineated floodplains or along recognizable channels. It generally occurs in flat areas, and generally increases with urbanization, which speeds accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows.

Riverine Flooding

Riverine flooding is overbank flooding of rivers and streams. Natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Two types of flood hazards are generally associated with riverine flooding:

- **Inundation**—Inundation occurs when floodwater is present and debris flows through an area not normally covered by water. These events cause minor to severe damage, depending on velocity and depth of flows, duration of the flood event, quantity of logs and other debris carried by the flows, and amount and type of development and personal property along the floodwater's path.

- **Channel Migration**—Erosion of banks and soils worn away by flowing water, combined with sediment deposition, causes migration or lateral movement of a river channel across a floodplain. A channel can also abruptly change location (termed "avulsion"); a shift in channel location over a large distance can occur within as short a time as one flood event.

The frequency and severity of flooding for river systems are based on discharge probability. The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels and storm surge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1-percent-annual-chance flood) to occur in a short time period. For riverine flooding, the same flood event can have flows at different points on a river that correspond to different probabilities of occurrence.

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas inundated by the 1-percent-annual-chance flood with flood depths of only 1 to 3 feet. These areas are generally flooded by low-velocity sheet flows of water.

Flash Flooding

The National Weather Service defines flash flooding as flooding that begins within 6 hours of the heavy rainfall or other cause (NOAA 2022). Flash floods can tear out trees, undermine buildings and bridges, and scour new channels. In urban areas, flash flooding results from the removal of vegetation and replacement of ground cover with impermeable surfaces such as roads and parking lots. The greatest risk from flash floods is that they occur with little to no warning. The major factors in predicting potential damage are the intensity and duration of rainfall and watershed and stream steepness.

11.1.2 FEMA Regulatory Flood Zones

The extent of flooding associated with a 1 percent annual probability of occurrence (also called the base flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations for a given discharge level are among the most important factors used in estimating flood damage.

Mapped Flood Zones

FEMA defines flood hazard areas as areas expected to be inundated by a flood of a given magnitude. These areas are determined via statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on DFIRMs, which provide the following information:

- Locations of specific properties in relation to SFHAs
- Base flood elevations (1-percent annual chance) at specific sites
- Magnitudes of flood in specific areas
- Undeveloped coastal barriers where flood insurance is not available
- Regulatory floodways and floodplain (1 percent and 0.2 percent annual chance) boundaries

Land covered by floodwaters of the base flood is the special flood hazard area on a DFIRM—an area where NFIP floodplain management regulations must be enforced, and where mandatory purchase of flood insurance applies. This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities, because many communities have maps showing the extent of the base flood and likely depths that will occur.

The base flood elevation (the water elevation of a flood that has a 1-percent chance of occurring in any given year) is one of the most important factors in estimating potential damage from flooding. A structure within a 1-percent-annual-chance floodplain has a 26-percent chance of undergoing flood damage during the term of a 30-year mortgage. The 1-percent-annual-chance flood is used by the NFIP as the basis for insurance requirements nationwide. DFIRMs also depict 0.2-percent-annual-chance flood designations.

DFIRMs and other flood hazard information can be used to identify the expected spatial extent of flooding from a 1-percent and 0.2-percent annual chance event. They depict the following SFHAs and other areas:

- **Zone A (Also known as Unnumbered A-zones)**—SFHAs where no base flood elevations or depths are shown because detailed hydraulic analyses have not been performed.
- **Zones A1-30 and AE—**SFHAs that are subject to inundation by the base flood, determined using detailed hydraulic analysis. Base flood elevations are shown within these zones.
- **Zone AH—**SFHAs that are subject to shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
- **Zone AO—**SFHAs subject to inundation by types of shallow flooding where average depths are between 1 and 3 feet. These are normally areas prone to shallow sheet flow flooding on sloping terrain.
- **Zone AR—**Areas with a temporarily increased flood risk due to the building or restoration of flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements apply, but rates do not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
- **Zone A99—**Areas with a 1 percent annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
- **Zone B and X (shaded)—**Zones where the land elevation as been determined to be above the base flood elevation, but below the 500-year flood elevation. These zones are not SFHAs.
- **Zones C and X (unshaded)—**Zones where the land elevation has been determined to be above both the base flood elevation and the 500-year flood elevation. These zones are not SFHAs.

Floodways

The FEMA designated floodway is the channel of a water course and portion of the adjacent floodplain that is needed to convey the base flood without increasing flood levels by more than a specified amount (typically, 1 foot). A floodway may be designated within the SFHA where the deepest, highest velocity flow is expected and any infrastructure will be at risk. Floodways should be kept free of obstructions and development to allow floodwaters to move downstream unobstructed. Any development in a floodway is subject to severe damage and high risks for occupants and emergency responders.

Unmapped Flood Areas

Flood damage may occur outside of SFHAs. FEMA typically does not designate SFHAs for areas subject to flooding from local drainage problems, particularly in urban areas; drainage basins of less than 1 square mile in area; or hillside areas subject to runoff, erosion, and mudflow. FEMA does not map flooding along the length of all streams or in areas that are undeveloped.

11.1.3 Floodplains

A floodplain is the area adjacent to a river, creek, lake or the ocean that becomes inundated during a flood. Riverine floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Floodplain Ecosystems and Beneficial Functions

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive, and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

Floodplains have many natural beneficial functions, and disruption of them can have long-term consequences for entire regions. Some well-known, water-related functions of floodplains (noted by FEMA) include:

- Natural flood and erosion control
- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation
- Surface water quality maintenance
- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperatures of water
- Provide groundwater recharge
- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low surface flows

Areas in the floodplain that typically provide these natural functions are wetlands, riparian areas, sensitive areas, and habitats for rare and endangered species.

Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; riverine floodplain land is fertile and suitable for farming; transportation by water is easily accessible; land is flatter and easier to develop; and there is value placed in ocean views. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels or causing erosion of natural flood protection systems such as dunes. Flood potential can be increased in several ways: reducing a stream's capacity to contain flows; increasing flow rates or velocities downstream; and allowing waves to extend further inland. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

11.1.4 Secondary Hazards

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or storm sewers.

11.2 HAZARD PROFILE

11.2.1 Federal Flood Program Participation

National Flood Insurance Program

The Cities of Dublin, Livermore and Pleasanton are all in good standing with the NFIP. Table 11-1 lists each municipal jurisdiction's date of entrance into the NFIP and the effective date of its current FIRM. The first FIRMs in the planning area were available in 1977 to 1983. The date of the current effective FIRM for all three cities in the planning area is December 21, 2018. DSRSD, as a service provider and special district, does not participate in the NFIP.

Table 11-1. Jurisdictions and Date Joined NFIP

Jurisdiction	NFIP Community #	NFIP Entry Date	Current Effective FIRM
Dublin*	060705	August 18, 1983	December 21, 2018
Livermore	060008	July 5, 1977	December 21, 2018
Pleasanton	060012	December 16, 1980	December 21, 2018
San Ramon*	069710	September 27, 1985	June 16, 2009

Source: (FEMA 2022)
*Cities encompassing DSRSD Service Area

Table 11-2 lists flood insurance statistics that help identify vulnerability within the planning area. The 361 policies in force provide more than $99.6 million in insurance. According to FEMA statistics, 23 flood insurance claims were paid between January 1, 1978, and April 30, 2022.

Table 11-2. Flood Insurance Statistics

	Date of Entry Initial FIRM Effective Date	# of Flood Insurance Policies as of 4/30/2022	Insurance In Force	Total Annual Premium	Claims Closed 11/1978 to 4/30/2022	
					Number	Value
Dublin	08/18/1983	91	$31,013,800	$150,817	3	N/A
Livermore	07/05/1977	177	$32,401,800	$105,042	1	N/A
Pleasanton	12/16/1980	93	$36,213,000	$78,978	19	$56,774
Total		**361**	**$99,628,600**	**$334,837**	**23**	**$56,774**

The Community Rating System

The Cities of Livermore and Pleasanton currently participate in the CRS program. Their CRS status is summarized in Table 11-3. Many of the mitigation actions identified in Volume 2 of this plan are creditable activities under the CRS program. Therefore, successful implementation of this plan offers the potential for these communities to enhance their CRS classifications and for currently non-participating communities to join the program.

Table 11-3. CRS Community Status in the Planning Area

Community	NFIP Community #	CRS Entry Date	Current CRS Classification	% Premium Discount, SFHA/non-SFHA
Livermore	060008	05/01/2015	6	20/10
Pleasanton	060012	10/1/1992	7	15/5
Total				

Source: (FEMA 2022)

11.2.2 Primary Flood Sources

The factors that induce flooding in Alameda County are winter storms with heavy rainfall, steep topography, and constricted floodways. Storms of wide-area distribution originate over the Pacific Ocean in winter and develop with the frontal lifting of air masses along the hills of the coastal range.

City of Dublin

According to the effective 2018 FEMA Flood Insurance Study for Alameda County, the City of Dublin has flood problems similar to those of Alameda County, with heavy winter rainfall, a steep topography, and constricted floodways.

City of Livermore

According to the effective 2018 FEMA Flood Insurance Study for Alameda County, the principal flooding problems in the City occur during winter. Storm runoff is concentrated rapidly by the network of tributaries that discharge through the hills into the major streams. The tributaries have carved well-defined courses through the hills, but upon reaching the flat Livermore Valley, the channels become shallow and inadequate for lower return-frequency flows. Constriction of Arroyo Seco flows at the Western Pacific and Southern Pacific Railroad crossing of the creek forces lower-frequency flood flows to spread out from these points. Another constricting hydraulic factor is a length of channel along Arroyo Las Positas upstream from Airway Boulevard. Rapid runoff rates, inadequate channels, and constricting structures combined with the development of some floodplain areas, make Livermore susceptible to damage when large rainstorms occur.

City of Pleasanton

According to the effective 2018 FEMA Flood Insurance Study for Alameda County, the main flooding problem is caused by the low capacity of the lower reaches of Arroyo De La Laguna, which causes backwater flooding in its tributary channels.

11.2.3 Past Events

Sources that provide historical information regarding previous occurrences and losses associated with flooding events in Alameda County and the planning area include FEMA, NWS, and NOAA’s National Centers for Environmental Information (NCEI). Between May 1953 and November 2022, FEMA issued disaster (DR) declarations for the State of California for 37 flood-related events, classified as one or a combination of the following: winter storms, debris and mud flows, severe winter storms, severe storms, mudslides, landslides, heavy rains, and high tides (FEMA 2022). Alameda County was included in 14 declarations, as listed in Table 11-4. Little recorded information is available regarding previous flooding occurrences in the Cities of Dublin, Livermore and Pleasanton. Table 11-5 describes known flood events that impacted the planning area between 1970 and April 2023. Known flooding prior to that period of record in the Alameda Creek watershed includes the following (FEMA 2018):

- Several less-damaging floods from 1863 to 1888
- Five major floods and five less-damaging floods from 1889 to 1910
- Two major floods and 16 less-damaging floods between 1912 and 1945
- Flooding in 1950 with damage estimated at $1,100,000
- Flooding in 1952 with damage estimated at $1,500,0900
- Flooding in 1955 with damage estimated at $3,700,000
- Flooding in 1958 with damage estimated at $1,850,000

The flooding that occurred on December 23, 1955, the largest recorded, was mainly produced by overflow from Alameda Creek. The estimated peak discharge of 21,000 cfs on Alameda Creek near Niles exceeded the previous maximum of 18,500 cfs, recorded in January 1952. Residential damage was the greatest in the community of Niles east of the Union City corporate limits (FEMA 2018).

11.2.4 Location

Mapped Flood Zones

Flooding in the planning area has been documented by gage records, high water marks, damage surveys, and personal accounts. This documentation was the basis for the FEMA’s Alameda County FIRM. The FIRM’s mapped 1-percent annual chance floodplain is shown on Figure 11-1. Figure 11-2 summarizes the land area shown on the FIRM for each municipal planning partner in the 1- and 0.2-percent annual chance floodplains.

Table 11-4. FEMA Disaster Declarations for Flood Events in Alameda County

FEMA Declaration Number	Event Date	Event Type	Location
DR-4683	December 27, 2022 – January 31, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides	44 counties including Alameda County
DR-4308	February 1 – February 23, 2017	Severe Winter Storms, Flooding, Mudslides	43 counties including Alameda County
DR-4305	January 18 – January 23, 2017	Severe Winter Storms, Flooding, Mudslides	23 counties including Alameda County
DR-4301	January 3 – January 12, 2017	Severe Winter Storms, Flooding, Mudslides	34 counties including Alameda County
DR-1646	March 29 – April 16, 2006	Severe Storms, Flooding, Landslides, and Mudslides	17 counties including Alameda County
DR-1628	December 17 – January 3, 2006	Severe Storms, Flooding, Mudslides, and Landslides	31 counties including Alameda County
DR-1155	December 28, 1996 – April 1, 1997	Severe Storms, Flooding, Mud and Landslides	48 counties including Alameda County
DR-1046	February 13 – April 19, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	57 counties including Alameda County
DR-1044	January 3 – February 10, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	42 counties including Alameda County
DR-758	February 12-March 10, 1986	Severe Storms & Flooding	39 counties including Alameda County
DR-677	January 21 – March 30, 1983	Coastal Storms, Floods, Slides & Tornadoes	40 counties including Alameda County
DR-1203	February 2 – April 30, 1998	Severe Winter Storms and Flooding	41 counties including Alameda County
DR-651	December 19, 1981 – January 8, 1983	Severe Storms, Flood, Mudslides & High Tide	10 counties including Alameda County
DR-283	February 16, 1970	Severe Storms & Flooding	17 counties including Alameda County

Source: (FEMA 2023)

Table 11-5. Flood Events in the Tri-Valley Planning Area

Event Date	Event Type	FEMA Declaration Number	Location	Description
December 27, 2022 – January 31, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides	DR-4683	44 counties including Alameda County	A series of nine atmospheric river events brought heavy rain, snow, substantial flooding, landslides, and mudslides to much of the state of California. The San Francisco Bay area experienced its wettest three-week period in 161 years.
December 13, 2021	Flooding, Heavy Rain	N/A	Bay Area including Alameda County	A low-pressure system descended from the Gulf of Alaska southward along the entire Pacific Coast and tapped into sub-tropical moisture originating from the Central Pacific to drop heavy rain throughout the state. A flash flood watch was issued for the Santa Lucia Mountains and Dolan Burn Scar area, where up to 12 inches of rain fell.
November 9, 2021	Atmospheric River	N/A	Bay Area including Alameda County	A weak to moderate atmospheric river event impacted the Bay Area November 8 and 9, bringing moderate to locally heavy rain and gusty winds. Several reports of roadway flooding were received, along with some downed powerlines and trees.

Event Date	Event Type	FEMA Declaration Number	Location	Description
October 24, 2021	Atmospheric River	N/A	Bay Area including Alameda County	An early season atmospheric river brought heavy rain, urban and small stream flooding, strong winds, and high surf to the region. Several downed trees were reported, along with wind gusts of 40 to 50 mph at lower elevations with 60 to 80 mph winds in the hills. One station in Alameda County reported a wind gust of 92 mph.
March 10, 2021	Flooding, Heavy Rain, Heavy Wind, Hail	N/A	Bay Area including Alameda County	A cold upper low moved through the region in early March bringing widespread showers and isolated thunderstorms to the Greater Bay Area. This system caused roadway flooding, debris flows, lightning, and small hail. Snow was also reported on some of the area's peaks throughout the region as snow levels dropped down to 2,000 feet. A mudslide occurred along the River Fire burn scar in Monterey County sending mud and debris into nearby homes.
January 28, 2021	Atmospheric River	N/A	Countywide	An atmospheric river caused flooding and debris flows over area burn scars as well as 15 to 20 inches of rain in the Santa Lucia Mountains. Mudflows near the River Fire burn scar in Monterey County caused damage to homes, covered roadways, and trapped animals at local ranches. Debris flows near the Dolan Fire burn scar caused an entire section of Highway 1 near Rat Creek to collapse into the Pacific Ocean.
April 5, 2020	Heavy Rain, Flooding, Hail	N/A	Bay Area including Alameda County (Castro Valley)	A low-pressure system off the coast of northern California brought a cold front through the Bay Area. This system produced heavy rainfall, creating minor roadway flooding as well as gusty winds and scattered thunderstorms with small hail. Wind gusts across the higher elevations were observed between 35 and 65 mph. Breezy surface winds also downed several trees across the area.
January 16, 2020	Heavy Rain, Flooding, Heavy Wind	N/A	Bay Area including Alameda County	A potent cold front swept through the region, bringing widespread rain, gusty winds, low elevation snow, and thunderstorms. This system brought widespread roadway flooding, downed trees, small hail, and snow as low as 2,400 feet in elevation.
December 7, 2019	Heavy Rain, Heavy Wind, Flooding	N/A	Bay Area including Alameda County	A cold front swept through the region bringing gusty southerly winds, heavy rain, and flooding. Winds brought down trees and power lines across the greater Bay Area, resulting in injuries to two people in San Francisco. Downed power lines also left over 1,000 people without power in the Santa Cruz Mountains as well as causing several additional power outages across San Francisco.
November 30, 2019	Heavy Rain, Flooding	N/A	Bay Area including Alameda County	A low-pressure system moving in from the Gulf of Alaska and drawing in moisture from the tropics combined to bring the first atmospheric river event of the winter season to the Greater Bay Area. This system brought widespread heavy rainfall, roadway flooding, and strong winds to the region. These winds caused downed trees and power outages across the area.
February 13, 2019	Atmospheric River, Flooding, Debris Flow, Heavy Wind	N/A	Tri-Valley Area (Livermore)	An atmospheric river with an associated cold front moved through the region bringing widespread flooding and debris flows. Multiple mainstem rivers flooded prompting evacuations from local officials. A tree fell on a car causing one fatality and one serious injury on Highway 17 while another downed tree caused a serious multi-car traffic accident that resulted in another fatality and multiple injuries.

Event Date	Event Type	FEMA Declaration Number	Location	Description
February 21, 2017	Atmospheric River	DR-4308	Countywide	Widespread rain caused flooding, debris flow, accidents, and overtopping of reservoir spillways. In Livermore and Pleasanton, there were multiple road closures including westbound 580, westbound Stanley Blvd, Happy Valley Road. Ten people were stranded by flash flood in Livermore along Collier Canyon Road.
February 9, 2017	Atmospheric River	DR-4308	Countywide	Strong wind and heavy rain produced road flooding and debris flows.
November 30,2014	Rain and wind	N/A	Tri-Valley area	Rain and wind brought a few downed trees and minor urban flooding. Heavy rain produced flooding on Interstate 580 onramp in Dublin and two westbound lanes were flooded in Livermore.
October 13, 2009	Heavy Rain and wind	N/A	Northern and Central CA	Heavy rain and wind downed numerous trees and power lines. Heavy rain caused major flooding on Bernal Avenue at Valley Avenue
March 29 – April 16, 2006	Severe Storms, Flooding, Landslides, and Mudslides	DR-1646	Countywide	Strong storms brought heavy rain to most of Alameda County causing landslides, eroding hillsides and cracked pavement. Oversaturated earth also caused landslide and/or erosion problems to private properties, which spilled over onto public rights-of-way.
December 17, 2005 – January 12, 2006	Winter Storms (Severe Storms, Flood, Mudslides, Landslides)	DR-1628	Bay Area including Alameda County	Storms were blamed for two deaths from falling trees, around 50 businesses were declared damaged, and three homes were nearly wiped out by mudslides. The event included severe storms, flooding, mudslides, and landslides. Estimated damage was over $100 million.
February 3, 1998	Flash Flood	N/A	Tri-Valley area	A levee breach along Arroyo Mocha damage roads and property in Dublin and Livermore. Estimated damage was $100,000.
December 28, 1996 – April 1, 1997	Severe Storms, Flooding, Mud and Landslides	DR-1155	48 counties including Alameda County	300 square miles in northern California were flooded and over 12,000 people were evacuated. Levee breaks were reported across the Sacramento and San Joaquin Valleys. Over 23,000 homes, business, agricultural lands, bridges, and roads were damaged. Eight deaths resulted from this event. Overall, the state had $1.8 billion in damage.
January 3 – February 10, 1995; and February 13 – April 19, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	DR-1044 and DR-1046	42 counties including Alameda County	Winter storms, flooding and landslides impacted a large area of the state. Storms in the Sacramento River Basin resulted in small stream flooding due to drainage system failures. Over 100 stations recorded their greatest one-day rainfall in history. Overall, there were 38 deaths, damage to homes and over $1.7 billion in damage.
February 12 – March 10, 1986	Severe Storms & Flooding	DR-758	Bay Area including Alameda County	The event damaged over 12,000 homes, destroyed over 1,300 homes, and caused 13 deaths and 67 injuries in California. Damage totaled over $407.5 million.
January 21 – March 30, 1983	Coastal Storms, Floods, Slides & Tornadoes	DR-677	40 counties including Alameda County	The state had over $500 million in damage from this event due to heavy rains, high winds, flooding, and levee breaks.
February 10, 1970	Severe Storms & Flooding	DR-283	Bay Area including Alameda County	Heavy winds, storms and flooding impacted the Bay Area, including Alameda County. Impacted areas had over $27 million in damage.

Sources: (NOAA NCEI 2022 , NOAA 2023); (Association of Bay Area Governments 2010); (California Governor's Office of Emergency Services 2018)

EXHIBIT A

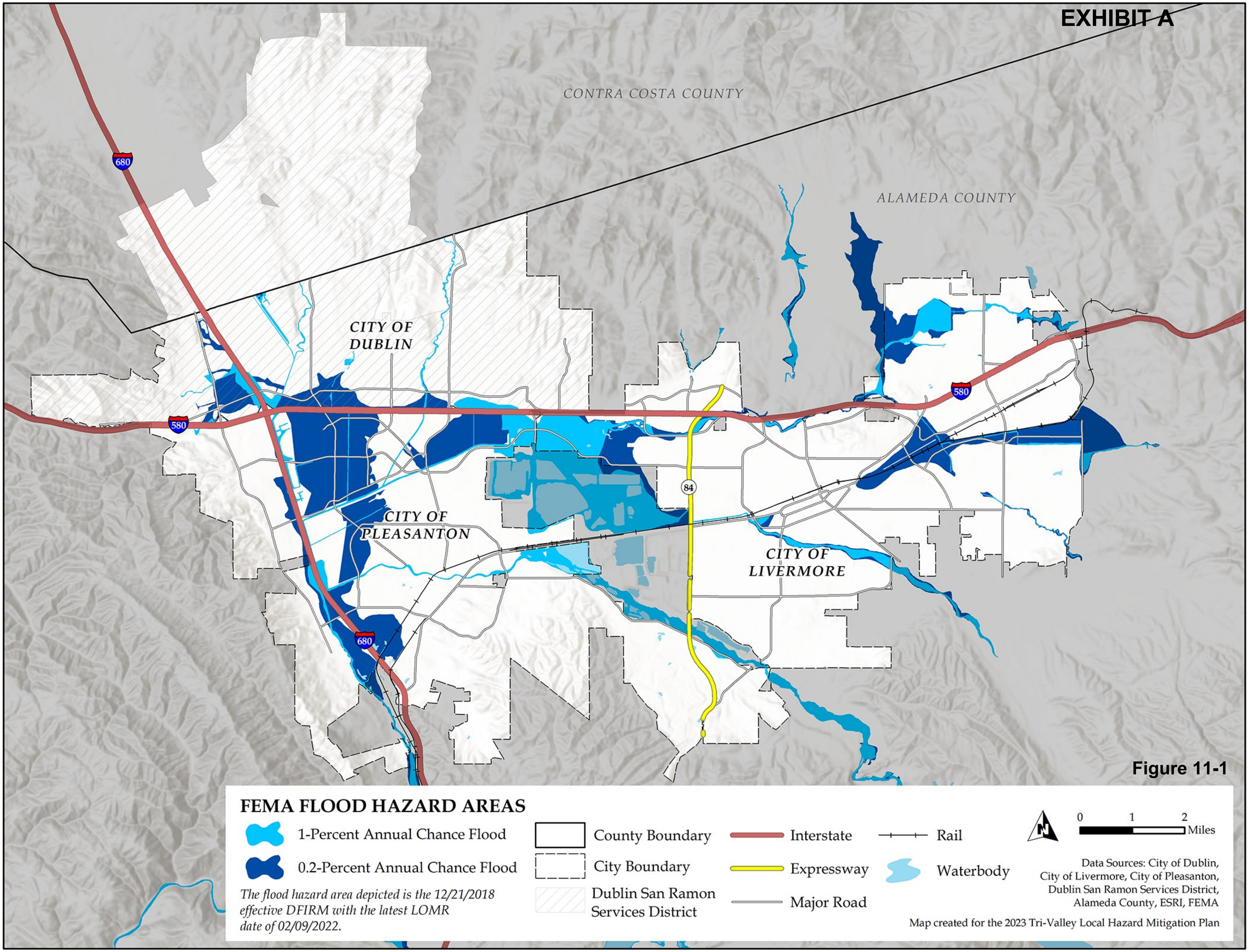


Figure 11-1

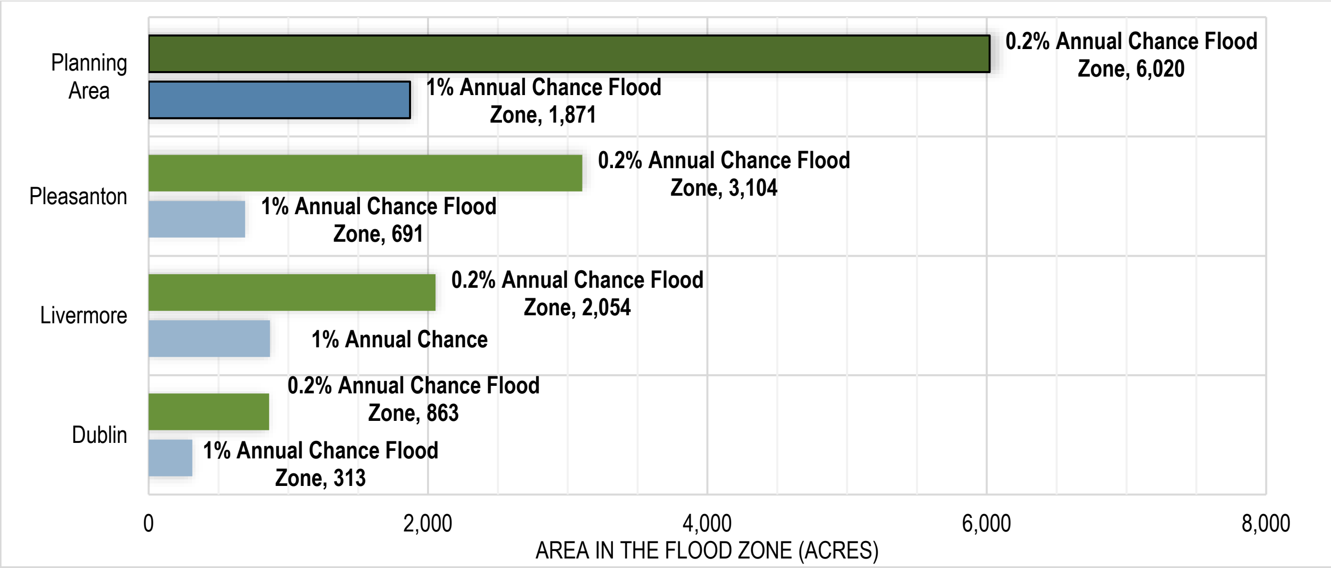


Figure 11-2. Area in the Flood Zone, by Jurisdiction and Flood Event

All principal flooding sources are incorporated in the currently effective FIRMs. The FIRMs are the most detailed and consistent data source available for determining flood extent. The effective 2018 Flood Insurance Study was used in this risk assessment to map the extent and location of the flood hazard.

Repetitive Loss

A repetitive loss property is an NFIP-insured property that has experienced repeated flood damage. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as repetitive loss properties. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures. The CRS program requires participating communities to identify repetitive loss areas. Based on information provided by FEMA Region 9 as of 2022, there are no repetitive loss structures within the city limits of Dublin or Livermore, and only one, a residence, in Pleasanton. The Pleasanton residence was not a severe repetitive loss structure. There were no severe repetitive loss structures in the planning area.

11.2.5 Frequency

According to NOAA NCEI, Alameda County has experienced 129 flood and flash flood events since 1996. Table 11-6 shows these statistics, as well as the annual average number of events and the percent chance of each flood hazard occurring in Alameda County in any given year.

Table 11-6. Probability of Future Occurrences of Flood Events

Hazard Type	Number of Occurrences Between 1996 and November 2022*	Rate of Occurrence	Recurrence Interval (in years)	% Chance of Occurrence in Any Given Year
Flash Flood	26	0.65	1.58	63.4%
Flood	103	2.56	0.40	251.2%
TOTAL	**129**			**Over 100%**

Source: (NOAA NCEI 2022)
*This table also includes the atmospheric river flood event of December 2022 – January 2023.

Smaller floods may occur on a more frequent basis and be categorized under a different hazard event type, most typically severe weather or severe storms. It is estimated that the planning area will experience the direct and indirect impacts of flooding each year, including urban flooding and smaller floods in identified flood-prone areas. These events may induce secondary hazards such as erosion, infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents and inconveniences.

11.2.6 Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak flow; Table 11-7 lists peak flows used by FEMA to map the floodplains of the planning area.

Table 11-7. Summary of Peak Discharges within the Planning Area

	Peak Flow (cubic feet/second)			
Source/Location	10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
ARROYO DE LA LAGUNA				
Downstream of Arroyo Del Valle	7,000	13,500	17,000	28,000
Downstream of Arroyo Mocho	6,000	12,000	15,000	25,000
ARROYO DEL VALLE				
Upstream of Arroyo De La Laguna	1,860	4,150	7,000	9,080
ARROYO LAS POSITAS				
Upstream of confluence with Arroyo Mocho'	1,800	1,800	1,800	1,800
At Gage (USGS No. 11176145)	2,000	4,200	5,000	6,700
ARROYO MOCHO				
Upstream of Arroyo De La Laguna	4,520	11,500	13,700	20,600
Upstream of Chabot Canal	4,450	11,450	13,600	20,300
Upstream of Tassajara Creek	5,300	10,300	12,400	16,700
Downstream of Arroyo Las Positas	5,200	10,200	12,300	16,500
At USGS Gage No. 11176000	2,100	3,800	4,500	5,900
Upstream of Arroyo	1,900	1,900	1,900	1,900
Las Positas Near Garden Circle	5,000	7,800	9,100[a]	11,900
Upstream of Tassajara Creek	5,100	7,900	9,200[a]	12,100
CHABOT CANAL				
At confluence with Arroyo Mocho	730	1,260	1,560	2,430
COLLIER CANYON CREEK				
Near North Canyon Parkway	470	990	1,200	1,600
Downstream of Tributary	470	990	1,200	1,600
Upstream of Tributary	390	810	980	1,300
COLLIER CANYON TRIBUTARY	180	410	500	680
HEWLETT CANAL				
At confluence with Chabot Canal	186	331	400	614

Source/Location	Peak Flow (cubic feet/second)			
	10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
LINE B-2-1				
At Interstate Highway 680	830	1,500	1,840	2,850
Upstream of Western Pacific RR	680	1,210	1,500	2,060
Upstream of confluence with Line B-2-3	230	420	520	800
LINE G-3				
At confluence with Arroyo Mocho	540	970	1,190	1,800
LINE J (ZONE 6) (CANADA DEL ALISO)				
At confluence with Line E (Zone 6) (Laguna Creek)	160	380	550	1,000
PLEASANTON CANAL				
At confluence with Arroyo Del La Laguna	280	480	580	850
TASSAJARA CREEK				
At confluence with Arroyo Mocho	1,540	3,200	4,140	6,900

a. Base flood elevations in the improved reach of Arroyo Mocho between Santa Rita and El Charro Roads are based on peak flows of 12,400 cubic feet per second at Santa Rita Road and 12,300 cubic feet per second at Garden Circle. These flows do not reflect overbank losses. The design flow for this reach of Arroyo Mocho is 12,500 cubic feet per second.

Source: (FEMA 2018)

11.2.7 Warning Time

Potential warning time available to a community for response to a flooding threat depends on the time between the first measurable rainfall and the first occurrence of flooding. The time needed to recognize a flood threat reduces potential warning time for a community. Because of the sequential pattern of weather conditions needed to cause serious flooding, occurrence of a flood without warning is unusual. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but populations in potential hazard areas can be warned in advance of flash flooding danger.

The National Weather Service (NWS) issues watches and warnings when forecasts indicate rivers may approach bank-full levels. Flood extent or severity categories used by NWS include minor flooding, moderate flooding, and major flooding, based on property damage and public threat:

- **Minor Flooding**—Minimal or no property damage, but possibly some public threat or inconvenience.
- **Moderate Flooding**—Some inundation of structures and roads near streams. Some necessary evacuations of people and/or transfer of property to higher elevations.
- **Major Flooding**—Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (National Weather Service 2009b).

When a watch is issued, the public should prepare for the possibility of a flood. When a warning is issued, the public is advised to stay tuned to a local radio station for further information and be prepared to take quick action if needed. A warning means a flood is imminent, generally within 12 hours, or is occurring. Local media broadcast NWS warnings.

11.3 EXPOSURE

A quantitative assessment of exposure to the flood hazard was conducted using the flood mapping shown in Figure 11-1 and the asset inventory developed for this plan. Results for the planning area are presented below.

11.3.1 Population

All populations living in mapped flood zones are exposed to the risk of flooding. Figure 11-3 shows the estimated population for each planning area city living in the 1-percent and 0.2-percent annual chance floodplains, compared to total city population. Figure 11-4 shows results for the entire planning area.

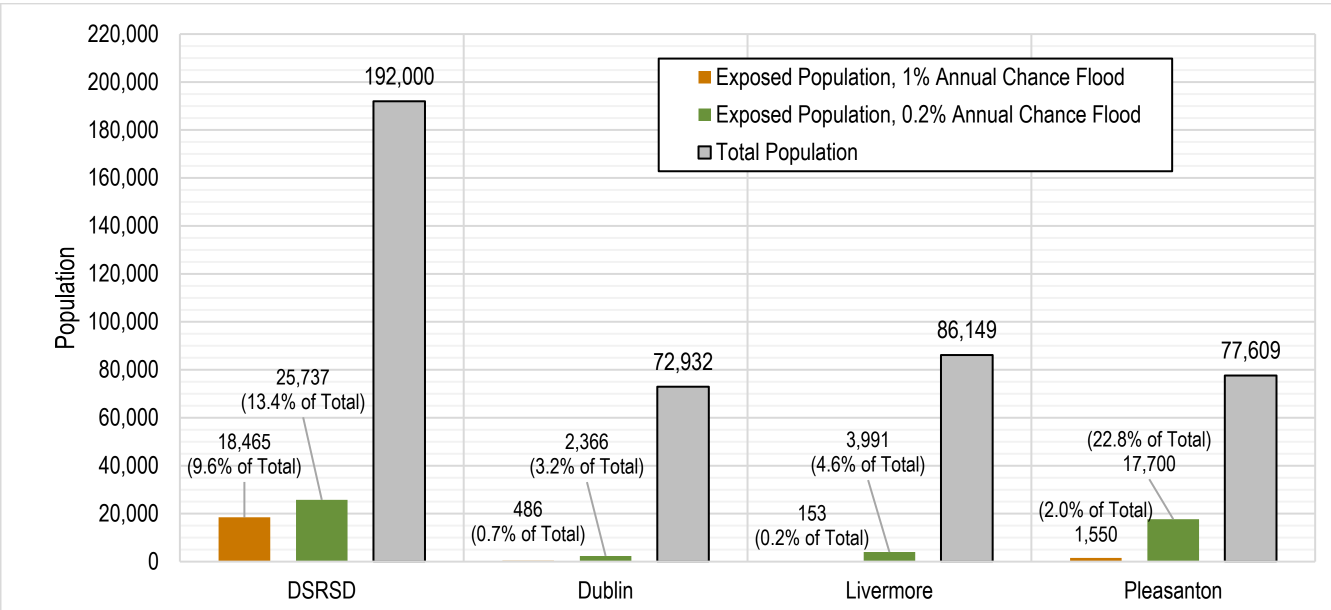


Figure 11-3. Population Exposed to Flood and Total Population, by Jurisdiction

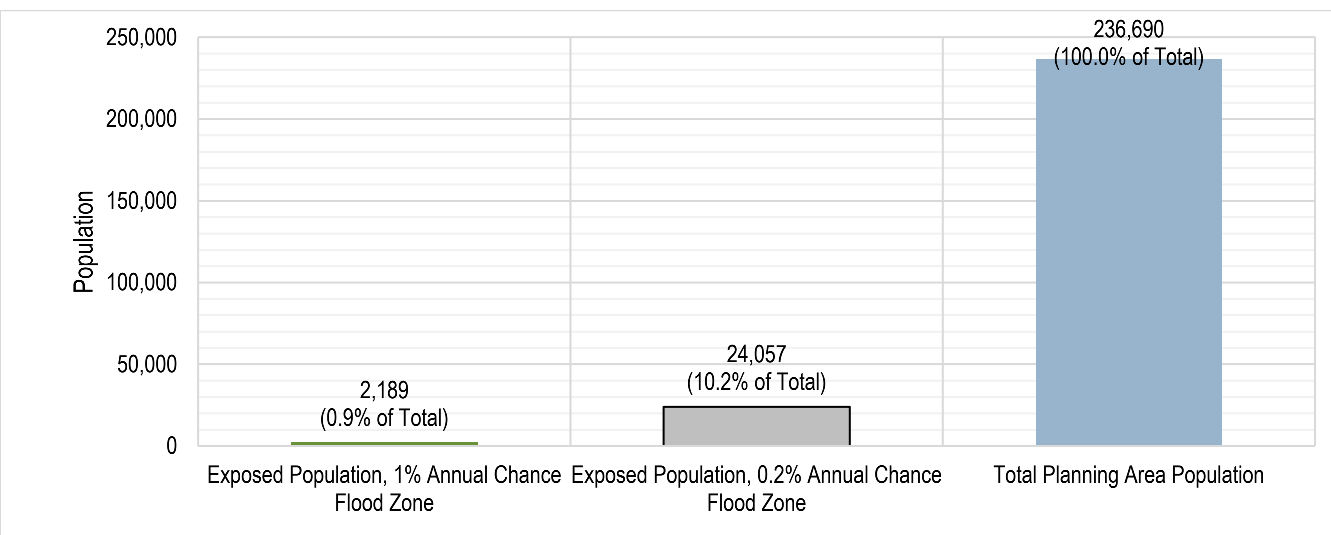


Figure 11-4. Total Planning Area Population Exposed to Flood

11.3.2 Property

The estimated value of planning area buildings within the 1- and 0.2-percent-annual-chance flood zones is shown in Figure 11-5 and Figure 11-6. Figure 11-7 shows the estimated exposed total value as a percentage of the total replacement value in each city and in the overall planning area. The numbers of structures in each flood zone, by occupancy class, are shown in Figure 11-8 and Figure 11-9.

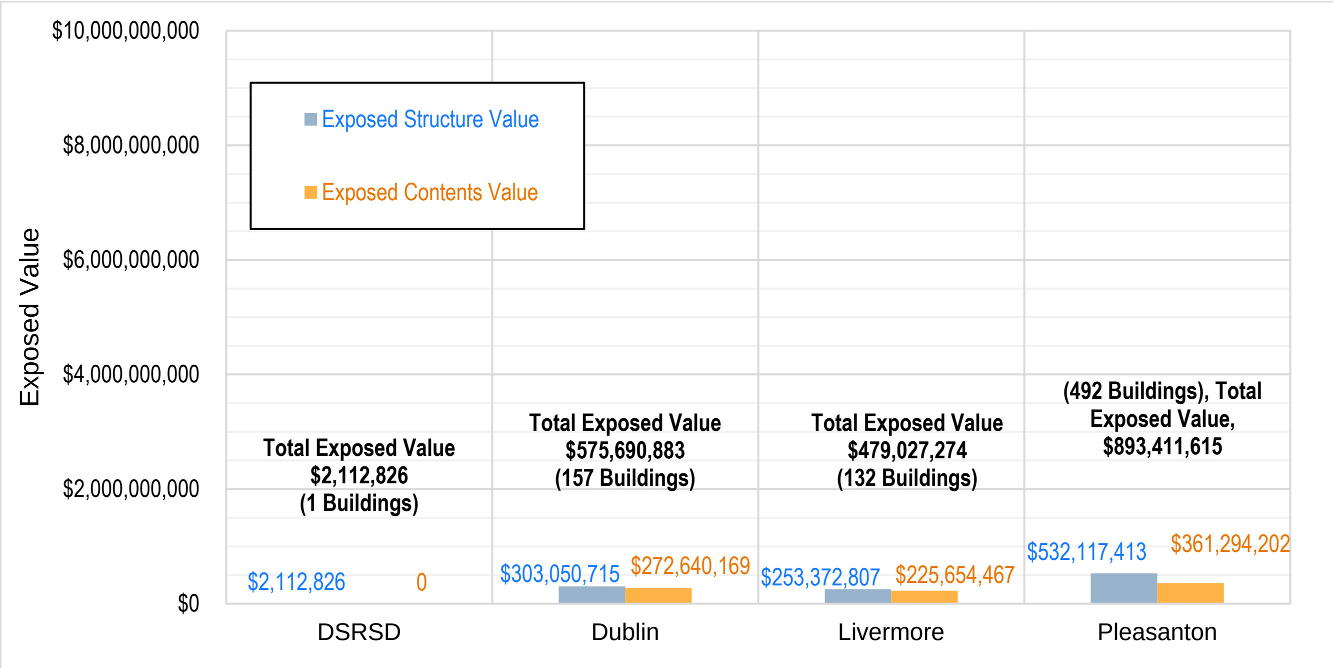


Figure 11-5. Number and Exposed Value of Buildings in the 1% Annual Chance Flood Zone

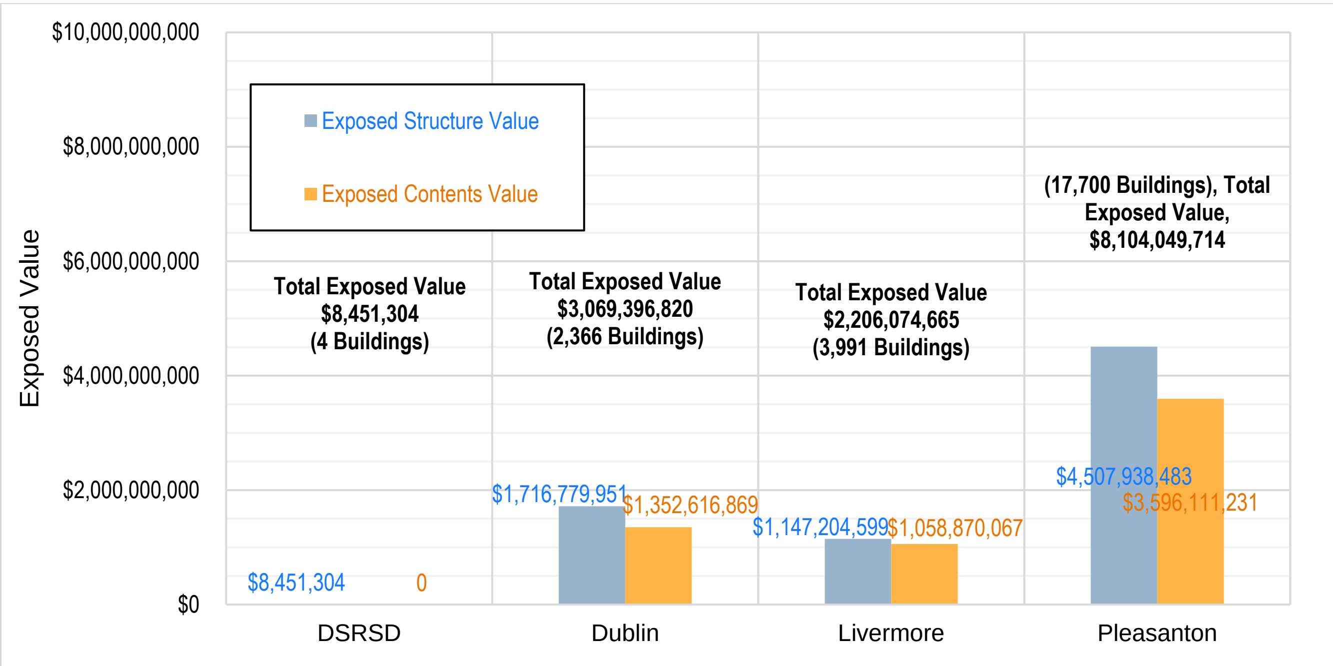


Figure 11-6. Number and Exposed Value of Buildings in the 0.2% Annual Chance Flood Zone

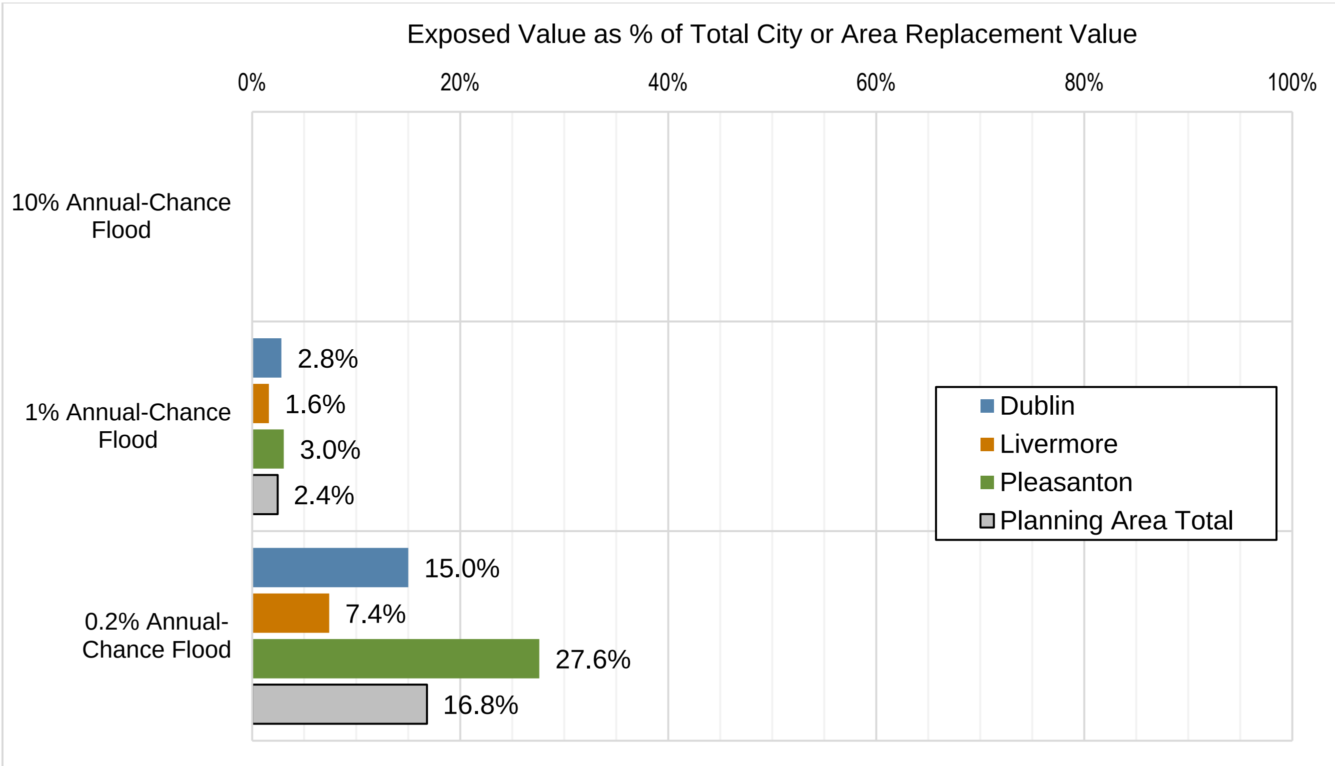


Figure 11-7. Total Value in Flood Areas as Percent of Total Replacement Value, by Jurisdiction

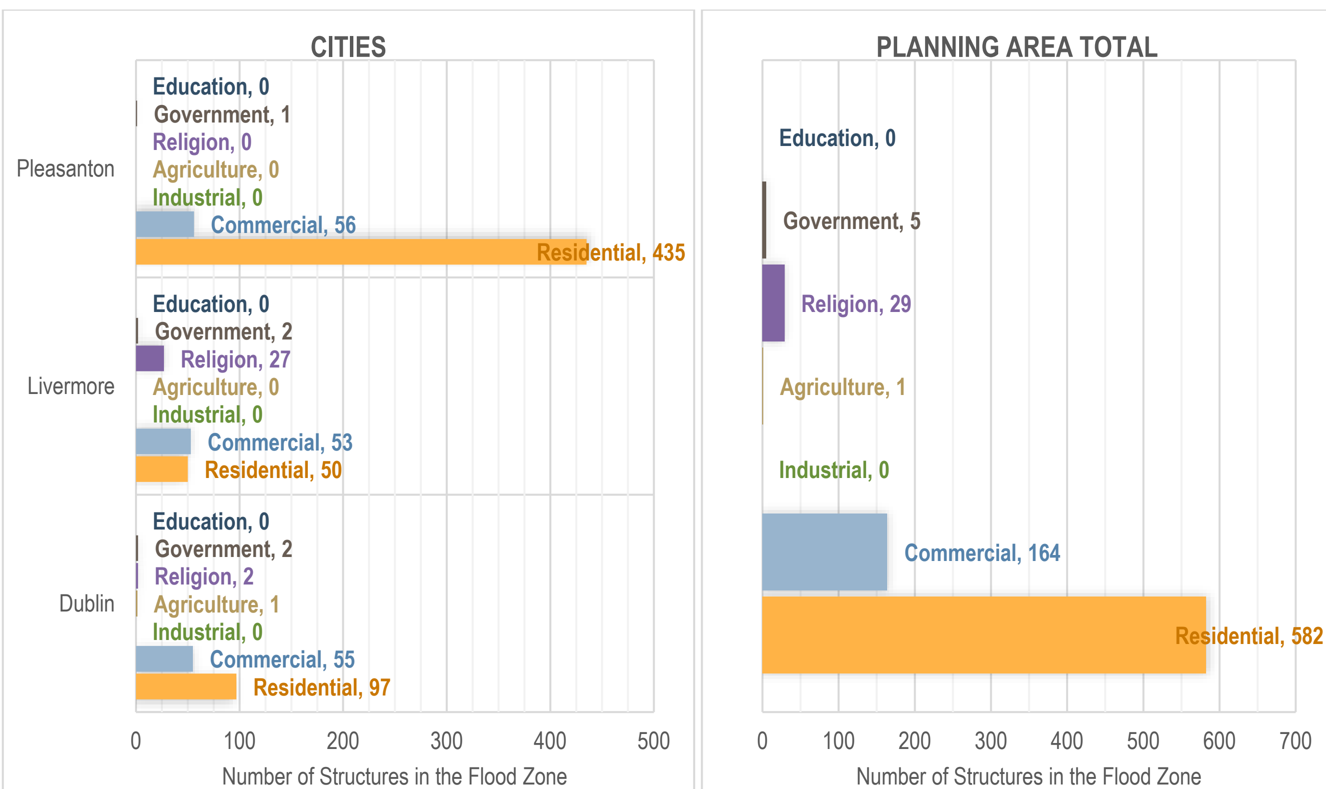


Figure 11-8. Structures in the 1% Annual Chance Flood Zone, by Jurisdiction and Occupancy Class

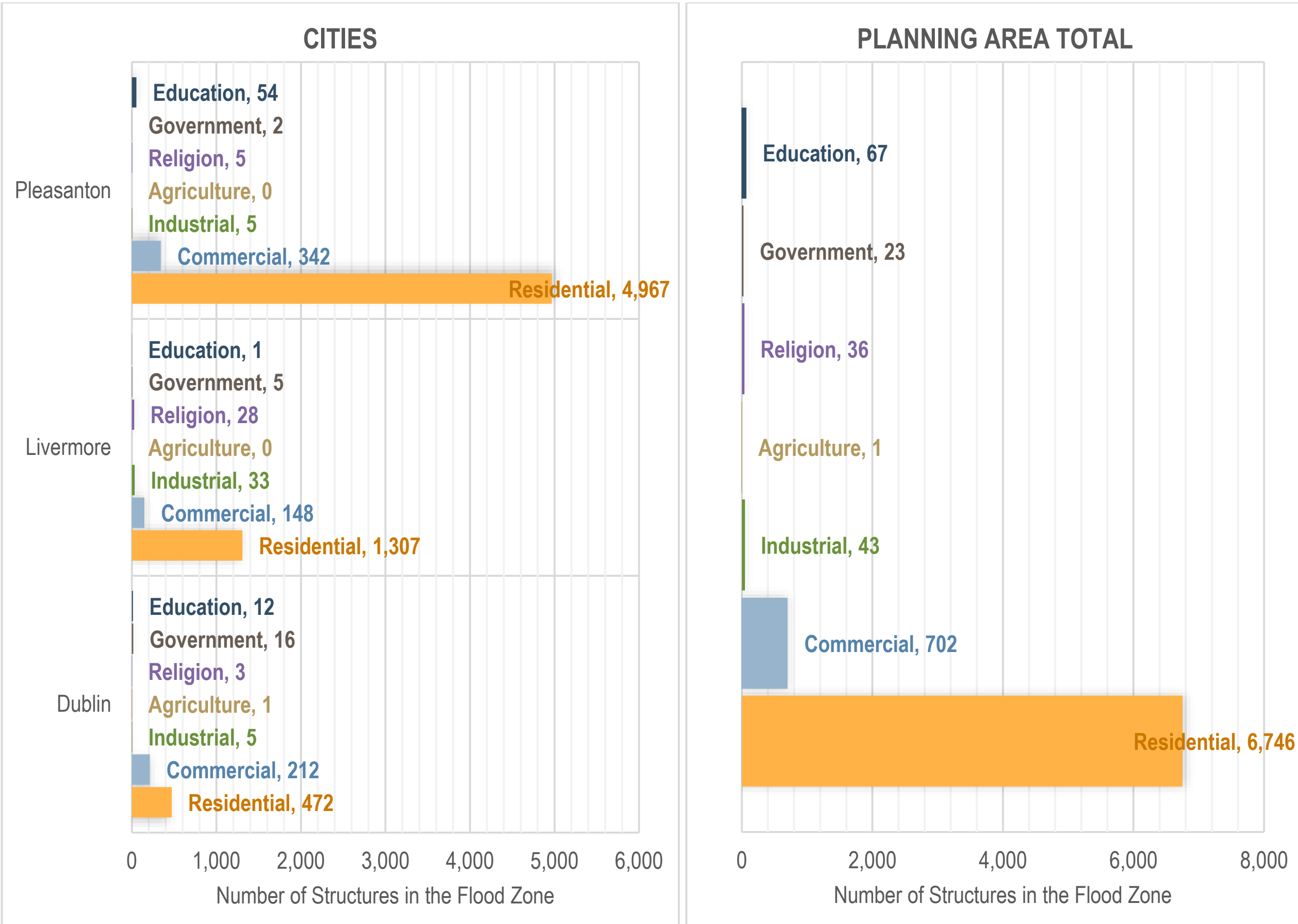


Figure 11-9. Structures in the 0.2% Annual Chance Flood Zone, by Jurisdiction and Occupancy Class

11.3.3 Critical Facilities

Estimates of critical facilities in the 1- and 0.2-percent annual chance flood hazard areas are summarized in Figure 11-10 and Figure 11-11. Critical facilities exposed to the flood hazard represent the following percentages of all critical facilities in the planning area:

- 7 percent (77 facilities) of all critical facilities are in the 1 percent-annual-chance flood hazard area.
- 23 percent (265 facilities) of all critical facilities are in the 0.2 percent-annual-chance flood hazard area.

11.3.4 Environment

Because floodplain management measures place restrictions on development in areas affected by flooding, floodplains often have a higher portion of area that is undeveloped open space or natural area. These undeveloped areas represent environment exposed to the flood hazard.

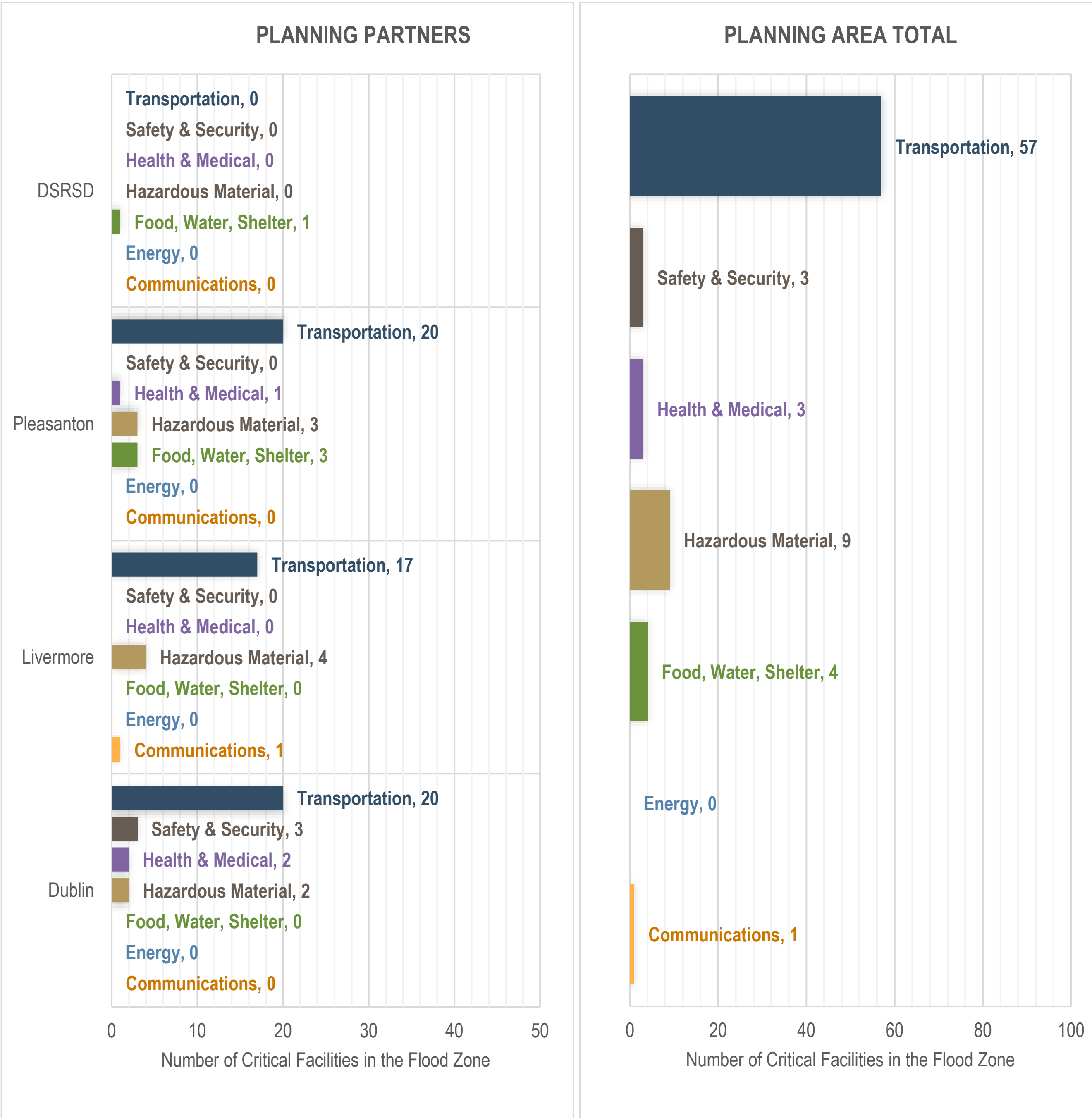


Figure 11-10. Critical Facilities in the 1-Percent Annual Chance Flood Zone, by Category and Jurisdiction

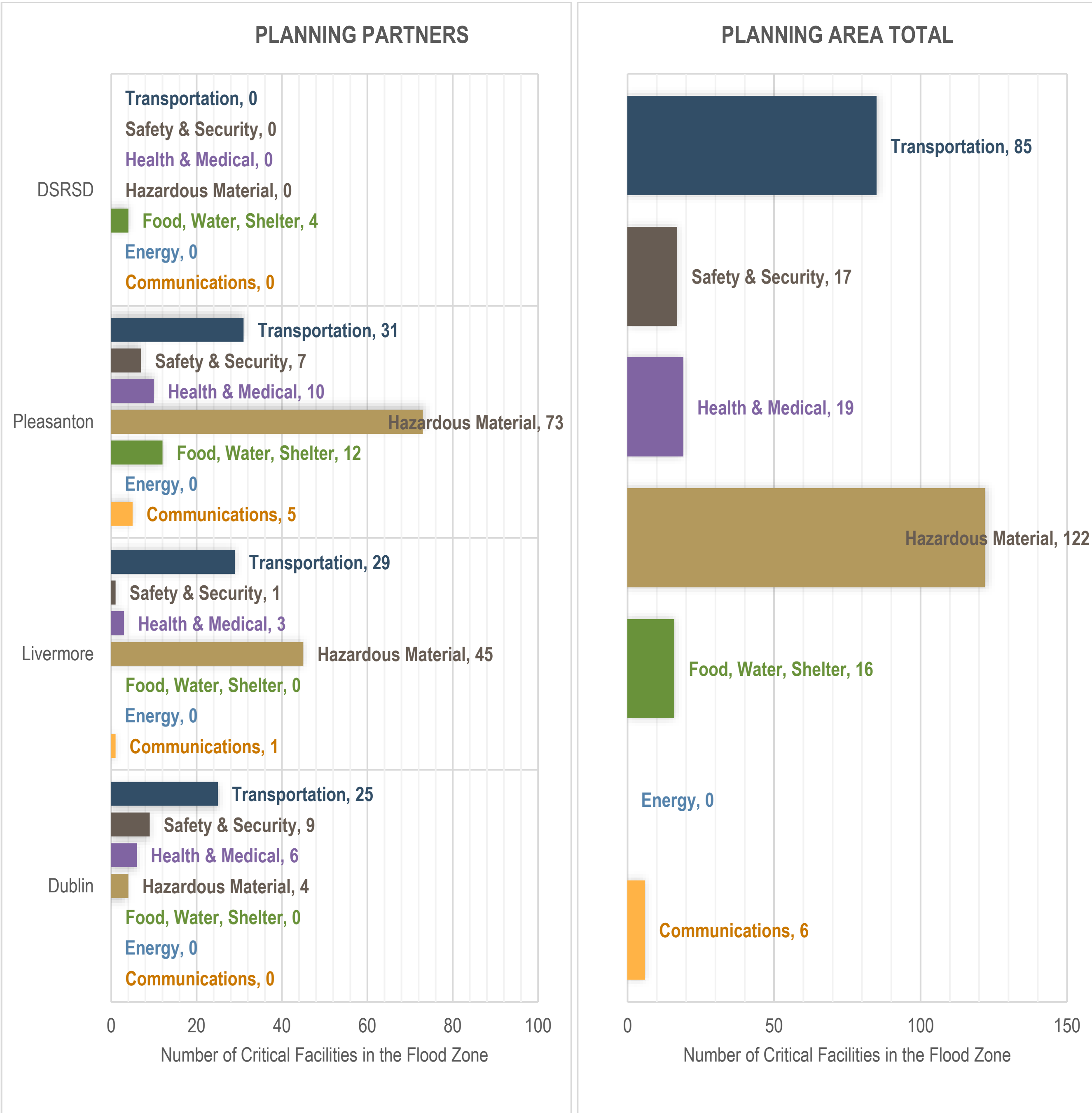


Figure 11-11. Critical Facilities in the 0.2-Percent Annual Chance Flood Zone, by Category and Jurisdiction

11.4 VULNERABILITY

Many of the areas exposed to flooding may not experience serious flooding or flood damage. This section describes vulnerabilities in terms of population, property, critical facilities, and the environment.

11.4.1 Population

Impacts on population in the planning area were estimated for the 1- and 2-percent annual chance flood events. Estimates for each city and the total planning area are presented in Figure 11-12 and Figure 11-13. DSRSD does not have any responsibility for sheltering or evacuation of displaced people.

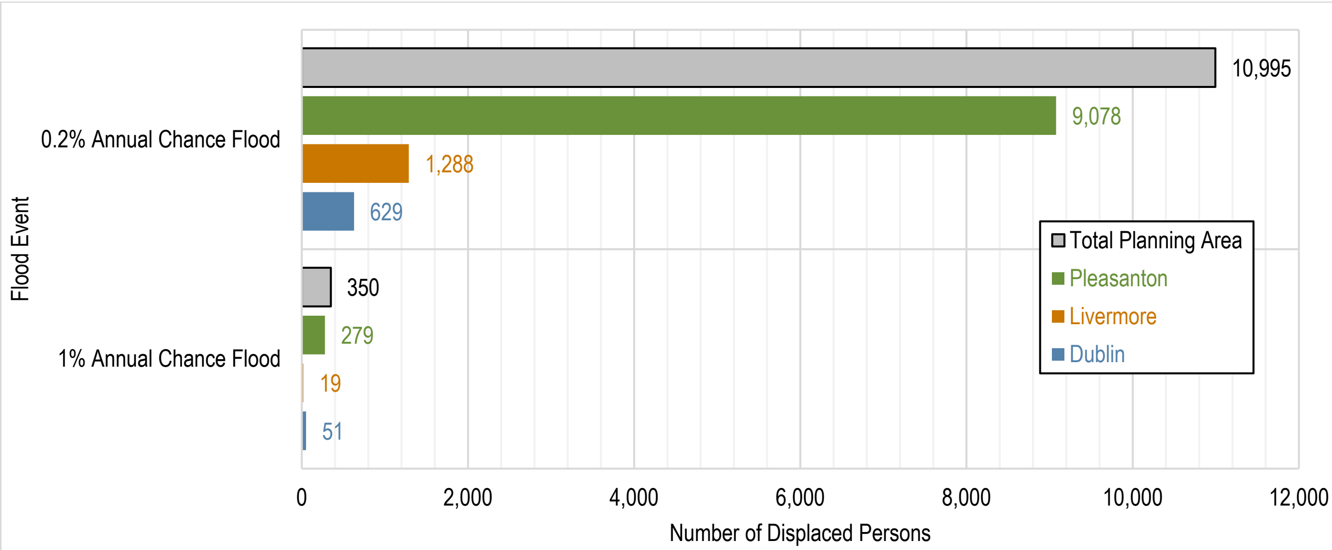


Figure 11-12. Estimated Number of Displaced Persons Due to Flood

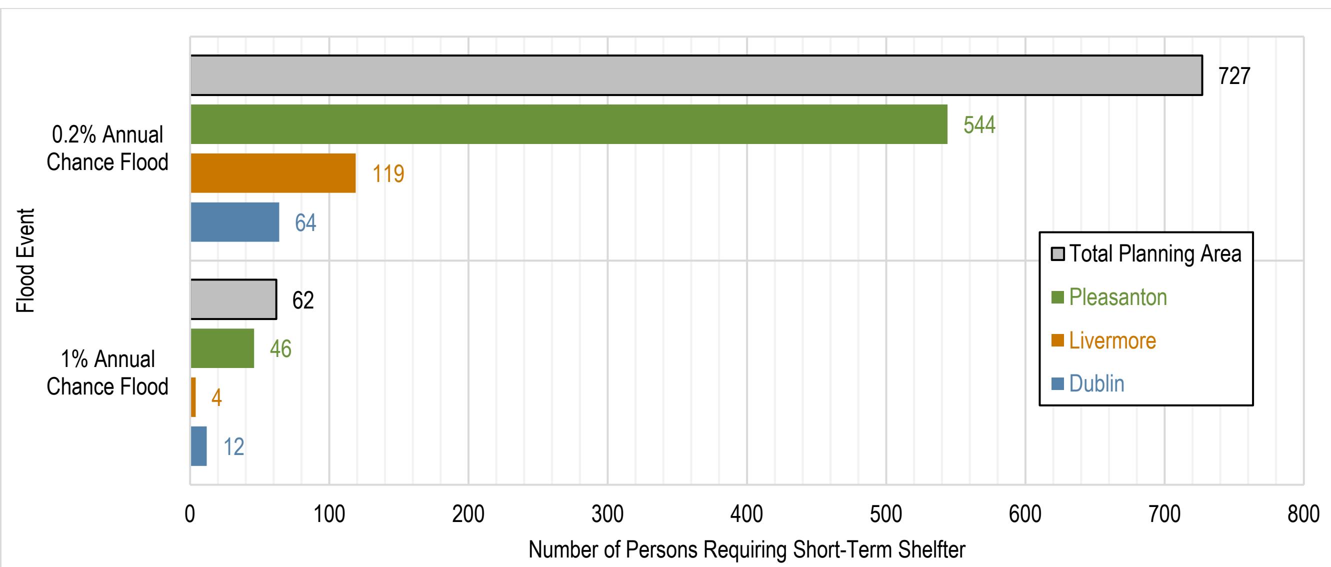


Figure 11-13. Estimated Number of Persons Requiring Short-Term Shelter Due to Flood

Vulnerable Populations

Socially vulnerable populations are susceptible to the flood hazard based on many factors, including their physical and financial ability to react or respond during a hazard event and the location and construction quality of their housing. Economically disadvantaged populations are likely to evaluate their risk and make decisions based on the major economic impact on their family and may not have funds to evacuate.

The aftermath of flooding events presents numerous threats to public health and safety, including unsafe food, contaminated drinking and washing water and poor sanitation, mosquitoes and animals, mold and mildew, carbon monoxide poisoning, and mental stress and fatigue. These impacts pose a unique risk to the local at-risk senior and disabled populations in Dublin, Livermore, and Pleasanton and those served by DSRSD due to existing health conditions and the increased need for proper nutrition.

Since the homeless population is often transient, they may be at risk during a flood event resulting in their displacement. The ability to notify them in advance may be limited since they most likely do not have immediate access to technology, such as email, cell phone, notifications, and alerts. Their ability to relocate or access and shelter may also be limited due to lack of transportation.

11.4.2 Property

Impacted Buildings

Impacted structures are those with finished floor elevations below the flood event water surface elevation. These structures are the most likely to receive significant damage in a flood event. Figure 11-14 shows the estimated number of buildings in Dublin, Livermore, and Pleasanton impacted by the flood events evaluated for this risk assessment.

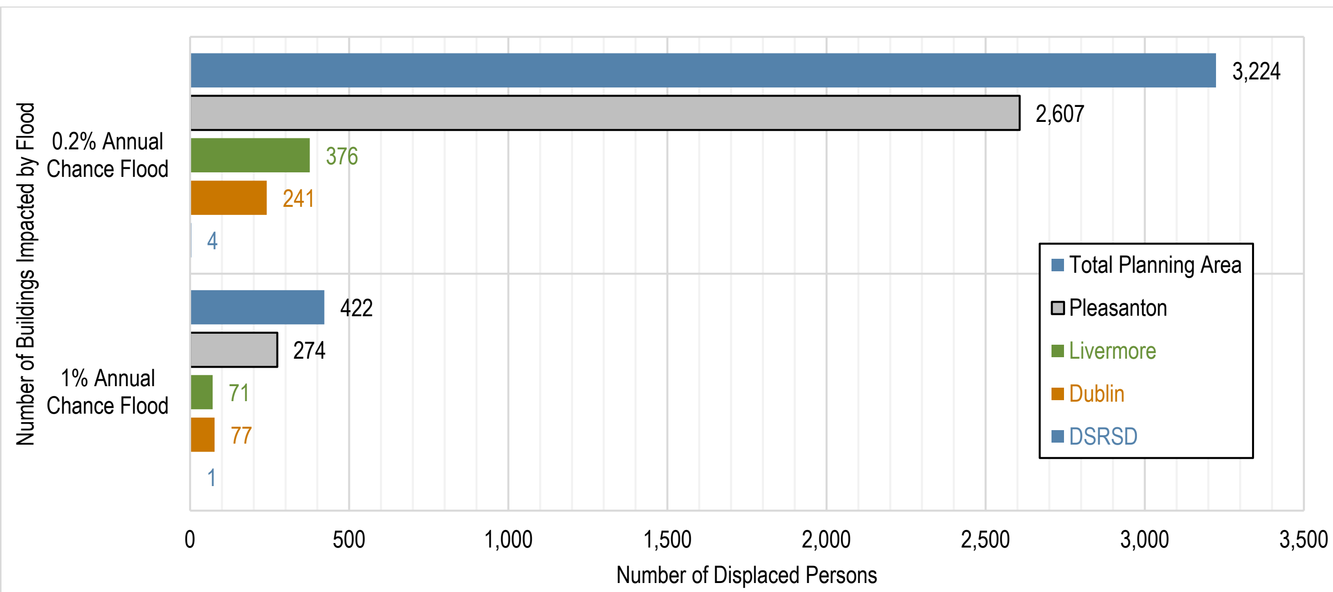


Figure 11-14. Estimated Number of Buildings Impacted by Flood

Damage to Structures and Contents

Using historical flood insurance claim data, Hazus estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, local data on facilities was used instead of the default inventory data provided with Hazus. The analysis is summarized in Figure 11-15 through Figure 11-18 for the overall planning area and each planning area city.

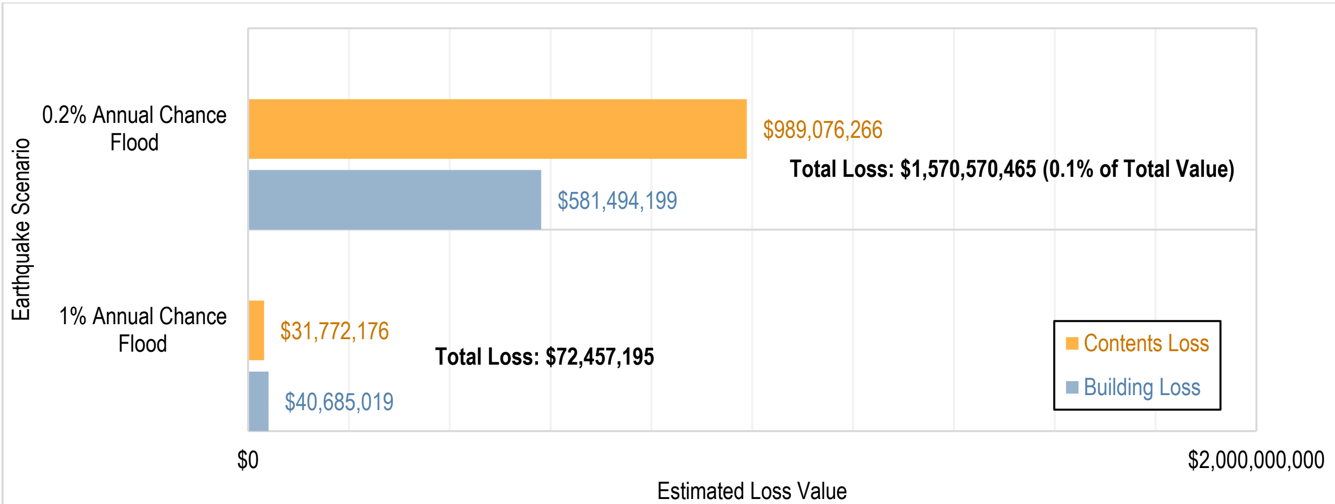


Figure 11-15. Loss Estimates for Flood, Total Planning Area

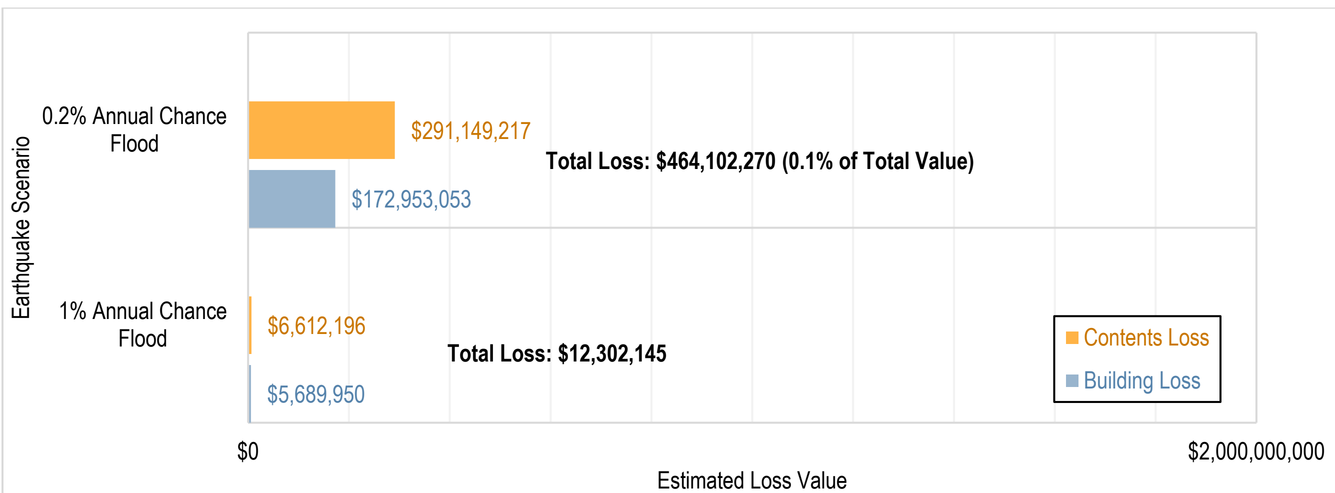


Figure 11-16. Loss Estimates for Flood, City of Dublin

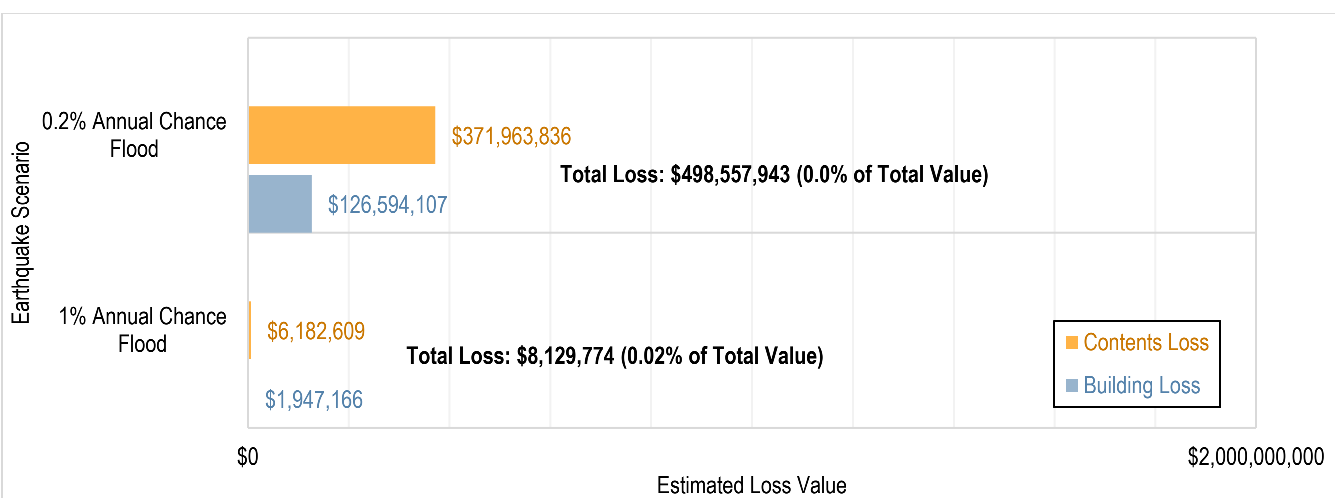


Figure 11-17. Loss Estimates for Flood, City of Livermore

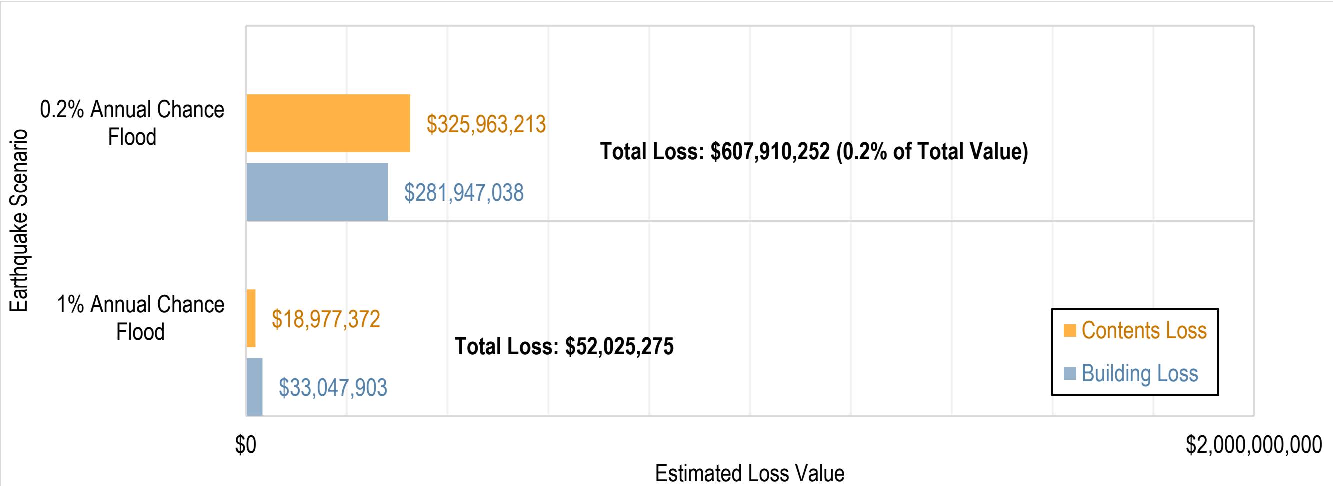


Figure 11-18. Loss Estimates for Flood, City of Pleasanton

Flood-Caused Debris

The Hazus analysis estimated the amount of flood-caused debris within the planning area generated by flooding, as summarized in Figure 11-19.

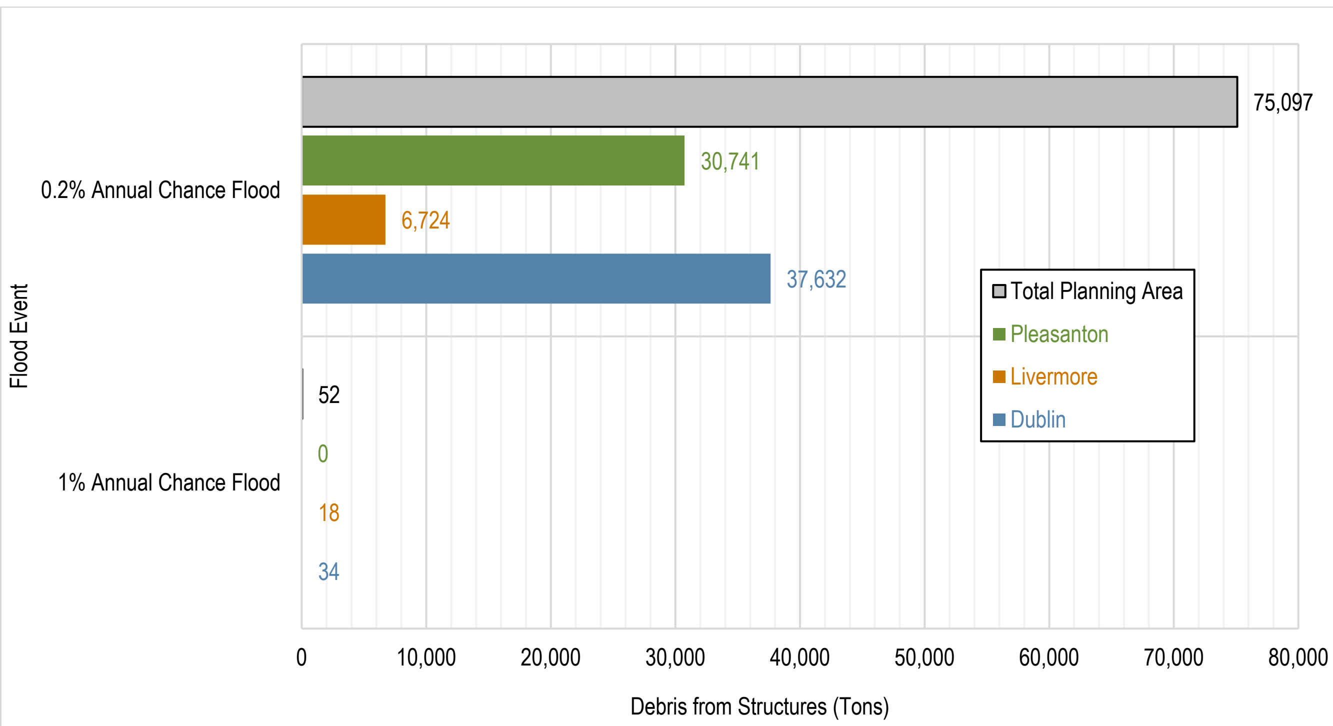


Figure 11-19. Estimated Flood-Caused Debris

11.4.3 Critical Facilities

Hazus was used to estimate the number of critical facilities affected by flooding and the resulting percent of damage to the building and contents. The estimated number of affected critical facilities and damage as a percent of total value are shown in Figure 11-20 and Figure 11-21 for the evaluated flood events. For the 1 percent-annual-chance-event, the average amount of damage to structures, measured as a percentage of total value, ranges from 0 to 9 percent of total value and average damage to contents ranges from 0 to 38 percent, depending on critical facility category.

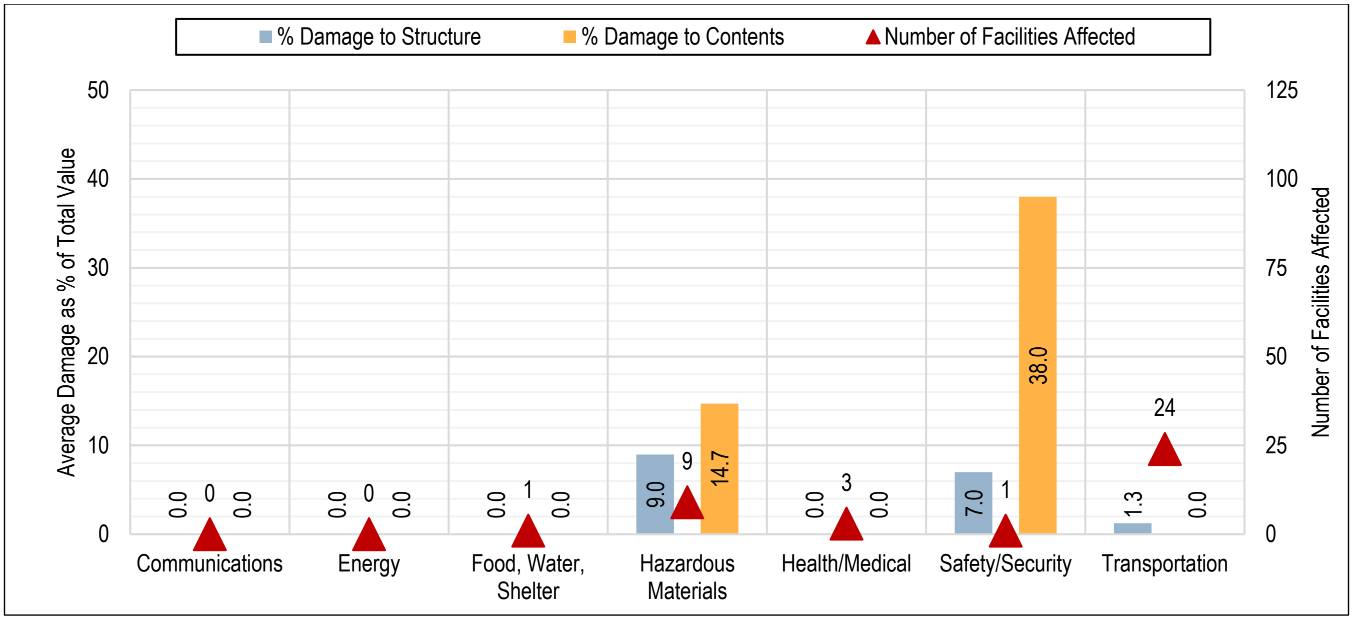


Figure 11-20. Estimated Damage to Critical Facilities from 1% Annual Chance Flood

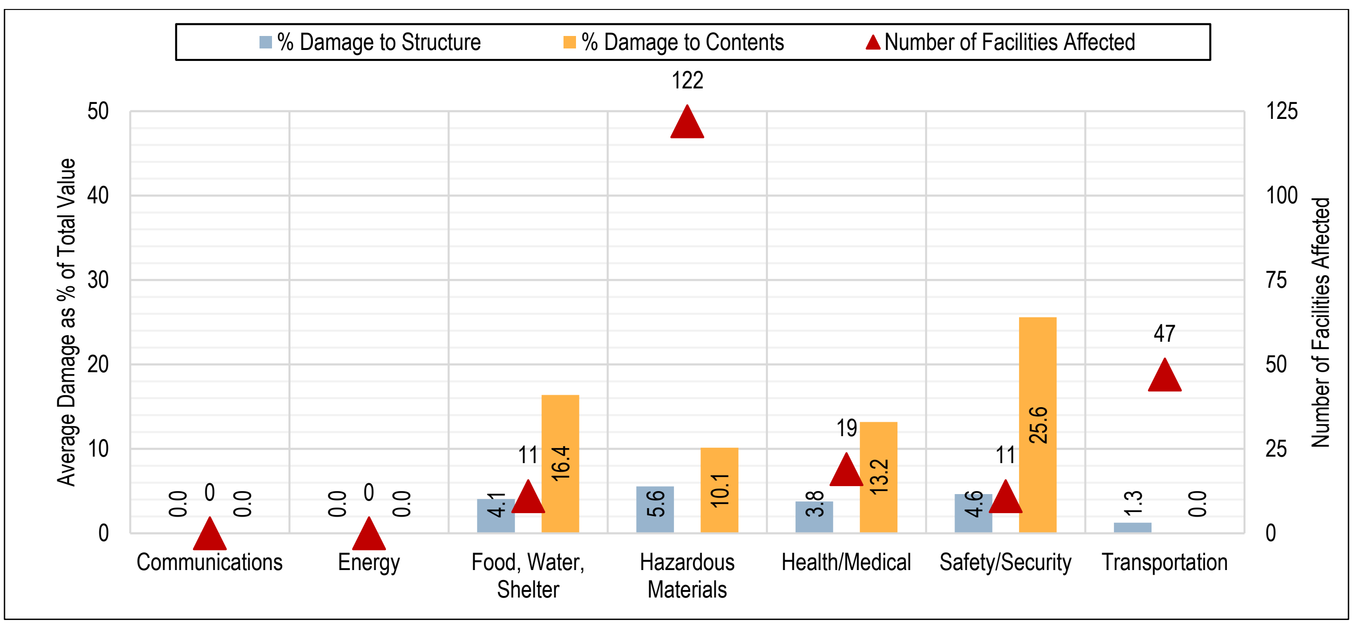


Figure 11-21. Estimated Damage to Critical Facilities from 0.2% Annual Chance Flood

Significant facilities predicted by Hazus to be affected by the 1 percent-annual-chance flood include the following:

- 1 primary education facilities
- 5 hazardous materials facilities
- 1 medical care facility
- 24 bridges

11.4.4 Environment

Flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development, such as bridge abutments, levees, or logjams from timber harvesting, can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Loss estimation platforms such as Hazus are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

11.5 FUTURE TRENDS IN DEVELOPMENT

The planning partners are equipped to handle future growth within flood hazard areas. All three cities have general plans that address frequently flooded areas in their safety elements and have committed to linking their general plans to this hazard mitigation plan. This will create an opportunity for wise land use decisions as future growth impacts flood hazard areas. Additionally, the three cities participant in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. They have committed to maintaining their good standing under the NFIP through actions identified in this plan.

11.6 SCENARIO

The primary water courses in the planning area have the potential to flood at irregular intervals, generally in response to a succession of intense winter rainstorms. Storm patterns of warm, moist air usually occur between early November and late March. A series of such weather events can cause severe flooding in the planning area. The worst-case scenario is a series of storms that flood numerous drainage basins in a short time. This could overwhelm the response and floodplain management capability within the planning area. Major roads could be blocked, preventing critical access for many residents and critical functions. High in-channel flows could cause water courses to scour, possibly washing out roads and creating more isolation problems.

11.7 ISSUES

The planning team has identified the following flood-related issues relevant to the planning area:

- The accuracy of the existing flood hazard mapping produced by FEMA in reflecting the true flood risk within the planning area is questionable. This is most prevalent in areas protected by privately owned levees and levees not accredited by the FEMA mapping process.

- The extent of the flood-protection currently provided by flood control facilities (dams, dikes and levees) is not known due to the lack of an established national policy on flood protection standards.
- Older levees are subject to failure or do not meet current building practices for flood protection.
- The risk associated with the flood hazard overlaps the risk associated with other hazards such as earthquake, landslide and wildfire. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.
- More information is needed on flood risk to support the concept of risk-based analysis of capital projects.
- There needs to be a sustained effort to gather historical damage data, such as high water marks on structures and damage reports, to measure the cost-effectiveness of future mitigation projects.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by flood hazards within and outside of the planning area.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods.
- The concept of residual risk should be considered in the design of future capital flood control projects and should be communicated with residents living in the floodplain.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.
- Existing floodplain-compatible uses such as agricultural and open space need to be maintained. There is constant pressure to convert these existing uses to more intense uses within the planning area during times of moderate to high growth.

12. LANDSLIDE

12.1 GENERAL BACKGROUND

12.1.1 Landslide Types

According to the USGS, the term landslide includes a wide range of ground movements. Landslides are commonly categorized by the type of initial ground failure, the material carried, or the nature of the movement. They include the following:

- **Block slides**—Blocks of rock that slide along a slip plane as a unit down a slope.
- **Creep**—A slow-moving landslide often only noticed through crooked trees and disturbed structures.
- **Debris avalanche**—A debris flow that travels faster than about 10 miles per hour (mph). Speeds in excess of 20 mph are not uncommon, and speeds in excess of 100 mph, although rare, can occur. The slurry can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path.
- **Earth flows**—Fine-grained sediments that flow downhill and typically form a fan structure.
- **Mudslides or Debris Flows**—Rivers of rock, earth, organic matter and other soil materials saturated with water. They develop in the soil overlying bedrock on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt.
- **Rock falls**—Blocks of rock that fall away from a bedrock unit without a rotational component.
- **Rock topples**—Blocks of rock that fall away from a bedrock unit with a rotational component.
- **Rotational slumps**—Blocks of fine-grained sediment that rotate and move down slope.
- **Transitional slides**—Sediments that move along a flat surface without a rotational component.

12.1.2 Landslide Risk Areas

Landslides are typically a function of soil type and steepness of slope. Soil type is a key indicator for landslide potential and is used by geologist and geotechnical engineers to determine soil stability for construction standards. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 33 percent
- Post-wildfire areas
- A history of landslide activity or movement during the last 10,000 years

- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, mixed with granular soils, such as sand or gravel.

The best predictor of where slides might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges. The recognition of ancient dormant landslide sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

12.1.3 Landslide Causes

Landslides are caused by a combination of geological and climate conditions and the influence of urbanization. They can be initiated by storms, earthquakes, fires, volcanic eruptions, or human modification of the land. Vulnerable natural conditions are affected by human development and the infrastructure that supports it. In some cases, irrigation increases the landslide potential. The following factors can contribute to slide formation:

- Change in slope of the terrain
- Increased load on the land
- Shocks and vibrations
- Change in water content
- Groundwater movement
- Frost action
- Weathering of rocks
- Removing or changing the vegetation covering slopes.

While small landslides are frequently a result of human activity, the largest landslides are often naturally occurring phenomena with little or no human contribution.

12.1.4 Landslide Management

Landslides can create immediate, critical threats to public safety. They can move rapidly down slopes or through channels, and can strike with little or no warning. Effective landslide management should include the following elements:

- Continuing investigation to identify natural landslides, understand their mechanics, assess their risk to public health and welfare, and understand their role in ecological systems
- Regulation of development in or near existing landslides or areas of natural instability through the cities' codes and ordinances and Alameda County code.
- Preparation for emergency response to landslides to facilitate rapid, coordinated action among Alameda County, the planning area, and state and federal agencies, and to provide emergency assistance to affected or at-risk citizens

- Evaluation of options including landslide stabilization or structure relocation where landslides are identified as a threat to critical public structures or infrastructure

12.1.5 Secondary Hazards

Mass movements are not generally known to result in secondary hazards. A landslide that blocks a river or stream does have the potential to cause flooding.

12.2 HAZARD PROFILE

12.2.1 Past Events

Landslides in the Bay Area typically occur either as a result of an earthquake or during heavy and sustained rainfall events. Urbanized areas, like the Cities of Dublin, Livermore and Pleasanton, and especially hilly areas of Alameda and Contra Costa County, have sustained damage from landslides caused by storms. Between January 1980 and May 2022, FEMA issued disaster (DR) declarations for the State of California for 11 landslide hazard-related events that affected Alameda or Contra Costa County, classified as one or a combination of the following events: severe winter storms, flooding, debris flow, mud flows, landslides and mudslides, as listed in Table 12-1.

Table 12-1. FEMA Landslide Disaster Declarations in Alameda County

FEMA Declaration	Event Date	Event Type	Location
DR-4308	February 1 – February 23, 2017	Severe Winter Storms, Flooding, Mudslides	43 counties including Alameda and Contra Costa
DR-4305	January 18 – January 23, 2017	Severe Winter Storms, Flooding, Mudslides	23 counties including Alameda and Contra Costa
DR-4301	January 3 – January 12, 2017	Severe Winter Storms, Flooding, Mudslides	34 counties including Alameda and Contra Costa
DR-1646	March 29 – April 16, 2006	Severe Storms, Flooding, Landslides, and Mudslides	17 counties including Alameda
DR-1628	December 17 – January 3, 2006	Severe Storms, Flooding, Mudslides, and Landslides	31 counties including Alameda and Contra Costa
DR-1155	December 28, 1996 – April 1, 1997	Severe Storms, Flooding, Mud and Landslides	48 counties including Alameda and Contra Costa
DR-1046	February 13 – April 19, 1995	Severe Winter Storms, Flooding, Landslides, Mudslides	57 counties including Alameda and Contra Costa
DR-1044	January 3 – February 10, 1995	Severe Winter Storms, Flooding, Landslides, Mudslides	42 counties including Alameda and Contra Costa
DR-979	January 5 – March 20, 1993	Severe Storms, Flooding, Mud and Landslides	27 counties including Contra Costa
DR-677	January 21 – March 30, 1983	Coastal Storms, Floods, Slides & Tornadoes	40 counties including Alameda and Contra Costa
DR-651	December 19, 1981 – January 8, 1983	Severe Storms, Flood, Mudslides & High Tide	10 counties including Alameda and Contra Costa

Source: (FEMA 2022)

Little recorded information is available regarding previous landslide occurrences in the Cities of Dublin, Livermore, and Pleasanton. Table 12-2 lists known landslide events that have impacted the planning area between January 1980 and May 2022.

Table 12-2. Landslide Events in the Tri-Valley Planning Area

Event Date	Event Type	FEMA Declaration	Location	Description
February 13, 2019	Flooding and Debris Flows	N/A	Livermore	Widespread flooding and debris flows prompted evacuations.
March 8, 2017	Landslide	N/A	Pleasanton	The backyards of three homes along Foothill Road slid/eroded into Arroyo De La Laguna Creek in Pleasanton.
February 20, 2017	Slide	DR-4308	Livermore	Slide blocked at least one land east bound 84 just west of Vallecitos and Tesla Road closed from mudslide in Livermore.
January 19, 2017	Mudslides	DR-4305	Tri-Valley area/ unincorporated county	Mudslide debris covered Palomares Road, Tesla Road, Mines Road, and Old Altamont Pass Road.
November 2, 2015	Mudslide	N/A	Livermore/ unincorporated county	Heavy rain caused mudslide on Patterson Pass Road, Tesla Road and Corral Hollow Road, east of Livermore
April 6-20, 2006	Heavy Rain and Debris Flows	DR-1646	Alameda County	Heavy rains caused landslides, eroding hillsides and cracked pavement. Landslide or erosion problems on private properties spilled over onto county rights-of-way. Overall, the County had approximately $10 million in damage to county roadways.
December 17, 2005 – January 12, 2006	Winter Storms	DR-1628	Alameda County	Severe storms brought flooding, mudslides, and landslides to most of Alameda County.
February 1995	Late Winter Storms (Severe Winter Storms, Flood, Landslide, Mudflows)	DR-1046	Statewide	All California counties except Del Norte were included in this declaration. In total, the state recorded 17 deaths; $190.6 million in public property damage, $122.4 million in individual damage, $46.9 million in business damage, $79 million in highway damage, and $651.6 million in agricultural damage; with 1,322 homes recording major damage, 267 listed as destroyed, and 2,299 recording minor damage.

Sources: (National Climatic Data Center 2022); (FEMA 2022); (Alameda County 2021)

12.2.2 Location

The California Geological Survey developed statewide mapping of landslide susceptibility classes based on regional rock strength and slope. The mapping assumed that landslide susceptibility is low on very low slopes in all rock materials and increases with slope and in weak rocks. The analysis factored in locations of past landslides. Figure 12-1 shows the planning area susceptibility classes—low, moderate, high, and very high/existing landslide. Most of the planning area has low susceptibility, though portions of all the cities' boundaries have moderate to high susceptibility. Western Pleasanton has very high susceptibility.

12.2.3 Frequency

Landslides are often triggered by events such as earthquakes, heavy rain, floods, or wildfires, so landslide frequency is often related to the frequency of these other hazards. In the planning area, landslides typically occur during and after major storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. The probability of a landslide event occurring in the planning area in any given year is high. Table 12-1 lists 10 federal disaster declarations for landslides in Alameda County between 1981 and May 2022, an average of once every four years. Table 12-2 lists eight landslide events in the Tri-Valley planning area between 1995 and May 2022, which averages about one event every three or four years.

EXHIBIT A

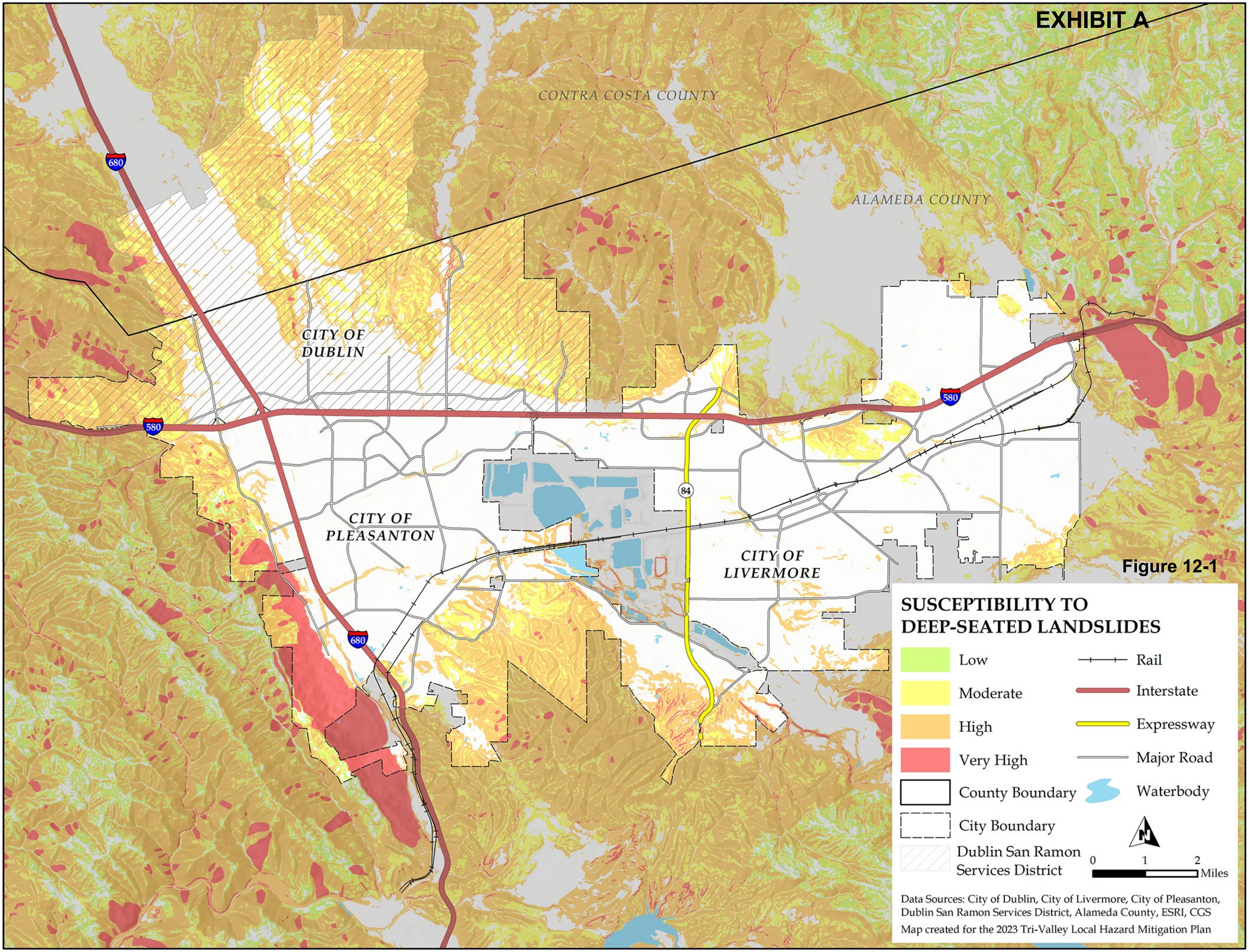


Figure 12-1

12.2.4 Severity

Landslides destroy property and infrastructure and can take human lives. Slope failures in the United States result in about 25 to 50 deaths per year and damage costing over $1 billion (U.S. Geological Survey n.d.). Landslides can pose a serious hazard to properties on or below hillsides. When landslides occur—in response to such changes as increased water content, earthquake shaking, addition of load, or removal of downslope support—they deform and tilt the ground surface. The result can be destruction of foundations, offset of roads, breaking of underground pipes, or overriding of downslope property and structures. In the planning area, landslides and mudslides have caused damage to homes, public facilities, roads, parks, and sewer lines in particular. Landslides can vary widely in extent, from a single rock tumbling down a hillside, to a major landslide or mudflow that covers several acres.

12.2.5 Warning Time

Mass movements can occur suddenly or slowly. The velocity of movement may range from a slow creep of inches per year to many feet per second, depending on slope angle, material and water content. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped roadbeds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows, and visible open spaces indicating frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together.

Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in predictions of what areas are at risk during general time periods. Currently, there is no practical warning system for individual landslides.

12.3 EXPOSURE

12.3.1 Population

Population exposure was estimated by calculating the number of buildings in each landslide susceptibility zone withing the planning area as a percent of total planning area buildings, and then applying this percentage to the estimated planning area population. Figure 12-2 shows the estimated population for each planning area city living in the moderate, high, and very high landslide susceptibility zones, compared to total city population. Figure 12-3 shows results for the entire planning area.

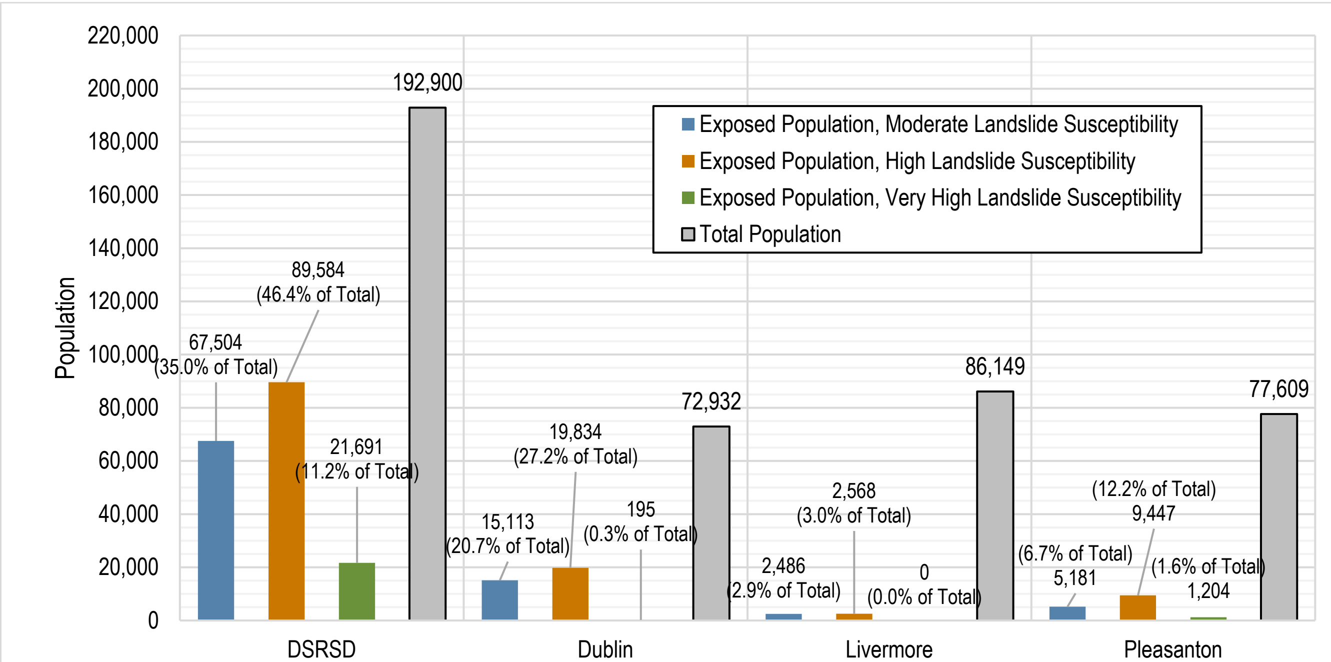


Figure 12-2. Population Exposed to Landslide Hazard and Total Population, by Jurisdiction

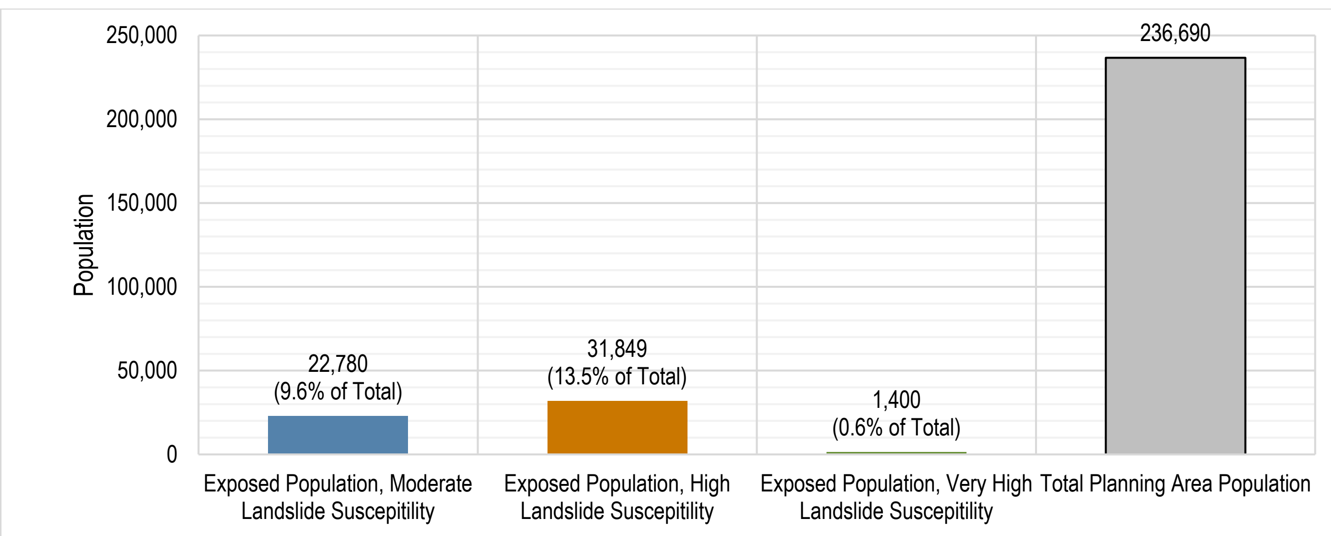
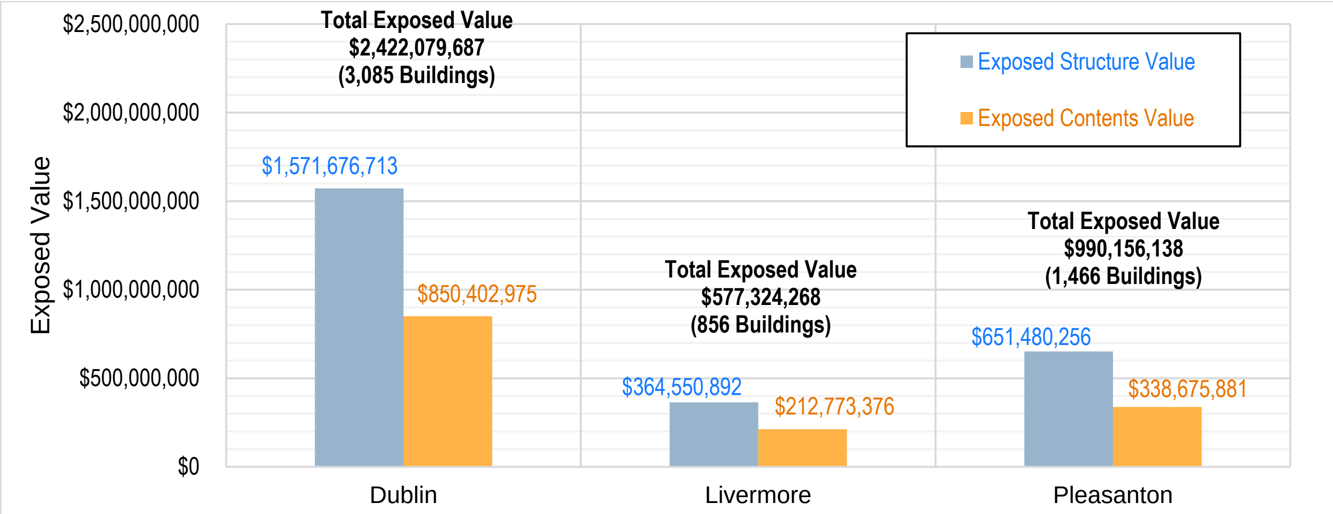


Figure 12-3. Total Planning Area Population Exposed to Landslide Hazard

12.3.2 Property

The estimated value of planning area buildings within the moderate, high, and very high landslide susceptibility zones is shown in Figure 12-4 through Figure 12-6. Figure 12-7 shows the estimated exposed total value as a percentage of the total replacement value in each city and in the overall planning area. The numbers of structures in each susceptibility zone, by occupancy class, are shown in Figure 12-8 through Figure 12-10.



DSRSD does not have any exposure for this zone

Figure 12-4. Number and Exposed Value of Buildings in the Moderate Landslide Susceptibility Zone

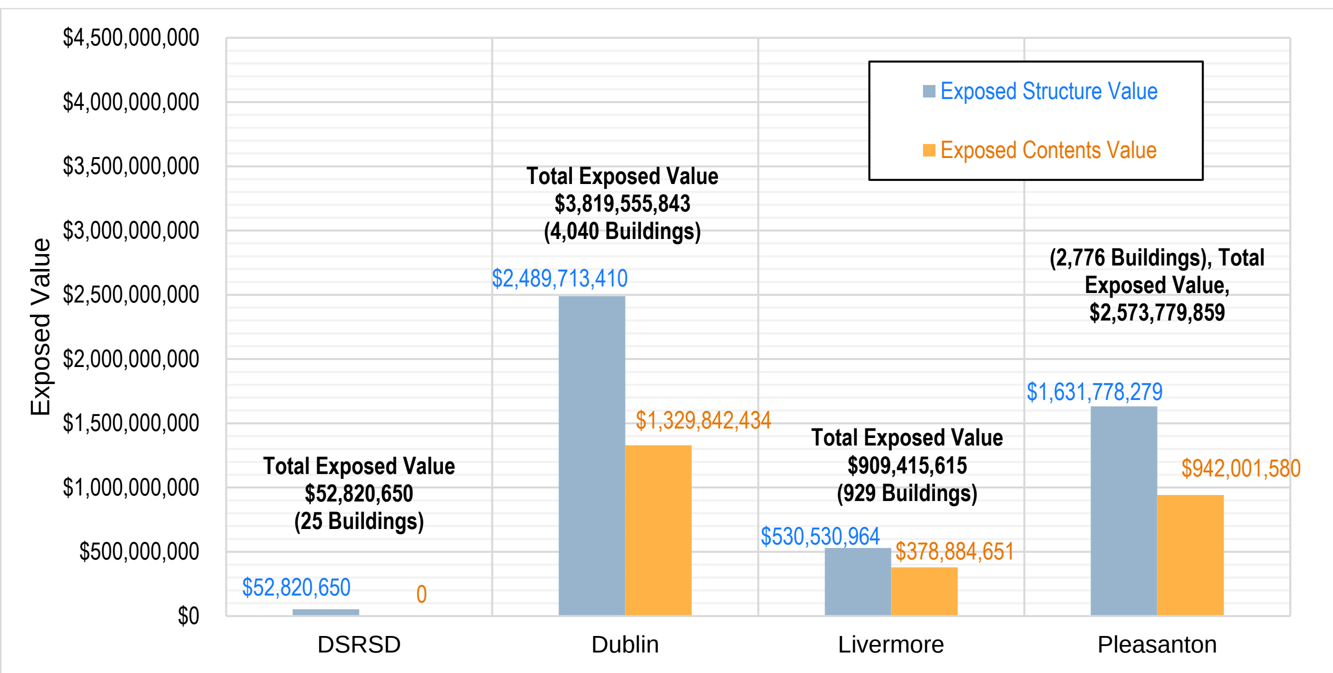
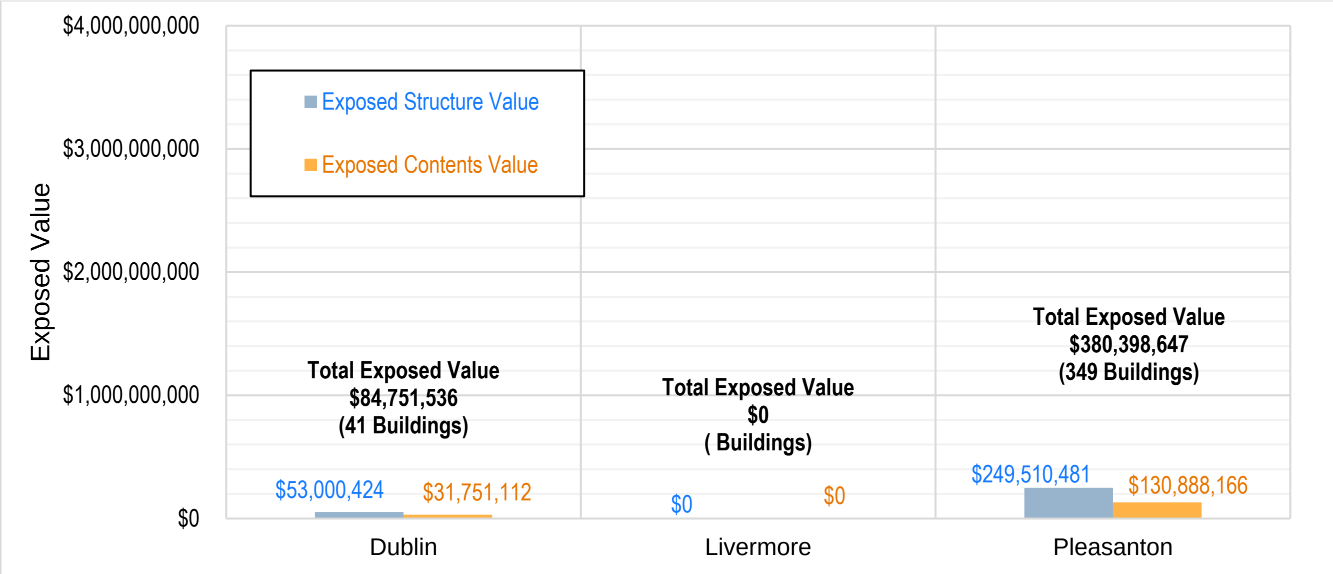


Figure 12-5. Number and Exposed Value of Buildings in the High Landslide Susceptibility Zone



DSRSD does not have any exposure for this zone

Figure 12-6. Number and Exposed Value of Buildings in the Very High Landslide Susceptibility Zone

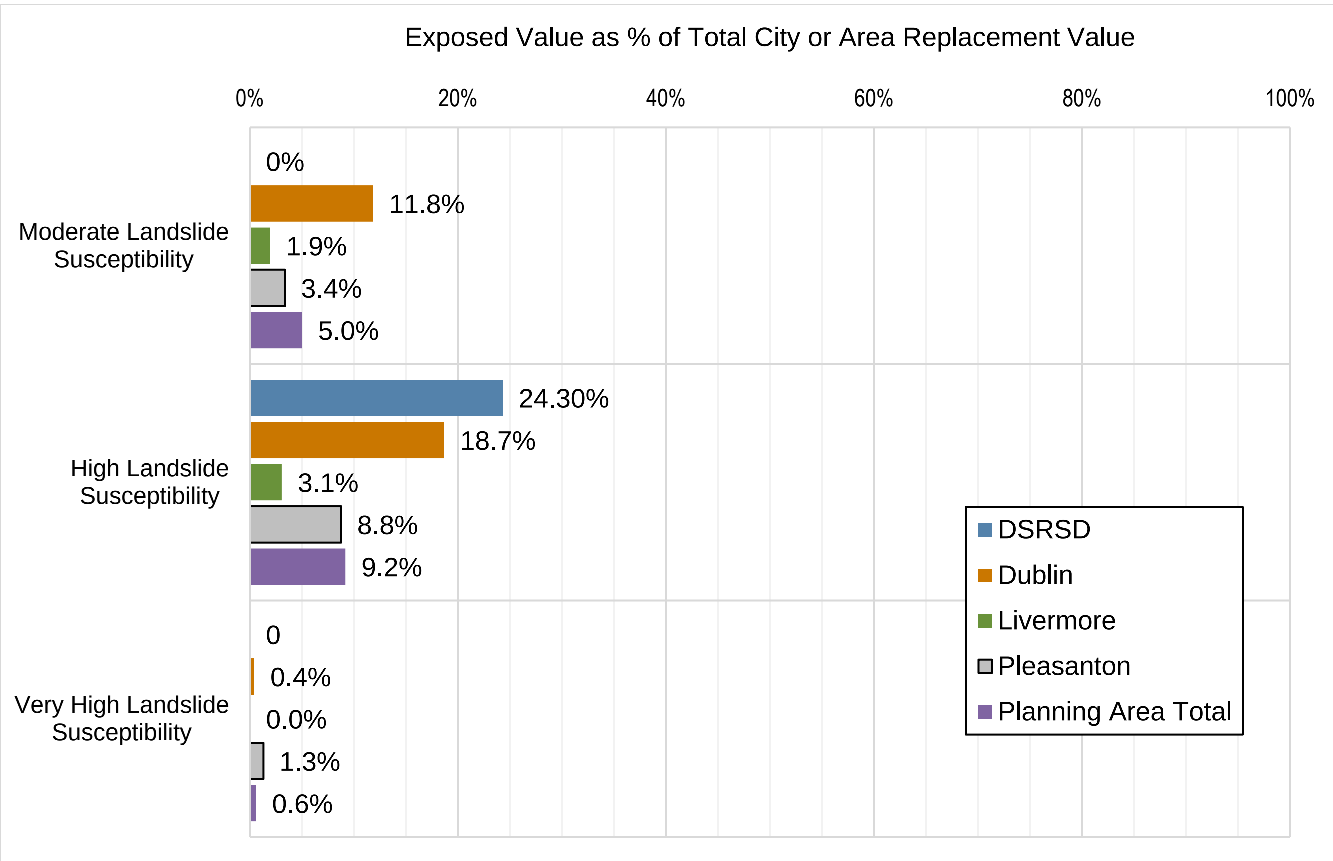


Figure 12-7. Total Value in Landslide Susceptibility Zones as % of Total Replacement Value, by City

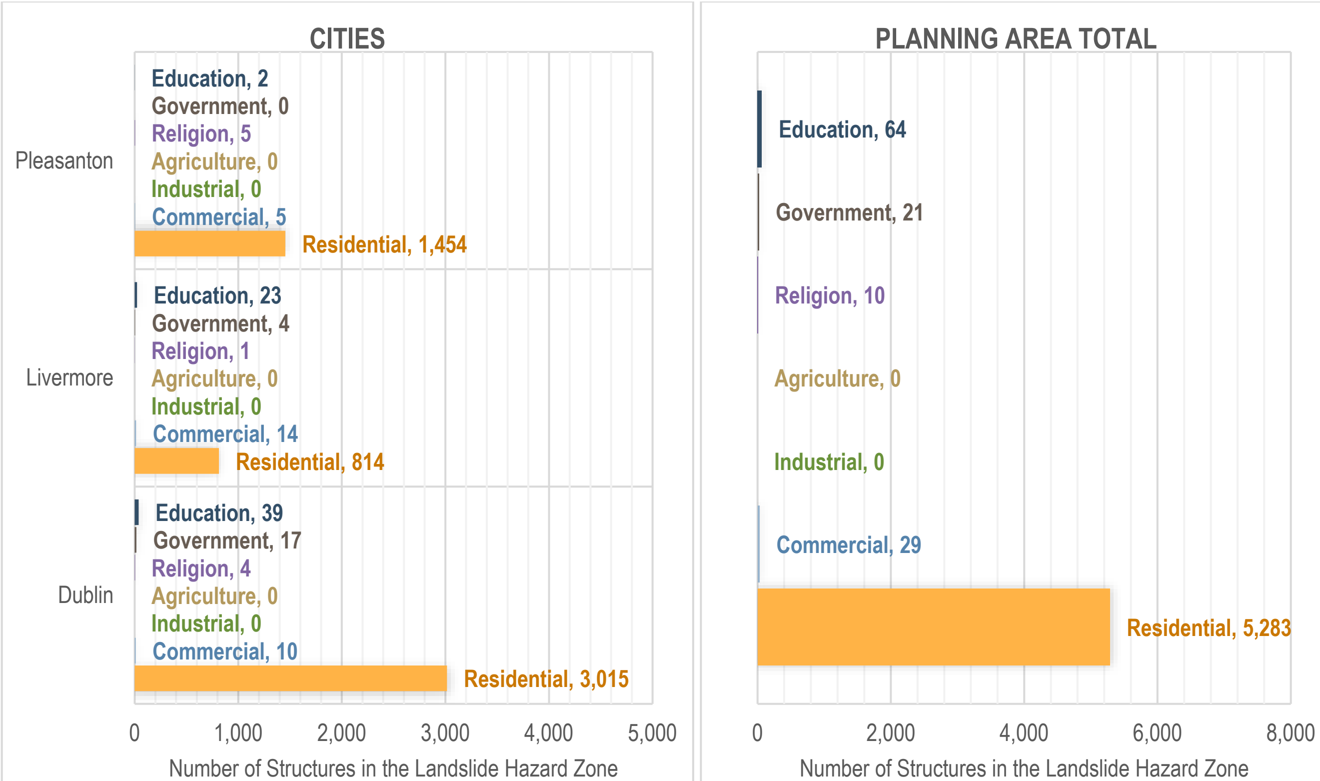


Figure 12-8. Structures in the Moderate Landslide Susceptibility Zone, by Jurisdiction and Occupancy Class

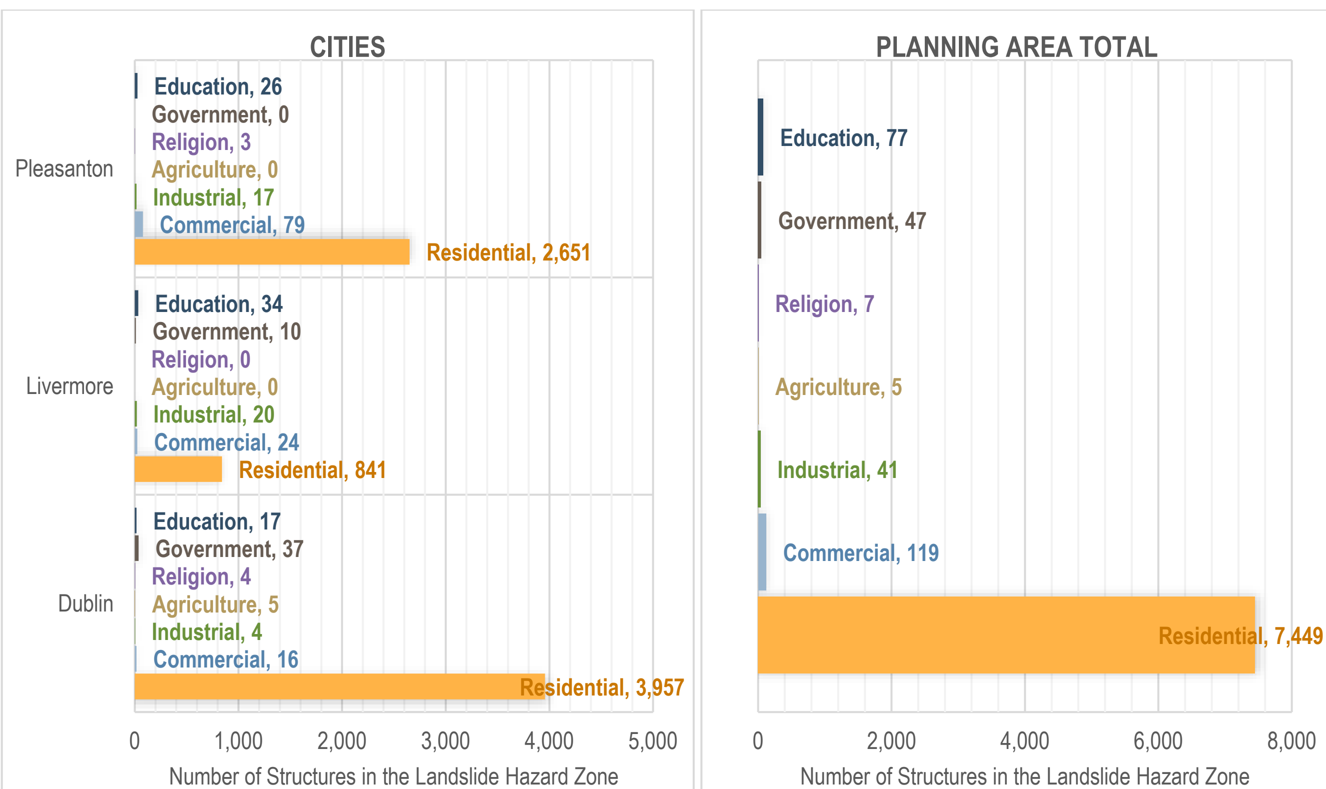


Figure 12-9. Structures in the High Landslide Susceptibility Zone, by Jurisdiction and Occupancy Class

Figure 12-10. Structures in Very High Landslide Susceptibility Zone, by Jurisdiction and Occupancy Class

12.3.3 Critical Facilities

Estimates of critical facilities in the mapped landslide susceptibility zones are summarized in Figure 12-11. The total count of critical facilities in high or very high landslide susceptibility zones (98) represents 8 percent of the planning area total of 1,161.

12.3.4 Environment

All natural areas within the high susceptibility zones for landslide are considered to be exposed to the hazard.

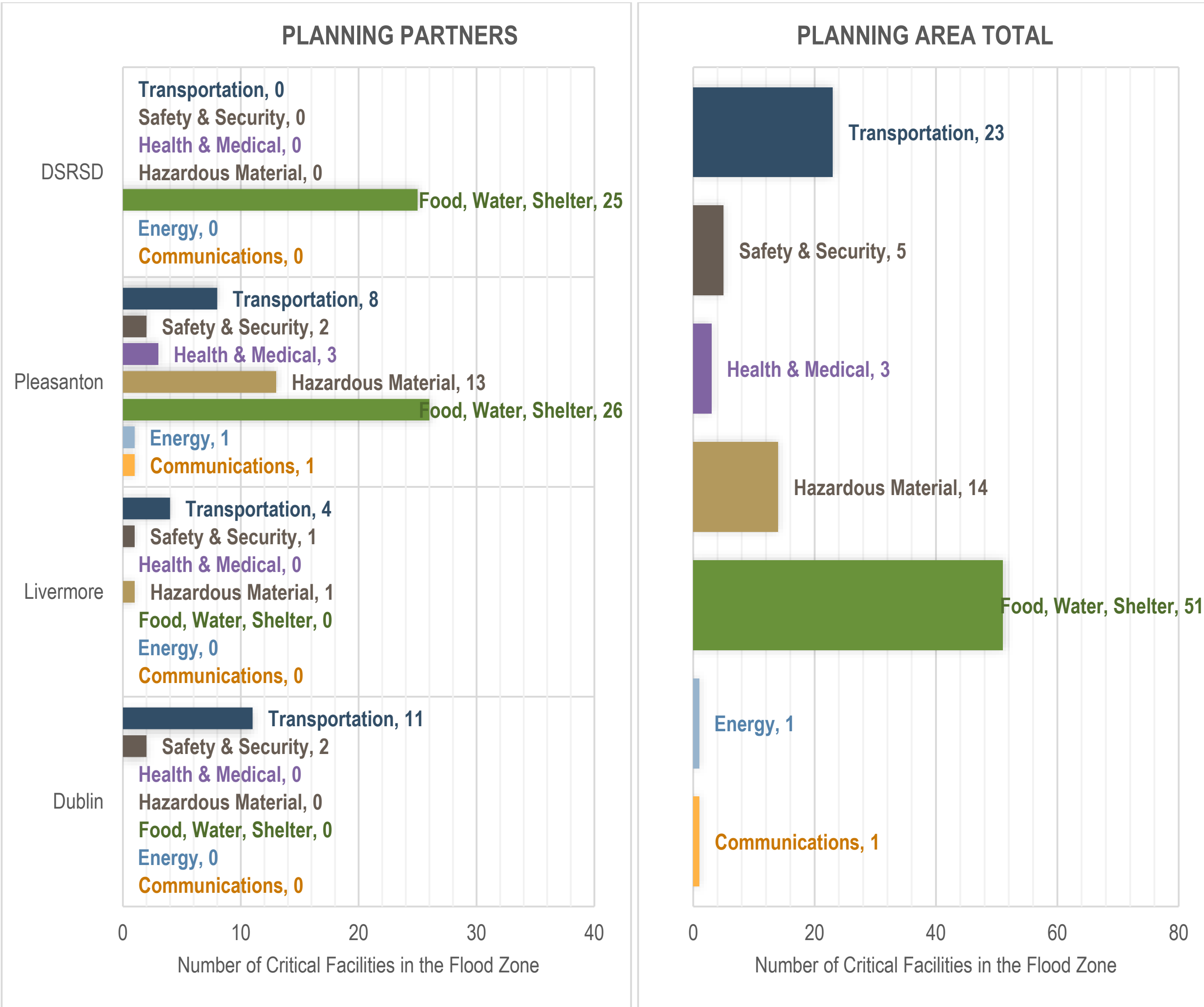


Figure 12-11. Critical Facilities in the High or Very High Landslide Susceptibility Zone

12.4 VULNERABILITY

Vulnerability estimates for the landslide hazard are described qualitatively. No loss estimation of these facilities was performed because damage functions have not been established for the landslide hazard.

12.4.1 Population

According to the CDC, health threats from landslides include the following (CDC 2018):

- Trauma caused by rapidly moving water and debris
- Broken electrical, water, gas and sewage lines that can lead to injury or illness
- Disrupted roadways that can endanger motorists and disrupt transport and access to health care

Landslide events can hinder evacuation routes, prevent the delivery of necessary goods to vulnerable populations in the Tri-Valley planning area, and delay emergency and medical responses to the area. Local vulnerable populations, such as the senior community, schools, individuals without vehicles, and individuals with disabilities within the cities of Dublin, Livermore, and Pleasanton and those served by DSRSD, may also have a difficult time evacuating the affected area in time due to their circumstances. A landslide might also impact access to senior centers, the veteran center in Livermore, schools, and disadvantaged community centers.

12.4.2 Property

Figure 12-12 shows estimates of potential loss representing 10 percent, 30 percent, and 50 percent of the assessed value of structures exposed to the landslide hazard (for the moderate, high, and very high susceptibility zones combined). These estimates allow emergency managers to assess a range of economic impacts based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

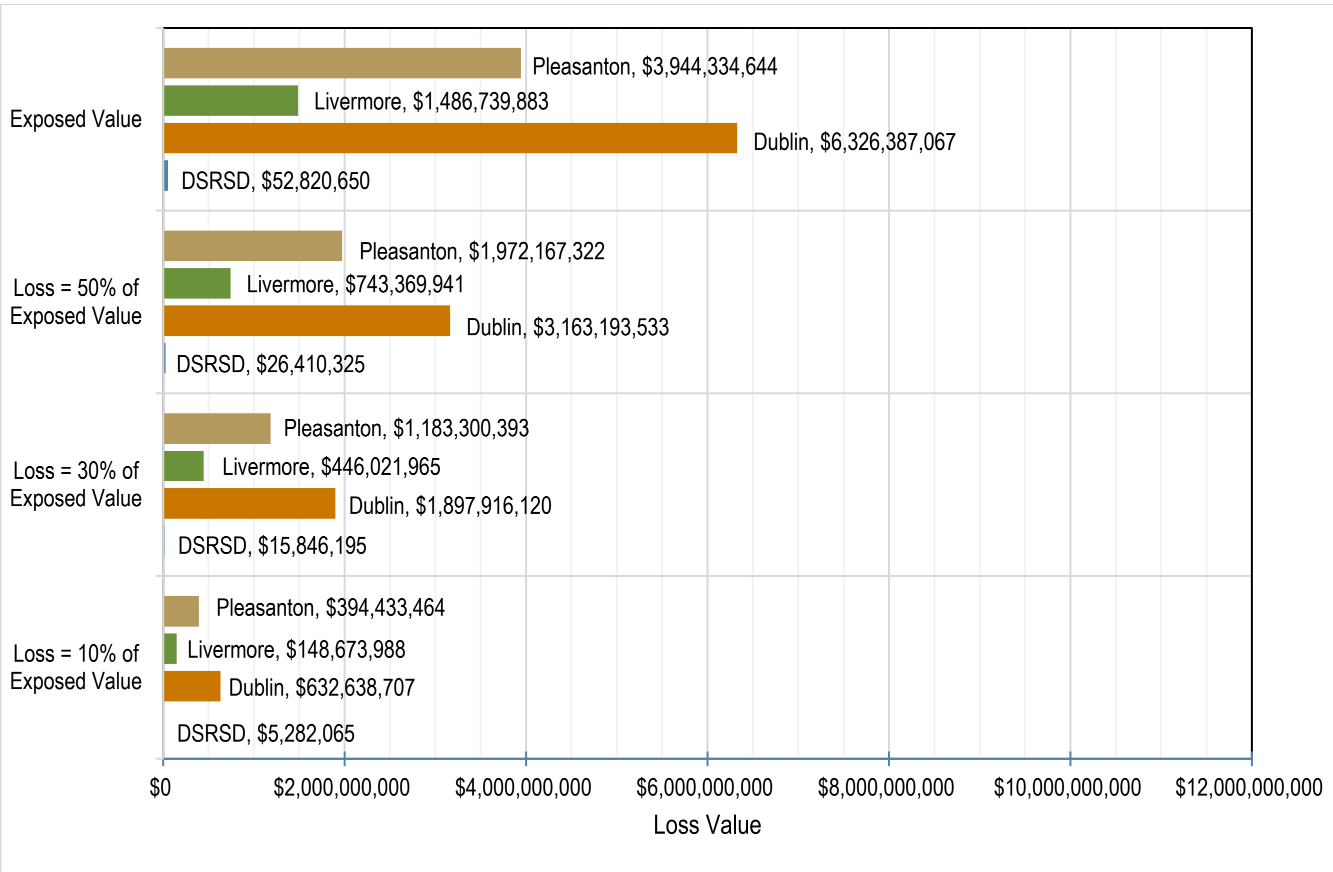


Figure 12-12. Loss Estimates for Landslide

12.4.3 Critical Facilities

There are 98 critical facilities exposed to the high or very high landslide susceptibility zone. No loss estimates were developed as a result of the lack of established damage functions for the landslide hazard.

12.4.4 Environment

Environmental problems as a result of landslides can be numerous. Vegetation and wildlife habitats may be damaged or destroyed. Soil and sediment runoff accumulate downslope, potentially blocking waterways and roadways and impairing the quality of streams and other water bodies. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods of time due to landslides.

12.5 FUTURE TRENDS IN DEVELOPMENT

The planning partners are equipped to handle future growth within landslide hazard areas. Landslide risk areas are addressed in the safety elements of local general plans. All three cities have committed to linking their general plans to this hazard mitigation plan. This will create an opportunity for wise land use decisions as future growth impacts landslide hazard areas.

Additionally, the State of California has adopted the International Building Code by reference in its California Building Standards Code. The Code includes provisions for geotechnical analyses in steep slope areas that have soil types considered susceptible to landslide hazards. These provisions assure that new construction is built to standards that reduce the vulnerability to landslide risk.

12.6 SCENARIO

Major landslides in the planning area occur as a result of soil conditions that have been affected by severe storms, groundwater or human development. The worst-case scenario for landslide hazards in the planning area would generally correspond to a severe storm that had heavy rain and caused flooding. Landslides are most likely during late winter when the water table is high. After heavy rains from November to December, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and accumulates on impermeable silt, it will cause weakness and destabilization in the slope. A short intense storm could cause saturated soil to move, resulting in landslides. As rains continue, the groundwater table rises, adding to the weakening of the slope. Gravity, poor drainage, a rising groundwater table and poor soil exacerbate hazardous conditions.

Landslides are becoming more of a concern as development moves outside of city centers into less-developed areas. It is probable that private and public property, including infrastructure, will be affected. Mass movements could affect bridges that pass over landslide-prone ravines and knock out rail service through the planning area. Road obstructions caused by mass movements would create isolation problems for residents and businesses in sparsely developed areas. Property owners exposed to steep slopes may suffer damage to property or structures. Landslides carrying vegetation such as shrubs and trees may cause a break in utility lines, cutting off power and communication access to residents.

12.7 ISSUES

Important issues associated with landslides in the planning area include the following:

- There are existing homes in landslide risk areas throughout the planning area. The degree of vulnerability of these structures depends on the codes and standards the structures were constructed to. Information to this level of detail is not currently available.

- Future development could lead to more homes in landslide risk areas.
- Mapping and assessment of landslide hazards are constantly evolving. As new data and science become available, assessments of landslide risk should be reevaluated.
- The impact of climate change on landslides is uncertain. If climate change impacts atmospheric conditions, then exposure to landslide risks is likely to increase.
- The risk associated with the landslide hazard overlaps the risk associated with other hazards such as earthquake, flood and wildfire. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.

13. SEVERE WEATHER

13.1 GENERAL BACKGROUND

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. Severe weather conditions with the greatest potential to impact the planning area are described in the following sections. Flooding and landslides associated with severe weather are discussed as separate hazards in Chapters 11 and 12. In this risk assessment, the "severe weather" hazard refers in aggregate to the various weather conditions profiled—severe storms, extreme heat, damaging winds and space weather. These conditions are treated as a single hazard for the following reasons:

- Each condition has impacted the planning area, with similar frequencies of occurrence, based on weather records.
- Each condition impacts the entire planning area, with no clearly mapped or defined extent. Without a mapped or defined extent, quantitative, geospatial analysis to assess exposure or vulnerability is not available. Therefore, the risk assessment for severe weather is qualitative and is based on the aggregate exposure and vulnerability to all weather conditions.

13.1.1 Severe Storms

Severe storm conditions in the planning area include heavy rain (atmospheric rivers and thunderstorms), lightning and hail. Heavy rain refers to events where the amount of rain exceeds normal levels. The amount of precipitation needed to qualify as heavy rain varies with location and season. Heavy rain is distinct from climate change analyses on increasing precipitation. It does not mean that the total amount of precipitation at a location has increased, just that the rain is occurring in a more intense event. More frequent heavy rain events, however, can serve as indicators of changing precipitation levels. Heavy rain is most frequently measured by tracking the frequency of events, analyzing the mean return period, and measuring the amount of precipitation in a certain period (most typically inches of rain within a 24-hour period) (Environmental Protection Agency 2021).

Thunderstorms

NOAA classifies a thunderstorm as a storm with lightning and thunder produced by cumulonimbus clouds, usually producing gusty winds, heavy rain, and sometimes hail. Thunderstorms are usually short in duration (seldom more than two hours). They have three stages:

- The developing stage is marked by a cumulus cloud that is being pushed upward by a rising column of air (updraft). The cumulus cloud soon looks like a tower. There is little to no rain during this stage but occasional lightning. The developing stage lasts about 10 minutes.

- In the mature stage, the updraft continues to feed the storm, precipitation begins to fall, and a downdraft begins (a column of air pushing downward). When the downdraft and rain-cooled air spread out along the ground, they form a line of gusty winds. The mature stage is the most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes.
- Eventually, a large amount of precipitation is produced and the updraft is overcome by the downdraft, beginning the dissipating stage. At the ground, the gusty winds move out a long distance from the storm and cut off the warm moist air that was feeding the thunderstorm.

According to the American Meteorological Society *Glossary of Meteorology*, thunderstorms are reported as light, medium, or heavy according to the following characteristics:

- Nature of the lightning and thunder
- Type and intensity of the precipitation
- Speed and gustiness of the wind
- Appearance of the clouds
- Effect on surface temperature.

A thunderstorm is classified as "severe" when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), or tornado.

Atmospheric Rivers

An atmospheric river is a common weather pattern that brings southwest winds and heavy rain to California. Atmospheric rivers are long, narrow regions in the atmosphere that transport water vapor carried away from the tropics. These columns of vapor move with the weather, carrying large amounts of water vapor and strong winds. When they make landfall, they often release the water vapor in the form of heavy rain or snow.

Lightning

Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt." This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning reaches temperatures approaching 50,000ºF instantaneously. The rapid heating and cooling of air near the lightning causes thunder. Lightning is a major threat during a thunderstorm. In the United States, between 1989 and 2018, lightning killed an average of 43 people per year (National Weather Service 2019).

Hail

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Super-cooled water may accumulate on frozen particles near the back-side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail.

13.1.2 Extreme Heat

Extreme heat is defined as temperatures that hover 10 ºF or more above the average high temperatures for a region for several days or weeks. Extreme heat events can lead to an increase in heat-related illnesses and deaths, cause drought, and impact water supplies. Heat waves do not strike victims immediately, but their cumulative effects slowly cause harm to vulnerable populations. Older adults, children, and sick or overweight individuals are at greater risk from extreme heat. Such events do not typically impact buildings; however, losses may be associated with the urban heat island effect and overheating of heating, ventilation, and air conditioning systems.

Extreme heat is the primary weather-related cause of death in the United States. Excessive heat claims over 100 lives each year in this country. In a 30-year record of weather fatalities across the nation (1990-2019), excessive heat claimed more lives each year than floods, lightning, tornadoes, and hurricanes (Erdman 2022). According to the *California Climate Adaptation Strategy*, heat waves have claimed more lives in California than all other declared disaster events combined. Despite this history, in a span of 60 years, only four heat emergencies (August 14, 2020; September 2, 2020; June 16, 2021; July 9, 2021) were proclaimed in California at the state level and none were proclaimed at a federal level.

The heat index is what the temperature feels like to the human body when relative humidity is combined with the air temperature. When the body gets too hot, it begins to perspire or sweat to cool itself off. If the perspiration is not able to evaporate, the body cannot regulate its temperature. When atmospheric moisture content (humidity) is high, the rate of evaporation from the body decreases, and the body feels warmer. Figure 13-1 shows the heat index used by the National Weather Service (National Weather Service n.d.).

NWS Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Figure 13-1. National Weather Service Heat Index

13.1.3 Damaging Winds

Straight-Line Winds

Straight-line wind is a general term used to describe winds that have no rotation (i.e., are not tornadoes). Damaging straight-line winds are those that exceed 50 to 60 mph. The Beaufort wind chart (Table 13-1) provides terminology and a description of potential impacts at different levels.

Table 13-1. Beaufort Wind Chart

Beaufort Number	Range (mph)	Terminology	Description
0	0	Calm	Calm. Smoke rises vertically.
1	1-3	Light air	Wind motion visible in smoke.
2	4-7	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate breeze	Dust and loose paper are raised. Small branches begin to move.
5	19-24	Fresh breeze	Smaller trees sway
6	25-31	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use is difficult.
7	32-38	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	Sever gale	Light structure damage.
10	55-63	Storm	Trees uprooted. Considerable structural damage.
11	64-73	Violent storm	Widespread structural damage.
12	74-95	Hurricane	Considerable and widespread damage to structures.

Source: (NWS n.d.)

Public Safety Power Shutoff Events

High winds can uproot trees, blow branches onto power lines or create sparks if power lines contact one another. When this occurs in combination with extreme heat and low humidity that dry out vegetation, it poses increased risks of wildfire. In 2012, the California Public Utilities Commission ruled that California Public Utilities Code gives electric utilities authority to shut off electric power to protect public safety by reducing the potential to ignite wildfires (California Public Utilities Commission 2021). Such shutoffs are referred to as public safety power shutoff events. Given the long, connected nature of power supply systems, a shutoff event targeted to a small at-risk area can affect a larger area outside the risk zone. The duration of a shutoff is tied directly to the severe weather that triggers it; the shutoff typically ends within 24 hours after the severe weather has passed (Pacific Gas & Electric 2022).

13.1.4 Space Weather

Space weather refers to variations in the space environment between the sun and earth. It includes phenomena that impact systems and technologies in orbit and on earth. Space weather can occur anywhere from the surface of the sun to the surface of the earth. As a space weather storm leaves the sun, it passes through the sun's corona and into the solar wind. When it reaches earth, it energizes earth's magnetosphere and accelerates electrons and protons down to earth's magnetic field lines where they collide with the atmosphere and ionosphere, particularly at high latitudes. Each component of space weather impacts a different technology. Figure 13-2 illustrates several types of space weather phenomena.

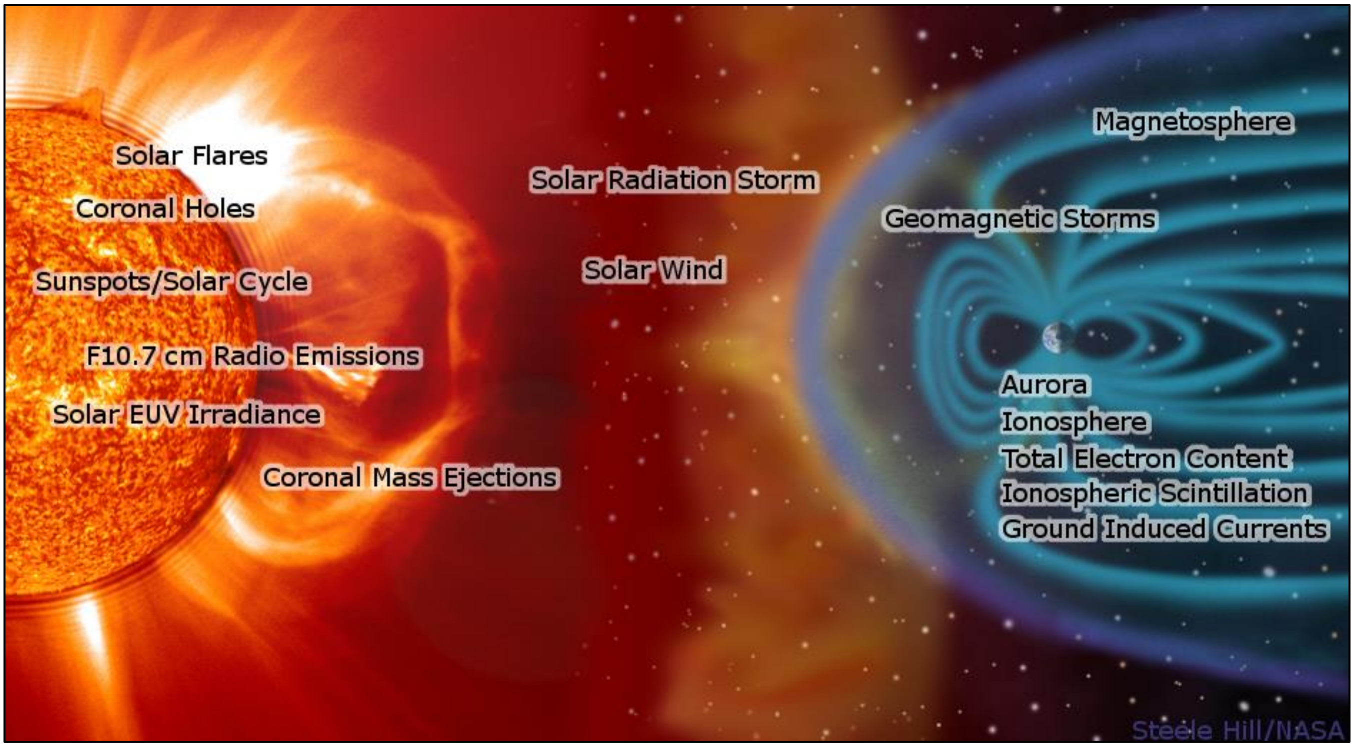


Figure 13-2. Space Weather Phenomena

A solar flare occurs when magnetic energy that has built up in the solar atmosphere is suddenly released. The flare ejects clouds of electrons, ions, and atoms through the corona of the sun into space. These clouds typically reach earth a day or two after the event. Solar flares last from minutes to hours. Radiation is emitted across virtually the entire electromagnetic spectrum, from radio waves at the long wavelength end, through optical emission to X-rays and gamma rays at the short wavelength end ((National Aeronautics and Space Administration 2016)). Solar flares only impact the earth when they occur on the side of the sun that faces the earth (National Aeronautics and Space Administration 2016a). If the energy from a solar flare reaches the earth, it has the potential to affect global positioning system (GPS) signals, television and radio transmissions, and telecommunications.

13.1.5 Secondary Hazards

The most significant secondary hazards associated with severe weather are floods and landslides. Heavy rain can overwhelm natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails.

13.2 HAZARD PROFILE

13.2.1 Past Events

Sources that provide historical information regarding previous occurrences and losses associated with severe weather events in Alameda County and the planning area include FEMA, NWS, and NOAA NCEI. Between 1970 and March 2022, Alameda County was included in 12 FEMA disaster declarations for severe storms, severe winter storms, mudslides, landslides and flooding. Impacts on the planning area were not identified in the sources reviewed.

According to NOAA NCEI, between 1996 and March 2022, no extreme heat nor tornado events were recorded in Alameda County. Three hail events occurred in the county, but not in the Tri-Valley planning area. Alameda County recorded 30 high wind events in this timeframe with wind magnitude ranging between 44 knots and 96 knots, 39 strong wind events with wind magnitude between 30 knots and 48 knots, and five thunderstorm wind events. Table 13-2 lists known severe weather events that impacted the planning area between 1970 and April 2017, along with solar flare events that occurred in North America.

Table 13-2. Severe Weather Events in the Tri-Valley Planning Area

Event Date	Event Type	FEMA Declaration	Location	Description
October 24, 2021	Atmospheric River, Flood, Heavy Rain	N/A	Alameda County	An atmospheric river system brought heavy rain, urban and small stream flooding, strong winds, and high surf to the region. Area streams rose rapidly. Multiple flood advisories and warnings were issued. Several downed trees were reported, along with wind gusts of 40 to 50 mph at lower elevations and 60 to 80 mph in the hills. One station in Alameda County reported a wind gust of 92 mph.
February 20, 2017	Atmospheric River, Heavy Rain, Flash Flood	N/A	Alameda County	An atmospheric river brought heavy rain, causing widespread flooding, debris flows, accidents, and overtopping of reservoir spillways. SR 84 completely closed in both directions due to Alameda Creek flooding between Mission in Fremont to Main Street in Sunol
February 7, 2017	Atmospheric River	DR- 4308	Alameda County, planning area, Bay Area	An atmospheric river produced widespread roadway flooding, debris flows, strong winds, and overtopping of reservoir spillways in the Bay Area. Pleasanton recorded 2.45 inches of rain on Feb. 20.
January 20, 2017	Atmospheric River	DR- 4305	Alameda County, planning area, Bay Area	
January 10, 2017	Atmospheric River	DR- 4301	Alameda County, planning area, Bay Area	An atmospheric river produced widespread roadway flooding, debris flows, and strong winds in the Bay Area. Pleasanton recorded 2.15 inches of rain on Jan 10.
December 10 – 11, 2014	Heavy Rains and High Winds	N/A	Alameda County, planning area, and Bay Area	An atmospheric river brought heavy rains and gusty winds to the Bay Area for several days. Rainfall of 1.5 to 2 inches an hour was reported. A flash flood warning was issued for Dublin, Livermore and Pleasanton. Wind gusts were recorded up to 83 mph. Rainfall totals ranged from 5.78 to 7.24 inches. Power outages occurred across the Bay Area. Total rainfall in Pleasanton was 3.27 inches.
December 2006	Geomagnetic Storms and Solar Flares	N/A	United States	This event disabled GPS signal acquisition over the United States.
April 6-20, 2006	Heavy Rain and Debris Flows	DR-1646	Alameda County and planning area	Storms brought heavy rain causing landslides, eroding hillsides and cracked pavement. Landslides or erosion on private properties spilled over onto county rights-of-way. Overall, the County had approximately $10 million in damage to county roadways.
December 17, 2005 – January 12, 2006	Winter Storms (Severe Storms, Flood, Mudslides, Landslides)	DR-1628	Alameda County, planning area, Bay Area	Damage estimates for the region were over $100 million. Storms were blamed for two deaths from falling trees, around 50 businesses declared damage, and three homes were nearly wiped out by mudslides.

Event Date	Event Type	FEMA Declaration	Location	Description
October 2003	Space Weather ("Halloween Storms of 2003")	N/A	Parts of the Europe and the United States	Solar flares impacted satellite-based systems and communications. A one-hour-long power outage resulted in Sweden. Aurorae were observed as far south as Texas.
December 28, 1996 – April 1, 1997	Severe Storms, Flooding, Mud and Landslides	DR-1155	48 counties including Alameda County	Over 12,000 people were evacuated in northern California. Levee breaks were reported across the Sacramento and San Joaquin Valleys. Over 23,000 homes and business, agricultural lands, bridges, and roads were damaged. The event caused eight deaths and $1.8 billion in damage.
March 13, 1989	Space Weather Storm	N/A	Quebec, Canada	A space weather storm disrupted the hydroelectric power grid in Quebec, Canada. This system-wide outage lasted for 9 hours and left 6 million people without power.
February 12 – March 10, 1986	Severe Storms & Flooding	DR-758	Bay Area including Alameda County	This event damaged over 12,000 homes, destroyed over 1,300 homes, and caused 13 deaths and 67 injuries in California. Damage totaled over $407.5 million.
January 3 – 5, 1982	Landslides, Floods, and Marine Effects	DR-651	Bay Area including Alameda County	A major storm caused widespread and catastrophic landslide damage throughout the Bay Area, resulting in numerous deaths and over $60 million in direct costs. In Alameda County, damage was concentrated in Oakland, Piedmont, and Berkeley. The County had approximately $3.5 million in damage.
February 10, 1970	Severe Storms & Flooding	DR-283	Bay Area including Alameda County	Heavy winds, storms and flooding impacted the Bay Area, including Alameda County. Impacted areas had over $27 million in damage.

Source: FEMA, 2017b; NOAA NCEI, 2022

13.2.2 Location

All severe weather conditions profiled in this chapter have the potential to happen anywhere in the planning area. No location mapping is currently available.

13.2.3 Frequency

The planning area can expect to experience exposure to and adverse impacts from severe weather events almost annually.

13.2.4 Severity

The most common problems associated with the severe weather conditions profiled in this assessment are immobility and loss of utilities. Fatalities are uncommon, but can occur. Roads may become impassable due to flooding, downed trees, or a landslide. Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury. Physical damage to homes and facilities can be caused by wind or flooding.

Atmospheric rivers or heavy precipitation can have significant impacts, including crop damage, soil erosion, and increased risk of flood. These events can drop up to 12 inches of rain over a few days and cause widespread flooding and disruption to road and air travel. Stormwater runoff from heavy rains can also impair water quality by washing pollutants into water bodies. Thunderstorms carry the same risks as heavy precipitation events, and depending on the type of storm, they can also result in tornados, lightning, and heavy winds, increasing risk of injury and property damage (Keller and Blodgett 2008).

Lightning severity is typically associated with both property damage and life safety (injuries and fatalities). The number of reported injuries from lightning is likely to be low, but planning area infrastructure losses can be up to thousands of dollars each year. Lightning also is associated with wildfire ignitions in the planning area.

An indicator of the potential severity of extreme heat is the number of heat advisories issued for the planning area by the National Weather Service. Figure 13-3 shows the annual number of heat advisories in Alameda and Contra Costa Counties since 2006.

Source: (Times Record News 2023)

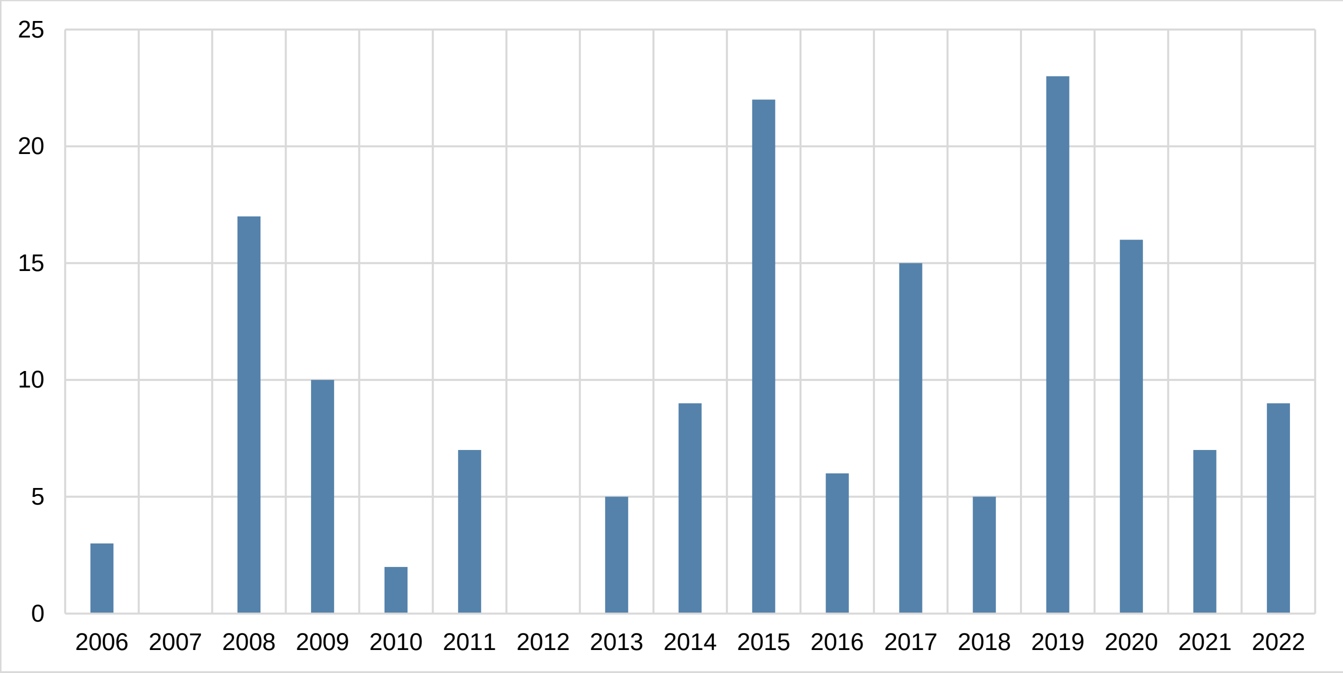


Figure 13-3. Annual Number of Heat Advisories in Alameda and Contra Costa Counties Since 2006

Windstorms can be a frequent problem in the planning area and have been known to cause damage to utilities. Strong, hot, dry offshore winds locally known as “diablo winds” can be particularly dangerous. These winds can occur at any time of year, but are especially dangerous in summer and fall when vegetation is at its driest. The wind speed given in wind warnings issued by the NWS is for a one-minute average; gusts may be 25 to 30 percent higher. The FEMA *Winds Zones of the United States* map (Figure 13-4) indicates the strength of windstorms in the United States and the general location of the most wind activity, based on 40 years of tornado data and 100 years of hurricane data collected by FEMA. The planning area, along with most of the Western United States, is in Wind Zone I, where wind speeds can reach up to 130 mph.

Solar flares can lead to long-term power grid outages. Moderate solar storms have affected transformers as they are not very resilient to long electromagnetic pulses (Global Resilience Network 2016). Recent events impacting the United States have disrupted the power grid, shut down satellites and air traffic precision navigation, and disabled GPS signals. Power outages induced by space weather can be life-threatening to those dependent on electricity for life support.

Source: (National Institutes of Standards and Technology 2011)

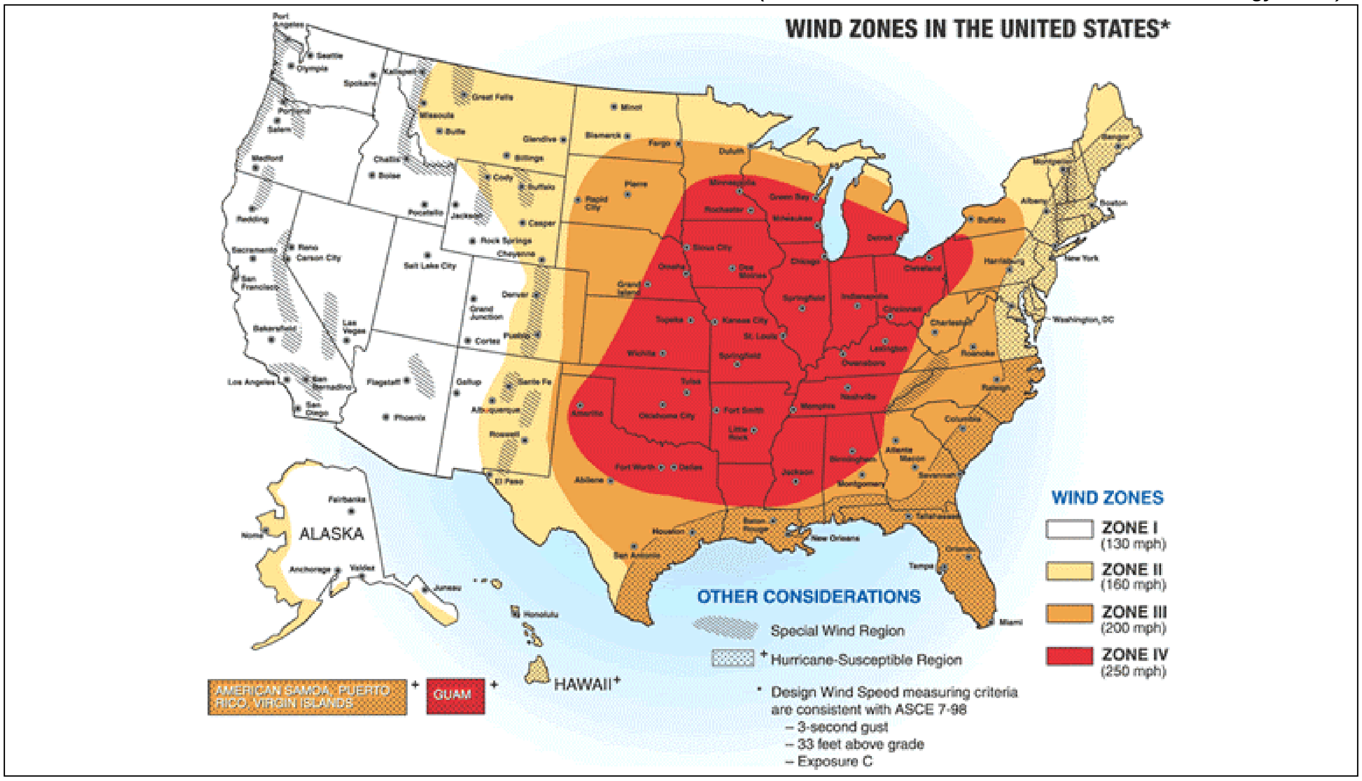


Figure 13-4. Wind Zones in the United States

13.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe weather event. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. The San Francisco Bay Area Weather Forecast Office of the NWS monitors weather stations and issues watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio and are forwarded to the local media for retransmission using the Emergency Alert System.

Space weather prediction in the United States is provided primarily by the Space Weather Prediction Center and the U.S. Air Force's Weather Agency. The Space Weather Prediction Center draws on a variety of data sources, both space- and ground-based, to provide forecasts, watches, warnings, alerts, and summaries to civilian and commercial users.

13.3 EXPOSURE AND VULNERABILITY

A lack of clearly defined extent mapping for the severe weather conditions profiled in this chapter prevents a detailed analysis of exposure and vulnerability. However, it can be assumed that the entire planning area is exposed to some extent to all severe weather conditions profiled. Certain areas are more exposed due to geographic location and local weather patterns.

13.3.1 Population

All people in the planning area are exposed to some degree to the severe weather hazard. The most common problems associated with severe weather events are immobility and loss of utilities. Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support, making the local at-risk senior community and individuals with disabilities in the cities of Dublin, Livermore, and Pleasanton and those served by DSRSD especially vulnerable. These populations face isolation and exposure during severe weather events and could suffer more secondary effects of the hazard. Those experiencing homelessness who lack adequate shelter may be directly exposed to severe weather, leading to the destruction of temporary shelter, heat stroke, hypothermia, or illness from this exposure.

Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out. The most common impacts of specific weather event types on people are as follows:

- **Severe Storms**—Nationally, lightning is one of the leading causes of weather-related fatalities, though lightning strikes are less common in the west than in other areas of the country. The majority of injuries and deaths associated with lightning occur when people are outdoors; however, almost one-third of lightning-related injuries occur indoors. Males are five times more likely than females to be struck by lightning and people between the ages of 15 and 34 account for 41 percent of all lightning strike victims.
- **Damaging Winds**—Debris carried by extreme winds and trees felled by gusty conditions can contribute directly to loss of life as well as increase the vulnerability of people by damaging buildings where people take shelter. Utility lines brought down by winds have been known to cause fires and create the possibility of lethal electric shock.
- **Extreme Heat**—Individuals with physical or mobility constraints, cognitive impairments, economic constraints, or social isolation are typically at greater risk to the adverse effects of extreme heat. Some medical conditions, such as heat stroke, are directly attributable to extreme heat, while others may be exacerbated by it, resulting in medical emergencies.
- **Space Weather —**The sun’s activities cause extreme space weather events that can affect the City’s population, mainly by power black-out events

13.3.2 Property

Most of the buildings within the census tracts that define the planning area are residential. Older structures were built without the influence of a structural building code that would mitigate the severe weather conditions profiled in this assessment. All of these buildings are considered to be exposed to the severe weather hazard, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage will depend on specific locations.

Loss estimations for the severe weather hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent, and 50 percent of the assessed value of exposed structures. Figure 13-5 lists the loss estimates. These estimates allow emergency managers to select a range of potential economic impact based on an assessment of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

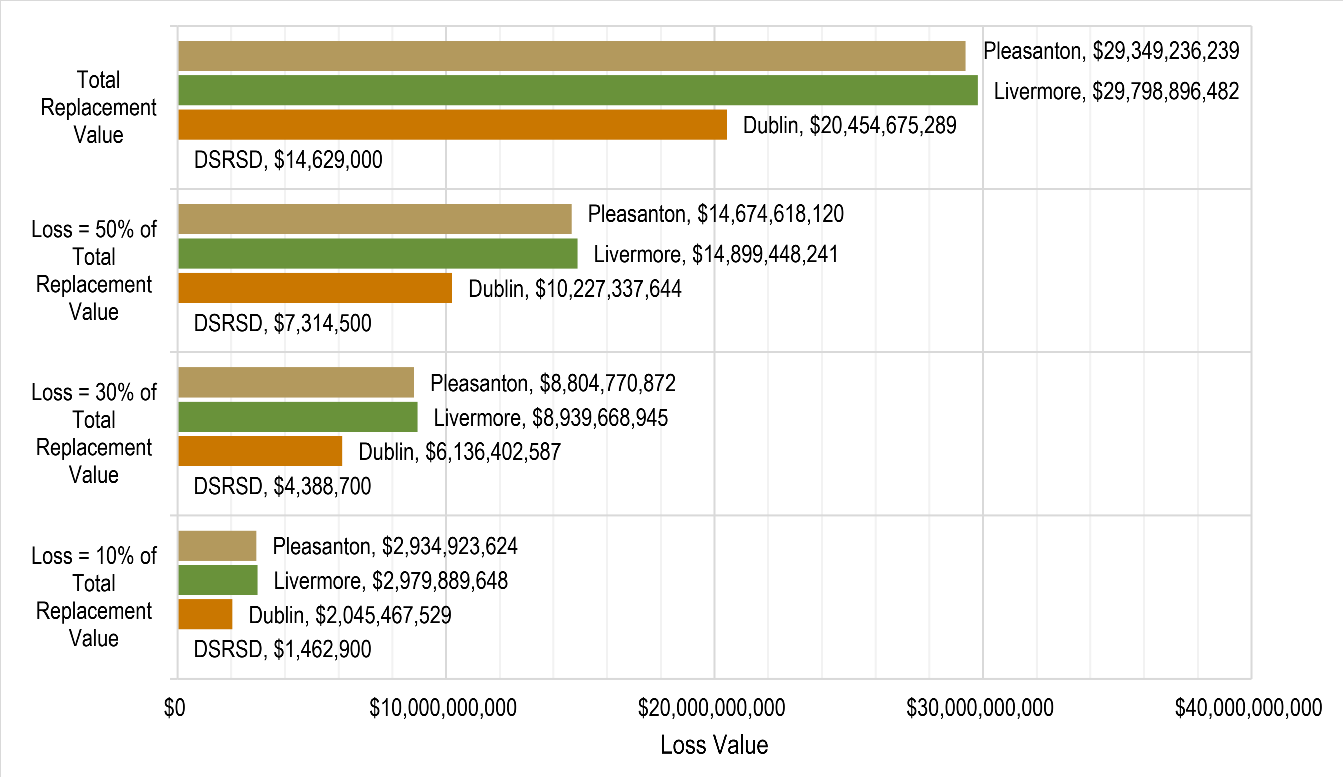


Figure 13-5. Loss Estimates for Severe Weather

13.3.3 Critical Facilities

All critical facilities are vulnerable during severe weather events, especially those that lack backup power generation capabilities. When facilities supplying power to planning area land line telephone systems are frequently disrupted, significant issues arise with communication in the planning area. In addition, some facilities are particularly vulnerable to specific types of severe weather events:

- **Thunderstorms**—Facilities and transportation systems are vulnerable to disruption from secondary hazards such as flooding or landslides.
- **Damaging Winds**—Facilities near trees or power lines that are likely to fall are vulnerable. Roads and other transportation infrastructure could be blocked by downed trees or other debris.
- **Extreme Heat**— Extreme heat is generally not a threat to damage critical facilities or infrastructure.
- **Space Weather**— Extreme space weather events can degrade or damage critical infrastructures, which may result in direct or cascading failures across key services such as electric power, communications, water supply, healthcare, and transportation (National Science & Technology Council 2019).

13.3.4 Environment

The environment is highly exposed to severe weather events. Natural habitats such as streams and trees are exposed to the elements during a severe storm and risk major damage and destruction. Prolonged rains can saturate soils and lead to slope failure. Flooding events caused by severe weather can produce river channel migration or damage riparian habitat.

13.4 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have adopted the International Building Code in response to California mandates. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in general plans within the planning area also address many of the secondary impacts (flood and landslide) of the severe weather hazard. With these tools, the planning partners are well equipped to deal with future growth and the associated impacts of severe weather.

13.5 SCENARIO

Severe weather impacts can be significant, particularly when secondary hazards occur. A worst-case event would involve prolonged high winds during a winter storm caused by an atmospheric river event. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads. Flooding and debris could further obstruct roads and bridges, further isolating residents.

13.6 ISSUES

Important issues associated with a severe weather in the planning area include the following:

- Older building stock in the planning area is built to low code standards. These structures could be highly vulnerable to severe weather events such as windstorms.
- The cities may need to open cooling centers during extreme heat events.
- Redundancy of power supply and communications equipment must be evaluated.
- The capacity for backup power generation is limited.
- Dead or dying trees as a result of drought conditions are more susceptible to falling during severe storm events.
- Public education on dealing with the impacts of severe weather needs to continue to be provided so that citizens can be better informed and prepared for severe weather events.
- Debris management (downed trees, etc.) must be addressed, because debris can impact the severity of severe weather events, requires coordination efforts, and may require additional funding.
- The effects of climate change may result in an increase of heavy rain or more atmospheric storm events, and will likely lead to increased temperatures and changes in overall precipitation amounts.

14. WILDFIRE

14.1 GENERAL BACKGROUND

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson. The potential for such fires is primarily influenced by the following factors:

- **Fuel**—Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire.
- **Weather**—Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. Conditions are favorable for severe wildfires when the temperature is high, relative humidity is low, wind speed is increasing and coming from the east (inland), and there has been little or no precipitation. These conditions occur more frequently inland where temperatures are higher and fog is less prevalent.
- **Terrain**—Topography includes slope and elevation. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of landforms (fire spreads more easily uphill than downhill).

14.1.1 Wildfire Hazard Mapping

Fire Hazard Severity Zones

The California Department of Forestry and Fire Protection (CAL FIRE) has modeled and mapped wildfire hazard zones using a computer model that designates moderate, high or very high fire hazard severity zones (FHSZ). CAL FIRE classifies these zones based on how a fire would behave in a given area and the probability of flames and embers threatening buildings. Each area gets a score for flame length, embers, and the likelihood of the area burning. Scores of smaller areas are then averaged over larger zones that encompass them.

CAL FIRE’s maps these zones using a model that derives fire frequency from 50 years of fire data. The model considers the frequency of fire weather, ignition patterns, and expected rate-of spread. It accounts for flying ember production, which is the principal driver of the wildfire hazard in densely developed areas. A related concern in built-out areas is the relative density of vegetative fuels that can serve as sites for new spot fires and spread fire between structures. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures.

14.1.2 Wildfire Protection Responsibility in California

Hundreds of local, state, and federal agencies have responsibility for wildfire protection in California. Often, two organizations share responsibility on the same parcel of land— one for wildfire protection, and the other for structural or "improvement" fire protection. To address wildfire jurisdictional responsibilities, the California state legislature adopted legislation establishing the following responsibility areas:

- **Federal Responsibility Areas (FRAs)**—FRAs are fire-prone wildland areas owned or managed by a federal agency (e.g., Forest Service, National Park Service, Bureau of Land Management, Fish and Wildlife Service, Department of Defense). Primary financial and rule-making jurisdictional authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually not the responsibility of the federal land management agency; structural protection responsibility is that of a local government agency.
- **State Responsibility Areas (SRAs)**—SRAs are lands where CAL FIRE has legal and financial responsibility for wildfire protection and administers fire hazard classifications and building standard regulations. SRAs are defined as lands that meet the following criteria:
  - Are county unincorporated areas
  - Are not federally owned
  - Have wildland vegetation cover rather than agricultural or ornamental plants
  - Have watershed or range/forage value
  - Have housing densities not exceeding three units per acre.

  Where SRAs contain built environment or development, the responsibility for fire protection of those improvements (non-wildland) is that of a local government agency.
- **Local Responsibility Areas (LRAs)**—LRAs include land in cities, cultivated agriculture lands, non-flammable areas in unincorporated areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city fire departments, fire protection districts, and counties, or by CAL FIRE under contract to local governments. The Cities of Dublin, Livermore and Pleasanton are located in incorporated LRAs. LRAs may include flammable vegetation and areas where the financial and jurisdictional responsibility for improvement and wildfire protection is that of a local government agency.

State law requires local governments to update their general plan safety elements to recognize SRAs and "Very High" FHSZs. The safety element must include information and policies on unreasonable risk from fire. The state encourages integration among jurisdictions to enhance mitigation and prevention efforts.

14.1.3 Secondary Hazards

Secondary effects of wildfires can in some cases cause more damage than the fire itself. Wildfires strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

14.2 HAZARD PROFILE

14.2.1 Local Climate Conditions Related to Wildfire

The planning area has a Mediterranean-like climate with no summer rains and potential high winds. Non-native and invasive weedy vegetation has replaced more fire resistant and ecologically stable native species in many places. In addition, highly flammable homes are located in high fire hazard zones. “Red flag” weather in the planning area features strong, hot, dry offshore winds known as “diablo winds.” These winds carry extremely dry air at high velocity and can push a fire down or up a slope quickly. They can occur at any time of year but are especially dangerous in the driest months of summer and fall.

14.2.2 Past Events

Between 1954 and May 2022, Alameda County was included in two FEMA major disaster (DR) fire management assistance declarations (DR-919 Oakland Hills Fire in 1991 and DR-295 Buckingham Norfolk Fire in 1970) but neither of these affected the planning area. With drought conditions in recent years, wildfires have occurred near the planning area, though none have caused sufficient damage to trigger a state or federal disaster declaration. Table 14-1 lists wildfires of over 10 acres recorded near the planning area in recent years (CAL FIRE 2023).

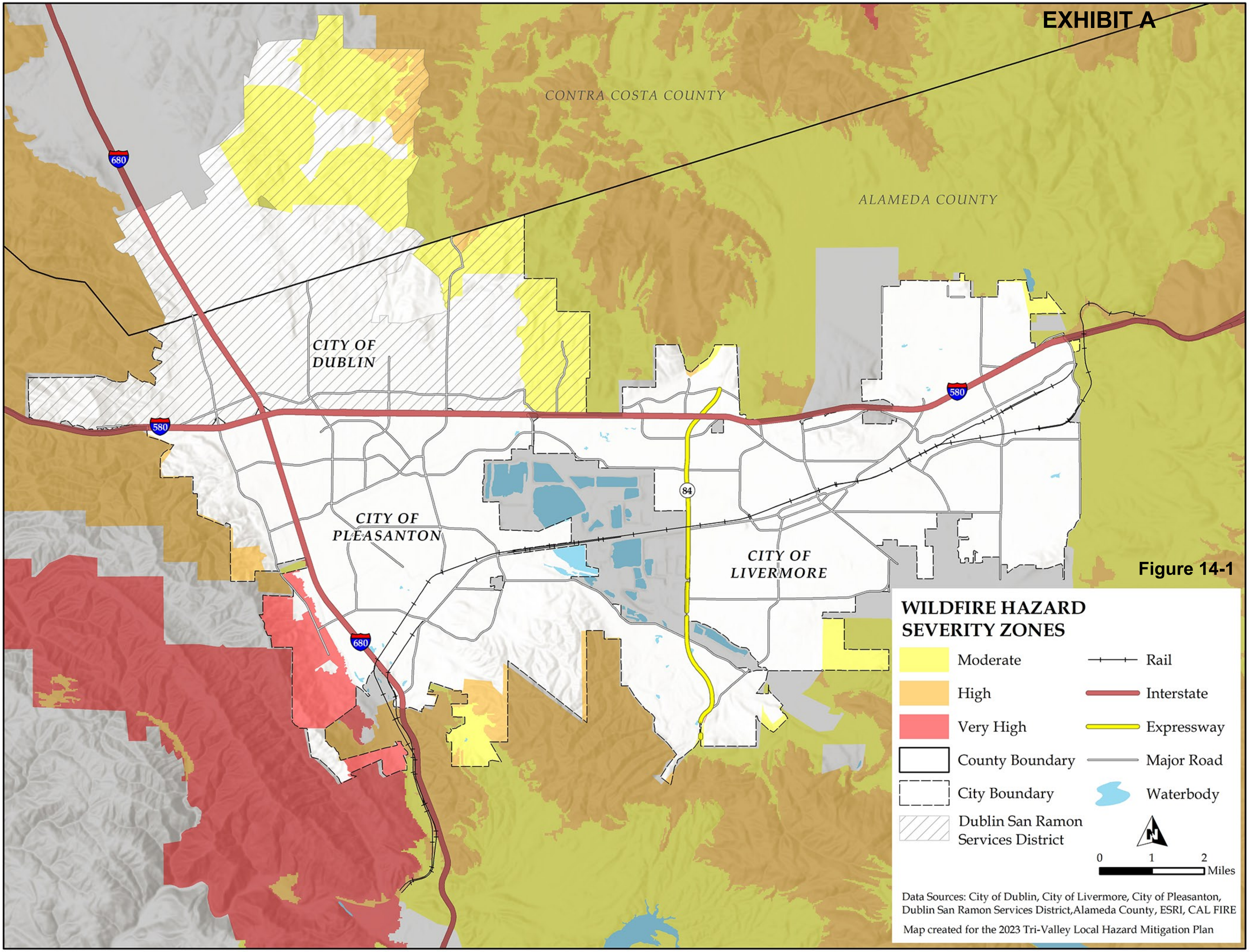
Table 14-1. Recent Fires Affecting Planning Area (Burning More Than 10 Acres)

Start Date	Date Contained	Acres Burned	Location
07/16/20	07/19/20	253	Near Tesla Road and McLaughlin Road, southeast of Livermore.
07/04/20	07/05/20	108	Near Sheridan Road, south of Sunol (which is just south of Pleasanton).
10/24/19	10/27/19	35	Near Mines Rd and Del Valle Rd, southeast of Livermore.
10/08/19	10/08/19	12	Near SR 84 and Little Valley Road in Sunol, south of Pleasanton.
09/02/19	09/02/19	11	Near Mines Road in Livermore.
08/31/19	08/31/19	19	Near eastbound 580 and North Flynn Road, east of Livermore.
08/21/19	08/21/19	139	Near Patterson Pass and Midway Road, east of Livermore.
08/09/19	08/12/19	240	Near Central Pkwy and Croak Rd, 4 miles east of Dublin.
06/21/19	06/24/19	30	Near Grant Line Rd and Mountain House Rd, east of Livermore.
11/14/18	01/04/19	20	Near Vallecitos Road and Little Valley, south of Livermore.
07/08/18	01/04/19	640	Near I-580 and Grantline Rd, east of Livermore.
07/25/18	01/04/19	34	Near Patterson Pass Road and Midway Rd, east of Livermore.
05/14/18	01/04/19	12	Near Grant Line Road and I-580, east of Livermore.
10/17/17	01/09/18	116	Near Fallon Road 3 miles East of Dublin.
08/22/17	01/09/18	200	Near Range Road and Cromwell Avenue, Camp Parks Dublin, National Guard Reserve Forces Training Center.
06/25/16	06/26/16	211	In the Altamont Pass, 10 miles east of Livermore.
08/19/15	08/22/15	2,700	Off Tesla Road near Corral Hollow between Livermore and Tracy. This fire took four days to contain with 18 fire personnel and five fire engines.
06/25/15	06/25/15	53	Near Tesla Road, southeast of Livermore.
10/04/13	10/04/13	150	Along Highland Road near Livermore.
07/06/13	07/06/13	38	Near Fallon Road and Camino Tassajara near Dublin.
06/08/13	06/08/13	240	Near Vasco Road and North Vasco Road, north of Livermore.

14.2.3 Location

Figure 14-1 shows the FHSZ mapping for the planning area.

EXHIBIT A



CONTRA COSTA COUNTY
ALAMEDA COUNTY
CITY OF DUBLIN
CITY OF PLEASANTON
CITY OF LIVERMORE
680
580
84
Figure 14-1
WILDFIRE HAZARD SEVERITY ZONES
Moderate
High
Very High
County Boundary
City Boundary
Dublin San Ramon Services District
Rail
Interstate
Expressway
Major Road
Waterbody
N
0
1
2
Miles
Data Sources: City of Dublin, City of Livermore, City of Pleasanton, Dublin San Ramon Services District, Alameda County, ESRI, CAL FIRE
Map created for the 2023 Tri-Valley Local Hazard Mitigation Plan

14.2.1 Frequency

Wildfire frequency can be assessed through review of the percent of a given area that has been burned in previous wildfire events. Based on CAL FIRE records of fires, about 3 percent of the mapped wildfire risk zones in Alameda County burned in the 138-year period from 1878 to 2016 (see Table 14-2).

Table 14-2. Record of Fire in Alameda County

FHSZ Category	Total Area in Zone (acres)	Area Burned, 1878 – 2016	
		Acres	Percent of Total Area
Moderate	10,564	115	1.09%
High	9,455	498	5.26%
Very High	472	0	0.00%

Source: CAL FIRE, 2016

14.2.2 Severity

The largest wildfire in the Bay Area, and one of the worst wildfires in the United States, occurred in 1991 in the Oakland Hills of Alameda County. The fire resulted in $1.7 billion in losses and received a FEMA disaster declaration. The fire spread across 1,520 acres, destroyed 3,354 homes and 456 apartments, injured 150 people and took the lives of 25 people (Alameda County 2021). There are no recorded incidents of loss of life from wildfires in the planning area.

Potential losses from wildfire include human life, structures and other improvements, and natural resources. There are no recorded incidents of loss of life from wildfires within the planning area. Given the immediate response times to reported fires, the likelihood of injuries and casualties is minimal.

Smoke and air pollution from wildfires can be a health hazard, especially for children, the elderly and those with respiratory and cardiovascular diseases. First responders are exposed to dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

14.2.3 Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm

If a fire does break out and spread rapidly, residents may need to evacuate within days or hours. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

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14.3 EXPOSURE

14.3.1 Population

Population exposed to the wildfire hazard was estimated using the structure count of buildings in each mapped FHSZ and multiplying by the estimated average population per household. Figure 14-2 shows the estimated population for each planning area city living in the moderate, high, and very high FHSZs, compared to total city population. Figure 14-3 shows results for the entire planning area.

Figure 14-2. Population Exposed to Wildfire Hazard and Total Population, by Jurisdiction

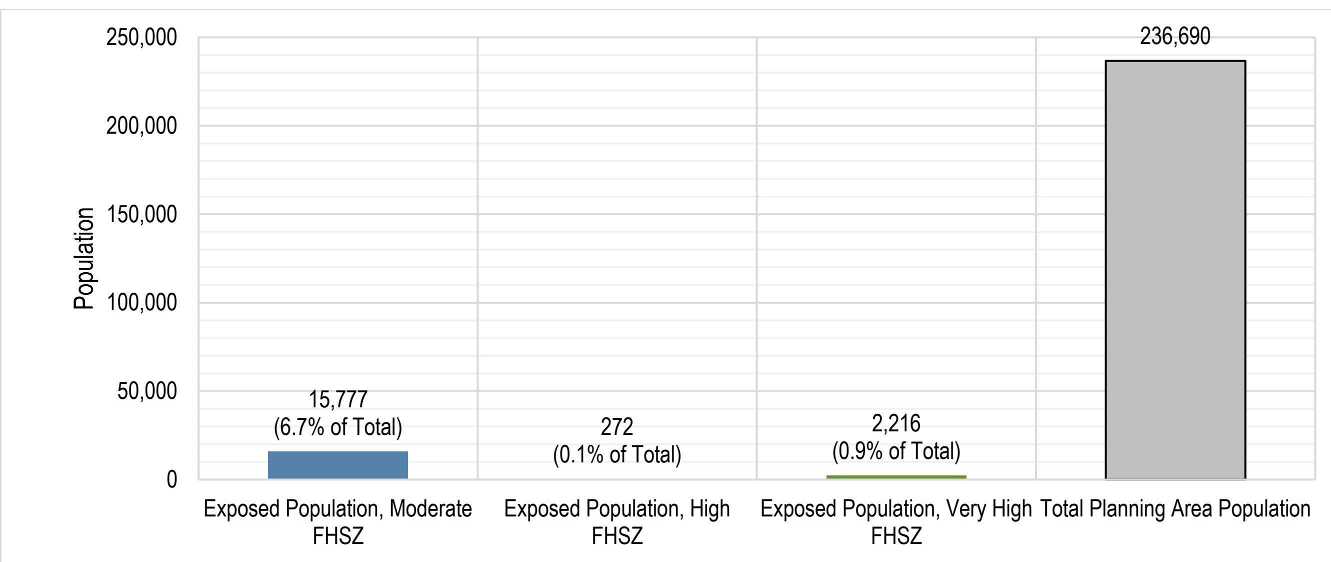

Figure 14-3. Total Planning Area Population Exposed to Wildfire Hazard

14.3.2 Property

The estimated value of planning area buildings within the moderate, high, and very high FHSZs is shown in Figure 14-4 through Figure 14-6. Figure 14-7 shows the estimated exposed total value as a percentage of the total replacement value in each city and in the overall planning area. The numbers of structures in each FHSZ, by occupancy class, are shown in Figure 14-8 through Figure 14-10.

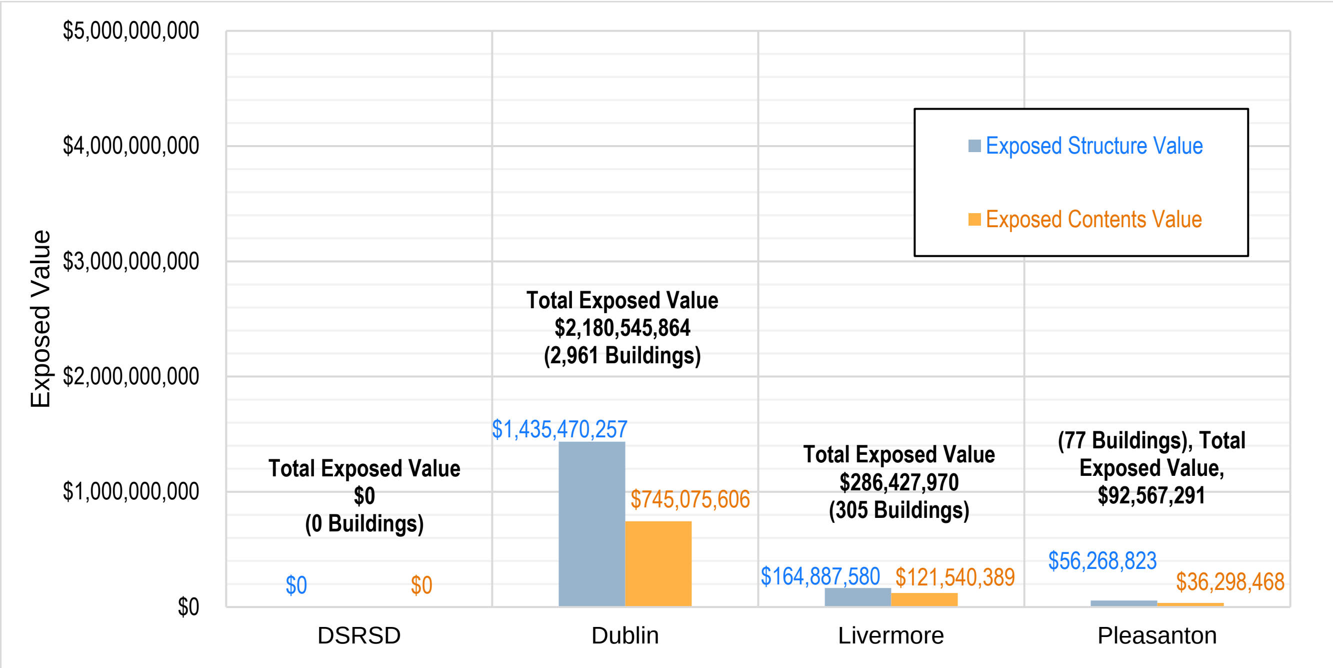

Figure 14-4. Number and Exposed Value of Buildings in the Moderate FHSZ

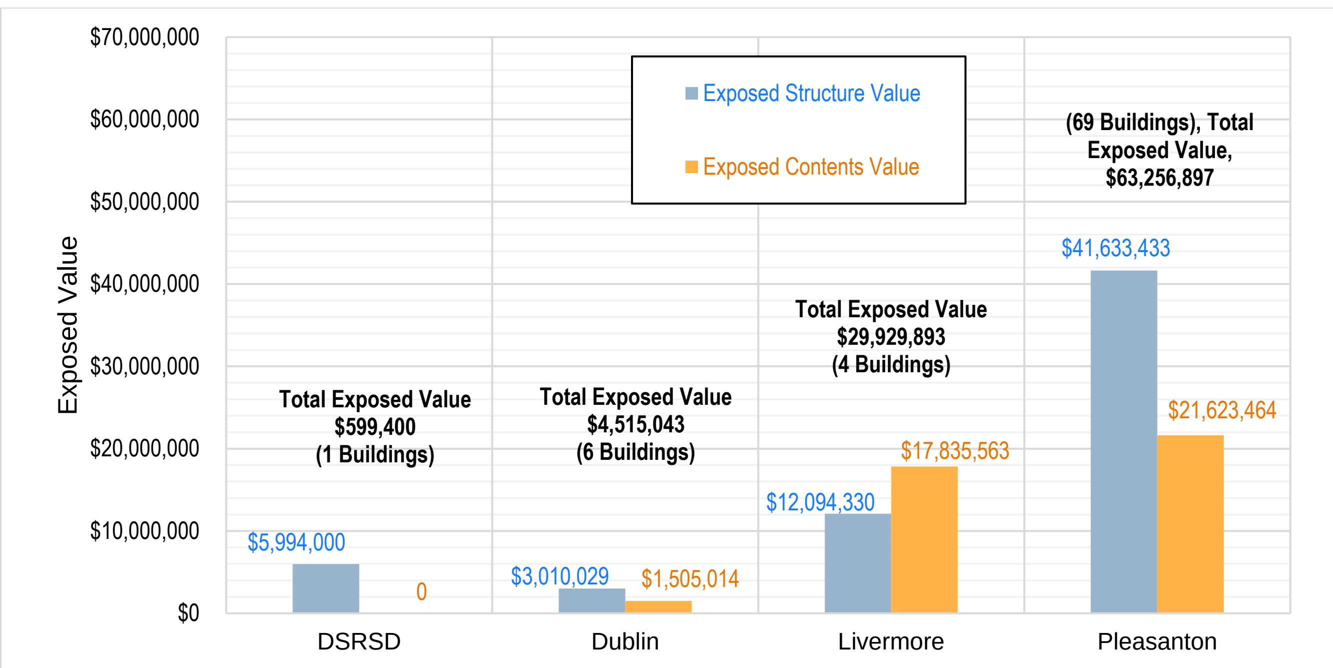

Figure 14-5. Number and Exposed Value of Buildings in the High FHSZ

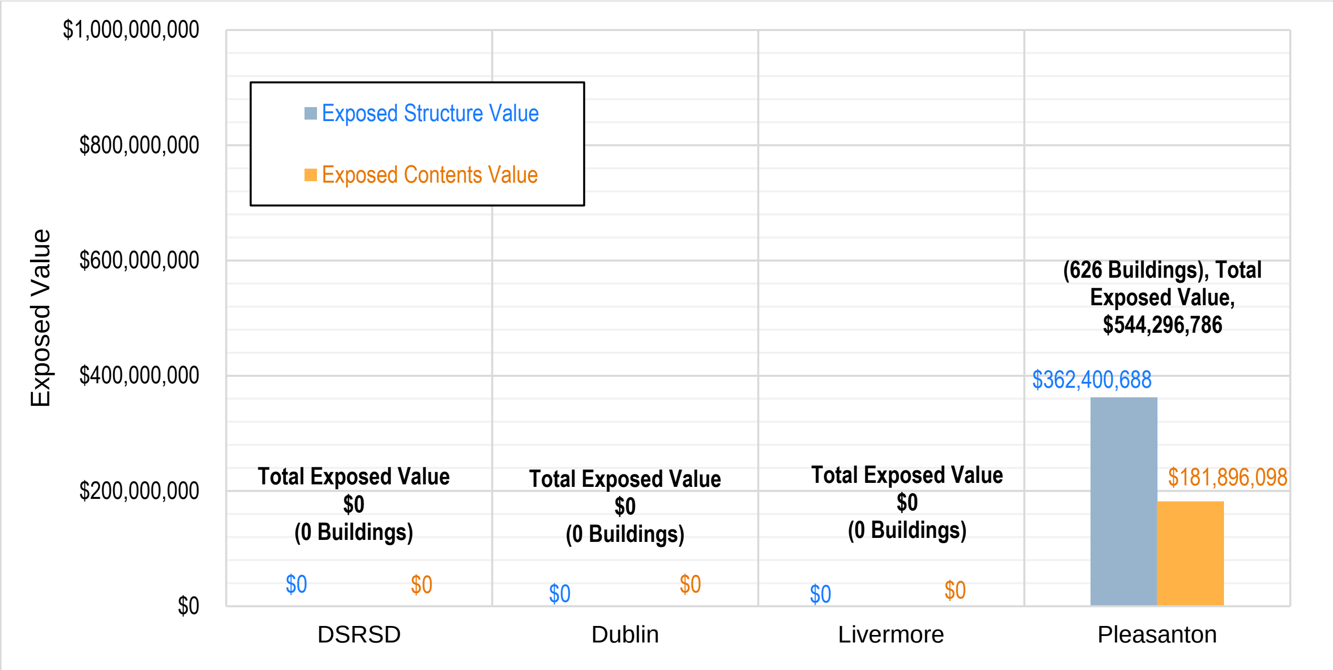

Figure 14-6. Number and Exposed Value of Buildings in the Very High FHSZ

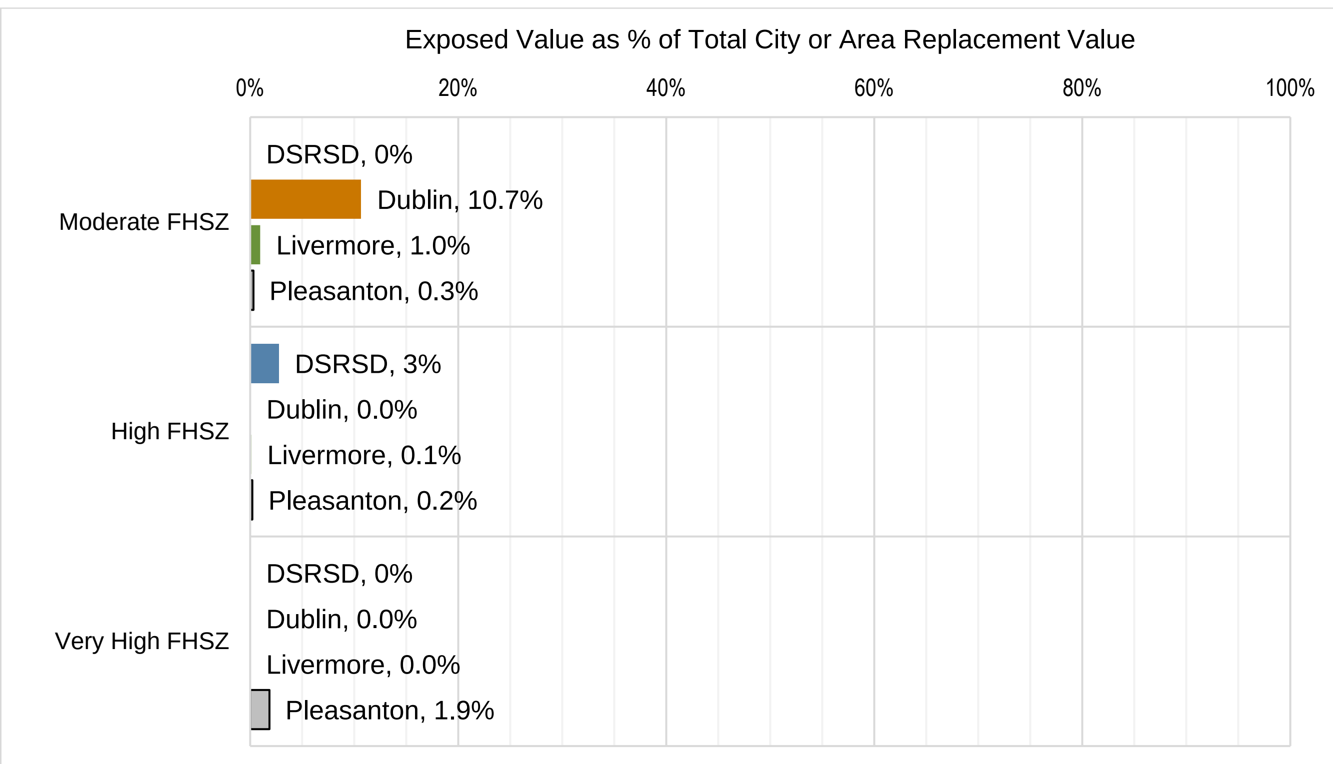

Figure 14-7. Total Value in FHSZs as Percent of Total Replacement Value, by Jurisdiction

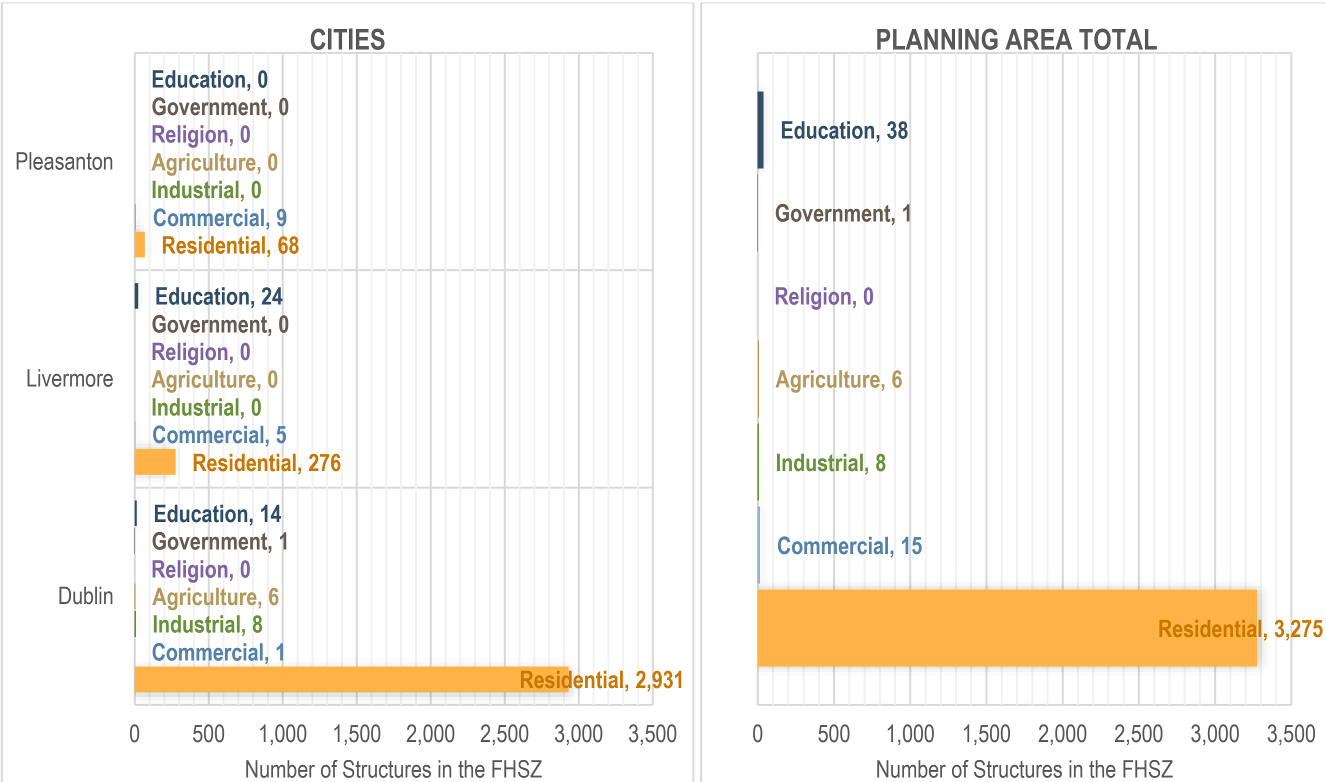

Figure 14-8. Structures in the Moderate FHSZ, by Jurisdiction and Occupancy Class

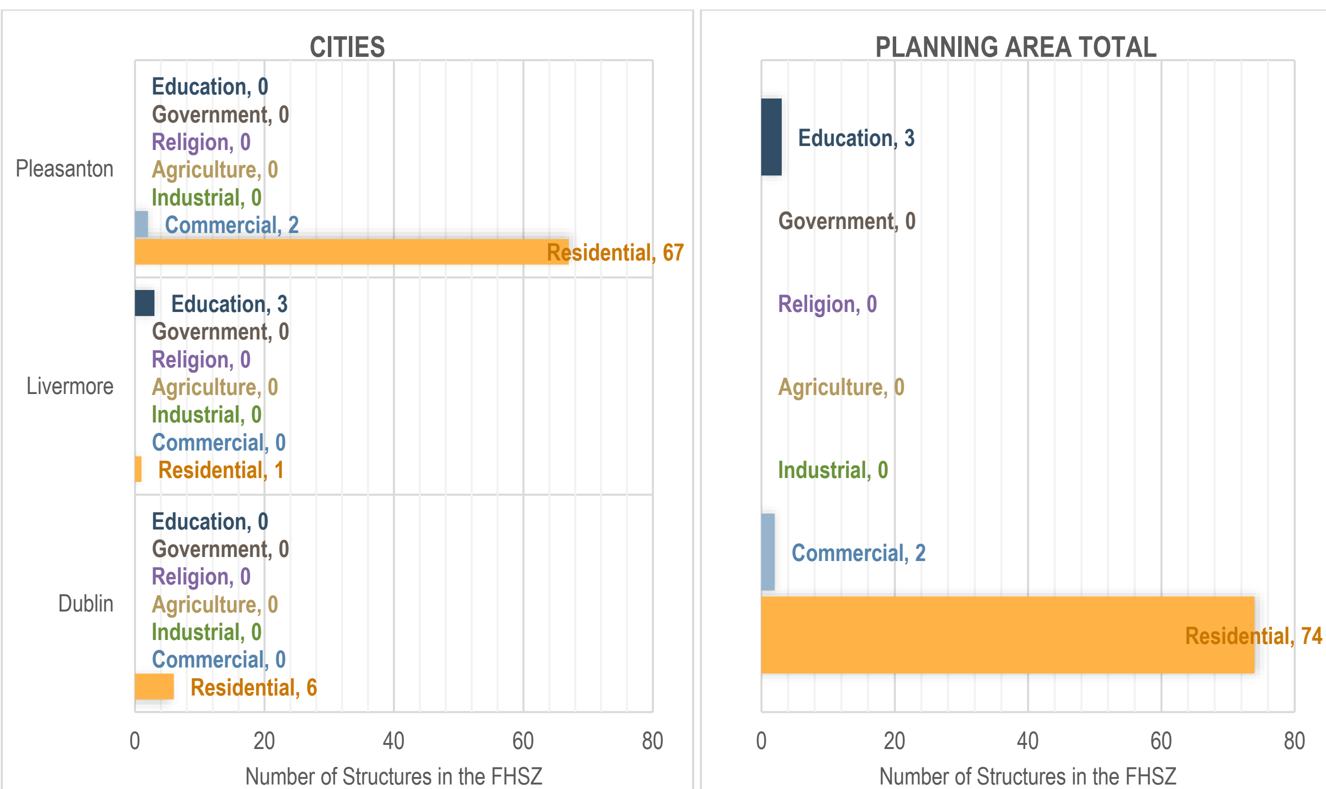

Figure 14-9. Structures in the High FHSZ, by Jurisdiction and Occupancy Class

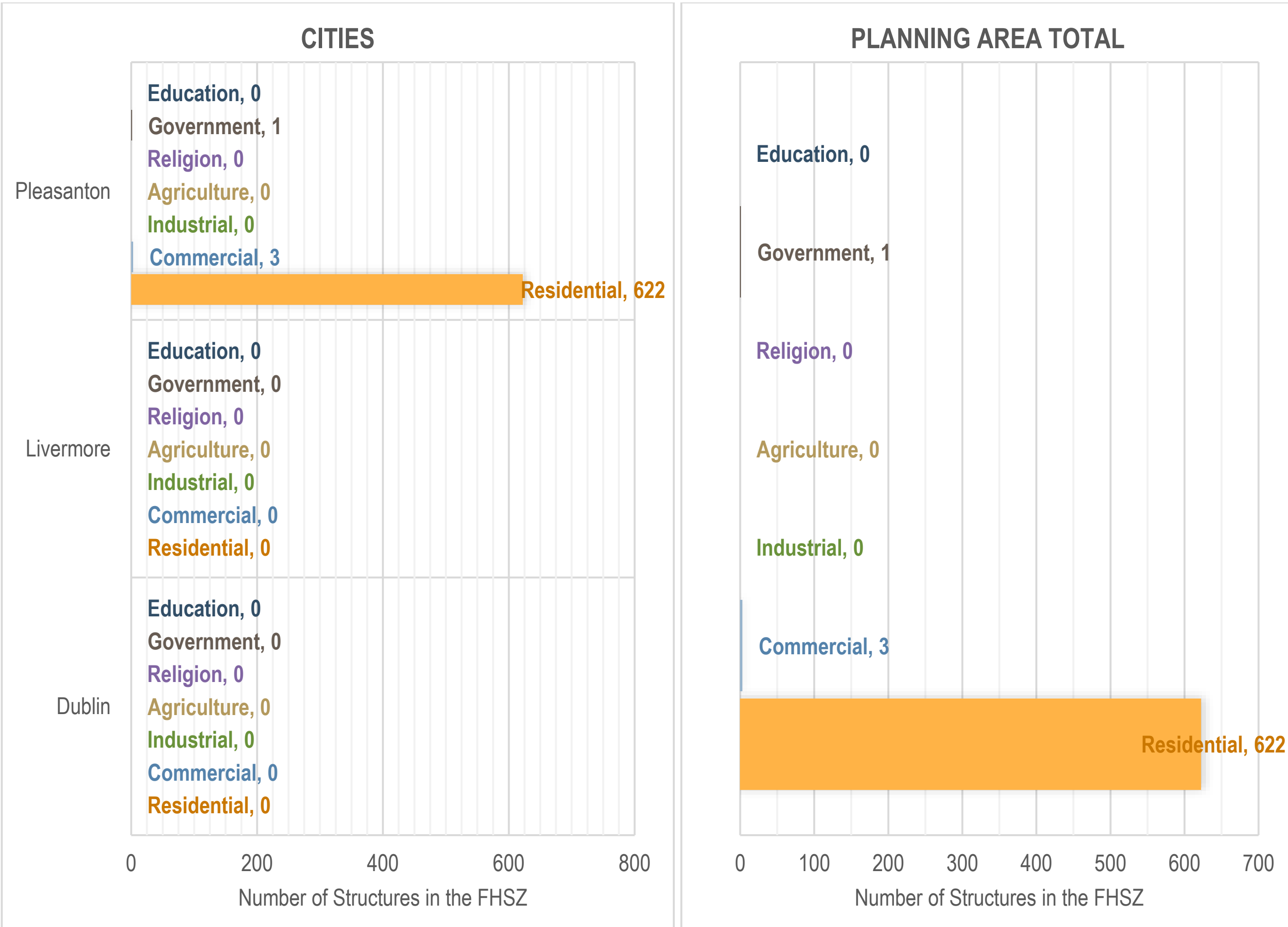

Figure 14-10. Structures in the Very High FHSZ, by Jurisdiction and Occupancy Class

14.3.3 Critical Facilities

Estimates of critical facilities in each FHSZ are summarized in Figure 14-11. The total count of critical facilities in high or very high fire hazard severity zones (11) represents 1 percent of the planning area total of 1,161.

14.3.4 Environment

All natural resources and habitats in mapped FHSZs are exposed to the risk of wildfire.

14.4 VULNERABILITY

Structures, above-ground infrastructure, critical facilities and natural environments are all vulnerable to the wildfire hazard. There is currently no validated damage function available to support wildfire mitigation planning. Except as discussed in this section, vulnerable populations, property, infrastructure and environment are assumed to be the same as described in the section on exposure.

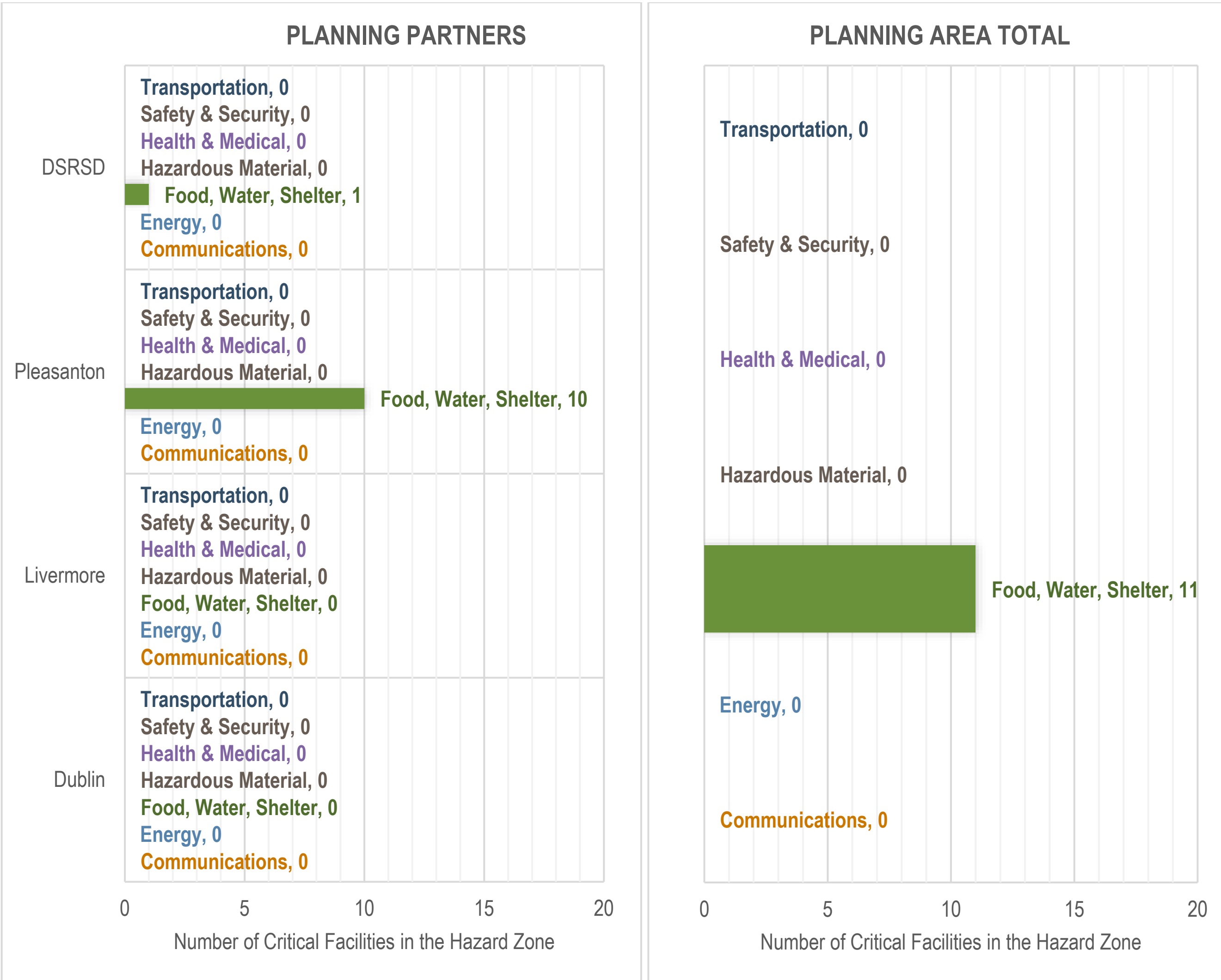

Figure 14-11. Critical Facilities in the High or Very High FHSZ

14.4.1 Population

Many communities and populations are especially vulnerable to wildfires, including low-income communities, migrant populations, populations whose primary language is not English, indigenous populations, communities of older adults, and those with respiratory and other health concerns. The local senior community and individuals within the cities of Dublin, Livermore, and Pleasanton and those served by DSRSD are especially vulnerable to respiratory issues in the event of reduced air quality following wildfire. Members of immigrant communities may be concerned about impacts to their immigration status and not seek help. The homeless population may also be affected with their exposure to smoke or airborne particulates, especially if no shelter or evacuation center has been open.

When a wildfire impacts an area with high rents where multiple families live in one structure, it may be difficult for those not listed on the lease to prove that they were affected by the fire; this could result in a lack of access to services. Additionally, fires quickly increase housing prices and rent prices, further displacing people already affected by the fire. Homelessness may increase as a result of wildfire events.

All people exposed to the wildfire hazard are potentially vulnerable to wildfire impacts. Populations with access and functional needs as well as elderly populations and the very young are more vulnerable as they may not be able to evacuate quickly enough to avoid the impacts of a wildfire. Persons with existing health issues may be more vulnerable to the health impacts associated with wildfire smoke. Wildfires also threaten the health and safety of those fighting the fires.

14.4.2 Property

All property exposed to the wildfire hazard is vulnerable. As of 2008, California State Building code requires minimum standards be met for new buildings in relative fire hazard zones. Older structures that were not constructed to these standards may be especially vulnerable.

Figure 14-12 shows estimates of potential loss representing 10 percent, 30 percent, and 50 percent of the assessed value of structures exposed to the wildfire hazard (for the moderate, high, and very high FHSZs combined). These estimates allow emergency managers to assess a range of economic impacts based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

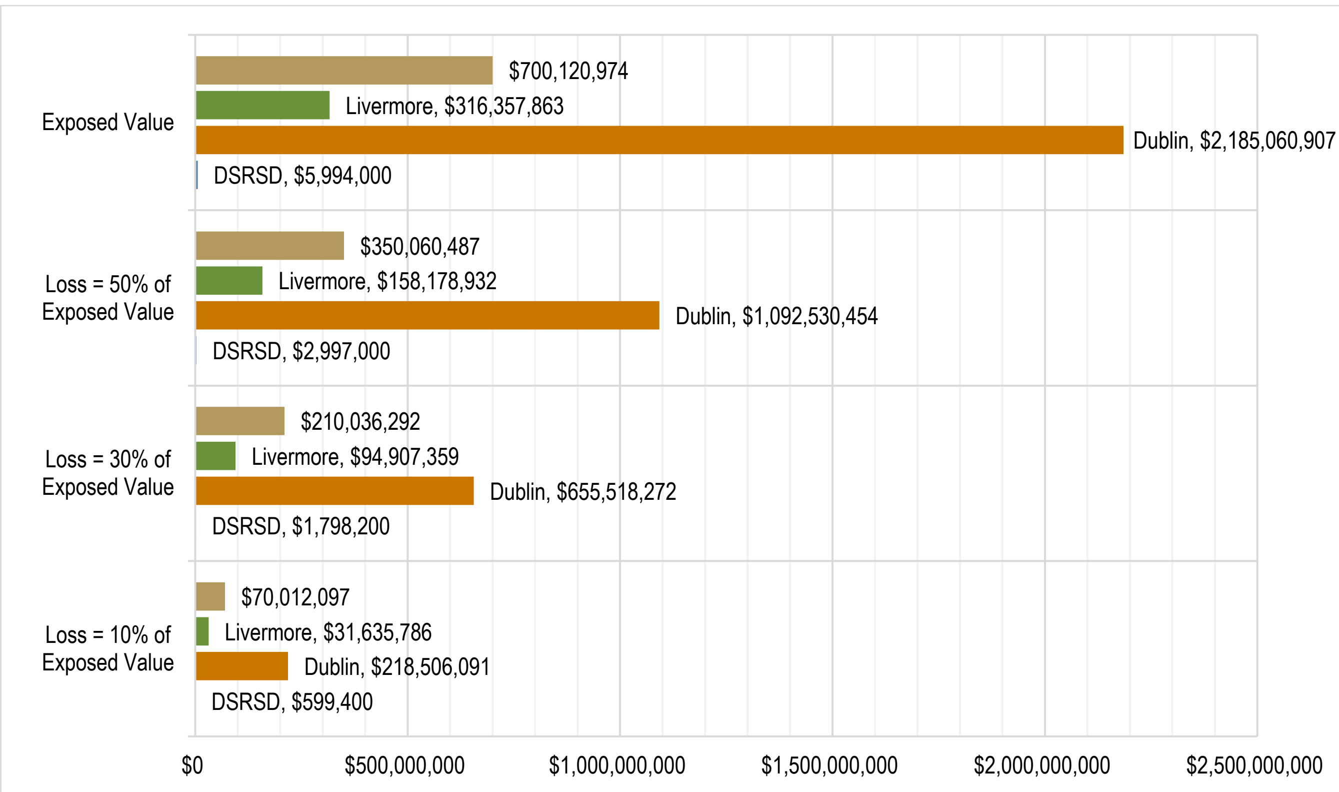

Figure 14-12. Loss Estimates for Wildfire

14.4.3 Critical Facilities

Critical facilities of wood frame construction are especially vulnerable to wildfire. In the event of wildfire, there would likely be little damage to most infrastructure. Most roads and railroads would be without damage except in the worst scenarios. Power lines are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and in some cases to isolated neighborhoods.

During a wildfire event, containers storing hazardous materials at sites in wildfire risk zones could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils and seeping into surface waters, and have a disastrous effect on the environment.

14.4.4 Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts:

- **Damaged Cultural and Historical Resources**—The destruction of cultural and historic resources may occur, scenic vistas can be damaged, and access to recreational areas can be reduced.
- **Damaged Fisheries**—Fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Destroyed Endangered Species Habitat—**Wildfire can have negative consequences for endangered species by degrading their habitat.
- **Disease and Insect Infestations**—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Reduced Agricultural Resources**—Wildfire can have disastrous consequences on agricultural resources, removing them from production and necessitating lengthy restoration programs.
- **Soil Erosion**—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Soil Sterilization**—Some wildfires burn so hot that they can sterilize the soil. Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost.
- **Spread of Invasive Plant Species**—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.

14.5 FUTURE TRENDS IN DEVELOPMENT

The highly urbanized portions of the planning area have little or no wildfire risk exposure. Urbanization tends to alter the natural fire regime, and can create the potential for the expansion of urbanized areas into wildland areas. The expansion of the wildland urban interface can be managed with strong land use and building codes. The planning area is well equipped with these tools and this planning process has assessed capabilities with regards to the tools. As the planning area experiences future growth, it is anticipated that the exposure to this hazard will remain as assessed or even decrease over time due to these capabilities.

14.6 SCENARIO

A major wildfire in the planning area might begin with a wet spring, adding to fuels already present on the forest floor. Flashy fuels would build throughout the spring. A dry summer could follow the wet spring, exacerbated by diablo winds. Carelessness with combustible materials or a tossed lit cigarette, or a sudden lightning storm could trigger a multitude of small, isolated fires.

The embers from these smaller fires could be carried miles by hot, dry winds. The deposition zone for these embers would be deep in the forests and interface zones. Fires that start in flat areas move slower, but wind still pushes them. It is not unusual for a wildfire pushed by wind to burn the ground fuel and later climb into the crown and reverse its track. This is one of many ways that fires can escape containment, typically during periods when response capabilities are overwhelmed. These small new fires would most likely merge. Suppression resources would be redirected from protecting the natural resources to saving more remote subdivisions.

While local fire districts would be extremely useful in the urban interface areas, they have limited wildfire capabilities or experience, and they would have a difficult time responding to the ignition zones. Even though the existence and spread of the fire is known, it may not be possible to respond to it adequately, so an initially manageable fire can become out of control before resources are dispatched.

14.7 ISSUES

The major issues for wildfire are the following:

- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones.
- Wildfires could cause multiple secondary natural hazards.
- Climate change could affect the wildfire hazard.
- Future growth into interface areas should continue to be managed, particularly in the western hillside area of Pleasanton.
- Area fire districts need to continue to train on wildland-urban interface events.
- Vegetation management activities. This would include enhancement through expansion of the target areas as well as additional resources.
- Regional consistency of higher building code standards such as residential sprinkler requirements and prohibitive combustible roof standards.

15. CLIMATE CHANGE

15.1 GENERAL BACKGROUND

"Climate change" refers to alterations in the long-term patterns of temperature, precipitation, humidity, wind, and seasons that play a fundamental role in shaping natural ecosystems and the human economies and cultures that depend on them. These shifts may result from natural processes (e.g., cyclical ocean patterns like El Niño or La Niña, volcanic activity, changes in the sun's energy output, variations in Earth's orbit), but they can also be driven by human activity. The worldwide warming trend of recent decades has been attributed to human activity resulting in rising concentrations of "greenhouse gases" in the earth's atmosphere.

Greenhouse gases are gases that trap heat in the atmosphere. Carbon dioxide is the most commonly known greenhouse gas; however, methane, nitrous oxide and fluorinated gases also contribute to warming. Emissions of these gases come from sources such as the combustion of fossil fuels, agricultural production, and changes in land use. According to the National Aeronautics and Space Administration (NASA), carbon dioxide concentrations measured about 280 parts per million before the industrial era began in the late 1700s and have risen dramatically since then, surpassing 400 parts per million in 2013 for the first time in recorded history (see Figure 15-1).

Source: NASA 2021

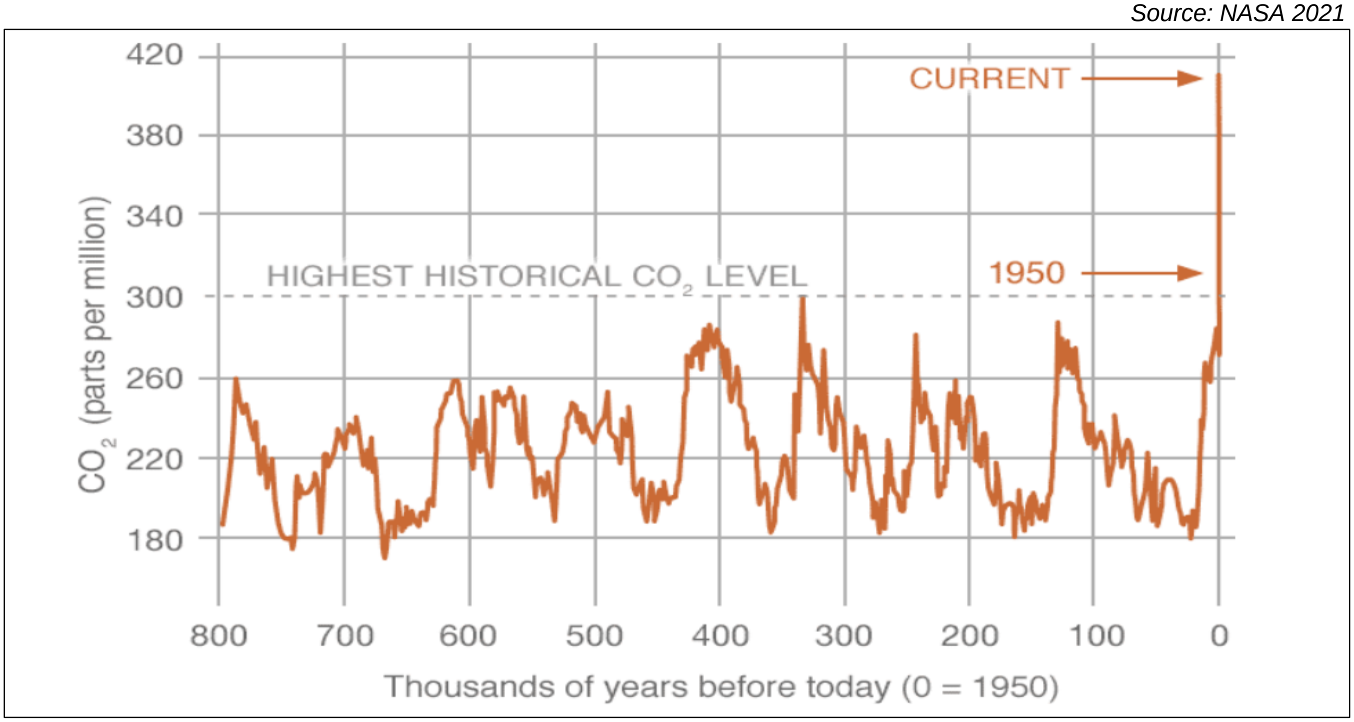

Figure 15-1. Global Carbon Dioxide Concentrations Over Time

15.1.1 How Climate Change Affects Hazard Mitigation

Climate change will affect the people, property, economy, and ecosystems of the planning area in a variety of ways. Consequences of climate change include increased periods of prolonged drought, potential for heat-related illnesses, detrimental impacts on agricultural productivity, and increased flood vulnerability. The most important effect for the development of this hazard mitigation plan is that climate change will have a measurable impact on the occurrence and severity of many natural hazards.

An essential aspect of hazard mitigation is predicting the likelihood of future hazard events. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of hazard events remains essentially unchanged over time. Thus, averages based on the past frequencies of, for example, floods are used to estimate future frequencies: if a river has flooded an average of once every 5 years for the past 100 years, then it can be expected to continue to flood an average of once every 5 years.

For hazards that are affected by climate conditions though, the assumption that future behavior will be equivalent to past behavior is not valid. For example, flooding is generally associated with precipitation frequency and quantity. However, the frequency of flooding will not remain constant if broad precipitation patterns change over time. Specifically, as hydrology changes, storms currently considered to be the 100-year flood might strike more often, leaving many communities at greater risk.

The risks of landslide, severe storms, severe weather, and wildfire are all affected by climate patterns as well. For this reason, an understanding of climate change is pertinent to efforts to mitigate natural hazards. Information about how climate patterns are changing provides insight on the reliability of future hazard projections used in mitigation analysis.

15.1.2 Current Indicators of Climate Change

Global Indicators

The major scientific agencies of the United States—including NASA and the National Oceanic and Atmospheric Administration (NOAA)—have presented evidence that climate change is occurring. NASA summarizes key evidence as follows (National Aeronautics and Space Administration 2023):

- **Global Temperature Rise**—The planet's average surface temperature has risen about 2.12 ºF since the late 19th century, a change driven largely by increased carbon dioxide emissions into the atmosphere and other human activities. Most of the warming occurred in the past 40 years. The years 2016 and 2020 are tied for the warmest year on record. The ocean has absorbed much of this increased heat, with the top 100 meters (about 328 feet) of ocean showing warming of more than 0.6 ºF since 1969. Earth stores 90 percent of its extra energy in the ocean.
- **Shrinking Ice Sheets**—The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost an average of 279 billion tons of ice per year between 1993 and 2019, while Antarctica lost about 148 billion tons of ice per year.
- **Glacial Retreat**—Glaciers are retreating almost everywhere around the world—including in the Alps, Himalayas, Andes, Rockies, Alaska and Africa.
- **Decreased Snow Cover**—Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier

- **Sea-Level Rise**—Global sea levels rose about 8 inches in the last century. The rate in the last two decades is nearly double that of the last century and is accelerating slightly every year.
- **Declining Arctic Sea Ice**—Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades
- **Extreme Events—**The number of record high temperature events in the United States has been increasing, while the number of record low temperature events has been decreasing, since 1950. The U.S. has also witnessed an increasing number of intense rainfall events.
- **Ocean Acidification**—Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing to about 7 to 10 billion metric tons per year.

California Indicators

Monitoring and research efforts across California have generated data that describe changes already underway in the state. Notable examples across the state include the following (California Office of Environmental Health Hazard Assessment 2018):

- Dissolved oxygen in coastal waters is declining throughout the south coast survey region
- Since 1950, the northern Sierra Nevada showed an overall snowpack decline of 7.4 inches.
- Unusually warm waters occurred in the Pacific Ocean in 2014-2015, leading to widespread impacts on marine life. This marine heat wave first appeared as a large area of exceptionally high sea surface temperatures in the Gulf of Alaska in November 2013 and later extended along the entire west coast of North America.
- The surface area of seven Sierra Nevada glaciers has decreased dramatically since the beginning of the 20th century. In 2014, the size of these glaciers ranged from 14 to 52 percent of their 1903 area.
- Sea level has risen by about 7 inches since 1900 at San Francisco and by about 6 inches since 1924 at La Jolla.
- Since 1906, the fraction of annual snowmelt runoff that flows into the Sacramento River between April and July has decreased by about 9 percent.
- Compared to the 1930s, forests across much of California today have lower densities of large trees, and higher densities of small trees. Water stress, which increases in a warming climate, poses a greater risk to large trees than to small trees.
- Annual tree mortality in California forests increased in 2014, and steep increases in mortality followed in subsequent years; the highest number, 62 million tree deaths, was recorded in 2016.
- Future droughts may be hotter, as warm temperatures coincide with periodic dry years; 2016 and 2020 were the warmest years on record.
- Heat-related deaths and illnesses in California increased dramatically in 2006 following a record-breaking heat wave. At least 140 deaths occurred between July 15 and August 1. Deaths related to this heat wave were largely attributed to elevated nighttime temperatures.
- The number of acres burned by wildfires statewide has been increasing since 1950. Large fires affecting 1,000 acres or more account for most of the area burned each year.

15.1.3 Projected Future Impacts

Climate change projections contain inherent uncertainty, largely derived from the fact that they depend on future greenhouse gas emission scenarios. Generally, the uncertainty in greenhouse gas emissions is addressed by the presentation of differing scenarios: low-emissions or high-emissions scenarios. In low-emissions scenarios, greenhouse gas emissions are reduced substantially from current levels. In high-emissions scenarios, greenhouse gas emissions generally increase or continue at current levels. Uncertainty in outcomes is generally addressed by averaging a variety of model outcomes. Despite this uncertainty, climate change projections present valuable information to help guide decision-making for possible future conditions.

Global Projections

The Intergovernmental Panel on Climate Change, which includes more than 1,300 scientists from the United States and other countries, project that Earth’s average temperatures will raise 2.5 to 10 ºF over the next century (National Aeronautics and Space Administration 2023). The Third and Fourth *National Climate Assessment Reports* indicate that climate change will continue through this century and beyond, with the following specific changes:

- Rising temperatures
- Increased droughts and heat waves
- Lengthening frost-free seasons and growing seasons
- Stronger hurricanes
- Changed patterns of precipitation
- Ice-free summers in the Arctic Ocean
- Sea level rise of 1 to 8 feet by 2100

Projections for the Bay Area and Alameda County

The *California Climate Adaptation Planning Guide* outlines the following climate change impact concerns for Bay Area communities (California Emergency Management Agency 2012):

- Increased temperature
- Reduced precipitation
- Sea level rise—coastal inundation and erosion
- Public health—heat and air pollution
- Reduced agricultural productivity
- Inland flooding
- Reduced tourism.

Some of these changes are direct or primary climatic changes, such as increased temperature, while others are indirect climatic changes or secondary impacts, such as heat wave frequency, resulting from these direct changes. Some direct changes may interact with one another to create unique secondary impacts. These primary and secondary impacts may then result in impacts on human and natural systems. The primary and secondary impacts likely to affect the planning area are summarized in Table 15-1.

Table 15-1. Summary of Likely Primary and Secondary Climate Change Impacts on the Planning Area

Primary Impact	Secondary Impact	Example Human and Natural System Impacts
Increased temperature	Heat wave	• Increased frequency of illness and death • Increased stress on mechanical systems, such as HVAC systems
Increased temperature and changes in precipitation	Changed seasonal patterns	• Reduced agricultural productivity • Reduced tourism
Increased temperature and/or reduced precipitation	Drought	• Reduced agricultural productivity • Decreased water supply
	Reduced Snowpack	• Decreased water supply • Reduced tourism
	Wildfire	• Increased incidence of landslide or mudslide • Reduced tourism • Increase in air pollution and related health impacts
Sea level rise	Permanent inundation of previously dry land	• Loss of assets and tax base • Loss of coastal habitat
	Larger area impacted by extreme high tide	• More people and structures impacted by storms • Increased incidence of loss of utilities and lifeline systems
	Increased coastal erosion	• Loss of assets and tax base
	Saltwater intrusion into freshwater systems	• Decreased water supply • Ecosystem disruption Sea level rise
Changes in wind patterns	Increased extreme events, including severe storms and fires	• More frequent disruption to systems resulting from severe storms
Ocean acidification		• Decreased biodiversity in marine ecosystems

Source: Adapted and expanded from *California Adaptation Planning Guide: Planning for Adaptive Communities*

Climate change projections contain inherent uncertainty, largely derived from the fact that they depend on future greenhouse gas emission scenarios. Generally, the uncertainty in greenhouse gas emissions is addressed by the presentation of differing scenarios: low-emissions or high-emissions scenarios. In low-emissions scenarios, greenhouse gas emissions are reduced substantially from current levels. In high-emissions scenarios, greenhouse gas emissions generally increase or continue at current levels. Uncertainty in outcomes is generally addressed by averaging a variety of model outcomes.

Despite this uncertainty, climate change projections present valuable information to help guide decision-making for possible future conditions. The following sections summarize information developed for the planning area by Cal-Adapt, a resource for public information on how climate change might impact local communities, based on the most current data available. The projections are averaged across Alameda County and include information from two emissions scenarios, which were developed by the Intergovernmental Panel on Climate Change (IPCC) (Cal-Adapt 2023):

- Low Emissions Scenario—Emissions peak around 2040 and then decline (this was designated Scenario B1 in previous IPCC analyses but is Scenario RCP 4.5 under more recent IPCC analyses)
- High Emissions Scenario—Emissions continue to rise strongly through 2050 and plateau around 2100 (this was designated Scenario A2 in previous IPCC analyses but is Scenario RCP 8.5 under more recent IPCC analyses).

Temperature

The historical (1961-1990) average maximum temperature in Tri-Valley planning area was 69.9 ºF and the average minimum temperature was 44.6 ºF. While average temperatures may fluctuate from year-to-year, and may differ from one municipality to the next, the trend for the planning area indicates that average temperatures are increasing (see Figure 15-2). The annual average maximum temperature increased by 7.7 ºF when comparing 1961 to 1990 and 2070 to 2099 records. Average temperatures are expected to continue to rise. Table 15-2 shows the estimated average temperatures for 2050 and 2099 under the low and high emission scenario.

Source: Cal-Adapt, 2017

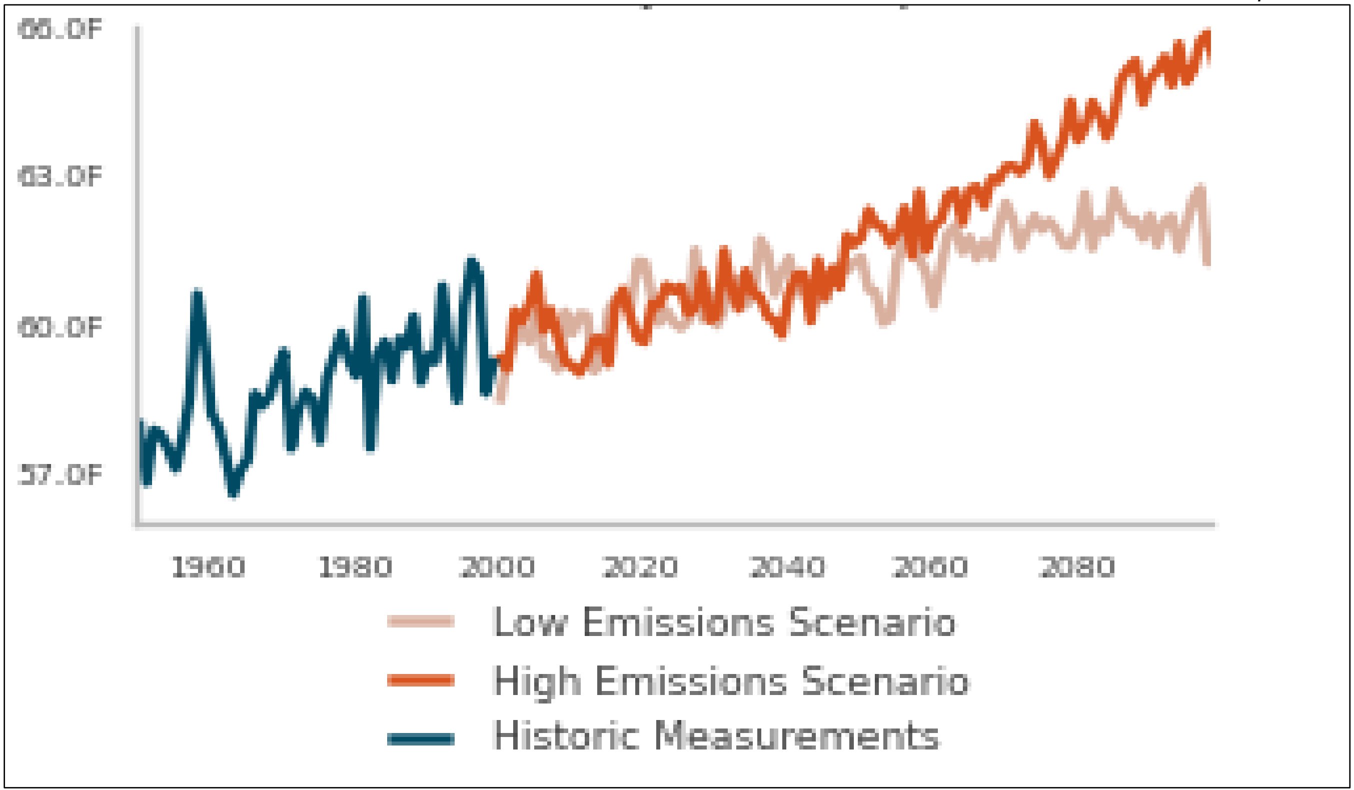

Figure 15-2. Observed and Projected Average Temperatures in Tri-Valley Planning Area

Table 15-2. Average Temperature Projections in Tri-Valley Planning Area

Emission Scenario	2050 Projection (°F)				2099 Projection (°F)			
	Average Temperature		Difference from Historical Average		Average Temperature		Difference from Historical Average	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Low Emissions (RCP 4.5)	73.9	50.1	+4.0	+5.5	76.23	49.3	+6.3	+4.7
High Emissions (RCP 8.5)	74.8	51.0	+4.9	+6.4	80.6	56.4	+10.7	+11.8

Extreme Heat

The extreme heat day temperature threshold for the planning area is 98.3 °F. The historical average (1961-1990) number of extreme heat days is 4.3 days. In the low emissions scenario, there are projected to be an annual average of 13 days with temperatures over the extreme heat day threshold between 2017 and 2050 and between

2051 and 2099. In the high emissions scenario, there are projected to be an annual average of 20 days with temperatures over the extreme heat day threshold between 2017 and 2050 and an average of 19 days per year between 2051 and 2099 (see Figure 15-3).

Source: Cal-Adapt, 2017

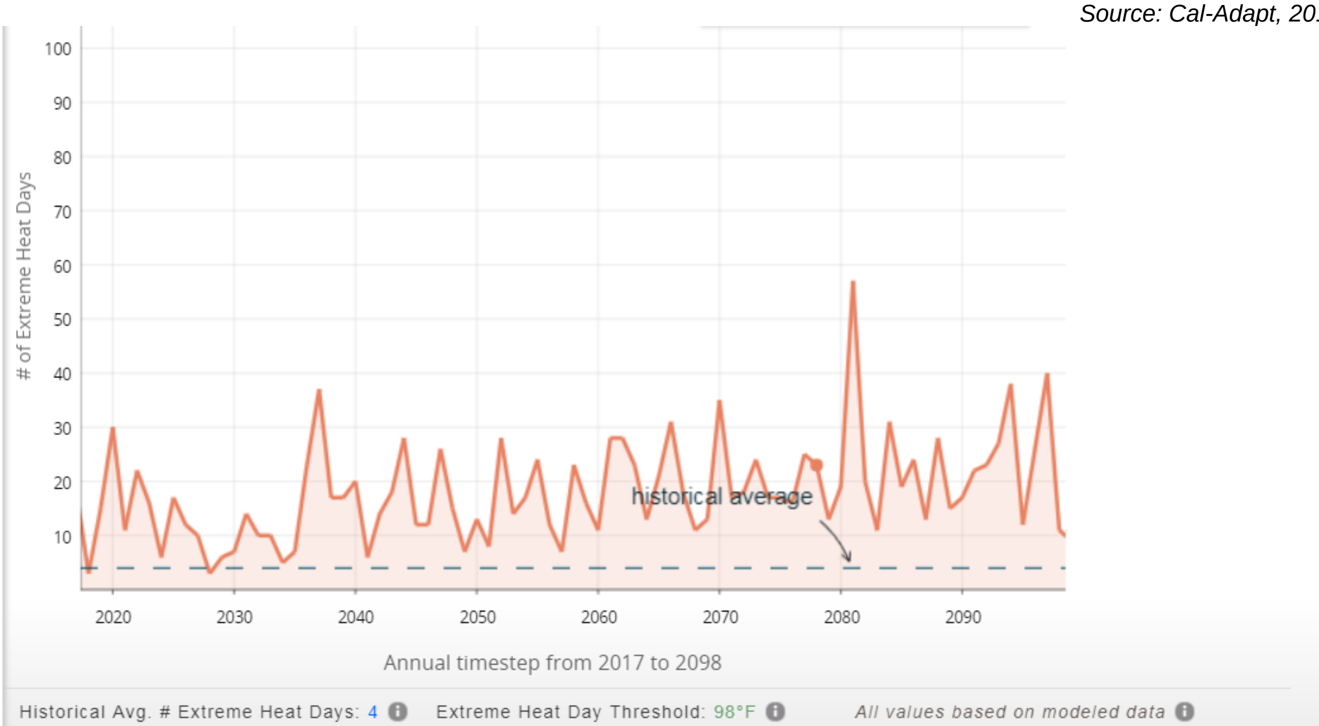

Figure 15-3. Projected Number of Extreme Heat Days by Year

Precipitation

Cal-Adapt shows that the historical annual mean precipitation (1961-1990) for the Tri-Valley planning area was 21.1 inches. Under the low and high emission scenario, annual precipitation is expected to average 22.75 inches from 2017 to 2050 and 29.22 inches from 2051 to 2099. In general, most precipitation is expected to continue to fall during the winter. Small changes in precipitation patterns in the state will have the potential to cause significant disruption to built and natural systems.

Snowpack

While there are no snow-water equivalency measurements for the planning area, Cal-Adapt indicates that changes in precipitation patterns may result in a reduction in snowpack. For example, Sierra Nevada snowpack may be reduced by as much as 70 to 90 percent.

Wildfire

Wildfire risk is expected to change in the coming decades (see Figure 15-4). Under both high- and low-emissions scenarios, the change in area burned in planning area decreases by 10 to 20 percent by 2050.

Source: Cal-Adapt, 2017

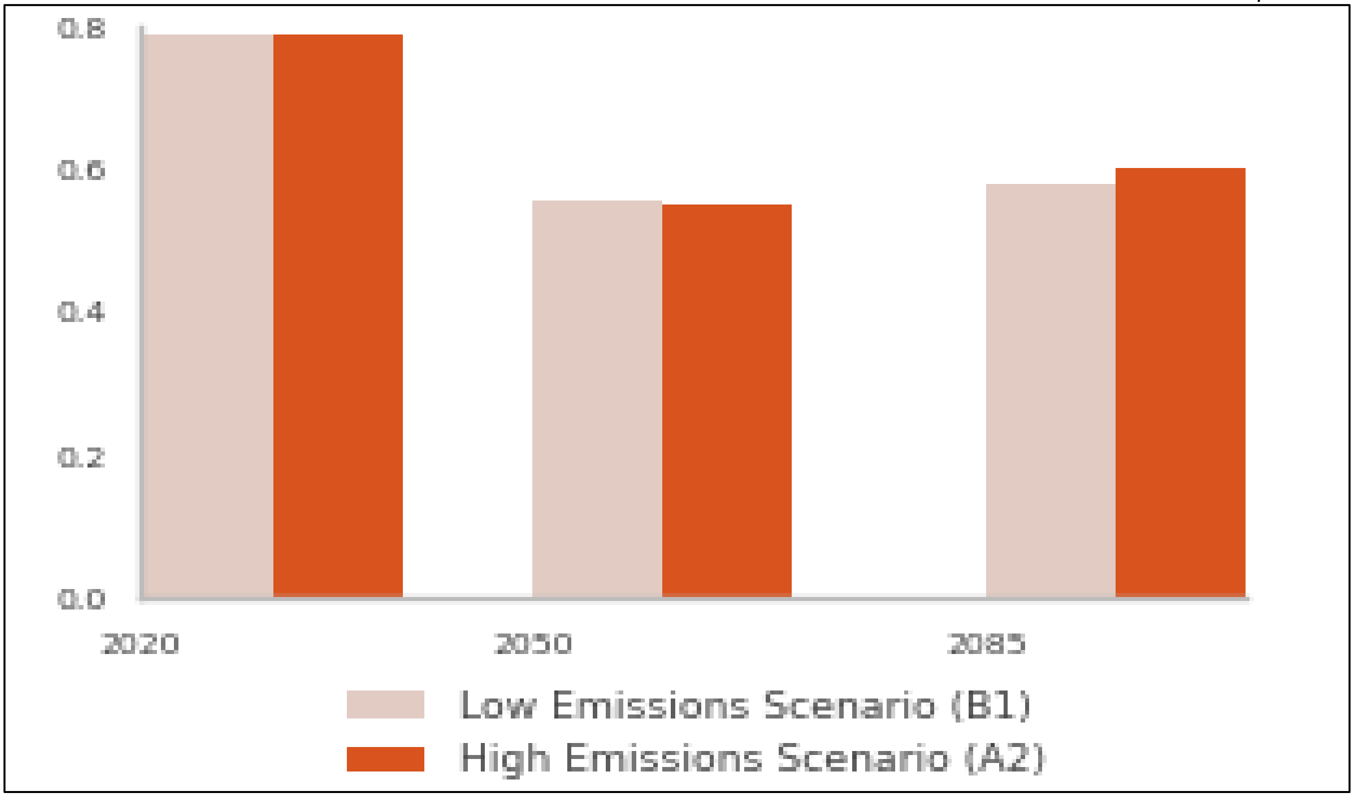

Figure 15-4. Projected Changes in Fire Risk, Relative to 2010 Levels

15.1.4 Responses to Climate Change

Communities and governments worldwide are working to address, evaluate and prepare for climate changes that are likely to impact communities in coming decades. Generally, climate change discussions encompass two separate but inter-related considerations—mitigation and adaptation:

- Mitigation in climate change discussions is defined as human intervention to reduce the impact on the climate system. It includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks.
- The IPCC defines adaption as "the process of adjustment to actual or expected climate and its effects."

Mitigation and adaptation are related, as the world's ability to reduce greenhouse gas emissions will affect the degree of adaptation that will be necessary. Some actions can both reduce greenhouse gas emissions and support adaptation to likely future conditions. Some adaptation actions also help communities reach other community goals (referred to as co-benefits). The ability to adapt to changing conditions is often referred to as adaptive capacity, which is "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (Intergovernmental Panel on Climate Change 2014).

Societies across the world are facing the need to adapt to changing conditions and to identify ways to increase their adaptive capacity. Some efforts are already underway. Farmers are altering crops and agricultural methods to deal with changing rainfall and rising temperature; architects and engineers are redesigning buildings; planners are looking at managing water supplies to deal with droughts or flooding.

Adaptive capacity goes beyond human systems, as some ecosystems show a remarkable ability to adapt to change and to buffer surrounding areas from the impacts of change. Forests can bind soils and hold large volumes of water during times of plenty, releasing it through the year; floodplains can absorb vast volumes of water during peak flows; coastal ecosystems can hold out against storms, attenuating waves and reducing erosion. Other ecosystem services—such as food provision, timber, materials, medicines and recreation—can provide a buffer to societies in the face of changing conditions. Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse effects of climate change. This includes the sustainable management, conservation and restoration of specific ecosystems that provide key services.

Assessment of the current efforts and adaptive capacity of the planning partners participating in this hazard mitigation plan are included in the jurisdiction-specific annexes in Volume 2.

15.2 VULNERABILITY ASSESSMENT

The following sections provide information on how each natural hazard of concern for this planning process may be impacted by climate change and how these impacts may alter current exposure and vulnerability for the people, property, critical facilities and the environment in the planning area.

15.2.1 Dam Failure

On average, changes in California’s annual precipitation levels are not expected to be dramatic; however, small changes may have significant impacts for water resource systems, including dams. Dams are designed partly based on assumptions about a river’s flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard.

If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. According to the California Department of Water Resources, flood flows on many California rivers have been record-setting since the 1950s. This means that water infrastructure, such as dams, have been forced to manage flows for which they were not designed. The California Division of Dam Safety has indicated that climate change may result in the need for increased safety precautions to address higher winter runoff, frequent fluctuations of water levels, and increased potential for sedimentation and debris accumulation from changing erosion patterns and increases in wildfires. According to the Division, climate change also will impact the ability of dam operators to estimate extreme flood events (California Department of Water Resources 2021b).

A strategy called Forecast Informed Reservoir Operations is being developed and tested in California as a way to inform decisions to retain or release water by allowing flexibility in operation policies and rules with enhanced monitoring and improved weather and water forecasts (Center for Western Weather and Water Extremes 2021).

Dams are constructed with safety features known as “spillways.” Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as “design failures,” result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

The following summarizes changes in exposure and vulnerability to the dam failure hazard resulting from climate change:

- **Population**—Population exposure and vulnerability to the dam failure hazard are unlikely to change as a result of climate change.
- **Property**—Property exposure and vulnerability to the dam failure hazard are unlikely to change as a result of climate change.
- **Critical facilities—**The exposure and vulnerability of critical facilities are unlikely to change as result of climate change. Dam owners and operators are sensitive to the risk and may need to alter maintenance and operations to account for changes in the hydrograph and increased sedimentation.
- **Environment**—The exposure and vulnerability of the environment to dam and levee failure are unlikely to change as a result of climate change. Ecosystem services may be used to mitigate some factors that could increase the risk of design failures, such as increasing the natural water storage capacity in watersheds above dams.

15.2.2 Drought

The long-term effects of climate change on regional water resources are unknown, but global water resources are already experiencing the following stresses without climate change:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure.

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. According to the National Climate Assessment, "higher surface temperatures brought about by global warming increase the potential for drought. Evaporation and the higher rate at which plants lose moisture through their leaves both increase with temperature. Unless higher evapotranspiration rates are matched by increases in precipitation, environments will tend to dry, promoting drought conditions" (U.S. Climate Resilience Toolkit 2021).

Because changes in precipitation patterns are still uncertain, the potential impacts and likelihood of drought are uncertain. DWR has noted impacts of climate change on statewide water resources by charting changes in snowpack, sea level, and river flow. As temperatures rise and more precipitation comes in the form of rain instead of snow, these changes will likely continue or grow even more significant. DWR estimates that the Sierra Nevada snowpack, which provides a large amount of the water supply for other parts of the state, will experience a 48- to 65-percent loss by the end of the century compared to the historical April 1 average (California Department of Water Resources 2021a). Projections for the planning area show a significant decline in projected snow water equivalent in April snowpack. Increasing temperatures may also increase net evaporation from reservoirs, which would reduce water availability for ecosystems and human use (Mount, Escriva-Bou and Sencan 2021).

By addressing current stresses on water supplies and by building a flexible, robust program, the County will be able to more adeptly respond to changing conditions and to survive dry years.

The following summarizes changes in exposure and vulnerability to the drought hazard resulting from climate change:

- **Population**—Population exposure and vulnerability to drought are unlikely to increase as a result of climate change. While greater numbers of people may need to engage in behavior change, such as water saving efforts, significant life or health impacts are unlikely.
- **Property**—Property exposure and vulnerability may increase as a result of increased drought resulting from climate change, although this would most likely occur in non-structural property such as crops and landscaping. It is unlikely that structure exposure and vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, may increase and threaten structures.
- **Critical facilities**—Critical facility exposure and vulnerability are unlikely to increase as a result of increased drought resulting from climate change; however, critical facility operators may be sensitive to changes and need to alter standard management practices and actively manage resources, particularly in water-related service sectors
- **Environment**—The vulnerability of the environment may increase as a result of increased drought resulting from climate change. Prolonged or more frequent drought resulting from climate change may stress ecosystems in the region, which include many special-status species.

15.2.3 Earthquake

The impacts of global climate change on earthquake probability are unknown, although scientists have identified tiny earthquakes triggered by the change of fault stress loads from rain and snow. Similarly, long-term drought can result in a significant change in the stress load on earth’s crust.

Pumping of groundwater from underground aquifers by humans, which is exacerbated during times of drought, has also been shown to impact patterns of stress loads by “unweighting” Earth’s crust. A 2014 study looked at the effects of groundwater extraction in California’s Central Valley on seismicity on the adjacent San Andreas Fault. The researchers found that such extractions can promote lateral changes in stress to the two sides of the San Andreas, which move horizontally against each other along the boundary of two major tectonic plates. This could potentially cause them to unclamp and slip, resulting in an earthquake (National Aeronautics and Space Administration 2019).

Because impacts on the earthquake hazard are not well understood, increases in exposure and vulnerability of local resources are not able to be determined.

15.2.4 Flood

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Scientists project greater storm intensity with climate change, resulting in more direct runoff and flooding. High frequency flood events in particular will likely increase with a changing climate. What is currently considered a 1-percent-annual-chance also may strike more often, leaving many communities at greater risk. Going forward, model calibration must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain areas to contribute to peak storm runoff. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

The following summarizes changes in exposure and vulnerability to the flood hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability may increase as a result of climate change impacts on the flood hazard. Runoff patterns may change, resulting in flooding in areas where it has not previously occurred.
- **Critical facilities**—Critical facility exposure and vulnerability may increase as a result of climate change impacts on the flood hazard. Runoff patterns may change, resulting in risk to facilities that have not historically been at risk from flooding. Changes in the management and design of flood protection critical facilities may be needed as additional stress is placed on these systems. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.
- **Environment**—The exposure and vulnerability of the environment may increase as a result of climate change impacts on the flood hazard. Changes in the timing and frequency of flood events may have broader ecosystem impacts that alter the ability of already stressed species to survive.

15.2.5 Landslide

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature is likely to affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. Each these factors would increase the probability of landslides.

The following summarizes changes in exposure and vulnerability to the landslide hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability would be unlikely to increase because of climate change impacts on the landslide hazard. These events may occur more frequently, but the extent and location should be contained within mapped hazard areas or recently burned areas.
- **Critical facilities**—Critical facility exposure and vulnerability would be unlikely to increase due to climate change impacts on the landslide hazard; however, critical facility owners and operators may experience more frequent disruption to service provision resulting from landslide hazards. For example, transportation systems may experience more frequent delays if movements blocking these systems occur more frequently.
- **Environment**—Exposure and vulnerability of the environment would be unlikely to increase because of climate change, but more frequent movements in river systems may impact water quality and have negative impacts on stressed species.

15.2.6 Severe Weather

Climate change presents a challenge for risk management associated with severe weather. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. The science for linking the severity of specific severe weather events to climate change is still evolving; however, a number of trends have been recorded that indicate how climate change may be impacting these events. According to the U.S. National Climate Change Assessment (U.S. Global Change Research Program 2014), there were more than twice as many high temperature records as low temperatures records broken between 2001 and 2012, and heavy rainfall events are becoming more frequent and more severe.

The increase in average surface temperatures can also lead to more intense heat waves that can be exacerbated in urbanized areas by what is known as urban heat island effect. The evidence suggests that heat waves are already increasing, especially in western states. According to information on Cal-Adapt provided above, extreme heat days are likely to increase in the planning area.

Climate change impacts on other severe weather events such as thunderstorms and high winds are still not well understood.

The following summarizes changes in exposure and vulnerability to the severe weather hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability are likely to increase as a direct result of climate change impacts on the severe weather hazard in term of summer extreme heat events and potentially winter storm events. Secondary impacts, such as the risk of fire or extent of localized flooding, may increase, impacting greater numbers of people and structures.
- **Critical facilities**—Critical facility exposure and vulnerability may increase as a result of climate change impacts on the severe weather hazard. Critical facility owners and operators may experience more frequent disruption to service provision. For example, more frequent and intense heat waves or storms may cause more frequent disruptions in power service.
- **Environment**—More frequent storms and heat events and more intense rainfall may place additional stress on already stressed ecosystems.

15.2.7 Wildfire

Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation.

Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

The following summarizes changes in exposure and vulnerability to the wildfire hazard resulting from climate change:

- **Population**—*California's Fourth Climate Change Assessment - Bay Regional Report* states that "wildfires will continue to be a major disturbance in the region. Future wildfire projections suggest a longer fire season, an increase in wildfire frequency, and an expansion of the area susceptible to fire."
- **Property and Critical facilities**—The exposure and vulnerability of property and infrastructure is anticipated to increase based on projections from California's *Fourth Climate Change Assessment*. The application and enforcement of codes and standards to mitigate the risk from wildfire hazards could help to decrease this risk as development moves into wildfire hazard areas.
- **Environment**— It is possible that the exposure and vulnerability of the environment will be impacted by changes in wildfire risk due to climate change. Natural fire regimes may change, resulting in more or less frequent or higher intensity burns. These impacts may alter the composition of the ecosystems in areas in and surrounding planning area. If more acres are burned every year, wildlife may be more stressed as the suitable habitat is lost.

15.3 ISSUES

The major issues for climate change are the following:

- Planning for climate change related impacts can be difficult due to the inherent uncertainty in projected future impacts.
- Average temperatures are expected to continue to increase in the planning area, which may lead to a host of primary and secondary impacts, such as an increased incidence of heat waves.
- Expected changes in precipitation patterns are poorly understood and could have significant impacts on the water supply and flooding in the planning area.
- Some impacts of climate change are poorly understood, such as potential impacts on the frequency and severity of earthquakes and thunderstorms.
- Atmospheric river events may result in stormwater flooding after stormwater management systems are overwhelmed.

16. PUBLIC HEALTH EMERGENCY

16.1 GENERAL BACKGROUND

16.1.1 Definitions

According to the Centers for Disease Control, a pandemic involves the international spread of a new disease (CDC 2016). While an epidemic remains limited to one city, region, or country, a pandemic spreads beyond national borders and possibly worldwide. Authorities consider a disease to be an epidemic when the number of people with the infection is higher than the forecast number within a specific region. A pandemic is an epidemic that becomes widespread in several countries at the same time. A pandemic affects a higher number of people and can be more deadly than an epidemic.

16.1.2 General Causes

A new virus strain or subtype that easily transmits between humans can cause a pandemic. Bacteria that become resistant to antibiotic treatment may also be behind the rapid spread. Sometimes, pandemics occur when new diseases develop the ability to spread rapidly, such as COVID-19. Humans may have little or no immunity against a new virus. Often, a new virus cannot spread between animals and people. However, if the disease changes or mutates, it may start to spread easily, and a pandemic may result. Seasonal flu epidemics generally occur because of a viral subtype that is already circulating among people. Novel subtypes, such as COVID-19, generally cause pandemics. These subtypes will not previously have circulated among humans.

16.1.3 Pandemic Response

A pandemic can lead to social disruption, economic loss, and general hardship on a wide scale. The severity is dependent upon the hazard and the population exposed to it. As the population increases, so does the risk of exposure to hazards. The key to reducing the disease hazard is isolation so that the exposed population does not continue to spread the hazard to the uninfected population. For disease and weather-related human health hazards, promoting education and personal preparedness will help to mitigate and reduce the severity of the hazard.

16.1.4 Identified Health Hazards in California

The California Department of Public Health has identified the conditions described in Table 16-1 as reportable human communicable diseases that could contribute to a serious epidemic in the state.

Table 16-1. Naturally Spread Diseases Seen in California

Description	Examples	
Animal Transmitted		
These are diseases that are transmitted to humans by domestic or non-domestic animals.	• Brucellosis (undulant fever) • Campylobacteriosis • Escherichia coli (E. coli) • Giardiasis • Middle Eastern Respiratory Syndrome (MERS) • Plague	• Psittacosis (ornithosis, parrot fever) • Q Fever • Rabies • Salmonellosis • Tularemia
Bloodborne		
Viruses, bacteria and parasites that can be carried in blood and cause disease are known as bloodborne pathogens. Transmission of these diseases may be from direct blood contact, needle sticks, intravenous drug use, sexual behavior, insects or other vectors.	• Hepatitis C • Malaria	
Community-Acquired Infections		
Community-acquired infections are infections that are contracted outside of a hospital (or are diagnosed within 48 hours of admission) without any previous health care encounter.	• Campylobacteriosis • Influenza due to novel strains • Legionellosis • Meningitis (viral, bacterial, fungal, parasitic)	• Respiratory syncytial virus • Smallpox • Tularemia
Foodborne		
Foodborne diseases can be spread when food becomes contaminated with fecal matter containing bacteria, viruses, or parasites. This contamination can happen at a farm, manufacturing plant, restaurant, or home. Foodborne diseases usually result in gastrointestinal illness, which can include symptoms such as diarrhea, vomiting, nausea, stomachache, and fever. People who are ill with a foodborne disease can give the infection to others, so proper hygiene and hand washing practices are essential to limit the spread of disease.	• Brucellosis • Campylobacteriosis • Cholera • Ciguatera fish poisoning • Cryptosporidiosis • Cyclosporiasis • Escherichia coli (E. coli) • Giardiasis	• Listeriosis • Salmonellosis • Scombroid fish poisoning • Shigellosis • Tularemia • Typhoid Fever • Vibriosis • Yersinia enterocolitica
Mosquito-Transmitted		
In addition to causing severe annoyance and allergic reaction, mosquitoes found in California are capable of spreading many diseases to humans.	• Chikungunya • Dengue • Malaria	• West Nile • Yellow Fever • Zika
Respiratory Viruses		
Respiratory viruses are responsible for influenza-like illness. They can also cause the common cold. The virus that caused the COVID-19 pandemic is a respiratory virus. People at high risk (those with certain underlying conditions, the elderly, the very young, and pregnant women) can develop severe illness that results in hospitalization or death.	• Coronaviruses (including SARS and MERS CoV) • Influenza • Respiratory Syncytial Virus	• Measles • Pertussis (whooping cough)
Waterborne Diseases		
Diseases caused by micro-organisms transmitted in water can be spread while bathing, washing, drinking water, or eating food exposed to contaminated water.	• Cholera • Giardiasis • Legionellosis	• Leptospirosis • Typhoid Fever • Vibriosis
Sexually Transmitted Disease		
The Centers for Disease Control and Prevention uses community engagement methods in their Community Approaches to Reducing Sexually Transmitted Diseases (CARS). California has state-mandated HIV/AIDS prevention education in middle and high schools.	• Hepatitis A, B, and C • Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS)	• Syphilis • Zika

16.1.5 Secondary Hazards

The largest secondary impact caused by human health hazards is economic. Large outbreaks of any human health hazard could reduce the work force significantly, causing businesses and agencies to close or be greatly impacted. The COVID-19 pandemic demonstrated the economic impacts of a public health emergency affecting all nations across the globe. Staffing issues, supply chain disruptions, and other economic issues related to the COVID-19 pandemic continue to affect individuals, companies, and organizations.

Another secondary impact is stigmatization. The fear of the human health hazard and fear of the unknown can lead to isolation, violence, and self-inflicted injury. Hospitals and health care providers can be overwhelmed with the “worried well” seeking care and comfort. Stigmatization of those infected by the disease may also play a role, along with political polarization that results from differences of opinion on the most effective way to handle public health emergencies. Providing key and critical information can reduce and mitigate this secondary risk.

16.2 HAZARD PROFILE

16.2.1 Past Events

COVID-19 Pandemic

In March 2020, Alameda County was included in the FEMA Major Disaster Declaration for the COVID-19 coronavirus pandemic. As of January 2023, about 394,000 people, or 23.9 percent of the Alameda County population, had contracted the coronavirus and 2,128 people, or 0.1 percent of the population, had died from it. As of January 2023, 73.1 percent of people in Alameda County had received the COVID-19 vaccine along with a booster dose (Alameda County 2023).

Throughout the cycle of the COVID-19 pandemic, safety precautions were adapted to current infection rates and circumstances. Tri Valley cities and Alameda County provided public service outreach through numerous channels, including the Alameda County Public Health Department website and the cities of Pleasanton, Livermore, and Dublin’s COVID-19 websites, which provide regular updates regarding:

- Vaccine information
- Business information
- Booster shots
- COVID-19 testing
- School/childcare and sports information
- Quarantine guidance
- Monoclonal antibody treatment
- Outreach activities.

Infectious Diseases

The following is a summary of recent infections disease outbreak events other than COVID-19:

- In the United States during the 2009 H1N1 influenza pandemic, there were 60 million confirmed cases of the disease, 270,000 people hospitalized due to the illness and 12,000 deaths. In California, there were 4,134 people hospitalized due to the illness and 596 deaths. In Alameda County, there were 243 confirmed cases, with 29 deaths (City of Dublin; City of Livermore; City of Plesanton 2018).
- The most recent data for influenza in California is for the 2019-2020 flu season. The California Department of Public Health identified 889 influenza-coded deaths on death certificates, compared to 613 in the 2018-2019 period, along with 22 laboratory-confirmed pediatric deaths. In Alameda County, there were 11.8 deaths from influenza per 100,000 from 2018 through 020. Overall, the influenza activity for this season was high in severity (CDPH 2021).
- California was impacted by the Enterovirus D68 outbreak in 2014. By October 2014, there were 32 reported cases in the state. Two of those cases were reported in Alameda County.
- In 2015, California experienced a norovirus outbreak. Between October and December, there were 32 confirmed cases of norovirus (California Department of Public Health 2015).
- In May 2022, an MPX (formerly called monkeypox) outbreak began in the United Kingdom before spreading to other countries including the United States. As of January 2023, 243 cases of MPX had been identified in Alameda County, but the risk to the general population remained low (Alameda County Health Care Services Agency 2023).

Vector-Borne

The following is a summary of recent vector-borne disease outbreak events:

- In Alameda County, between 2006 and 2015, there were 35 confirmed cases of Lyme disease and six reported cases of West Nile Virus (California Department of Public Health 2015).
- As of September 16, 2016, 18 Zika cases were reported in Alameda County, all from returning travelers.

16.2.2 Location

All of the planning area is susceptible to human health hazards. While some hazards, such as Lyme disease, can have a geographic presence within the planning area, other diseases can cause exposure to the planning area from outside the local region. Planning area residents who travel can become exposed to diseases while abroad and bring the diseases back with them, potentially placing the region at risk for exposure. Frequent travel on aircraft, public transportation, and in crowded areas may increase planning area residents’ risk of contracting communicable disease. Extreme weather poses an equal human health hazard across the planning area.

16.2.3 Frequency

Predicting the future occurrences of disease outbreaks is difficult; however, based on the history of past occurrences, it is likely that the planning area will be impacted in the future. An increase in population and population density in the planning area have the potential to increase residents’ exposure and susceptibility to outbreaks. Infected mosquitos and ticks will continue to inhabit and impact the planning area.

16.2.4 Severity

The severity of the human health hazard varies from individual to individual. Typically, young children and older adults are more susceptible to acquiring communicable diseases due to developing or diminishing immune systems. These populations often experience the most severe of symptoms, as their immune systems are not capable of fighting off infection or efficiently regulating temperature. In general, severity varies depending on the pathology of the disease, the health of the infected, and the availability of treatments for alleviating symptoms or curing the disease.

16.3 EXPOSURE AND VULNERABILITY

Health hazards that affect residents of the Tri-Valley area and Alameda County may arise in a variety of situations, such as during a communicable disease outbreak or after a natural disaster. While all of the population in the Tri-Valley area is considered at risk to the human health hazards discussed in this chapter, the young and the elderly, pregnant women, those with compromised immune systems, and those with special needs are considered the most vulnerable. Food insecurity can impact those who lose employment during a pandemic, who are not eligible for Supplemental Nutrition Assistance Program benefits due to immigration status, or who may not be able to access food at stores because of supply chain issues or lack of stock. Food banks may be the only option for these families.

16.4 FUTURE TRENDS IN DEVELOPMENT

The potential for communicable diseases, vector-borne diseases or extreme weather in the planning area is not likely to lessen or prohibit growth or development.

16.5 SCENARIO

A worst-case human health scenario for the planning area would be an epidemic or large-scale incident of any of the human health hazards discussed in this chapter. Medical treatment facilities in the planning area would be overwhelmed and taxed beyond their capabilities as the numbers of patients escalates. Impacts on the work force could have acute and long-term economic impacts on the planning area’s primary employers. First responders would be exposed to the human health hazards, which could deplete the medical work force and could have profound impact on the potential escalation of the scenario.

16.6 ISSUES

Important issues associated with the human health hazards include but are not limited to the following:

- Prevention through vaccination and personal emergency and disaster preparation will help to reduce the impacts of human health hazards.
- Medical and response personnel need to be integrated in a unified command to provide care when needed in response to human health hazards.
- Medical and response personnel must be adequately trained and supplied.
- Up-to-date and functional all-hazard contingency planning should be carried out.
- A system needs to be in place to inform the public with a unified message about the human health hazard.
- Health agencies and facilities require surge capacity management and adaptation to the rising number and needs of the region.

17. HUMAN-CAUSED HAZARDS

17.1 GENERAL BACKGROUND

Although the DMA does not require an assessment of human-caused hazards, this plan includes human-caused hazards for the following reasons:

- The planning partners take a proactive approach to disaster preparedness in order to protect the public safety of all citizens.
- Preparation for and response to a human-caused disaster will involve much of the same staff training, critical decision-making, and commitment of resources as for a natural hazard.
- The hazard mitigation planning effort is an opportunity to inform the public about all hazards, including human-caused hazards.
- The likelihood of a human-caused hazard in the planning area is greater than several of the identified natural hazards in this plan.

Human-caused hazards fall into the following categories:

- Intentional, criminal, malicious acts, including acts of terrorism, cyber threats, civil unrest, riots, and active threats.
- Technological incidents that arise accidentally from human activities such as the manufacture, transportation, storage and use of hazardous materials; pipeline failure and release; and transportation.

17.1.1 Intentional Hazards

This section addresses man-made hazards caused by individuals with ill-intent, specifically involving a criminal act. Terrorism, active threats, cyber threats, and civil unrest are the primary topics addressed in this section.

Terrorism

Defining Terrorism

Acts of terrorism are intentional, criminal, malicious acts with the following characteristics:

- They involve the use of illegal force.
- They are intended to intimidate or coerce.
- They are committed in support of political or social objectives.

The Federal Bureau of Investigation (FBI) categorizes two types of terrorism in the United States:

- **Domestic terrorism** involves groups or individuals whose terrorist activities are directed at elements of our government or population without foreign direction. The bombing of the Alfred P. Murrah federal building in Oklahoma City is an example of domestic terrorism. The FBI is the primary response agency for domestic terrorism. The FBI coordinates domestic preparedness programs and activities of the United States to limit acts posed by terrorists, including the use of weapons of mass destruction.
- **International terrorism** involves groups or individuals whose terrorist activities are foreign-based or directed by countries or groups outside the United States, or whose activities transcend national boundaries. Examples include the 1993 bombing of the World Trade Center and the attacks of September 11, 2001, at the World Trade Center and the Pentagon.

Three factors distinguish terrorism hazards from other types of hazards:

- In the case of chemical, biological, and radioactive agents, their presence may not be immediately obvious, making it difficult to determine when and where they may have been released, who has been exposed, and what danger is present for first responders and emergency medical technicians.
- There is limited scientific understanding of how these agents affect the population at large.
- Terrorism evokes strong emotional reactions, ranging from anxiety to fear to anger to despair to depression.

Most terrorist events in the United States have been bombing attacks, involving detonated or undetonated explosive devices, tear gas, pipe bombs, or firebombs. The effects of terrorism can vary from loss of life and injuries to property damage and disruptions in services such as electricity, water supplies, transportation, or communications. The event may have an immediate effect or a delayed effect. Terrorists often choose targets that offer limited danger to themselves and areas with relatively easy public access. Foreign terrorists look for visible targets where they can avoid detection before and after an attack such as international airports, large cities, major special events, and high-profile landmarks.

Cyberterrorism

Cyberterrorism is the use of computers and information, particularly over the Internet, to recruit others to a cause, cause physical or financial harm, or cause a severe disruption of service. It can be driven by religious, political, or other motives. Like traditional terrorism tactics, cyberterrorism seeks to evoke strong emotional reactions, but it does so through information technology rather than a physically violent or disruptive action.

Cyberterrorism has three main types of objectives (Kostadinov 2012):

- **Organizational**—Cyberterrorism with an organizational objective includes functions other than cyber-attacks. Terrorist groups today use the internet every day for recruitment, training, fundraising, communication, or planning. Organizational cyberterrorism can use platforms such as social media as a tool to spread a message beyond country borders and instigate physical forms of terrorism. Organizational efforts may include system attacks as a tool for training new members of a faction in cyber warfare.
- **Undermining**—Cyberterrorism with undermining as an objective seeks to hinder the normal functioning of computer systems, services, or websites. Such methods include defacing, denying, and exposing information. These attacks aim to undermine the victim’s high dependence on online structures to support vital operational functions. They typically do not result in grave consequences unless undertaken as part of a larger attack. Undermining attacks on computers include the following:

- Physical attack against computer equipment, a computer facility, or transmission lines to disrupt the reliability of equipment.
- Using electromagnetic energy, usually in the form of an electromagnetic pulse, to attack computer equipment or data transmissions. By overheating circuitry or jamming communications, an electronic attack disrupts the reliability of equipment and the integrity of data.
- Using malicious code directed against computer processing code, instruction logic, or data. The code can generate malicious network packets that disrupt data or logic. This type of cyber-attack can disrupt the reliability of equipment, the integrity of data, and the confidentiality of communications.

- **Destructive**—The destructive objective for cyberterrorism is what organizations fear most. Through the use of computer technology and the Internet, the terrorists seek to inflict destruction or damage on tangible property or assets, and even death or injury to individuals. There are no cases of pure cyberterrorism as of the date of this plan.

Addressing Terrorism

While education, heightened awareness, and early warning of unusual circumstances may deter crime and terrorism, intentional acts that harm people and property are possible at any time. Public safety entities react to the threat, locating, isolating and neutralizing further damage, and investigating potential scenes and suspects to bring criminals to justice. Those involved with terrorism response, including public health and public information staff, are trained to deal swiftly with the public's emotional reaction. The area of the event must be clearly identified in all emergency alert messages to prevent those not affected by the incident from overwhelming local emergency rooms and response resources, which would reduce service to those actually affected. The public must be informed clearly and frequently about what government agencies are doing to mitigate the impacts of the event. The public will also be given clear directions on how to protect the health of individuals and families.

In dealing with terrorism, the unpredictability of human beings must be considered. People with a desire to perform criminal acts may seek out targets of opportunity that may not fall into established lists of critical facilities. First responders train not only to respond to organized terrorism events, but also to respond to random acts by individuals who, for a variety of reasons ranging from fear to emotional trauma to mental instability, may choose to harm others and destroy property.

The Alameda County Office of Emergency Services is responsible for mitigation, preparedness, planning, coordination of response, and recovery activities related to county emergencies and disasters, including terrorism. The department serves as the primary coordination point for emergency management's activities affecting more than one jurisdiction, and the unincorporated areas of the county.

Active Threats

Active threats may include active shootings, secondary explosives, and/or chemical or biological threats.

Active Shooter

Active shooter attacks are typically motivated by the desire to maximize human casualties. They are differentiated from other attack types by the indiscriminate nature of the victim's targets of opportunity rather than actions directed toward a specific target. Active shooter attacks have evolved over the last decade ranging from "lone wolf" shooters who act alone and without any organizational affiliation to organized groups acting in concert to achieve a specific objective. Current active shooter threat force tactics commonly employ a blend of lone shooters and multi-person teams as part of a larger assault.

Active shooters may choose to use a variety of weapons during an attack. In the United States, active shooter events typically involve the use of handguns, followed by rifles, and less commonly shotguns. With additional planning and preparation, attackers periodically implement the use of explosive devices to increase the potential for loss of human life or serve as a distraction to confuse bystanders and law enforcement.

Biological Threats

Biological hazards include disease-causing microorganisms and pathogens, such as bacteria and viruses. The distinguishing characteristic of these substances is their ability to multiply within a host and cause an infection. Some bacteria and viruses can spread from one individual to another. Infections typically occur as a result of airborne exposure, skin contact, or ingestion. In general, exposure to bacteria and viruses can occur through inhalation (as is the case with airborne *B. anthracis* spores, which cause anthrax), ingestion of contaminated food or water (the case with *E. coli*, which causes gastrointestinal infection), contact with infected individuals, or contact with contaminated surfaces (which may be harboring, for example, viruses that cause influenza). As a result, domestic and transnational threat groups have considered targeting heating, ventilation, and air conditioning systems of large commercial buildings.

Anthrax has been used as a weapon for nearly 100 years and is one of the most likely agents to be used in a biological threat. Its spores are easily found in nature, can be produced in a lab, and can last for a long time. It can be released quietly and without anyone knowing. Microscopic spores can be put into powders, sprays, food, and water. Due to their size, one may not be able to see, smell or taste them (CDC 2020). Terrorists may release anthrax spores in public places. In 2001, letters containing powdered anthrax spores were sent through the U.S. mail, causing skin and lung anthrax in 22 people. Five people died, all due to lung anthrax.

If a biological attack were to occur within the planning area, a large number of personnel could be impacted. Buildings in the impacted area and transportation infrastructure might be closed for investigation and cleanup. These areas would not be accessible until cleanup is completed, which would impact the businesses. Hospitals could become overwhelmed with people coming in fearing contamination. Residents and businesses may need to shelter in place in the area of the attack.

Chemical Threats

Chemical weapons are often classified according to their effect on the body, based on the primary organ system affected by exposure. They are poisonous vapors, aerosols, liquids, and solids that have toxic effects on humans, animals, and plants. Exposure pathways include inhalation, skin contact, ingestion or injection. Depending on the severity of exposure, impacts may include temporary illness or injury, permanent medical conditions, or death. An attack using chemical threats can come without warning. Signs of a chemical release include difficulty breathing; eye irritation; losing coordination; nausea; or a burning sensation in the nose, throat and lungs (Ready.gov 2022). Harmful chemicals that could be used in an attack include the following:

- Chemical weapons developed for military use (warfare agents)
- Toxic industrial and commercial chemicals that are produced, transported, and stored in the making of petroleum, textiles, plastics, fertilizers, paper, foods, pesticides, household cleaners, and other products
- Chemical toxins of biological origin such as ricin (DHS 2004).

There have been reports of chlorine found in explosive devices, mortars, rockets, and missiles. Chlorine has been used in the past, mainly in blunt, terrorist-style attacks. Some experts believe that groups are trying to advance their technology for deploying the chemical in combat operations (Military Times 2015). Chlorine is an acutely toxic industrial compound that can cause severe coughing, pulmonary, eye and skin irritation, and even death at higher concentrations (Homeland Security Digital Library 2007).

A chemical release in the planning area could lead to closed down streets and major transportation routes (including bridges) for extended periods of time, causing transportation delays and traffic. Many homes and businesses would also be impacted as they would need to be evacuated for an extended period of time. There could also be impact on the environment and/or natural resources that would require cleanup. Hazardous material response teams and fire-rescue would be needed to respond to the incident and coordinate cleanup efforts.

Explosive Devices

Improvised explosive device (IED) attacks are the favored method of terrorist groups around the world. The evolution in explosive materials, firing devices, and their ease of concealment and delivery has increased the effectiveness of this hazard. IED attacks are typically motivated by the desire to maximize human casualties. Explosive incidents account for 70 percent of all terrorist attacks worldwide. These types of attacks range from small-scale letter bombs to large- scale attacks on specific buildings. According to the FBI, 172 improvised explosive devices were reported in the United States between October 2012 and April 2013.

IEDs generally consist of TNT equivalent explosives (e.g., black or smokeless powder) in a container (e.g., galvanized pipe, paint can, etc.). These propellants are easily purchased on the commercial market. IEDs may also contain added shrapnel to induce greater casualties or shaped charges that direct the force of the explosive towards the target. Devices may be hidden in everyday objects such as briefcases, flowerpots or garbage cans, or on the person of the attacker in the case of suicide bombers. The most commonly used container is galvanized pipe, followed by PVC pipe. When shrapnel is added to the device, the type of shrapnel varies; BBs and other small pieces of hardware are common, as is glass or gravel.

An attack using IEDs or other explosive devices within the planning area has potential large-scale consequences that may require multi-agency and multi-jurisdictional coordination. Depending on the location of the attack, businesses and other venues may be closed for investigation and due to damage. If the attack occurred in or near residences, evacuations and/or sheltering may occur.

Fire as a Weapon

The use of fire for criminal, gang, and terrorist activities, as well as targeting first responders, is not new. The World Health Organization estimates that 195,000 people die each year from fire, while according to the Global Terrorism Database an average of 7,258 people die annually from terrorism, and that includes deaths in conflict zones such as Afghanistan and Iraq (Stewart 2013).

Cyber Threats

A cyber threat is an intentional and malicious crime that compromises the digital infrastructure of a person or organization, often for financial or terror-related reasons. Such attacks vary in nature and are perpetrated using digital mediums or sometimes social engineering to target human operators. Generally, attacks last minutes to days, but large-scale events and their impacts can last much longer. As information technology continues to grow in capability and interconnectivity, cyber threats become increasingly frequent and destructive.

Cyber threats differ by motive, attack type and perpetrator profile. Motives range from the pursuit of financial gain to political or social aims. Cyber threats are difficult to identify and comprehend. Types of threats include using viruses to erase entire systems, breaking into systems and altering files, using someone's personal computer to attack others, or stealing confidential information. The spectrum of cyber risks is limitless, with threats having a wide-range of effects on the individual, community, organization, and nation.

Cyber-Attacks

Public and private computer systems are likely to experience a variety of cyber-attacks, from blanket malware infection to targeted attacks on system capabilities. Cyber-attacks specifically seek to breach computer security measures designed to protect an individual or organization. The initial attack is followed by more severe attacks for the purpose of causing harm, stealing data, or financial gain. Organizations are prone to different types of attacks that can be either automated or targeted in nature. Table 17-1 describes the most common cyber-attack mechanisms faced by organizations today.

Table 17-1. Common Mechanisms for Cyber-attacks

Type	Description
Socially Engineered Trojans	Programs designed to mimic legitimate processes (e.g., updating software, running antivirus software). When the victim runs the fake process, the Trojan is installed on the system.
Unpatched Software	Nearly all software has weak points that may be exploited by malware. Most common software exploitations occur with Java, Adobe Reader, and Adobe Flash. These vulnerabilities are often exploited as small amounts of malicious code are often downloaded via drive-by download.
Phishing	Malicious email messages that ask users to click a link or download a program. Phishing attacks may appear as legitimate emails from trusted third parties.
Password Attacks	Third party attempts to crack a user's password and gain access to a system. Password attacks do not typically require malware, but rather stem from software applications on the attacker's system. These applications may use a variety of methods to gain access, including generating large numbers of generated guesses, or dictionary attacks, in which passwords are systematically tested against all of the words in a dictionary.
Drive-by Downloads	Malware is downloaded unknowingly by the victims when they visit an infected site.
Denial of Service Attacks	Attacks that focus on disrupting service to a network in which attackers send high volumes of data until the network becomes overloaded and can no longer function.
Man in the Middle	Man-in-the-Middle attacks mirror victims and endpoints for online information exchange. In this type of attack, the attacker communicates with the victims, who believe they are interacting with a legitimate endpoint website. The attacker is also communicating with the actual endpoint website by impersonating the victim. As the process goes through, the attacker obtains entered and received information from both the victim and endpoint.
Malvertising	Malware downloaded to a system when the victim clicks on an affected ad.
Advanced Persistent Threat	An attack in which the attacker gains access to a network and remains undetected. Advanced Persistent Threat attacks are designed to steal data instead of cause damage.

With millions of threats created each day, the importance of protection against cyber-attacks becomes a necessary function of everyday operations for individuals, government facilities, and businesses. The increasing dependency on technology for vital information storage and the often automated method of infection means higher stakes for the success of measurable protection and education. Cyber-attacks may lead to widespread business interruptions and likely considerable repair and response costs. A cyber-attack could cause sewage pump stations to fail, which could result in contaminated beaches, unsanitary conditions and/or potentially unsafe water supply.

Since 2013, a new type of cyber-attack is becoming increasingly common against individuals and small- and medium-sized organizations. This attack is called cyber ransom. Cyber ransom occurs when an individual downloads ransom malware, or ransomware, often through phishing or drive-by download, and the subsequent execution of code results in encryption of all data and personal files stored on the system. The victim then receives a message that demands a fee in the form of electronic currency or cryptocurrency, such as Bitcoin, for the decryption code (Figure 17-1). In October 2015, the FBI said that commonly used ransomware is so difficult to override, that victims should pay the ransom to retrieve their data (BusinessInsider.com 2015)

Source: (PBS 2017)

Figure 17-1. Example Pop-Up Message Indicating Ransomware Infection

If an attack were to occur that impacted the planning area, multi-jurisdictional response would need to be coordinated, in accordance with local and county emergency operations plans. To reduce the planning area's vulnerability, cyber security should be improved by providing network defense intelligence and conducting regular evaluations of network security posture and readiness. Additionally, the planning area should provide education on cyber threats and cyber-attack measurements.

Cyberterrorism

Cyberterrorism is the use of computers and information, particularly over the Internet, to recruit others to an organization's cause, cause physical or financial harm, or cause a severe disruption of infrastructure service. Such disruptions can be driven by religious, political, or other motives. Like traditional terrorism tactics, cyberterrorism seeks to evoke very strong emotional reactions, but it does so through information technology rather than a physically violent or disruptive action. Cyberterrorism has three main types of objectives (Kostadinov 2012):

- **Organizational**—Cyberterrorism with an organizational objective includes specific functions outside of or in addition to a typical cyber-attack. Terrorist groups today use the internet on a daily basis. This daily use may include recruitment, training, fundraising, communication, or planning. Organizational cyberterrorism can use platforms such as social media as a tool to spread a message beyond country borders and instigate physical forms of terrorism. Additionally, organizational goals may use systematic attacks as a tool for training new members of a faction in cyber warfare.
- **Undermining**—Cyberterrorism with undermining as an objective seeks to hinder the normal functioning of computer systems, services, or websites. Such methods include defacing, denying, and exposing information. While undermining tactics are typically used due to high dependence on online structures to support vital operational functions, they typically do not result in grave consequences unless undertaken as part of a larger attack. Undermining attacks on computers include the following (Waldron 2011):
  - Directing conventional kinetic weapons against computer equipment, a computer facility, or transmission lines to create a physical attack that disrupts the reliability of equipment.
  - Using electromagnetic energy, most commonly in the form of an electromagnetic pulse, to create an electronic attack against computer equipment or data transmissions. By overheating circuitry or jamming communications, an electronic attack disrupts the reliability of equipment and the integrity of data.
  - Using malicious code directed against computer processing code, instruction logic, or data. The code can generate a stream of malicious network packets that disrupt data or logic by exploiting vulnerability in computer software, or a weakness in computer security practices. This type of cyber-attack can disrupt the reliability of equipment, the integrity of data, and the confidentiality of communications (Wilson 2008).
- **Destructive**—The destructive objective for cyberterrorism is what organizations fear most. Through the use of computer technology and the Internet, the terrorists seek to inflict destruction or damage on tangible property or assets, and even death or injury to individuals.

Civil Unrest

Civil disturbance refers to groups of people purposely choosing not to observe a law, regulation or rule, usually in order to bring attention to their cause, concern or agenda. Disturbances may take the form of small gatherings or large groups blocking or impeding access to planning area municipality facilities or businesses to actions directed at intimidating staff, visitors, and causing property damage. Civil disturbances can arise from a number of causes for a variety of reasons. Protests intended to be a peaceful demonstration to the public and the government can escalate into general chaos.

The circumstances surrounding civil disturbance may be spontaneous or may result from escalating tensions within an institutional facility, community or the larger society. This was the case in Ferguson, MO and other recent national examples, where local police activities resulted in a massive community response that began as protest but evolved into less controlled, potentially violent response from community members. Civil disorder can erupt anywhere, but the most likely locations are areas with large population groupings or gatherings. Civil disorder can also occur near locations where a “trigger event” occurred, as was the case in Ferguson.

The following types of large gatherings are typically associated with civil disturbances:

- **Crowds**:

- A casual crowd is identified as individuals or small groups with nothing in common to bind them together. If they have an agenda, it is their own. Casual crowds are made up of individuals or small groups occupying the same common place.
- Sighting crowds are people gathering for an event. People migrating to sporting events, gathering to observe a fire or accident, and those that attend music concerts are all types of sighting crowds. Individuals or small groups gather at these events for the same purpose. It is the event and/or one's curiosity that compels a crowd to come together.
- Agitated crowds have responses based on the elements (people, space, and event). Individuals with strong emotional feelings within a crowd can quickly spread and influence the rest of the crowd. As more people within the crowd become emotionally involved, a sense of unity may develop, causing changes in the overall demeanor of the crowd. Yelling, screaming, and name-calling are all associated with an agitated crowd.

- **Mobs—**Mobs have all the elements found in the crowd types described above, but also display aggressive, physical, and sometimes violent actions. Under these conditions, individuals within a crowd will often say or do things they usually would not do. Extreme acts of violence and property damage are often part of mob activities. They consist of, or involve, the elements of people and groups being mixed together and becoming fluid. Mobs are usually emotional, loud, tumultuous, violent, and lawless. There are different levels of mobs (Alvarez and Bachman 2019):
  - An aggressive mob is one that attacks, riots, and terrorizes. The object of violence may be a person, property, or both. An aggressive mob is distinguished from an aggressive crowd only by lawless activity. Examples of aggressive mobs are the inmate mobs in prisons and jails, mobs that act out their frustrations after political defeat, or violent mobs at political protests or rallies.
  - An escape mob is attempting to flee from something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs are generally difficult to control and can be characterized by unreasoning terror.
  - An acquisitive mob is one motivated by a desire to acquire something. Riots caused by other factors often turn into looting sprees. This mob exploits an authority's lack of control in safeguarding property.
  - An expressive mob is one that expresses fervor or revelry following some sporting event, religious activity, or celebration. Members experience a release of pent up emotions in highly charged situations.
  - A flash mob is a large group of people who gather in some predetermined location, perform some brief action, and then quickly disperse. Youth flash mobs in Boston, Philadelphia, Brooklyn, New York, Kansas City, Missouri, Orange, New Jersey, and elsewhere in the United States have resulted in violence, vandalism, injuries, and arrests.
- **Riots**—A riot is form of civil disorder characterized by a group lashing out in a violent public disturbance against authority, property, or people. Riots typically involve vandalism and the destruction of property, public or private. The property targeted varies depending on the riot and the inclinations of those involved. Targets can include shops, cars, restaurants, government institutions, and religious buildings.

Civil disorders can result in numerous secondary hazards. Depending on the size and scope of the incident, civil disturbance may lead to widespread urban fire, utility failure, transportation interruption, and environmental hazards. Civil disorders can be a secondary hazard after a severely destructive disaster. This may include looting, blocking of roadways, which may impact emergency response vehicles, and demonstrations.

17.1.2 Technological Hazards

Technological hazards are associated with human activities such as the manufacture, transportation, storage and the use of hazardous materials. Incidents related to these hazards are assumed to be accidental, with unintended consequences. Technological hazards in the planning area can be categorized as follows:

- Hazardous materials incidents
- Pipeline and utility failure
- Transportation accidents.

Hazardous Materials Incidents

Hazardous materials are substances that are severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Many hazardous materials are commonly used substances that are harmless in their normal uses but dangerous if released. The EPA designates more than 800 substances as hazardous and identifies many more as potentially hazardous due to their characteristics and the circumstances of their release.

If released or misused, hazardous substances can cause death, serious injury, long-lasting health effects, and damage to structures, other properties, and the environment. Many products containing hazardous substances are used and stored in homes, and these products are shipped daily on highways, railroads, waterways, and pipelines. The following are the most common type of hazardous material incidents:

- **Fixed-Facility Hazardous Materials Incident**—This is the uncontrolled release of materials from a fixed site capable of posing a risk to health, safety and property. It is possible to identify and prepare for a fixed-site incident because federal and state laws require those facilities to notify state and local authorities about what is being used or produced at the site.
- **Hazardous Materials Transportation Incident**— A hazardous materials transportation incident is any event resulting in uncontrolled release of materials during transport that can pose a risk to health, safety, and property as defined by Department of Transportation Materials Transport regulations. Transportation incidents are difficult to prepare for because there is little if any notice about what materials could be involved should an accident happen. Hazardous materials transportation incidents can occur at any place within the country, although most occur on the interstate highways or major federal or state highways, or on the major rail lines. In addition to materials such as chlorine that are shipped throughout the country by rail, thousands of shipments of radiological materials, mostly medical materials and low-level radioactive waste, take place via ground transportation across the United States. Many incidents occur in sparsely populated areas and affect very few people.
- **Interstate Pipeline Hazardous Materials Incident**—A significant number of interstate natural gas, heating oil, and petroleum pipelines run through California. These are used to provide natural gas to the utilities in California and to transport these materials from production facilities to end-users.

CERCLA, the Emergency Planning and Community Right-to-Know Act, and California law require responsible parties to report hazardous material releases if certain criteria are met. All releases of hazardous substances (including radionuclides) exceeding reportable quantities must be reported by the responsible party to the National Response Center. If an accidental chemical release exceeds the Right-to-Know Act applicable minimal reportable quantity, the facility must notify state emergency response commissions and local emergency planning committees for any area likely to be affected by the release, and provide a detailed written follow-up as soon as practicable. Information about accidental chemical releases must be made available to the public.

Pipeline and Utility Failure

Raw Materials Pipelines

Transmission and distribution pipelines provide two differing services. Transmission pipelines transport raw material for further refinement. These pipes are large and far reaching, operating under high pressure. Distribution pipelines provide processed materials to end users. These are smaller in diameter, some as small as a half an inch, and operate under lower pressure.

Although pipelines are the safest and most reliable way to transport natural gas, crude oil, liquid petroleum products, and chemical products, there is still an inherent risk due to the nature of the hazardous materials. Pipelines are regulated by the Office of the State Fire Marshal. The Pipeline and Hazardous Materials Safety Administration enforces oil and gas pipeline safety regulations. The federal government enforces hazardous material transport pursuant to its interstate commerce regulation authority. Pipelines are also monitored by system control and data acquisition (SCADA) systems that measuring flow rate, temperature and pressure. The SCADA system transfers real-time data via satellite from the pipelines to a control center where the valves, pumps, and motors are remotely operated. If tampering with the pipeline occurs, an alarm sounds. The ensuing valve reaction is instantaneous, with the alarm system isolating any rupture and setting off a chain reaction that shuts down pipeline pumps and alerts pipeline operators within seconds.

Failures of distribution and transmission pipelines can occur when pipes corrode, are damaged during excavation, are incorrectly operated, or are damaged by other forces. More serious accidents occur on distribution pipelines than on any other type due to their number, intricate networking, and location in highly populated areas.

Water

Water disruption is a secondary impact from a natural disaster or intentional act. A breach in the pipelines that carry water through the planning area would have significant temporary impacts on the cities until alternative water sources are pumped and treated. Long-term disruption would have significant impacts on residences and businesses in the planning area if demand exceeds secondary supplies and water conservation measures do not provide enough relief to reduce demand to equal the secondary supplies.

Wastewater

Disruption of the planning area’s wastewater collection and wastewater treatment plants would have significant citywide and regional impacts. Such disruption could result if the system were to be overwhelmed by a significant storm or discharge of materials in such quantities that the treatment plant could not adequately treat the waste. Natural hazards such as earthquake or flood, major power outages, or terrorism directed at the facilities and systems could disrupt the process of collecting and treating millions of gallons of sewage. Wastewater treatment plants may also have emergencies internal to the plant such as oxygen deficiencies that render them incapable of treating waste. The disruption of service may also have significant environmental impacts on the waterways adjacent to the treatment plants.

Petroleum Refineries

A petroleum refinery’s main job is to separate crude oil into its many parts, which are then reprocessed into products. The type, number, and size of process units at a particular refinery depends on factors such as the type of crude oil and the products made. The units making up a refinery are tanks, furnaces, distillation towers, reactors, heat exchangers, pumps, pipes, fittings, and valves. Products include the following:

- Fuels, such as gasoline, diesel, heating oil, kerosene, jet fuel, bunker fuel oil, and liquefied petroleum gas
- Solvents, including benzene, toluene, xylene, hexane, and heptane, which are used in paint thinners, dry-cleaning solvents, degreasers, and pesticide solvents
- Lubricating oils and insulating, hydraulic, and medicinal oils
- Petroleum wax
- Greases, which are primarily a mixture of various fillers
- Asphalt.

These products can be hazardous not only in their final state but as they are being processed and refined. The principal hazards at refineries are fire and explosion. Refineries process a multitude of products with low flash points. Although systems and operating practices are designed to prevent such catastrophes, they can occur. In a refinery, hazardous chemicals can come from many sources and in many forms. In crude oil, there are not only the components sought for processing, but impurities such as sulfur, vanadium, and arsenic compounds. The oil is split into many component streams that are further altered and refined to produce the final product range. Most, if not all, of these component stream chemicals are inherently hazardous to humans, as are the other chemicals added during processing. Hazards include fire, explosion, toxicity, corrosiveness, and asphyxiation.

At refineries, the potential for fires, explosions, releases of flammable or toxic materials, or other accidents that could cause injuries, fatalities, or spills could occur and would be primarily associated with the flammable vapors and other flammable materials transported as cargo by tankers visiting the marine terminal. Damage prevention measures include routine inspection and maintenance, corrosion protection, continuous monitoring and control technologies, public awareness programs, and integrity management and emergency response plans.

Transportation Accidents

Transportation accidents are incidents involving air, road or rail travelers resulting in death or serious injury. The potential for transportation accidents that block ingress, egress, and movement through the planning area is significant, as is the likelihood of hazardous material incidents resulting from a traffic or rail accident.

17.2 HAZARD PROFILE

17.2.1 Past Events

Intentional Hazards

Terrorism Events

The Bay Area has not experienced a regional terrorism event. However, the 2016 hosting of the Super Bowl in Santa Clara County increased mainstream exposure of the Bay Area for potential future terrorist events. The following incidents in or near Alameda County have been recorded:

- February 26, 2019—A 23-year-old Oakland man was sentenced to nearly 16 years in federal prison after he created Facebook and Twitter accounts for individuals he thought were members of ISIS. The man also stated he wanted to carry out terrorist acts in the United States in support of ISIS (DOJ 2019).
- September 9, 2003—A bombing at Shaklee Corp in Pleasanton was attributed to a faction of the Animal Liberation Front (Alameda County 2012).
- August 8, 2003—Two bombings at the Chiron Corp in Emeryville were attributed to a faction of the Animal Liberation Front (Alameda County 2012).

Cyber Threats

The following recent cyber threat events in or near Alameda County have been recorded:

- In 2019, a cyber-attack locked all members of the Alameda County Bar Association out of their computers and servers for a period of time. No data was reported lost in this attack and no ransom was paid (DeepNet 2019).
- In October 2017, the Alameda County Library's servers were hacked and the private information of up to 400,000 people was compromised. Officials are still unsure of the total scope of this attack (CBS San Francisco 2017).
- In December 2015, University of California at Berkeley experienced a massive cyber-attack that left upwards of 80,000 people exposed to cyber-crime. The university is one of the largest employers in the Bay Area, and this cyber-attack reached beyond jurisdictional and county lines to affect the entire Bay Area.
- On December 1, 2014, a global cyber-attack shut down web access to agenda, minutes, and video for many Bay Area government agencies, including Alameda County. The San Francisco-based company Granicus, which provides web services for government agencies nationwide, reported the outage (Johnson 2014).

Civil Unrest

The 2012 Alameda County Emergency Operations Plan and other resources identify the following civil unrest incidents (Alameda County 2012):

- May 1, 2021—Seven people were arrested in Oakland following annual May Day demonstrations. The individuals were arrested for a number of offenses, including assault on a police officer, assault with a deadly weapon, and resisting arrest. Some demonstrators also broke into a vacant home.
- May 31, 2020 – June 1, 2020—In response to the death of George Floyd on May 25, 2020, at the hands of Minneapolis police, thousands of demonstrators gathered in the Bay Area. These demonstrations resulted in the looting of multiple business and shopping malls. A shooting took place in which a woman was shot in the arm. Tear gas was deployed by police, leading to further agitation (Yelimeli 2020).
- November 24 – December 10, 2014—After a grand jury decision in the Michael Brown case in Ferguson, MO, there was a 17-day revolt in Oakland that resulted in marches, blocked roadways, looting of businesses, destruction of property, and arrests.
- October 20, 2011— Occupy Oakland protesters took to the streets in Oakland over economic inequality, corporate excess, and homelessness. Hundreds of participants set up tents in Frank Ogawa Plaza. Some arrests were made for disruptive behavior; however, for the most part, the protest remained peaceful.

- January 7, 2009—This was the most notorious civil disturbance in Alameda County and occurred as a response to shooting by a Bay Area Rapid Transit police officer. It began as a peaceful protest but turned into a destructive riot resulting in trash can fires, multiple cars set on fire, broken storefront windows, and looting of stores.

Over the years, fights and lock-downs occur and some develop into full-scale threatening riots at the Alameda County Jail, Santa Rita, in Dublin. One occasion was August 26, 2010, when an inmate was killed. Security measures have not completely stopped the violence perpetrated on inmates and staff. The Federal Correctional Facility in Dublin is a low security federal correctional institution for female inmates that has not had recorded riots or fatalities.

In Pleasanton on September 9, 2016, hundreds of protesters gathered and 23 were arrested for civil disobedience at the Alameda County Fairgrounds. They gathered to protest the “militarization of police” at an event called Urban Shield, an annual law enforcement preparedness training.

Technological Hazards

Hazardous Materials

Although hazardous material incidents can happen almost anywhere, certain areas are at higher risk. Jurisdictions near roadways that are frequently used for transporting hazardous materials and jurisdictions with industrial facilities that use, store, or dispose of such materials all have an increasing potential for major incidents, as do jurisdictions crossed by certain railways, waterways, airways and pipelines. Hazardous materials are transported through the planning area via highways and pipelines. The planning area’s level of exposure to hazardous materials can be understood by examining the type of businesses, commercial traffic routes, and highway exposure.

Alameda County and its incorporated cities have experienced many accidental hazardous materials incidents. On November 7, 2007, a container ship struck a pier bumper at the western span of the Bay Bridge, which caused 58,000 gallons of bunker fuel to be released into the water. Oil slicks, oil globs, and oiled and dead wildlife were reported around the Bay and Pacific coastline. Beaches, marines and other shoreline areas were closed for cleanup in Alameda County and surrounding areas. In 2009, an oil tanker, located south of the Bay Bridge, was being fueled when human errors caused the tanks to overflow. This released 400 gallons of fuel into the bay and led to birds being oiled and approximately 6 miles of East Bay being oiled, specifically Bay Farm Island and Alameda Island (Alameda County 2012).

Table 17-2 lists the number of hazardous material incidents reported to Cal OES Warning Center by year and spill site type between 2012 through 2016. Additional historical hazardous material spill report data is available on Cal OES website. The records show that a total of 166 hazardous materials spills occurred over 5-year timeframe in Tri-Valley planning area.

Pipeline Incidents

Accidents involving underground pipelines in Alameda County have caused injury, fatalities and property damage. Recent events have involved natural gas lines in Oakland, Union City, Berkeley, and Livermore. In particular, on September 9, 2010, a natural gas pipeline explosion in San Bruno (San Mateo County) killed eight people and reduced the Crestmoor neighborhood to ashes. There have been incidents involving hazardous liquids as well, including an event on May 20, 2016, involving crude oil in Tracy (PHMSA 2022).

Table 17-2. Hazard Materials Spills in Tri-Valley Planning Area Reported to Cal OES (2012-2016)

Spill Site	2012	2013	2014	2015	2016	Total
Airport	0	0	0	0	0	0
Industrial Plant	0	2	0	2	0	4
Merchant/Business	3	5	3	6	6	23
Military Base	0	0	0	0	0	0
Oil Field	0	0	0	1	0	1
Other	3	5	2	2	5	17
Pipeline	0	0	0	2	1	3
Railroad	0	1	2	2	1	6
Refinery	0	1	0	0	0	1
Residence	2	1	1	0	7	11
Road	15	11	18	14	10	68
School	0	0	0	0	0	0
Service Station	5	6	9	7	1	28
Treatment/Sewage Facility	0	1	0	0	0	1
Utilities/Substation	0	0	1	0	0	1
Waterways	1	0	0	0	1	2
Total	29	33	36	36	32	166

Source: (Cal OES 2017)

According to Pipeline and Hazardous Materials Safety Administration, between 2010 to July 2017, there was one reported natural gas pipeline incident in the planning area. The incident occurred on June 11, 2012, in Livermore, when Pacific Gas & Electric had an unintentional release of gas (PHMSA 2022).

Transportation Accidents

According to the 2012 Alameda County Emergency Operations Plan, the County has not experienced an incident of a commercial flight or large plane. However, a number of general aviation aircraft incidents have occurred. These types of incidents are typically localized and somewhat contained.

Alameda County has experienced train derailments in the past. Recent events have been small, with minimal damage. In August 2004, a non-hazmat car derailed and two tank cars carrying methanol were damaged. Material release was not reported. In July 2005, a train derailed near a Kinder Morgan pipeline, which had to be shut down in case of any release (Alameda County 2012). In March 2016, 14 people were injured when a commuter train derailed after hitting a tree that had fallen onto the tracks. No fatalities were reported in this incident (Marzullo and Barnard 2016).

Between 2010 and 2022, there were three aviation fatality incidents in Livermore (along with 17 nonfatal), none in Dublin and one aviation fatality incident in Pleasanton as reported by the National Transportation Safety Board (NTSB). The following is information regarding recent fatality incidents in the planning area (NTSB 2023):

- June 1, 2015, Livermore—A Piper PA 22-135 collided with terrain after losing control mid-flight shortly after departing from Livermore Municipal Airport. One fatality resulted from this incident.
- June 21, 2014, Livermore—A Parker Loehle Mustang T5151 lost control and collided with terrain after an on-flight fire of unknown origin occurred. One fatality resulted from this incident.

- May 21, 2015, Pleasanton—A Cessna 210F collided with terrain, resulting in one fatality. The NTSB determined the pilot was varying plane altitude to avoid clouds before encountering an area of rising terrain that proved to be unavoidable.
- May 9, 2010, Livermore—A Piper PA-280235 pilot used visual flight into instrument meteorological conditions, which resulted in a collision with obstacles and terrain. Two fatalities occurred.

The California Office of Traffic Safety provides the total number of fatal and injury collisions on local city streets between 2017 through 2020 (see Table 17-3). Over this period, 5,258 fatal and injury collisions occurred in the Tri-Valley planning area.

Table 17-3. Total Fatal and Injury Collision Data for Tri-Valley Planning Area

Jurisdiction	2017	2018	2019	2020	Total
Dublin	128	129	162	73	**492**
Livermore	285	370	308	195	**1,158**
Pleasanton	301	284	247	147	**979**
Total	**714**	**783**	**717**	**415**	**5,258**

Source: (California OTS 2023)

The only railway accident reported in recent years occurred on March 8, 2016, when a commuter train detailed after it struck a downed tree on the tracks. The incident occurred in Niles Canyon, south of the City of Pleasanton, where two train cars derailed and one plunged into a creek. It occurred at night and only nine people were injured (San Francisco CBS 2016).

17.2.2 Location

Intentional Hazards

Terrorism, Civil Unrest, and Active Threats

The State of California and Office of Homeland Security have identified numerous high-profile targets for potential terrorists in California. Large population centers, high-visibility tourist attractions, and critical infrastructure accessible to the public present security challenges of an ongoing nature in California. The network of highways, railways, ports, and airports used to transport significant amounts of hazardous materials poses a significant technological hazards threat. Multiple incidents may happen simultaneously, and all typically require a multi-agency, multi-jurisdictional response.

In particular, the Santa Rita County Jail and Federal Correctional Facility, both in Dublin, are locations where civil unrest may occur. Also, the Lawrence Livermore National Laboratory and Sandia National Laboratory are U.S. Department of Energy national labs are critical facilities that may have active threats.

Cyber Threats

Both public and private operations in the Cities of Dublin, Livermore and Pleasanton are threatened on a near-daily basis by the millions of currently engineered cyber-attacks developed to automatically seek technological vulnerabilities. Possible cyberterrorist targets include the banking industry, power plants, air traffic control centers, and water systems; especially facilities that rely on computers, computer systems, and programs for their operations.

Technological Hazards

Hazardous Materials Release

Hazardous materials are stored before and after they are transported to their intended use. This may include service stations that store gasoline and diesel fuel in underground storage tanks; hospitals that store radioactive materials, flammable materials and other hazardous substances; or manufacturers, processors, distributors, and recycling plants for chemical industries that store a variety of chemicals on site (FEMA 2022). For the purpose of this plan, fixed sites include buildings or property where hazardous materials are manufactured or stored, and are regulated under various programs by the EPA.

The Toxic Substances Control Act of 1976 (TSCA) provides the EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. Certain substances are generally excluded from TSCA, including food, drugs, cosmetics, and pesticides. TSCA addresses the production, importation, use, and disposal of specific chemicals, including polychlorinated biphenyls (PCBs), asbestos, radon, and lead-based paint. According to TSCA, there are no facilities with these substances in the planning area (EPA 2021).

Facilities identified in the Resource Conservation and Recovery Act Information databases (RCRA Info) were also reviewed for this plan. Hazardous waste information is contained in RCRA Info, a national program management and inventory system about hazardous waste handlers. In general, entities that generate, transport, treat, store, and dispose of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies pass on the information to regional and national EPA offices. This regulation is governed by the RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984. There are 73 RCRA facilities in Dublin, 162 facilities in Livermore, and 132 facilities in Pleasanton (EPA 2021).

Petroleum Refineries

There are five petroleum refinery operations along the Bay Area’s Contra Costa-Solano refinery belt.

Pipelines and Utilities

Distribution pipelines run through highly populated areas providing refined materials for public use and consumption. Large gas distribution lines, called “mains,” along with much smaller service lines that travel to homes and businesses, account for the vast majority of underground pipeline system.

Figure 17-2 shows gas transmission and hazardous liquid pipelines as well as the locations of accidents and incidents within the planning area. Both natural gas and hazardous liquid pipelines traverse the planning area. The primary operator of the gas transmission pipelines is Northern California Power Agency and Pacific Gas & Electric. The primary operator for the hazardous liquid pipeline is Shell Pipeline Company (PHMSA 2023).

Zone 7 Water Agency (Zone 7), a water wholesaler, provides treated drinking water to four major retailers in the Valley area that serve approximately 240,000 people and businesses. The wholesale water has three sources: South Bay Aqueduct that originates from the California State Water Project; Lake Del Valle storage reservoir that is approximately 10 miles from Livermore; and groundwater from local wells (Zone 7 Water Agency 2023).

Source: (PHMSA 2023)

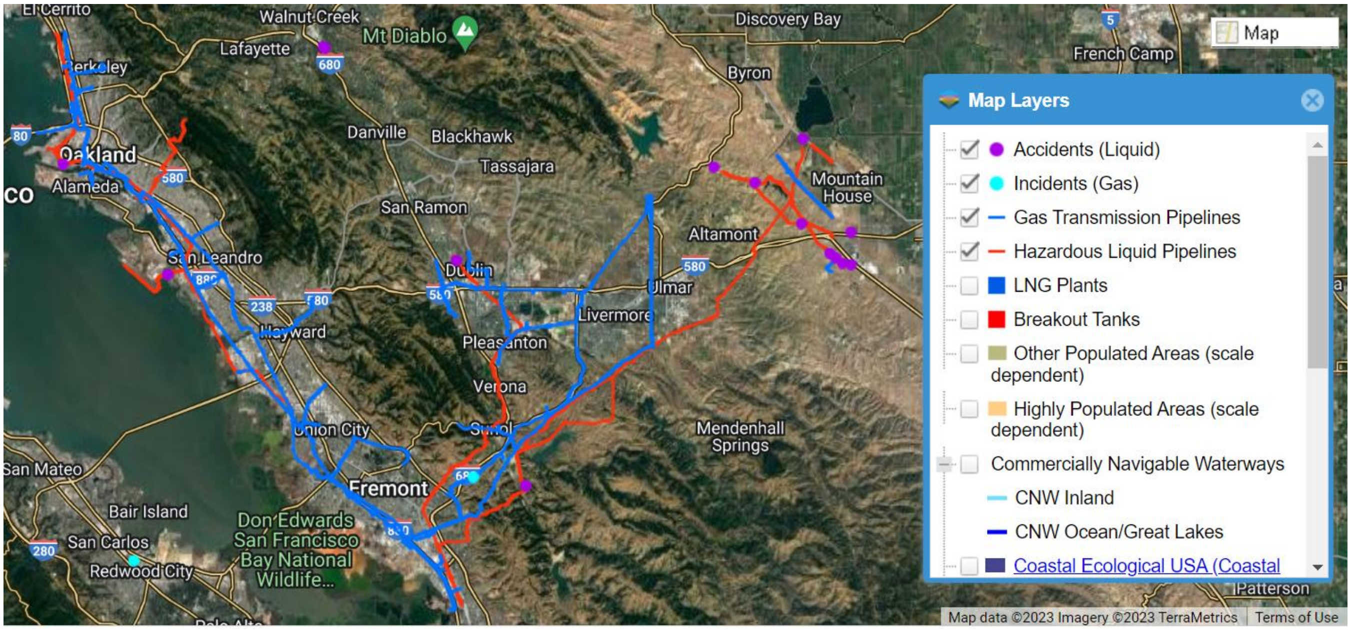

Figure 17-2. Gas Transmission and Hazardous Liquid Pipelines Near the Planning Area

Transportation Incidents

Incidents involving hazardous materials in transit or incidents occurring on roads and rail can occur through a variety of vehicles in and around the planning area. In the City of Dublin, there are 193 miles of road and no commuter train or transportation rails. In the City of Livermore, there are 348 miles of roadway, 12 miles of railroad and the Altamont Commuter express commuter train. In the City of Pleasanton, there are 340 miles of roadway, 6 miles of commuter train, and 8 miles of transportation rail (Association of Bay Area Governments 2010).

The Tri-Valley planning area is serviced by the Livermore Municipal Airport. It was a 5,255-foot main paved runway and a second 2,700-foot unlighted training runway. The nearest airports with scheduled airline service are Oakland, San Jose, and Stockton. The main artery through the planning area is Interstate 580, which feeds traffic from the Bay Area to the Central Valley of California. Union Pacific Railroad freight line traverses the Cities of Livermore and Pleasanton and Amtrak passenger train has a station in Livermore. The Altamont Commuter Express commuter train stops in Livermore and Pleasanton. It extends from Stockton to San Jose.

17.2.3 Frequency

Intentional Hazards

Terrorism, Civil Unrest, and Active Threats

As of 2022, California's economy was the largest of any state in the United States. The planning area's proximity to San Francisco and Silicon Valley presents unique conditions for terrorist attacks. The transportation, energy, and communications systems that cross the planning area have impacts on the local, regional, and even national economy. In general, the risks of a terrorist event involving a WMD are as follows:

- **Chemical**—The risk of a chemical event is present in the Cities of Dublin, Livermore and Pleasanton. The agricultural community in Alameda County uses and stores significant amounts of chemicals for peaceful and productive means that could be used in destructive ways.
- **Explosives**—Pipe bomb and suspicious package events have occurred in Alameda County in the past. While none of the events has been specifically identified as a WMD-related attack, the elements necessary to construct a WMD are readily available. Additionally, the agricultural communities maintain sufficient products and quantities for use in explosive events.
- **Radiological/Nuclear**—The major transportation arteries for vehicles or rail that cross through the planning area contribute to the risk of a radiological event. Such products can unknowingly pass through any one of the regional transportation corridors.
- **Biological**—Anthrax incidents that occurred in the United States in October 2001 demonstrate the potential for spreading terror through biological WMDs. The introduction of Newcastle disease in the United States demonstrates how an agent can be introduced to livestock, causing harm to public health and the economy.
- **Combined Hazards**—WMD agents can be combined to have a greater total effect. When combined, the impacts of the event can be immediate and longer-term. Casualties will likely suffer from both immediate and long-term burns and contamination. Given the risks associated with chemical agents in Alameda County, the possibility exists for such a combined event to occur.

Cyber Threats

Cyber-attacks are experienced on a daily basis, often without being noticed. Up-to-date virus protection software used in both public and private sectors prevent most cyber-attacks from becoming successful. Programs that promote public education to that end are also an effective way in which to mitigate cyber threats. Cyberterrorism is much less common than cyber-attacks, and the frequency is unknown.

Technological Hazards

Hazardous material incidents may occur at any time in the Cities of Dublin, Livermore and Pleasanton, given the presence of transportation routes bisecting the planning area, the location of businesses and industry that use hazardous materials, the presence of scattered illegitimate businesses such as clandestine drug laboratories at any given time, and the improper disposal of hazardous waste.

17.2.4 Severity

The severity of human-caused hazards could range from a minor transportation accident or power outage to a full-scale terrorist attack.

The term mass casualty incident (MCI) is often applied to transportation accidents involving air and rail travel, as well as multi-vehicle highway accidents. However, MCIs may also result from hazardous materials incidents or acts of violence, such as shootings or hostage situations. Effects may include serious injuries, loss of life, and associated property damage. Because large numbers of patients may be involved, significant MCIs may tax local emergency medical and hospital resources, and therefore require a regional response. MCIs may occur throughout the planning area, day or night, at any time of the year: Interstate 580 offer the potential for MCIs because of the heavy volume of traffic, although no highway or surface street in the City is exempt from this hazard.

The railroad tracks traversing Alameda County, carrying Amtrak passengers as well as freight, also face the risk of an MCI, as do the air corridors above the county. Severe weather may play a role in roadway, air, or rail accidents. MCIs may also result from acts of violence or terrorism, which could include a chemical, biological or radiological incident, contaminating persons and requiring mass decontamination.

Hazardous Materials

Table 17-4 shows the number of injuries and fatalities associated with hazardous material spills reported to Cal OES Warning Center between 2012 through 2016. Additional historical hazardous material spill report data is available on the Cal OES website. The records show that eight people were injured and five fatalities occurred in a 5-year timeframe in planning area. Hazardous material releases also affect the environment through contamination of soil, but data are not available on the area that has been affected by such contamination.

Table 17-4. Injuries and Fatalities from Hazardous Materials Spills in Tri-Valley Planning Area

Severity	2012	2013	2014	2015	2016	Total
Number of Injuries	2	1	3	0	2	**8**
Number of Fatalities	0	1	3	1	0	**5**
Total	**2**	**2**	**6**	**1**	**2**	**13**

Source: Cal OES, 2017

17.2.5 Warning Time

Very few terrorism incidents—fewer than 5 percent—are preceded by a warning. Technological accidents occur without predictability under circumstances that give responders little time to prepare.

17.3 SECONDARY HAZARDS

The largest secondary impact caused by human-caused hazards would be economic, and could be significant:

- The cost of a terrorist act would be felt in terms of loss of life and property, disruption of business activity and long-term emotional impacts. Recovery would take significant resources and expense at the local level.
- Computer security breaches associated with data and telecommunications losses can have significant economic impact.
- Pipeline and tank failure impacts can include both the cost of community recovery for the area surrounding the failure site and the cost of disruption of services for the transported material.
- Hazardous materials releases have the potential to cause major disruptions to local businesses that house hazardous materials. Additionally, a hazardous materials release could cause businesses to close if they are located in the path of the hazardous materials flow.
- The economic impacts should a transportation facility be rendered impassable would be significant. The loss of a roadway or railway would have serious effects on the local economy and ability to provide services. Loss of major travel routes would result in loss of commerce, and could impact the ability to provide emergency services to citizens by delaying response times or limiting routes for equipment such as fire apparatus, police vehicles, and ambulances. The ability to receive fuel deliveries would also be impacted. The effects of re-routed traffic could have a serious impact on local roadways.

17.4 EXPOSURE

17.4.1 Population

A human-caused hazard event could range from an isolated accident to a highly coordinated attack by multiple agents upon multiple targets. Large-scale incidents have the potential to kill or injure many citizens in the immediate vicinity, and may also affect people a relative distance from the initial event. Variables affecting exposure for a WMD attack and a hazardous material accident include the physical and chemical properties of the WMD, the ambient temperature, wind speed, wind direction, barometric pressure, and humidity.

Computer models can provide general data to first responders to advise evacuations or sheltering in place. With so many variables to determine “toxic endpoints” as defined by the California Environmental Protection Agency, distances are difficult to forecast. In general, those close to transportation corridors or businesses with acutely hazardous materials are more at risk for some sort of effect. Each chemical incident will be different and the scenarios are too numerous to describe in this plan.

Hazardous materials pose a significant risk to emergency response personnel. All potential first responders and follow-on emergency personnel must be properly trained to the level of emergency response actions required of their individual position at the response scene. Hazardous materials also pose a serious long-term threat to public health and safety, property and the environment.

17.4.2 Property

The planning area is located in Alameda County, among the fastest growing counties in California, making it a higher profile target for terrorism. Additionally, the planning area’s proximity to San Francisco and Silicon Valley make it vulnerable to secondary and cascading effects of a possible terrorist threat.

17.4.3 Critical Facilities

Terrorism events can pose a serious long-term threat to damaging critical facilities. In particular, the industrial corridor along the northern and northwestern portions of the county are highly visible targets. The high-profile buildings in the planning area include the Federal Correctional Facility, the Alameda County Jail - Santa Rita, and Camp Parks, which are all in Dublin. Additionally, Lawrence Livermore National Laboratory and Sandia National Laboratory are considered high profile critical facilities within the planning area. Critical facilities are limited to City facilities, Alameda County facilities, and other government facilities, private utility infrastructure and administrative offices, and medical facilities.

Critical facilities may house hazardous materials and rail, highways, and interstates transport hazardous materials on a daily basis. The exposure of critical facilities to a terrorism event or hazardous material incident is based on the facility’s criticality and physical vulnerability:

- Criticality is a measure of the potential consequence of an accidental or terrorist event as well as the attractiveness of the facility to a potential adversary or threat. The criticality for each critical facility is based on the factors shown in Table 17-5.
- Vulnerability is a measure of the physical opportunity for an accident or an adversarial attack. This assessment takes into consideration physical design, existing countermeasures, and site layout. The vulnerability for each critical facility is based on the criteria shown in Table 17-6.

Table 17-5. Criticality Factors

Criterion	Low Criticality	Medium Criticality	High Criticality
Awareness[a]	Not known/Neighborhood	City/Region/County	State/National
Hazardous Materials[b]	None / limited and secure	Moderate to large and secure	Large, minimum or no security
Collateral Damage Potential[c]	None or low	Moderate/immediate area or within 1 mile radius	High/immediate area or within 1 mile radius
Site Population[d]	0 – 300	301 – 1,000	1,001 or greater
Public/ Emergency Function[e]	No emergency function, or could be used for emergency function in the future	Support emergency function—redundant site	Emergency function—critical service with or without redundancy

a. Awareness—How aware is the public of the existence of the facility, site, system, or location?
b. Hazardous Materials—Are flammable, explosive, biological, chemical and/or radiological materials present on site?
c. Collateral Damage Potential—What are the potential consequences for the surrounding area if the asset is attacked or damaged?
d. Site Population—What is the potential for mass causalities, based on the capacity of the facility.
e. Public or Emergency Functions—Does the facility perform a function during an emergency? Is this facility or function capable of being replicated elsewhere?

Table 17-6. Vulnerability Criteria

Criterion	Low Vulnerability	Medium Vulnerability	High Vulnerability
Accessibility[a]	Remote location, secure perimeter, tightly controlled access	Controlled access, protected or unprotected entry	Open access, unrestricted, patrolling security, sign restrictions
Automobile Proximity[b]	Not within 75’ – 100’	Not within 25’ – 50’	Adjacent or not within 10’
Asset Mobility[c]	Moves or is relocated frequently	Moves or is relocated occasionally	Permanent/Fixed
Proximity to other Critical Facilities[d]	Greater than 1.5 – 2 miles	Greater than 3/4 - 1 mile	Within 1/2 – 3/4 mile
Secure Design[e]	No areas for concealment of packages, air intakes are on roof, access ways are not under the structure.	Area of concealment present, greater than 25’ from the structure; Air intakes located at least 10’ above ground, may have under structure access drives.	Areas of concealment within 25’, air intakes at ground level, under structure access drives.

a. Accessibility—How accessible is the facility or site to the public?
b. Automobile Proximity—How close can an automobile get to the facility? How vulnerable is the facility to a car bomb attack?
c. Asset Mobility—Is the facility or asset’s location fixed or mobile? If mobile, how often is it moved, relocated, or repositioned?
d. Proximity to other critical facilities—If the facility is close to other critical facilities, then there could be an increased probability of the facility receiving collateral damage.
e. Secure design—General evaluation of areas of obstruction, air intake locations, parking lot and road design and locations and other site design aspects.

17.4.4 Environment

The risk of human-caused hazards to the environment is considerable. Hazardous materials spilled along roads or railways could easily pollute rivers, streams, wetlands, riparian areas and adjoining fields. Other hazardous materials released into the air could severely impact plant and animal species. Reducing the risk exposure to the built environment can also mitigate potential losses to the natural environment.

17.5 VULNERABILITY

17.5.1 Population

A survey found that persons with disabilities are more anxious about their personal risk from terrorism than persons without disabilities, even when equally prepared. Another study reported that persons who increased their disaster preparations in response to the possibility of terrorist attacks included African Americans, Latinos, persons with disabilities or household dependents, and non–US-born populations (NIH National Library of Medicine 2009).

Although human-caused hazards have not resulted in a large number of deaths in this area, this type of hazard can be deadly and widespread. Injuries and casualties were not estimated for this hazard. Any individuals exposed to human-caused hazards are considered to be at risk, particularly those working as first responder professionals.

17.5.2 Property

All structures in the planning area are physically vulnerable to a human-caused hazard. The emphasis on accessibility, the opportunity for roof access, driveways underneath some structures, unmonitored areas, the proximity of many structures to transportation corridors and underground pipelines, and the potential for a terrorist to strike any structure randomly all have an impact on the vulnerability of structures.

17.5.3 Critical Facilities

The U.S. Office of Homeland Security’s 2003 *National Strategy for the Physical Protection of Critical Infrastructure of Critical Infrastructure and Key Assets* lays a foundation to work together to prepare and protect critical infrastructure and key assets nationwide from terrorist events. Critical facilities entities know their vulnerabilities to terrorism. They have executed numerous preparedness plans and exercises for years and fortified their facilities to minimize their vulnerability.

The impact of a hazardous material spill or transportation incident will likely be localized to the particular facility, hospital, airport, railroad, road, or highway. The potential losses to existing development vary because of the variable nature of the hazardous material spill, but costs from product loss, property damage and decontamination and other costs can add up to millions of dollars.

17.5.4 Environment

The environment vulnerable to a human-caused hazard is the same as the environment exposed to the hazard. While human-caused disasters have caused significant damage to the environment, estimating damage can be difficult. Loss estimation platforms such as Hazus are not equipped to measure environmental impacts of these types of hazards. The best gauge of vulnerability of the environment would be a review of damage from past human-caused hazard events. Loss data for damage to the environment were not available at the time of this plan update. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

Most hazardous materials incidents are localized and are quickly contained or stabilized. Depending on the characteristic of the hazardous material or the volume of product involved, the affected area can be as small as a room in a building or as large as many square miles that require soil remediation. More widespread effects occur when a product contaminates the municipal water supply or water system such as a river, lake, or aquifer. Such environmental damage can linger for decades.

17.5.5 Economic impacts

Economic impacts from human-caused hazards could be significant. The cost of a terrorist act would be felt in terms of loss of life and property, disruption of business activity and long-term emotional impacts. Recovery would take significant resources at the local level.

Utility losses could cause a reduction in employment, wholesale and retail sales, utility repairs, and increased medical risks. The planning area may lose sales tax and property taxes, and the finances of private utility companies and the businesses that rely on them would be disrupted.

The economic impact of data and telecommunications losses can be great, as computer security breaches, crime conducted via the world wide web such as identify theft, and many more forms of human-caused economic losses occur daily. Millions of dollars are lost each year as criminals and cyberterrorists steal sensitive information and funds from individuals and organizations.

The economic impacts would be significant if a transportation facility were rendered impassable. The loss of a roadway or railway would have serious effects on the planning area's economy and ability to provide services. Loss of travel routes on Interstate 580 would result in loss of commerce, and may impact the planning area's ability to provide emergency services to its citizens by delaying response times or limiting routes for egress to critical healthcare facilities or ingress of equipment such as fire apparatus, police vehicles, and ambulances. Fuel deliveries would also be impacted. The effects of re-routed traffic could also have a serious impact on local roadways. Heavy traffic on routes through the planning area already occur at peak commute times when Interstate 580 is congested.

17.6 FUTURE TRENDS IN DEVELOPMENT

The potential for human-caused hazards is not likely to lessen or prohibit development in the planning area. The threat of human-caused hazards and the availability of Homeland Security Funds will influence future development of critical facilities.

17.7 SCENARIO

Two human-caused hazard scenarios could have a significant impact on the planning area:

- The first scenario would involve hazardous materials being transported via rail, pipeline, or highway (Interstate 580) across the planning area. The release of hazardous materials via intentional or unintentional means could impact large population centers within the planning area. Advance knowledge of these shipments and their contents would play a role in preparedness for this scenario, thus reducing its potential impact. The biggest issue in response to hazardous material is material identification and containment.
- The second scenario would be a large-scale cyber-attack on Dublin, Livermore, and Pleasanton city servers. Such an attack would require the planning area governments to revert to non-network based operations and put a strain on daily operations. If such an attack would last for an extended period of time, fiscal operations may be impacted.

17.8 ISSUES

Future actions needed at the local level to address human-caused hazards include but are not limited to the following:

- Continue all facets of emergency preparedness training for police, fire, public works, and city manager/public information staff in order to respond quickly in the event of a human-caused disaster. Enhance awareness training for all employees to recognize threats or suspicious activity in order to prevent an incident from occurring.
- Work with the private sector to enhance and create business continuity plans in the event of an emergency.
- Encourage local businesses to adopt information technology and telecommunications recovery plans.
- Prepare and present the human-caused hazard risk and preparedness program to the public through meetings, town hall gatherings, and preparedness fairs and outreach.
- Maintain any and all citizen advisory groups and periodically e-mail emergency preparedness information including human-caused hazard preparedness instructions and reminders.
- Work proactively with hazardous materials facilities to follow best management practices:
  - Placards and labeling of containers
  - Emergency plans and coordination
  - Standardized response procedures
  - Notification of the types of materials being transported through the planning area at least annually
  - Random inspections of transporters as allowed by each company
  - Installation of mitigating techniques along critical locations
  - Routine hazard communication initiatives
  - Consideration of using safer alternative products.
- Continue all facets of the hazardous materials team training and response through commitment of resources from the Fire Department budget.
- Work with the private sector to enhance and create business continuity plans in the event of an emergency.
- Coordinate with planning area school districts to ensure that their emergency preparedness plans include preparation for human-caused incidents.

18. RISK RANKING

A risk ranking was performed for the natural hazards of concern described in this plan. This risk ranking assesses the probability of each hazard's occurrence as well as its likely impact on the people, property, and economy of the planning area, using methodologies promoted by FEMA. The results are used in establishing mitigation priorities. This chapter summarizes the planning-area-wide risk ranking prepared by the planning team using aggregate results of the risk assessment. Results for individual municipalities are provided in the Volume 2 annexes for individual planning partners.

When available, estimates of risk were generated with data from Hazus or GIS using methodologies promoted by FEMA, based on the hazard profiles and exposure and vulnerability evaluations. For hazards of concern without quantitative datasets, qualitative assessments were used. As appropriate, results were adjusted based on local knowledge and other information not captured in the quantitative assessments.

The hazards of interest were not ranked for the following reasons:

- A key component of risk is probability of occurrence. It is not feasible to assign recurrence intervals for the hazards of interest, which generally lack extensive historical occurrence records.
- Federal hazard mitigation planning regulations do not require the assessment of non-natural hazards (44 CFR, 201.6). It is FEMA's position that this is a local decision.

18.1 PROBABILITY OF OCCURRENCE

The probability of occurrence of a hazard is indicated by a probability factor based on likelihood of annual occurrence:

- High—Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium—Hazard event is likely to occur within 100 years (Probability Factor =2)
- Low—Hazard event is not likely to occur within 100 years (Probability Factor =1)
- No exposure—There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is generally based on past hazard events in the area. Figure 18-1 summarizes the probability assessment for each hazard of concern for this plan. These probability factors are the same for the overall planning area and for each planning partner. The probability of future events would likely affect overall Tri-Valley planning area similarly for the four planning partners.

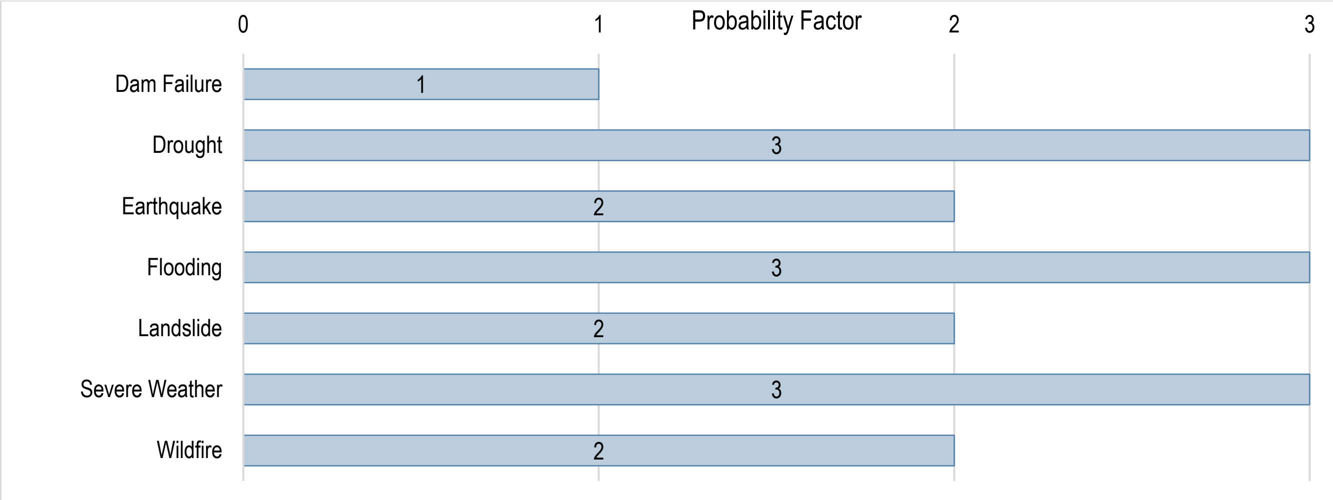

Figure 18-1. Probability Factors for Hazards of Concern

18.2 IMPACT

Hazard impacts were assessed in three categories: impacts on people, impacts on property and impacts on the local economy. Numerical impact factors were assigned as follows:

- **People**—Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:
  - High—50 percent or more of the population is exposed to a hazard (Impact Factor = 3)
  - Medium—25 percent to 49 percent of the population is exposed to a hazard (Impact Factor = 2)
  - Low—25 percent or less of the population is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the population is exposed to a hazard (Impact Factor = 0)
- **Property**—Values were assigned based on the percentage of the total ***property value exposed*** to the hazard event:
  - High—30 percent or more of the total assessed property value is exposed to a hazard (Impact Factor = 3)
  - Medium—15 percent to 29 percent of the total assessed property value is exposed to a hazard (Impact Factor = 2)
  - Low—14 percent or less of the total assessed property value is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the total assessed property value is exposed to a hazard (Impact Factor = 0)
- **Economy**—Values were assigned based on the percentage of the total ***property value vulnerable*** to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total assessed value of the property exposed to the hazard. For some hazards, such as wildfire, landslide and severe weather, vulnerability was considered to be the same as exposure due to the lack of loss estimation tools specific to those hazards. Loss estimates separate from the exposure estimates were generated for the earthquake and flood hazards using Hazus.

- High—Estimated loss from the hazard is 20 percent or more of the total exposed property value (Impact Factor = 3)
- Medium—Estimated loss from the hazard is 10 percent to 19 percent of the total exposed property value (Impact Factor = 2)
- Low—Estimated loss from the hazard is 9 percent or less of the total exposed property value (Impact Factor = 1)
- No impact—No loss is estimated from the hazard (Impact Factor = 0)

The impacts of each hazard category were assigned a weighting factor to reflect the significance of the impact. These weighting factors are consistent with those typically used for measuring the benefits of hazard mitigation actions: impact on people was given a weighting factor of 3; impact on property was given a weighting factor of 2; and impact on the economy was given a weighting factor of 1. Figure 18-2 and Figure 18-3 summarize the unweighted and weighted impact factors for each hazard.

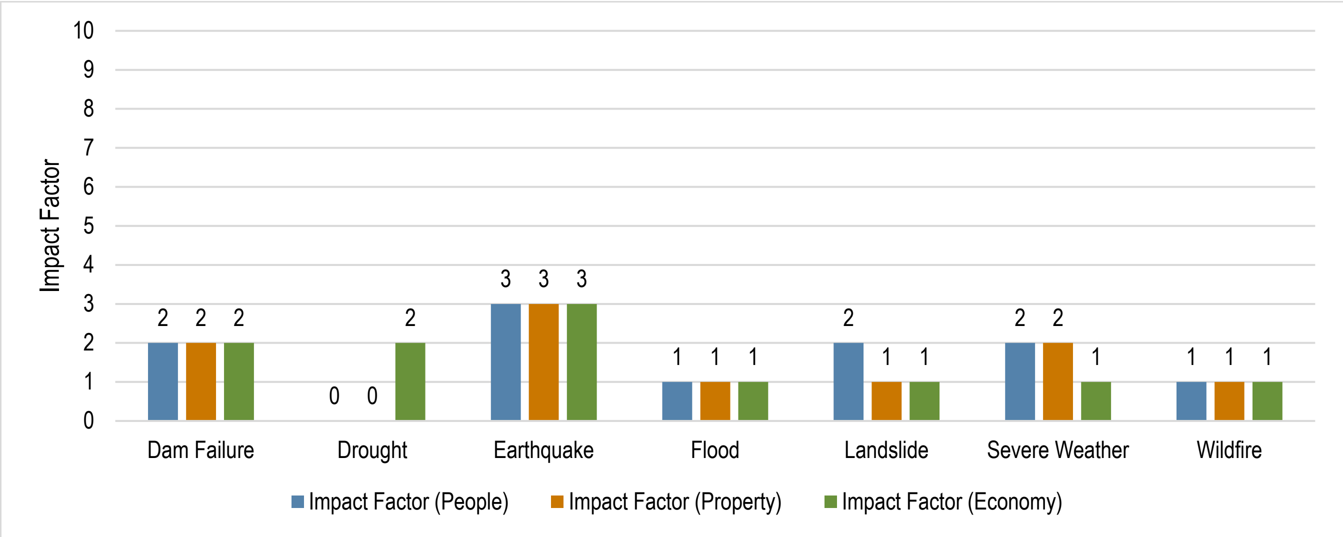

Figure 18-2. Impact Factors for Hazards of Concern

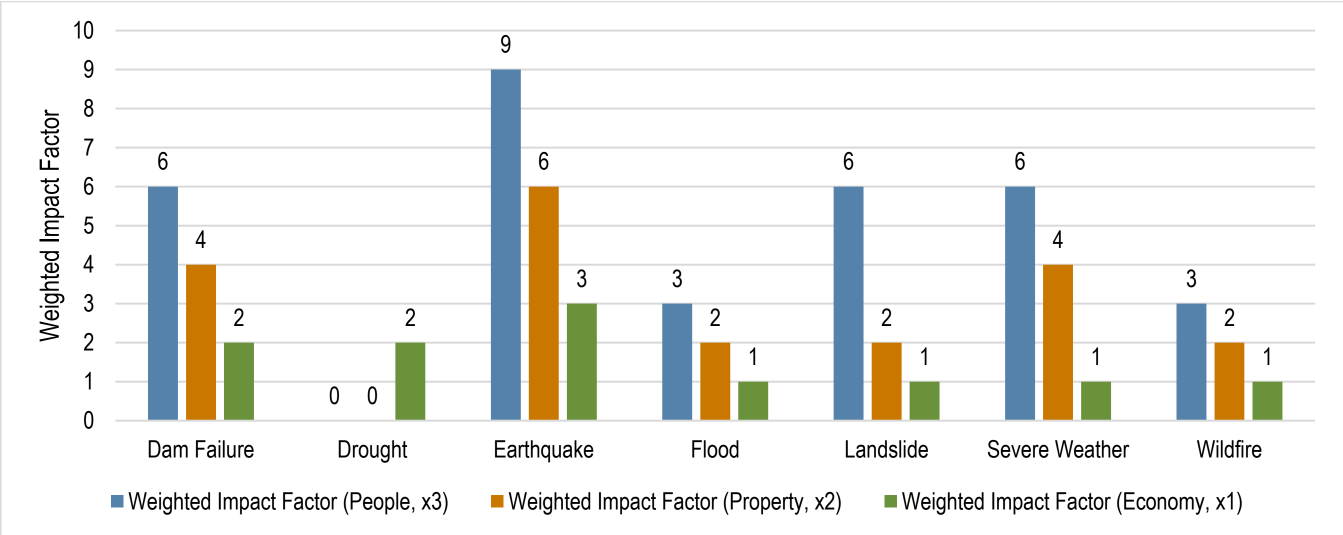

Figure 18-3. Weighted Impact Factors for Hazards of Concern

18.3 RISK RATING AND RANKING

The risk rating for each hazard was determined by multiplying the probability factor by the sum of the weighted impact factors for people, property, and operations, as summarized in Figure 18-4.

Based on these ratings, a priority of high, medium, or low was assigned to each hazard. The hazards ranked as being of highest concern are dam failure, landslide, and earthquake. Hazards ranked as being of medium concern are flood, severe storms, severe weather, and wildfire. The hazards ranked as being of lowest concern are drought, sea-level rise/coastal erosion, and tsunami. Figure 18-5 shows the hazard risk ranking.

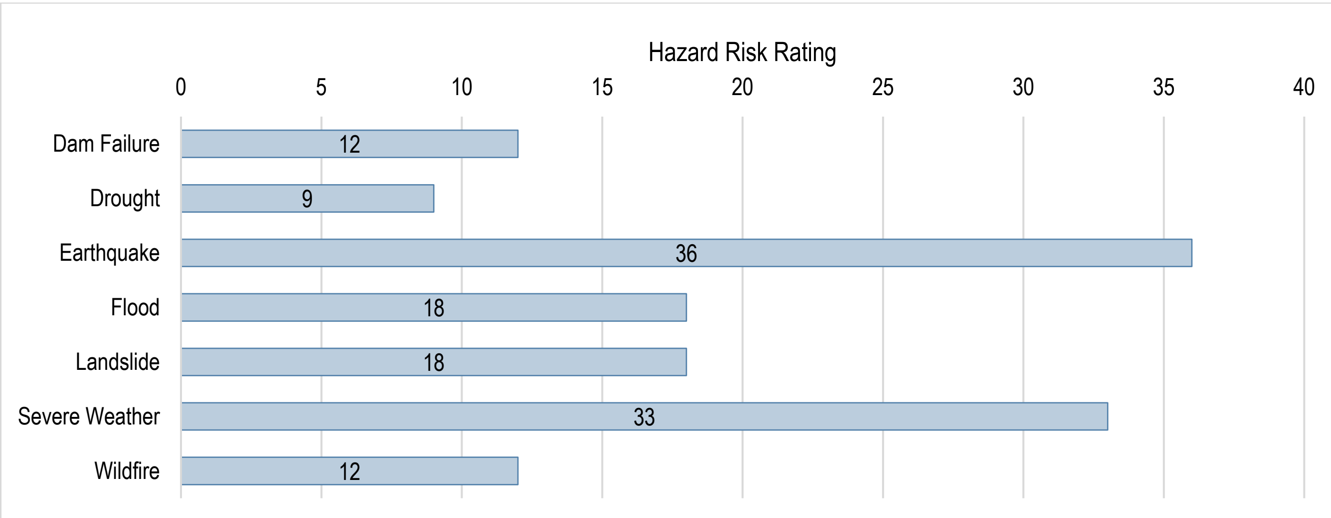

Figure 18-4. Total Risk Rating for Hazards of Concern

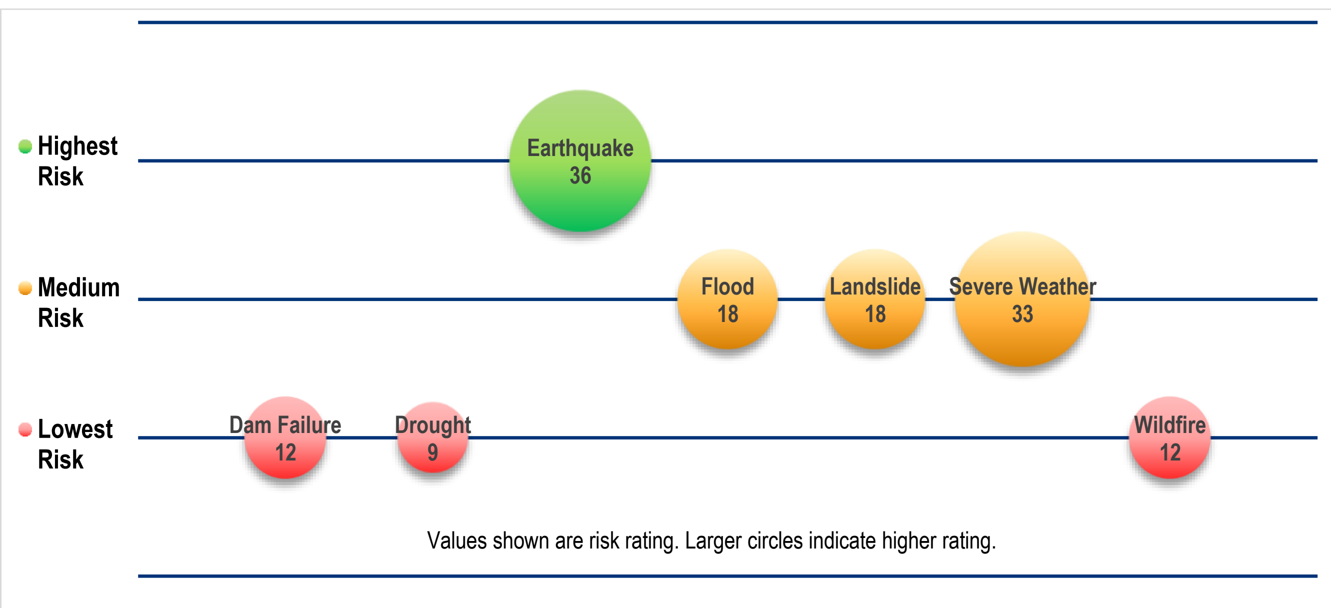

Figure 18-5. Hazard Risk Ranking

EXHIBIT A

Tri-Valley Local Hazard Mitigation Plan

PART 3—MITIGATION STRATEGY

19. GOALS AND OBJECTIVES

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The Steering Committee established a guiding principle, a set of goals and measurable objectives for this plan, based on data from the preliminary risk assessment and the results of the public involvement strategy. The guiding principle, goals, objectives and actions in this plan all support each other. Goals were selected to support the guiding principle. Objectives were selected that met multiple goals. Actions were prioritized based on the action meeting multiple objectives.

19.1 MISSION STATEMENT

A mission statement focuses the range of objectives and actions to be considered. This is not a goal because it does not describe a hazard mitigation outcome. The Steering Committee selected the following mitigation statement for the 2023 planning effort:

> "Through community partnerships, establish a plan to reduce the vulnerability to hazards in order to protect the health, safety, welfare, environment and economy of the planning area."

19.2 GOALS

The following are the nine mitigation goals for this plan:

1. Ensure that hazards are identified and considered in land use decisions.
2. Improve local emergency management capability.
3. Promote community awareness, understanding, and interest in hazard mitigation policies and programs.
4. Incorporate hazard mitigation as an integrated public policy and standard practice.
5. Reduce community exposure and vulnerability to hazards where the greatest risk exists.
6. Increase resilience of infrastructure and critical facilities.
7. Promote an adaptive and resilient planning area that responds proactively to future conditions.
8. Develop and implement mitigation strategies that identify the best alternative to protect natural resources, promote equity, and use public funds in an efficient and cost effective manner.
9. Prioritize and direct resources to increase disaster resiliency among historically underserved populations, for individuals with access and functional needs, and in communities disproportionately impacted by disasters.

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

19.3 OBJECTIVES

Each selected objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows:

1. Develop and provide updated information to improve the understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety health, property and the environment.
2. Use local general plan, zoning, and subdivision requirements to help establish resilient and sustainable communities.
3. Increase public participation in systems that provide warning and emergency communications.
4. Encourage the retrofit of vulnerable structures in the planning area.
5. Consider programs that incentivize risk reduction.
6. Reduce repetitive property losses due to hazards by updating land use, design, and construction policies.
7. Continually build linkages and promote dialog about emergency management within the public and private sectors.
8. Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of hazards.
9. Inform the public, including underrepresented and marginalized community groups, on the risk of exposure to hazards and ways to increase the public’s capability to prepare for, respond to, recover from, and mitigate the impacts of these events.
10. Identify projects that simultaneously reduce risk while increasing planning area resilience and sustainability.
11. Where feasible and cost-effective, research, develop, and promote adoption of building and development laws, regulations, and ordinances exceeding the minimum levels needed for life safety.
12. Encourage hazard mitigation measures that promote and enhance natural processes, minimize adverse impacts on the ecosystem, and promote social equity.

20. MITIGATION BEST PRACTICES AND ADAPTIVE CAPACITY

20.1 MITIGATION BEST PRACTICES

Catalogs of hazard mitigation alternatives were developed that present a broad range of alternatives to be considered for use in the planning area, in compliance with 44 CFR (Section 201.6(c)(3)(ii)). One catalog was developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized in two ways:

- By who would have responsibility for implementation:
  - Individuals (personal scale)
  - Businesses (corporate scale)
  - Government (government scale).
- By what the alternative would do:
  - Manipulate the hazard
  - Reduce exposure to the hazard
  - Reduce vulnerability to the hazard
  - Build local capacity to respond to or prepare for the hazard.

Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the planning partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalog was to provide a list of what could be considered to reduce risk of the flood hazard within the planning area. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible.
- The action is already being implemented.
- There is an apparently more cost-effective alternative.
- The action does not have public or political support.

The catalogs for each hazard are presented in Table 20-1 through Table 20-7.

Table 20-1. Alternatives to Mitigate the Dam Failure Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Relocate out of dam failure inundation areas. • **Reduce vulnerability:** ❖ Elevate home to appropriate levels. • **Build local capacity:** ❖ Learn about risk reduction for the dam failure hazard. ❖ Learn the evacuation routes for a dam failure event. ❖ Educate yourself on early warning systems and the dissemination of warnings.	• **Manipulate the hazard:** ❖ Remove dams. ❖ Harden dams. • **Reduce exposure:** ❖ Replace earthen dams with hardened structures. • **Reduce vulnerability:** ❖ Flood-proof facilities within dam failure inundation areas. • **Build local capacity:** ❖ Educate employees on the probable impacts of a dam failure. ❖ Develop a continuity of operations plan.	• **Manipulate the hazard:** ❖ Remove dams. ❖ Harden dams. • **Reduce exposure:** ❖ Replace earthen dams with hardened structures ❖ Relocate critical facilities out of dam failure inundation areas. ❖ Consider open space land use in designated dam failure inundation areas. • **Reduce vulnerability:** ❖ Adopt higher regulatory floodplain standards in mapped dam failure inundation areas. ❖ Retrofit critical facilities within dam failure inundation areas. • **Build local capacity:** ❖ Map dam failure inundation areas. ❖ Enhance emergency operations plan to include a dam failure component. ❖ Institute monthly communications checks with dam operators. ❖ Inform the public on risk reduction techniques ❖ Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas. ❖ Consider the probable impacts of climate in assessing the risk associated with the dam failure hazard. ❖ Establish early warning capability downstream of listed high hazard dams. ❖ Consider the residual risk associated with protection provided by dams in future land use decisions. ❖ Develop comprehensive planning policies that encourage wise land use in hazard prone areas. ❖ Develop a post-disaster recovery plan that addresses the dam failure hazard. ❖ Develop a debris management plan.

Table 20-2. Alternatives to Mitigate the Drought Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Drought-resistant landscapes ❖ Reduce water system losses ❖ Modify plumbing systems (through water saving kits) ❖ For homes with on-site water systems: increase storage, utilize rainwater catchment • **Build local capacity:** ❖ Practice active water conservation	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Drought-resistant landscapes ❖ Reduce private water system losses ❖ Support alternative irrigation techniques to reduce water use and encourage use of climate-sensitive water supplies ❖ For businesses with on-site water systems: increase storage, utilize rainwater catchment • **Build local capacity:** ❖ Practice active water conservation	• **Manipulate the hazard:** ❖ Groundwater recharge through stormwater management ❖ Develop a water recycling program • **Reduce exposure:** ❖ Identify and create groundwater backup sources • **Reduce vulnerability:** ❖ Reduce water system losses ❖ Distribute water saving kits ❖ Increase use of recycled water ❖ Diversify water supply diversion points ❖ Develop recycled water projects • **Build local capacity:** ❖ Public education on drought resistance ❖ Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers ❖ Implement drought contingency plan ❖ Develop criteria "triggers" for drought-related actions ❖ Improve accuracy of water supply forecasts ❖ Prioritize groundwater projects for competitive funding ❖ Develop a post-disaster recovery plan that addresses the drought hazard ❖ Modify rate structure to influence active water conservation techniques ❖ Consider the probable impacts of climate change on the risk associated with the drought hazard

Table 20-3. Alternatives to Mitigate the Earthquake Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate outside of hazard area (off soft soils) • **Reduce vulnerability:** ❖ Retrofit structure (anchor house structure to foundation) ❖ Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) ❖ Build to higher design • **Build local capacity:** ❖ Practice "drop, cover, and hold" ❖ Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event ❖ Keep cash reserves for reconstruction ❖ Become informed on the hazard and risk reduction alternatives available. ❖ Develop a post-disaster action plan for your household	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate or relocate mission-critical functions outside hazard area where possible • **Reduce vulnerability:** ❖ Build redundancy for critical functions and facilities ❖ Retrofit critical buildings and areas housing mission-critical functions • **Build local capacity:** ❖ Adopt higher standard for new construction; consider "performance-based design" when building new structures ❖ Keep cash reserves for reconstruction ❖ Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility. ❖ Develop a continuity of operations plan	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ Locate critical facilities or functions outside hazard area where possible • **Reduce vulnerability:** ❖ Harden infrastructure ❖ Provide redundancy for critical functions ❖ Adopt higher regulatory standards ❖ Identify projects that limit transportation downtime • **Build local capacity:** ❖ Enhance hazard mapping based on data and science ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (e.g., tax incentives, information) ❖ Include retrofitting and replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components such as pipe, power line, and road repair materials ❖ Develop and adopt a continuity of operations plan ❖ Initiate triggers guiding improvements (such as <50% substantial damage or improvements) ❖ Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. ❖ Develop a post-disaster action plan that includes grant funding and debris removal components. ❖ Identify food security strategies, including distribution priorities ❖ Develop comprehensive planning policies that encourage wise land use in hazard prone areas. ❖ Develop a post-disaster recovery plan that addresses the earthquake hazard. ❖ Develop a debris management plan.

Table 20-4. Alternatives to Mitigate the Flood Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Clear storm drains and culverts ❖ Use low-impact development techniques • **Reduce exposure:** ❖ Locate outside of hazard area ❖ Elevate utilities above base flood elevation ❖ Use low-impact development techniques • **Reduce vulnerability:** ❖ Raise structures above base flood elevation ❖ Elevate items within house above base flood elevation ❖ Build new homes above base flood elevation ❖ Flood-proof structures • **Build local capacity:** ❖ Buy flood insurance ❖ Develop household plan, such as retrofit savings, communication with outside, 72-hour self-sufficiency during and after an event	• **Manipulate the hazard:** ❖ Clear storm drains and culverts ❖ Use low-impact development techniques • **Reduce exposure:** ❖ Locate critical facilities or functions outside hazard area ❖ Use low-impact development techniques • **Reduce vulnerability:** ❖ Build redundancy for critical functions or retrofit critical buildings ❖ Provide flood-proofing when new critical infrastructure must be located in floodplains • **Build local capacity:** ❖ Keep cash reserves for reconstruction ❖ Support and implement hazard disclosure for sale of property in risk zones. ❖ Solicit cost-sharing through partnerships with others on projects with multiple benefits.	• **Manipulate the hazard:** ❖ Maintain drainage system ❖ Institute low-impact development techniques on property ❖ Dredging, levee construction, and providing regional retention areas ❖ Structural flood control, levees, channelization, or revetments. ❖ Stormwater management regulations and master planning ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff • **Reduce exposure:** ❖ Locate or relocate critical facilities outside of hazard area ❖ Acquire or relocate identified repetitive loss properties ❖ Promote open space uses in high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. ❖ Adopt land development criteria such as planned unit developments, density transfers, clustering ❖ Institute low impact development techniques on property ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff ❖ Restore existing flood control and riparian corridors • **Reduce vulnerability:** ❖ Harden infrastructure, bridge replacement program ❖ Provide redundancy for critical functions and infrastructure ❖ Adopt higher regulatory standards. ❖ Stormwater management regulations and master planning. ❖ Adopt "no-adverse impact" floodplain management policies that strive to not increase the flood risk on downstream communities. ❖ Preserve natural spaces that serve as buffers against flood • **Build local capacity:** ❖ Enhance hazard mapping based on data and science ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) ❖ Incorporate retrofitting or replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Consider participation in the Community Rating System ❖ Maintain and collect data to define risks and vulnerability ❖ Train emergency responders ❖ Create an elevation inventory of structures in the floodplain ❖ Develop and implement a public information strategy ❖ Charge a hazard mitigation fee ❖ Integrate floodplain management policies into other planning mechanisms within the planning area. ❖ Consider the probable impacts of climate change on the flood hazard ❖ Consider the residual risk associated with structural flood control in future land use decisions ❖ National Flood Insurance Program compliance ❖ Adopt a Stormwater Management Master Plan ❖ Comprehensive planning policies-Wise land use in hazard prone areas ❖ Develop a post-disaster recovery plan that addresses the flood hazard ❖ Develop a debris management plan

Table 20-5. Alternatives to Mitigate the Landslide Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope ❖ Minimize vegetation removal and the addition of impervious surfaces. • **Reduce exposure:** ❖ Locate structures outside of hazard area (off unstable land and away from slide-run out area) • **Reduce vulnerability:** ❖ Retrofit home • **Build local capacity:** ❖ Institute warning system, and develop evacuation plan ❖ Keep cash reserves for reconstruction ❖ Educate yourself on risk reduction techniques for landslide hazards	• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope • **Reduce exposure:** ❖ Locate structures outside of hazard area (off unstable land and away from slide-run out area) • **Reduce vulnerability:** ❖ Retrofit at-risk facilities • **Build local capacity:** ❖ Institute warning system, and develop evacuation plan ❖ Keep cash reserves for reconstruction ❖ Develop a continuity of operations plan ❖ Educate employees on the potential exposure to landslide hazards and emergency response protocol.	• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope • **Reduce exposure:** ❖ Acquire properties in high-risk landslide areas. ❖ Adopt land use policies that prohibit the placement of habitable structures in high-risk landslide areas. • **Reduce vulnerability:** ❖ Adopt higher regulatory standards for new development within unstable slope areas. ❖ Armor/retrofit critical infrastructure against the impact of landslides. • **Build local capacity:** ❖ Enhance hazard mapping based on data and science ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas: better land controls, tax incentives, information ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Educate the public on the landslide hazard and appropriate risk reduction alternatives. ❖ Develop comprehensive planning policies that encourage wise land use in hazard prone areas. ❖ Develop a post-disaster recovery plan that addresses the landslide hazard. ❖ Develop a debris management plan.

Table 20-6. Alternatives to Mitigate the Severe Weather Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Insulate house ❖ Provide redundant heat and power ❖ Insulate structure ❖ Plant appropriate trees near home and power lines ("Right tree, right place" National Arbor Day Foundation Program) • **Build local capacity:** ❖ Trim or remove trees that could affect power lines ❖ Promote 72-hour self-sufficiency ❖ Obtain a NOAA weather radio. ❖ Obtain an emergency generator.	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Relocate critical infrastructure (such as power lines) underground ❖ Reinforce or relocate critical infrastructure such as power lines to meet performance expectations ❖ Install tree wire • **Build local capacity:** ❖ Trim or remove trees that could affect power lines ❖ Create redundancy ❖ Equip facilities with a NOAA weather radio ❖ Equip vital facilities with emergency power sources. ❖ Prioritize utility recovery based on safety and critical infrastructure needs	• **Manipulate the hazard:** ❖ None • **Reduce exposure:** ❖ None • **Reduce vulnerability:** ❖ Harden infrastructure such as locating utilities underground ❖ Trim trees back from power lines ❖ Designate snow routes and strengthen critical road sections and bridges • **Build local capacity:** ❖ Enhance hazard mapping based on data and science ❖ Support programs such as "Tree Watch" that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. ❖ Establish and enforce building codes that require all roofs to withstand snow loads ❖ Increase communication alternatives ❖ Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. ❖ Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines ❖ Provide NOAA weather radios to the public ❖ Develop a post-disaster recovery plan that addresses the severe weather hazards ❖ Develop a debris management plan

Table 20-7. Alternatives to Mitigate the Wildfire Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry overgrown underbrush and diseased trees • **Reduce exposure:** ❖ Create and maintain defensible space around structures ❖ Locate outside of hazard area ❖ Mow regularly • **Reduce vulnerability:** ❖ Create and maintain defensible space around structures and provide water on site ❖ Use fire-retardant building materials ❖ Create defensible spaces around home • **Build local capacity:** ❖ Employ techniques from the National Fire Protection Association's Firewise Communities program to safeguard home ❖ Identify alternative water supplies for fire fighting ❖ Install/replace roofing material with non-combustible roofing materials.	• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry underbrush and diseased trees • **Reduce exposure:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area • **Reduce vulnerability:** ❖ Create and maintain defensible space around structures and infrastructure and provide water on site ❖ Use fire-retardant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. • **Build local capacity:** ❖ Support Firewise community initiatives. ❖ Create /establish stored water supplies to be utilized for firefighting.	• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry underbrush and diseased trees ❖ Implement best management practices on public lands. • **Reduce exposure:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area ❖ Enhance building code to include use of fire resistant materials in high hazard area. • **Reduce vulnerability:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Use fire-retardant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. ❖ Consider higher regulatory standards (such as Class A roofing) ❖ Establish biomass reclamation initiatives • **Build local capacity:** ❖ Enhance hazard mapping based on data and science ❖ More public outreach and education efforts, including an active Firewise program ❖ Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas ❖ Identify fire response and alternative evacuation routes ❖ Seek alternative water supplies ❖ Become a Firewise community ❖ Use academia to study impacts/solutions to wildfire risk ❖ Establish/maintain mutual aid agreements between fire service agencies. ❖ Create/implement fire plans ❖ Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions ❖ Develop comprehensive planning policies that encourage wise land use in hazard prone areas. ❖ Develop a post-disaster recovery plan that addresses the wildfire hazard. ❖ Develop a debris management plan.

20.2 ADAPTIVE CAPACITY

Adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC, 2014b). This term is typically used while discussing climate change adaptation; however, it is similar to the alternatives presented in the tables for building local capacity. In addition to hazard-specific capacity building, the following list provides general alternatives that planning partners considered to build capacity for adapting to both current and future risks (California Emergency Management Agency 2012):

- Incorporate climate change adaptation into relevant local and regional plans and projects.
- Establish a climate change adaptation and hazard mitigation public outreach and education program.
- Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation and mitigation strategy development and regional approaches.
- Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness.
- Increase participation of low-income, immigrant, non-English-speaking, racially and ethnically diverse, and special-needs residents in planning and implementation.
- Ask local employers and business associations to participate in local efforts to address climate change and natural hazard risk reduction.
- Conduct a communitywide assessment and develop a program to address health, socioeconomic, and equity vulnerabilities.
- Focus planning and intervention programs on neighborhoods that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts.
- Use performance metrics and data to evaluate and monitor the impacts of climate change and natural hazard risk reduction strategies on public health and social equity.
- Develop coordinated plans for mitigating future flood, landslide, and related impacts through concurrent adoption of updated general plan safety elements and local hazard mitigation plans.
- Implement general plan safety elements through zoning and subdivision practices that restrict development in floodplains, landslide, and other natural hazard areas.
- Identify and protect locations where native species may shift or lose habitat due to climate change impacts (sea level rise, loss of wetlands, warmer temperatures, and drought).
- Collaborate with agencies managing public lands to identify, develop, or maintain corridors and linkages between undeveloped areas.
- Promote economic diversity.
- Incorporate consideration of climate change impacts as part of infrastructure planning and operations.
- Conduct a climate impact assessment on community infrastructure.
- Identify gaps in legal and regulatory capabilities and develop ordinances or guidelines to address those gaps.
- Identify and pursue new sources of funding for mitigation and adaptation activities.
- Hire new staff or provide training to current staff to ensure an adequate level of administrative and technical capability to pursue mitigation and adaptation activities.

21. PLAN ADOPTION AND MAINTENANCE

21.1 PLAN ADOPTION

A hazard mitigation plan must document that it has been formally adopted by the governing bodies of the jurisdictions requesting federal approval of the plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, each jurisdiction requesting approval must document that it has been formally adopted. DMA compliance and its benefits cannot be achieved until the plan is adopted. This plan was submitted for a pre-adoption review to Cal OES and FEMA Region 9 prior to adoption. Once pre-adoption approval was provided, all planning partners formally adopted the plan. Copies of the resolutions adopting this plan for all planning partners can be found in Appendix D of this volume.

21.2 PLAN MAINTENANCE STRATEGY

Plan maintenance is the formal process for achieving the following:

- Ensuring that the hazard mitigation plan remains an active and relevant document and that the planning partnership maintains its eligibility for applicable funding sources
- Monitoring and evaluating the plan annually and producing an updated plan every five years
- Continuing public participation throughout the plan maintenance and implementation process
- Incorporating the mitigation strategies outlined in this plan into existing planning mechanisms and programs, such as any relevant comprehensive land-use planning process, capital improvement planning process, and building code enforcement and implementation.

A steering committee will be maintained to participate in the plan maintenance strategy, which is summarized in Table 21-1. The sections below further describe each element. Livermore Senior Planner Jake Potter is tasked with overseeing the overall plan maintenance, evaluation, monitoring, and updating. He will oversee scheduling regular meetings to review planning strategies, review action items and their status, develop any reports, and coordinate related activities to ensure active use of this plan. Mr. Potter will assemble a hazard mitigation plan review team that consists of at least one representative from the planning partners not less than once a year during the life of the plan in order to evaluate and monitor its progress, address any updates, and make necessary and appropriate changes to the plan.

Table 21-1. Plan Maintenance Matrix

Approach	Timeline	Lead Responsibility[a]	Support Responsibility
Monitoring			
Preparation of status updates and action implementation tracking as part of submission for midterm progress report.	2-1/2 years after the adoption and final approval of the plan by FEMA. Actual reporting period TBD	Dublin: City Manager Livermore: City Manager Pleasanton: City Manager Dublin San Ramon Services District: General Manager	Jurisdictional points of contact identified in Volume 2 annexes
Evaluation			
Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile the midterm progress report; assess appropriate action for preparing the next hazard mitigation plan update.	2-1/2 years after final plan approval by FEMA, or upon comprehensive update to General Plan or major disaster	City of Dublin City of Livermore City of Pleasanton Dublin/San Ramon Services District	Jurisdictional points of contacts identified in Volume 2 annexes
Update [b]			
The Tri-Valley partnership will reconvene the planning partners, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon comprehensive update to General Plan or major disaster	The governing body for all planning partners covered by this plan	Jurisdictional point of contacts identified in Volume 2 annexes
Grant Monitoring and Coordination			
As grant opportunities present themselves, the Tri-Valley planning partners will consider options to pursue grants to fund actions identified in this plan	As grants become available	Alameda County Emergency Managers Association provides a regional platform for grant notification and coordination	Jurisdictional point of contacts identified in Volume 2 annexes
Continuing Public Involvement			
The principle means for providing the public access to the implementation of this plan will be the Tri-Valley hazard mitigation plan website: https://www.tri-valley-hmp.com/	Annually	Planning Partners	All planning partners will provide a link to website on their jurisdictional websites. Information will be available at city halls and the DSRSD main office. Update information will be sent via social media and distributed to community groups, including ones that include socially vulnerable populations
Plan Integration			
Integrate relevant information from the hazard mitigation plan into other plans and programs where viable and opportunities arise	Ongoing	The governing body for all planning partners covered by this plan	Jurisdictional point of contacts identified in Volume 2 annexes

a. Responsible lead party may designate an alternate

b. The approach to the plan update process may change based on partnership decisions made during the evaluation phase and the preparation of the midterm progress report.

21.2.1 Plan Monitoring

The planning team and the Steering Committee have established goals and objectives and have prioritized mitigation actions that will be implemented through existing plans, policies, and programs. The planning partners will have individual responsibility for overseeing and monitoring the plan implementation, with primary responsibility identified in each jurisdictional annex plans (see Volume 2) and summarized in Table 21-1. At a minimum, the planning partners will track and report the status of the jurisdiction-specific hazard mitigation actions for inclusion into a midterm progress report.

21.2.2 Plan Evaluation

Plan evaluation will be achieved through the assessment of the status of actions as submitted by planning partners for the development of a midterm progress report. Each planning partner will evaluate the progress of its individual action plan at the midterm of the period between the completion of this plan and the next update. This progress report should be completed within two and a half years of plan approval, or upon initiation of an accelerated plan update as described under Section 21.2.3, whichever occurs first. The review will include the following:

- Summary of any hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of continuing public involvement
- Brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or actions that involve hazard mitigation.

The Steering Committee has created a template to guide the planning partners in preparing a progress report (see Appendix E). The progress report template may be used as a tool for annual progress reporting at the discretion of the planning partners and based on available jurisdictional resources. The completed report should be distributed as follows:

- Posted on the hazard mitigation website dedicated to the hazard mitigation plan
- Provided to the local media through a press release
- Presented to planning partner governing bodies to inform them of the progress of actions implemented during the reporting period.

Progress reporting is not a federal requirement. However, it may enhance the planning partnership's opportunities for funding. While failure to implement this component of the plan maintenance strategy will not jeopardize a planning partner's compliance under the DMA, it may jeopardize its opportunity to partner and leverage funding opportunities with other partners. Upon completion, the mid-term progress report will be posted to the hazard mitigation website, which will invite the public to provide comment on its content.

21.2.3 Plan Update

Local hazard mitigation plans must be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the DMA (44 CFR, Section 201.6(d)(3)). The planning partners intend to update the hazard mitigation plan on a five-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than five years based on the following triggers:

- A presidential disaster declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of a planning partner's general plan.

The update will, at a minimum, include the following elements:

- The update process will be convened through a steering committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plans will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms (such as the comprehensive plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- Planning partner governing bodies will adopt the updated plan.

When developing the midterm progress report, jurisdictional partners will evaluate the appropriate course of action for a plan update. The progress report will recommend a process for updating the plan based on available resources, regional initiatives, and overall timing. Options for updating this plan include the following:

- Development of an updated multi-jurisdictional plan similar to the current plan
- Development of single jurisdictional plans
- Participation in development of an operational-area initiative led by Alameda County.

21.2.4 Grant Monitoring and Coordination

The Alameda County Emergency Managers Association provides an opportunity to maintain awareness of current and future grant opportunities. Currently, Dublin, Livermore, Pleasanton and Dublin/San Ramon Services District participate in this association through the Alameda County Fire Department's contracted emergency management services. All planning partners have agreed to continue to coordinate with each other as grant opportunities arise.

21.2.5 Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the hazard mitigation website and by distribution of the midterm progress report to the media. The website will house the final plan and become the central source of information about the plan, the partnership and plan implementation and the platform for the public to provide comment on plan directives and initiatives. The website will also house the mid-term progress report as discussed in Section 21.2.1 and will be set up so that the public can provide comment on the report's content and conclusions. All planning partners have agreed to provide links to the website on their individual websites. The City of Livermore has agreed to maintain the hazard mitigation plan website. Copies of the plan will be distributed to local libraries. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new steering committee. This strategy will be based on the needs and capabilities of the Planning Partnership at the time of the update.

The public outreach strategy used during development of the current update, as described in Section 3.8.1, provides a framework for public engagement through the planning process. It can be adapted for continued public outreach through the plan performance period. Information, updates, and opportunities for public involvement, including outreach to socially vulnerable communities, may be distributed via social media to community groups and organizations and made available at government offices and other venues.

Throughout the performance period, each planning partner will maintain regular public outreach through social media. Posts will include information about progress on specific mitigation actions underway or complete, hazard events that have occurred since the plan's adoption, upcoming and recent meetings of the plan maintenance steering committee, and upcoming dates related to progress reports or the next plan update. The StoryMap that was created as part of this plan's development will be maintained and updated, with each planning partner providing pertinent content for the updates. Hazard-related presentations will be given to elected officials and to schools and community groups. Partners will continue to assess public understanding of hazards and mitigation through questionnaires and surveys. Outreach materials will emphasize photos, quotes, and other elements most likely to engage a wide range of the public.

21.2.6 Integration with Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The comprehensive plans of the planning partners are considered to be integral parts of this plan. The planning partners, through adoption of comprehensive plans and zoning ordinances, have planned for the impact of natural hazards. The plan development process provided them with the opportunity to review and expand on policies contained within these planning mechanisms. The planning partners used their comprehensive plans and the hazard mitigation plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of the planning area. An update to a comprehensive plan may trigger an update to the hazard mitigation plan.

All municipal planning partners committed to linking the hazard mitigation plan to their comprehensive plans by identifying a mitigation action as such and giving that action a high priority. Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Master fire protection plans.

Specific activities identified for incorporating mitigation into other planning mechanisms can be found in each jurisdictional annex located in Volume 2 of this hazard mitigation plan. Some action items in this plan can be implemented through creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

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EXHIBIT A

Tri-Valley Local Hazard Mitigation Plan

Appendix A. Hazard Mitigation Survey Results

A. HAZARD MITIGATION SURVEY RESULTS

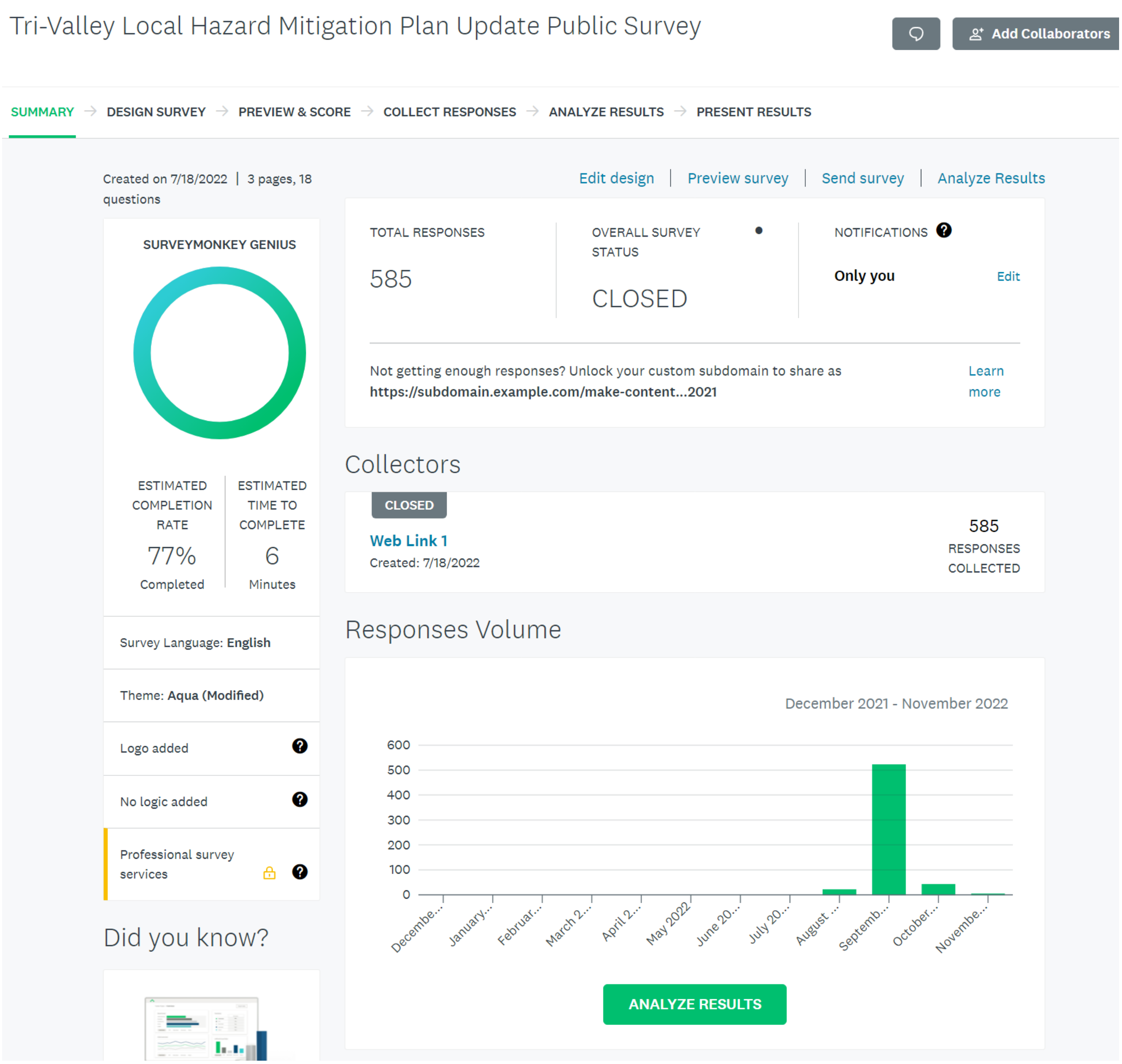
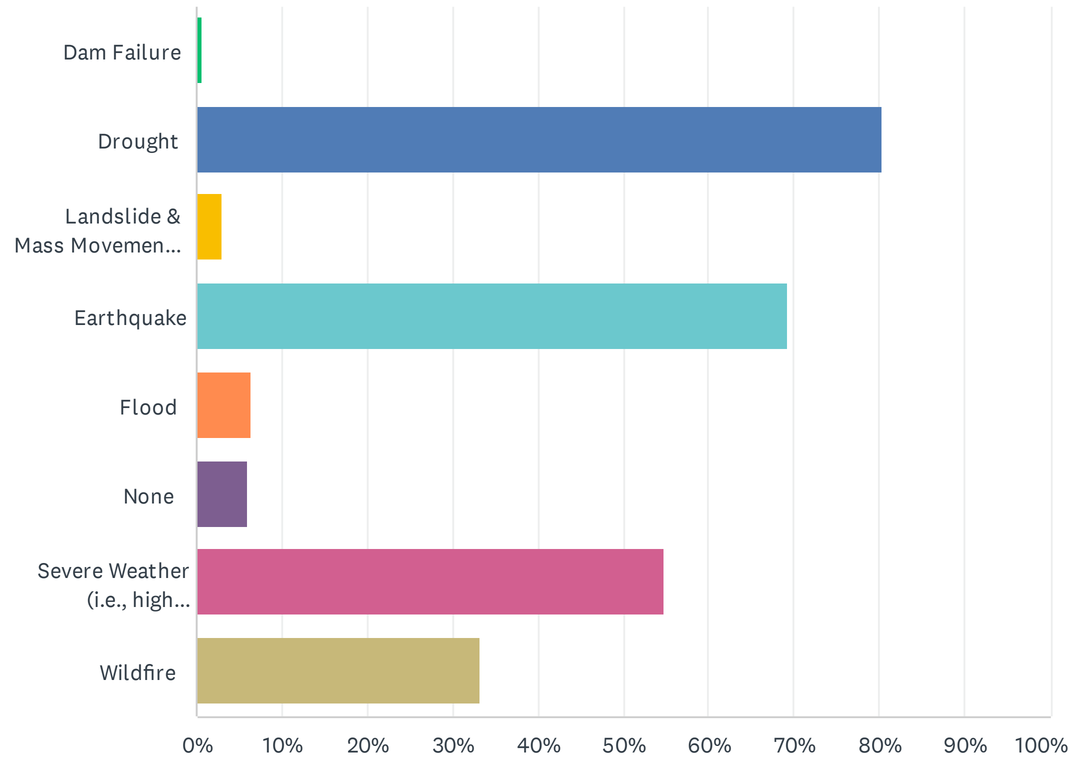


EXHIBIT A

Q1 Which of the following natural hazards have you experienced in the Tri-Valley planning area? (Check all that apply)

Answered: 577 Skipped: 8



ANSWER CHOICES	RESPONSES	
Dam Failure	0.69%	4
Drought	80.42%	464
Landslide & Mass Movements (geologic hazards)	2.95%	17
Earthquake	69.32%	400
Flood	6.41%	37
None	6.07%	35
Severe Weather (i.e., high wind, heavy rain, lightning)	54.77%	316
Wildfire	33.28%	192
Total Respondents: 577		

EXHIBIT A

Q2 How concerned are you about the following natural hazards in the Tri-Valley area?

Answered: 580 Skipped: 5

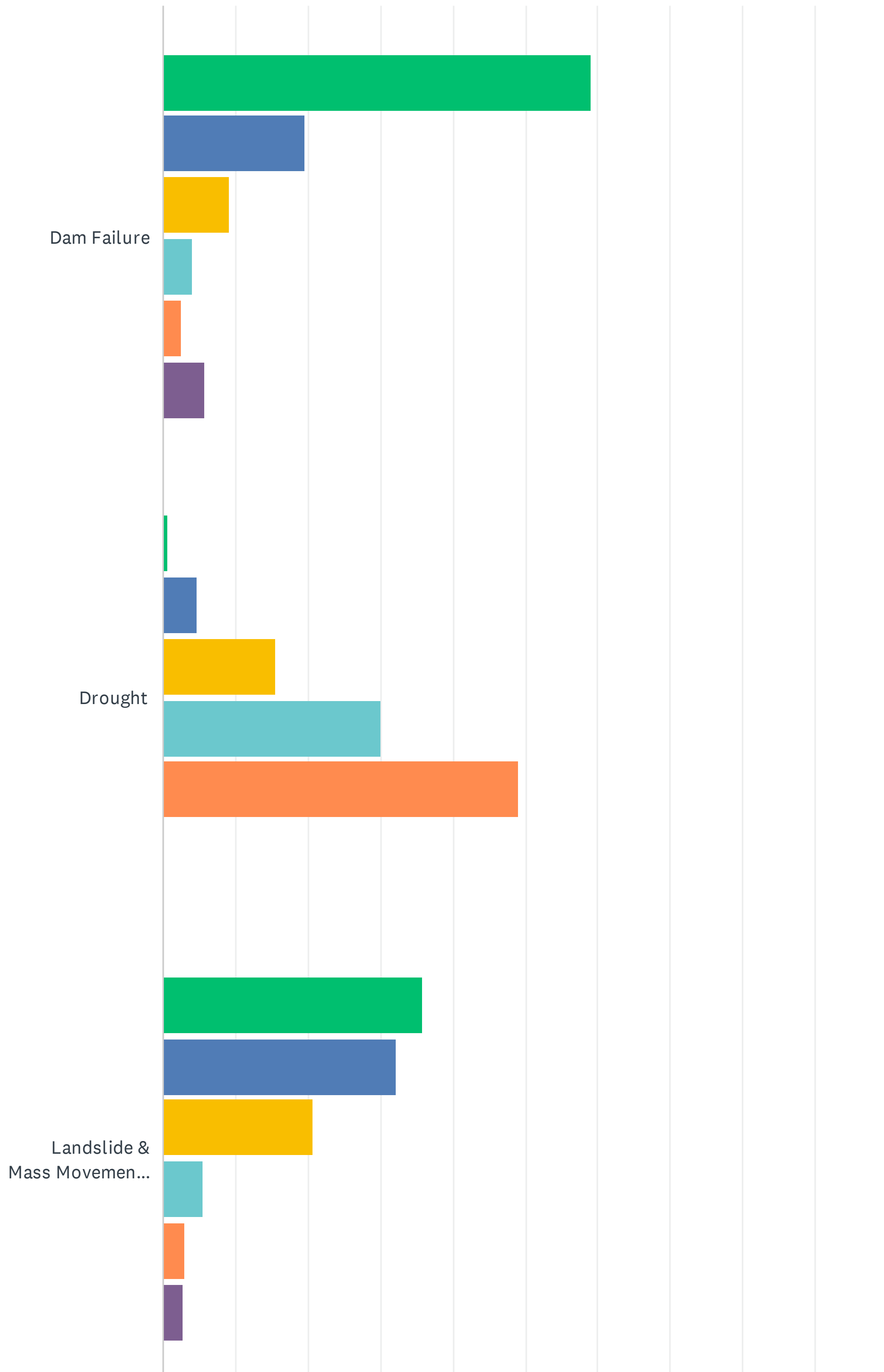


EXHIBIT A

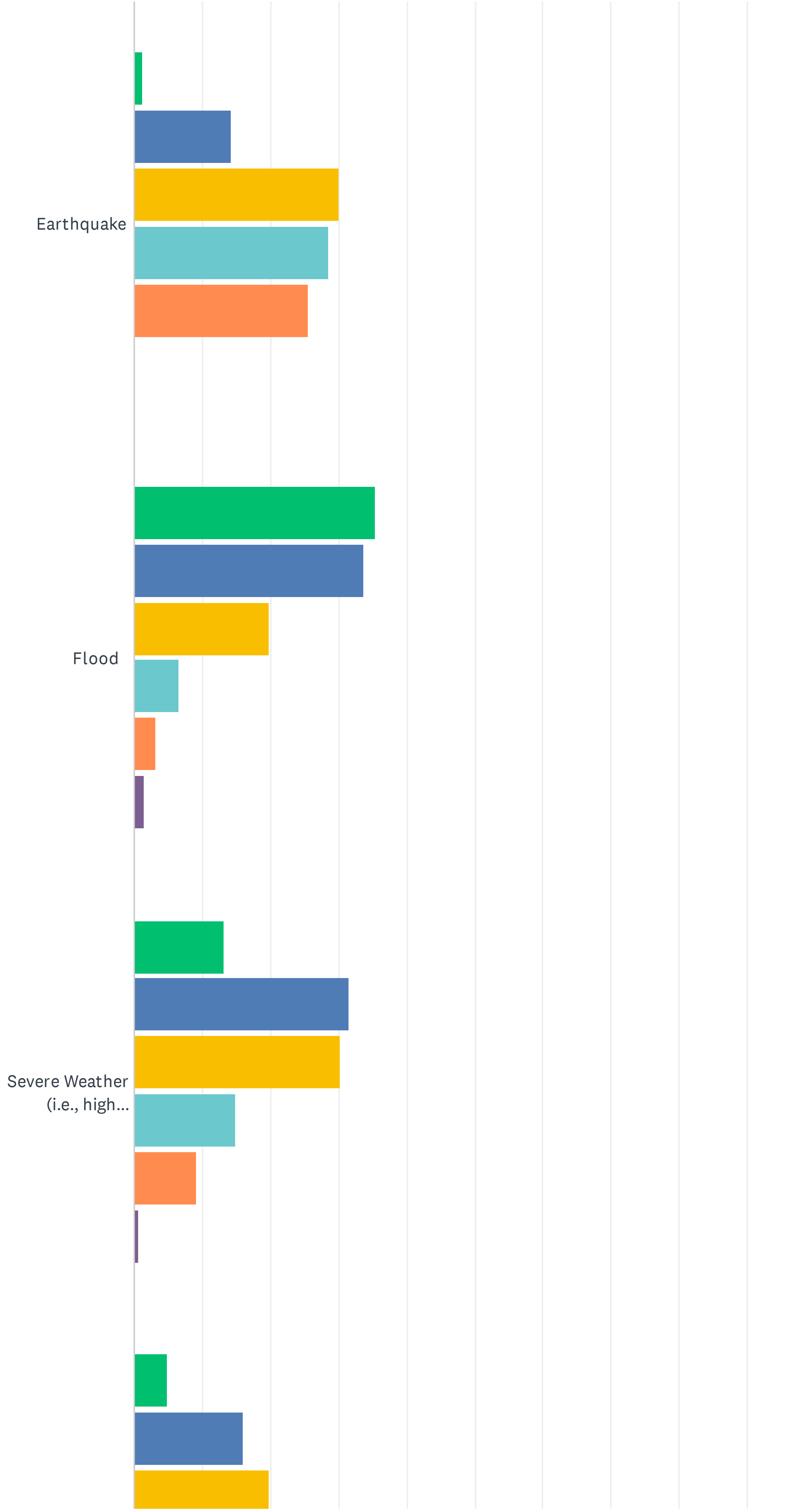
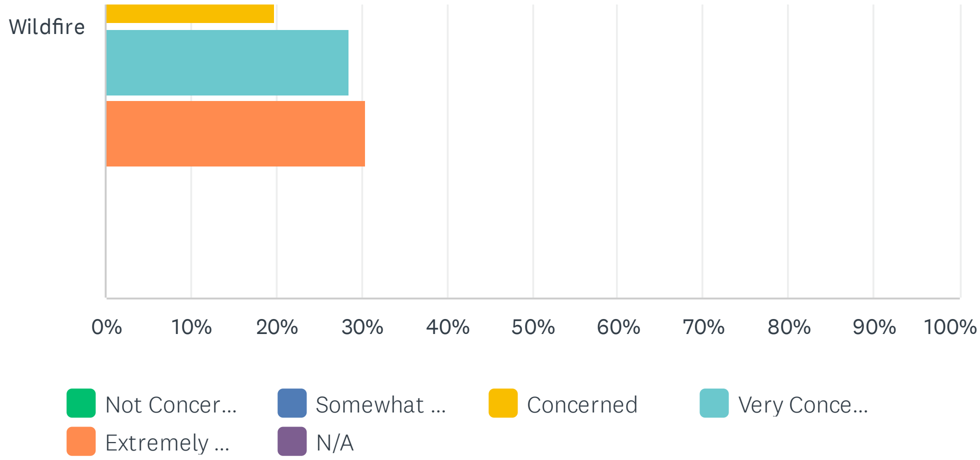


EXHIBIT A

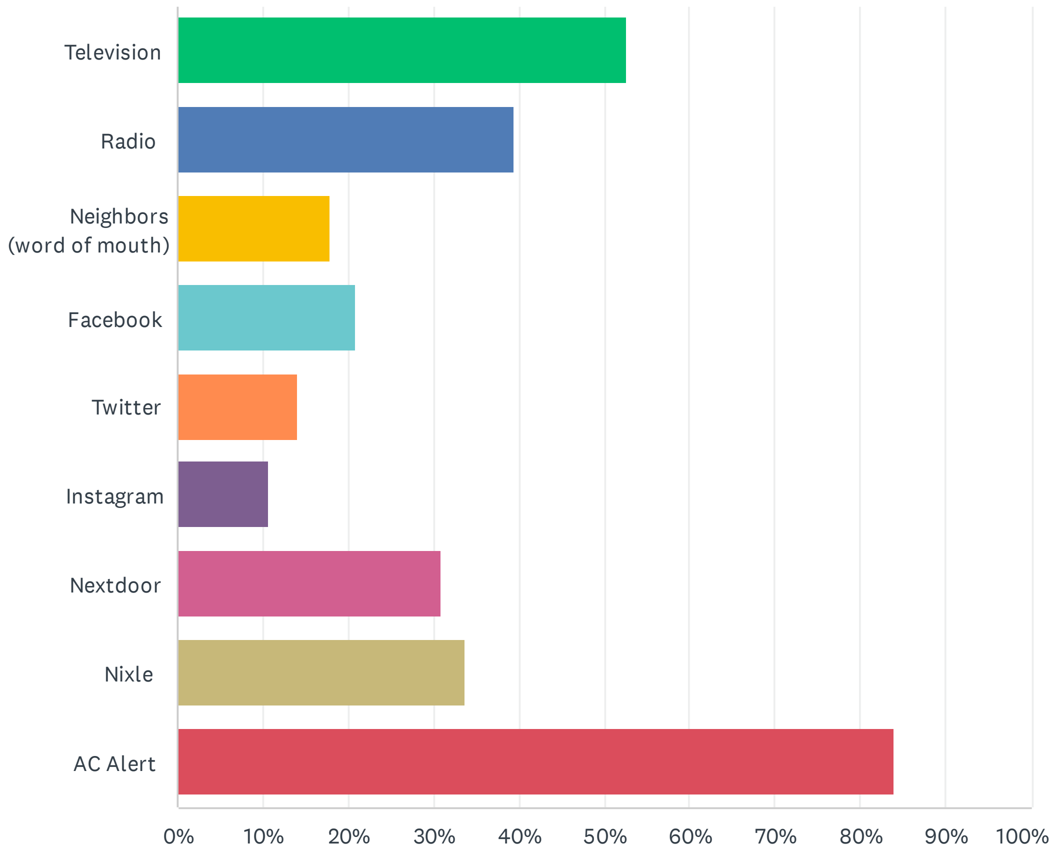


	NOT CONCERNED	SOMEWHAT CONCERNED	CONCERNED	VERY CONCERNED	EXTREMELY CONCERNED	N/A	TOTAL	WEIGHTED AVERAGE
Dam Failure	59.07% 329	19.57% 109	9.16% 51	3.95% 22	2.51% 14	5.75% 32	557	1.63
Drought	0.70% 4	4.70% 27	15.51% 89	30.14% 173	48.95% 281	0.00% 0	574	4.22
Landslide & Mass Movements (geologic hazards)	35.83% 201	32.26% 181	20.68% 116	5.53% 31	3.03% 17	2.67% 15	561	2.05
Earthquake	1.21% 7	14.34% 83	30.05% 174	28.67% 166	25.56% 148	0.17% 1	579	3.63
Flood	35.39% 201	33.63% 191	19.89% 113	6.51% 37	3.17% 18	1.41% 8	568	2.07
Severe Weather (i.e., high wind, heavy rain, lightning)	13.26% 76	31.59% 181	30.19% 173	15.01% 86	9.25% 53	0.70% 4	573	2.75
Wildfire	4.89% 28	16.06% 92	19.90% 114	28.62% 164	30.54% 175	0.00% 0	573	3.64

EXHIBIT A

Q3 How would you prefer to be notified about a disaster event?(Check all that apply)

Answered: 559 Skipped: 26



ANSWER CHOICES	RESPONSES	
Television	52.59%	294
Radio	39.36%	220
Neighbors (word of mouth)	17.89%	100
Facebook	20.93%	117
Twitter	14.13%	79
Instagram	10.73%	60
Nextdoor	30.95%	173
Nixle	33.63%	188
AC Alert	84.08%	470
Total Respondents: 559		

EXHIBIT A

Q4 What steps has your household taken to prepare for a disaster? (Check all that apply)

Answered: 580   Skipped: 5

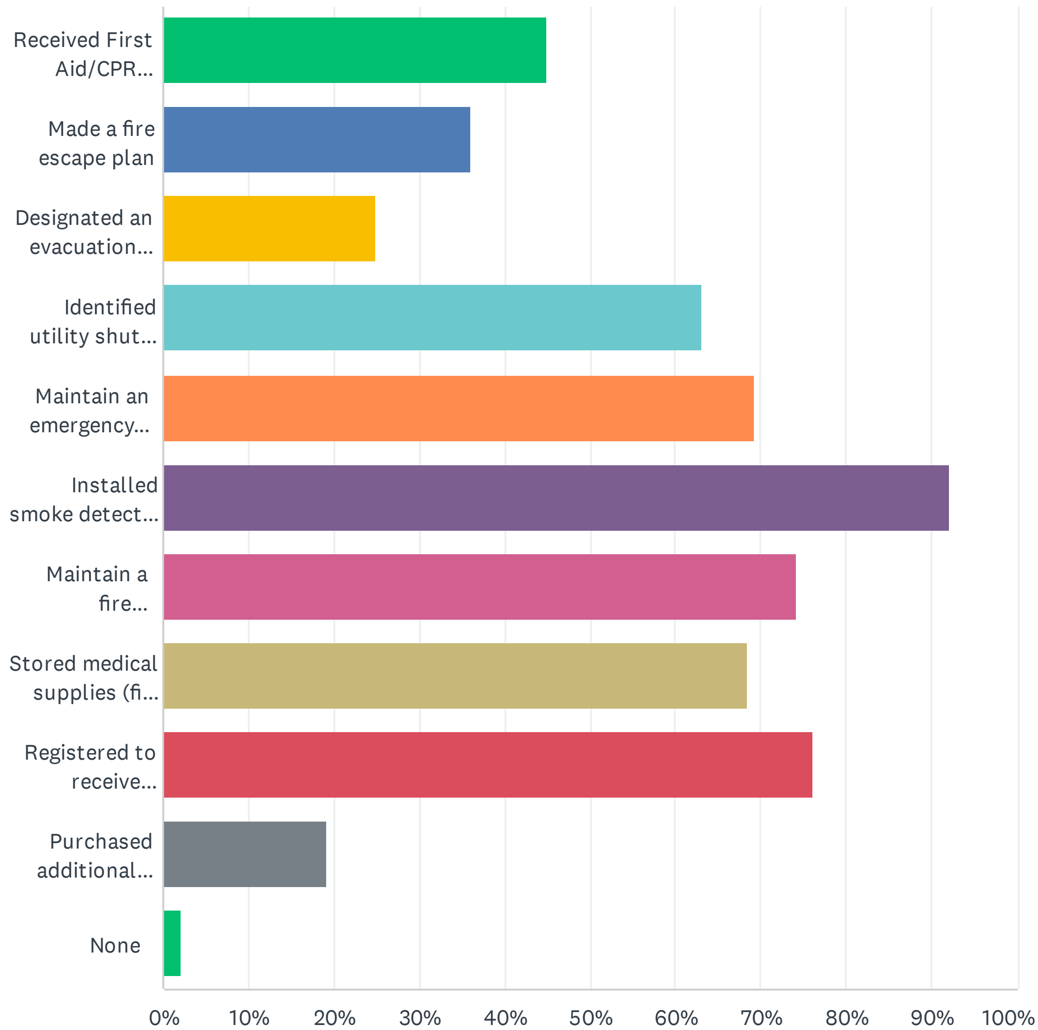


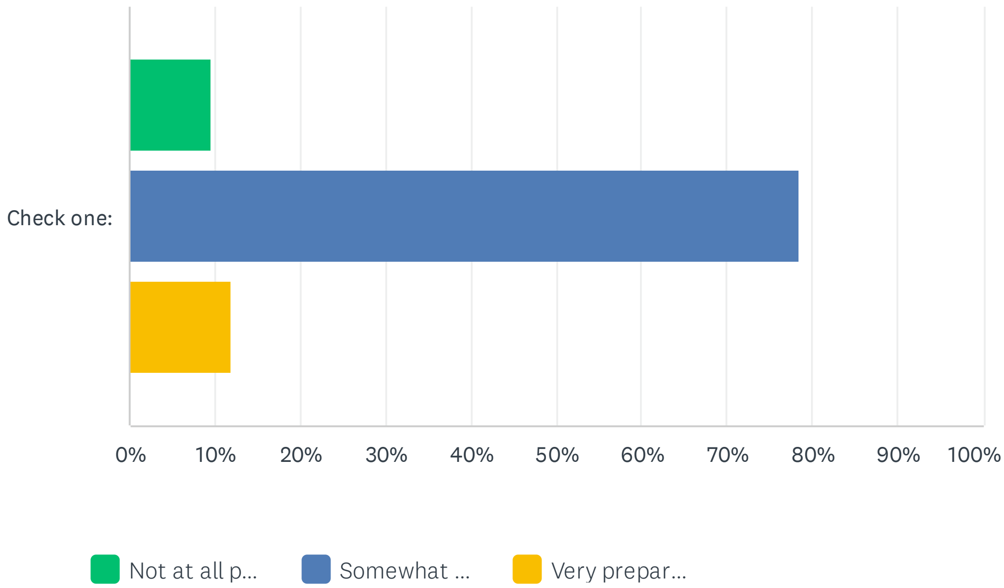
EXHIBIT A

ANSWER CHOICES	RESPONSES	
Received First Aid/CPR training	45.00%	261
Made a fire escape plan	36.03%	209
Designated an evacuation meeting place	25.00%	145
Identified utility shutoff locations	63.10%	366
Maintain an emergency supply kit (batteries, flashlights, battery-powered radio, food/water)	69.31%	402
Installed smoke detectors on each level of the house	92.07%	534
Maintain a fire extinguisher at home	74.14%	430
Stored medical supplies (first aid kit, medications)	68.45%	397
Registered to receive emergency alerts	76.03%	441
Purchased additional insurance	19.14%	111
None	2.07%	12
Total Respondents: 580		

EXHIBIT A

Q5 How prepared is your household to deal with a hazard event? Check one:

Answered: 569 Skipped: 16

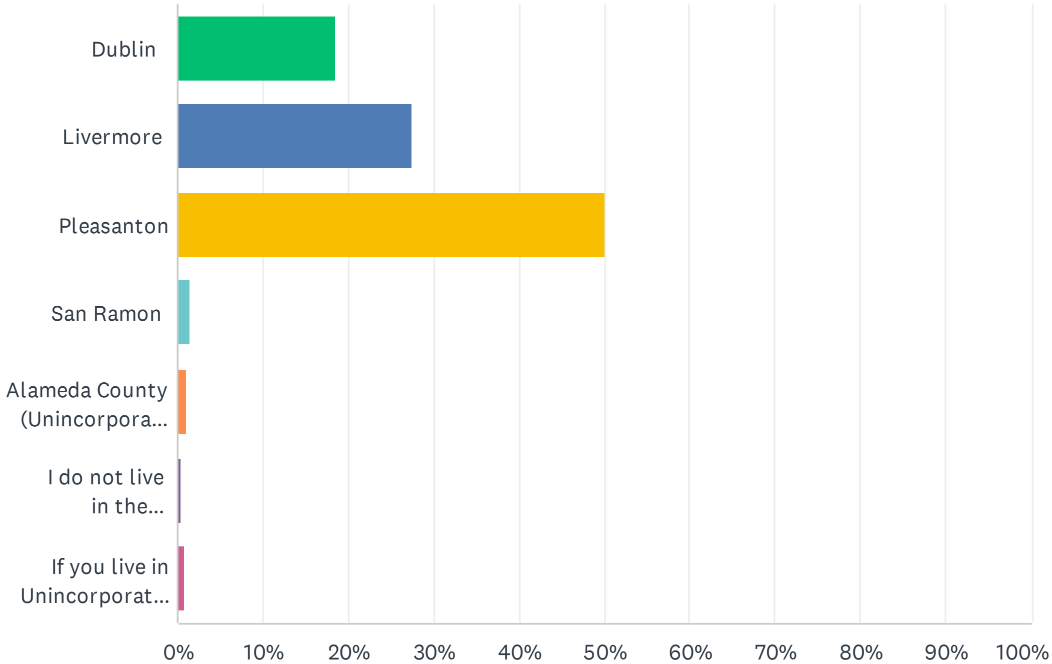


	NOT AT ALL PREPARED	SOMEWHAT PREPARED	VERY PREPARED	TOTAL	WEIGHTED AVERAGE
Check one:	9.67% 55	78.38% 446	11.95% 68	569	2.26

EXHIBIT A

Q6 Where do you live?

Answered: 580 Skipped: 5

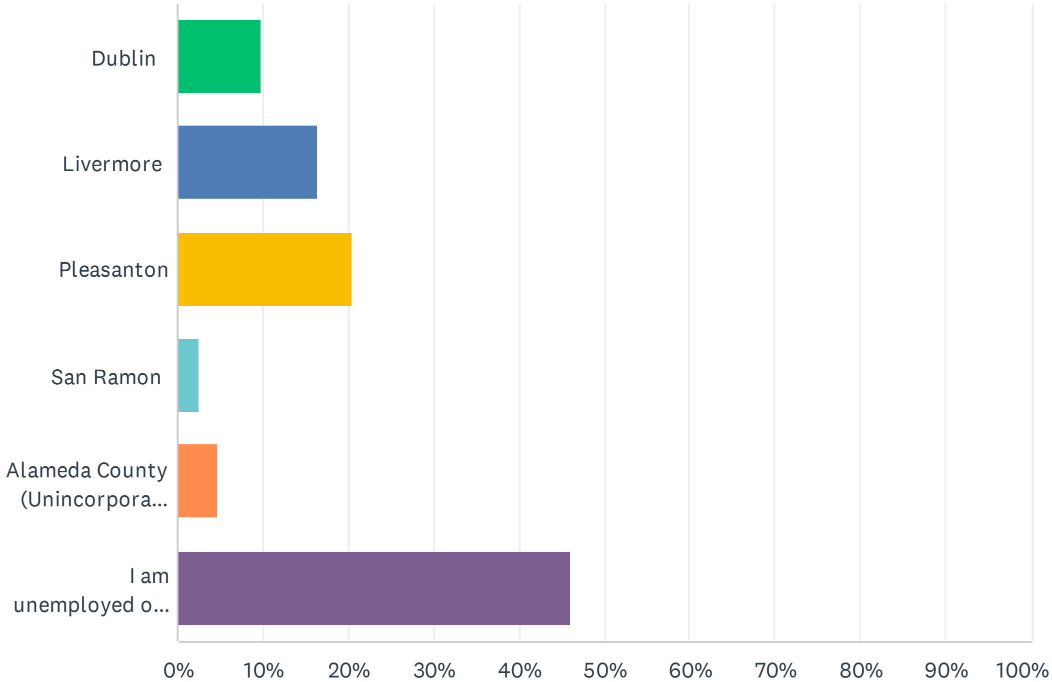


ANSWER CHOICES	RESPONSES	
Dublin	18.45%	107
Livermore	27.59%	160
Pleasanton	50.17%	291
San Ramon	1.55%	9
Alameda County (Unincorporated)	1.03%	6
I do not live in the Tri-Valley planning area	0.34%	2
If you live in Unincorporated County, please provide the name of your community.	0.86%	5
TOTAL		580

EXHIBIT A

Q7 Where do you work?

Answered: 540   Skipped: 45

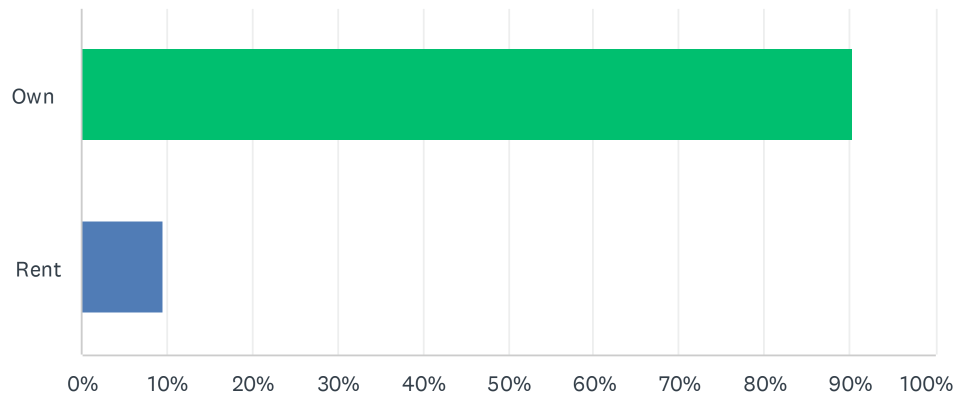


ANSWER CHOICES	RESPONSES	
Dublin	9.81%	53
Livermore	16.48%	89
Pleasanton	20.37%	110
San Ramon	2.59%	14
Alameda County (Unincorporated)	4.63%	25
I am unemployed or retired.	46.11%	249
TOTAL		540

EXHIBIT A

Q8 Do you own or rent your place of residence?

Answered: 579 Skipped: 6

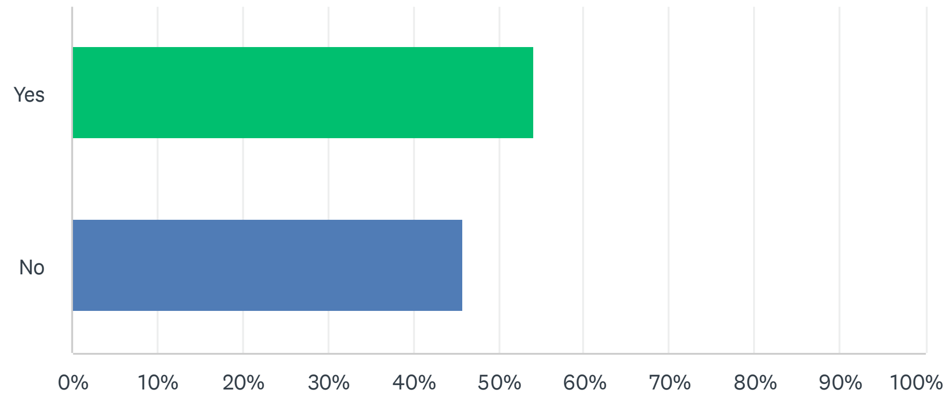


ANSWER CHOICES	RESPONSES	
Own	90.33%	523
Rent	9.67%	56
TOTAL		579

EXHIBIT A

Q9 When you moved into your home, did you consider the impact a disaster could have on your home?

Answered: 579 Skipped: 6

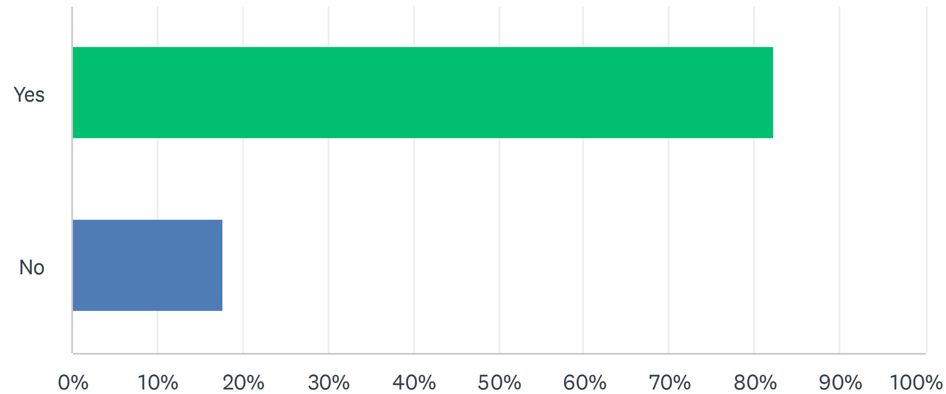


ANSWER CHOICES	RESPONSES	
Yes	54.06%	313
No	45.94%	266
TOTAL		579

EXHIBIT A

Q10 Would the disclosure of natural hazard information influence your decision to purchase or move into a home today?

Answered: 547 Skipped: 38

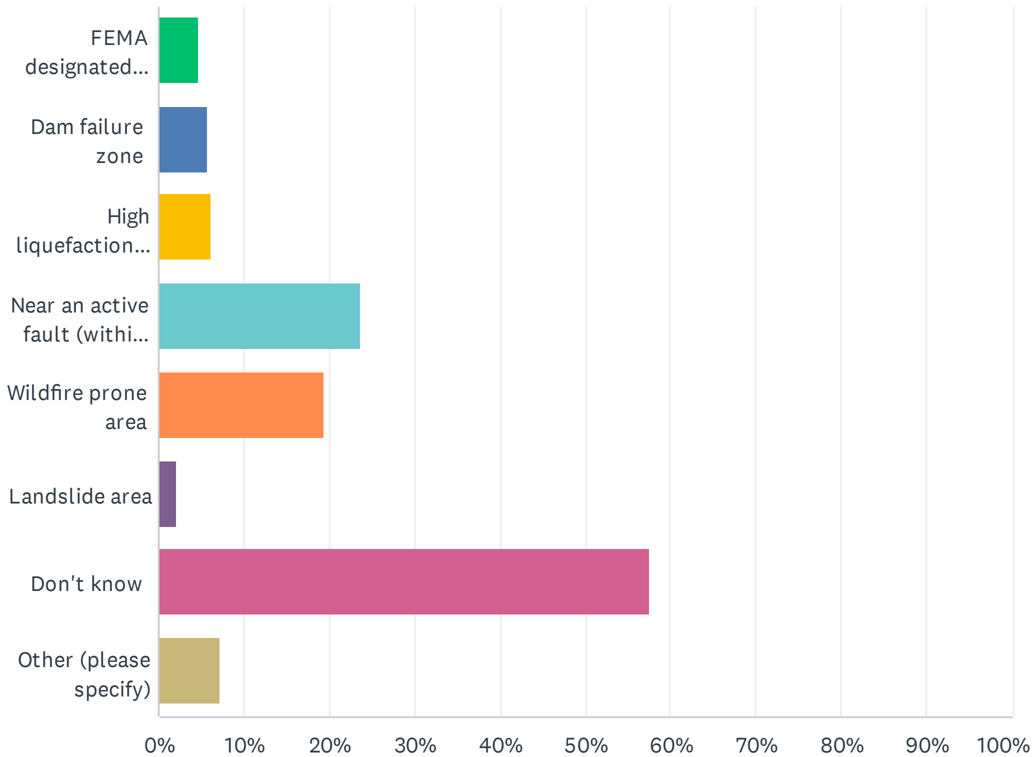


ANSWER CHOICES	RESPONSES	
Yes	82.27%	450
No	17.73%	97
TOTAL		547

EXHIBIT A

Q11 Is your home located in any of the following hazard areas (check all that apply):

Answered: 457 Skipped: 128

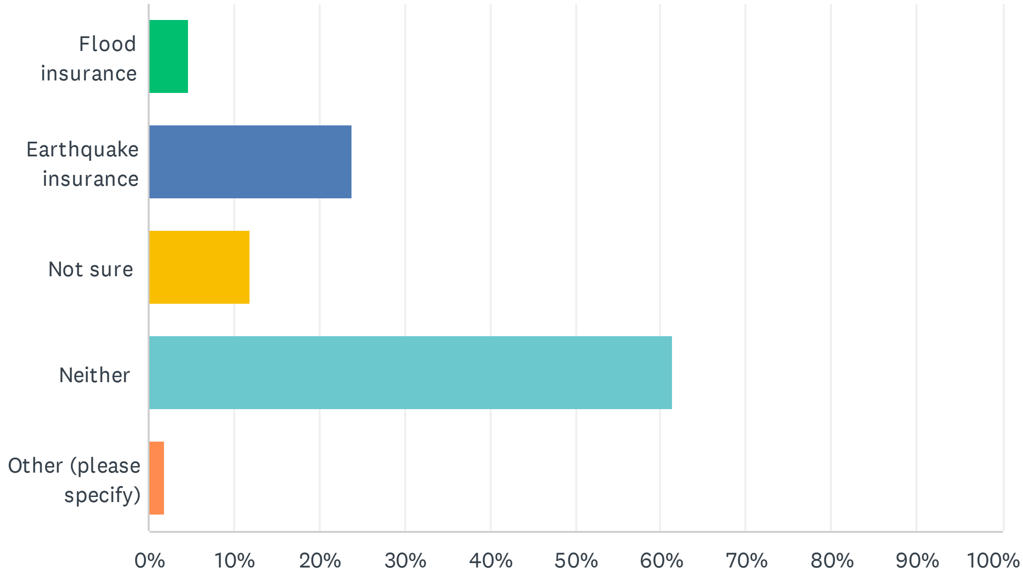


ANSWER CHOICES	RESPONSES	
FEMA designated floodplain	4.60%	21
Dam failure zone	5.69%	26
High liquefaction zone	6.13%	28
Near an active fault (within 1 mile)	23.63%	108
Wildfire prone area	19.47%	89
Landslide area	2.19%	10
Don't know	57.55%	263
Other (please specify)	7.22%	33
Total Respondents: 457		

EXHIBIT A

Q12 Do you have hazard-specific insurance (check all that apply)?

Answered: 538 Skipped: 47



ANSWER CHOICES	RESPONSES	
Flood insurance	4.65%	25
Earthquake insurance	23.98%	129
Not sure	11.90%	64
Neither	61.34%	330
Other (please specify)	1.86%	10
Total Respondents: 538		

EXHIBIT A

Q13 What is the primary language spoken or written in your home?

Answered: 559 Skipped: 26

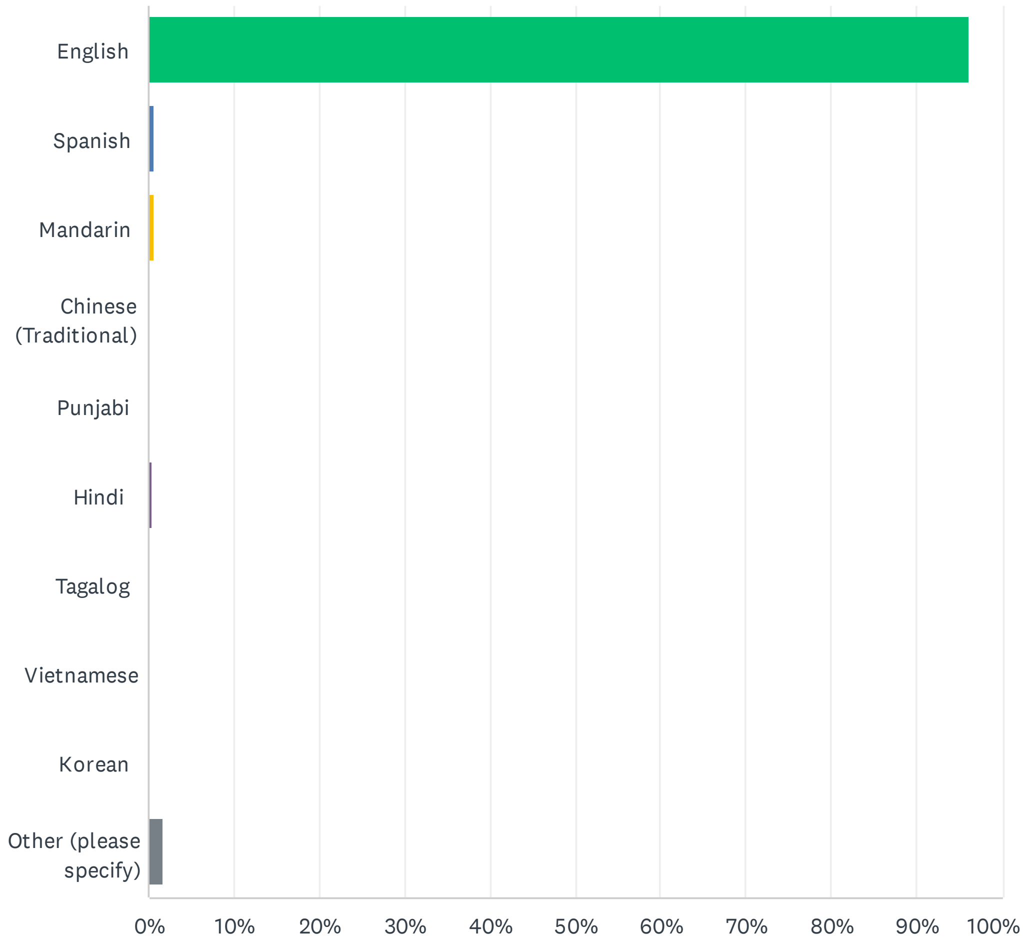


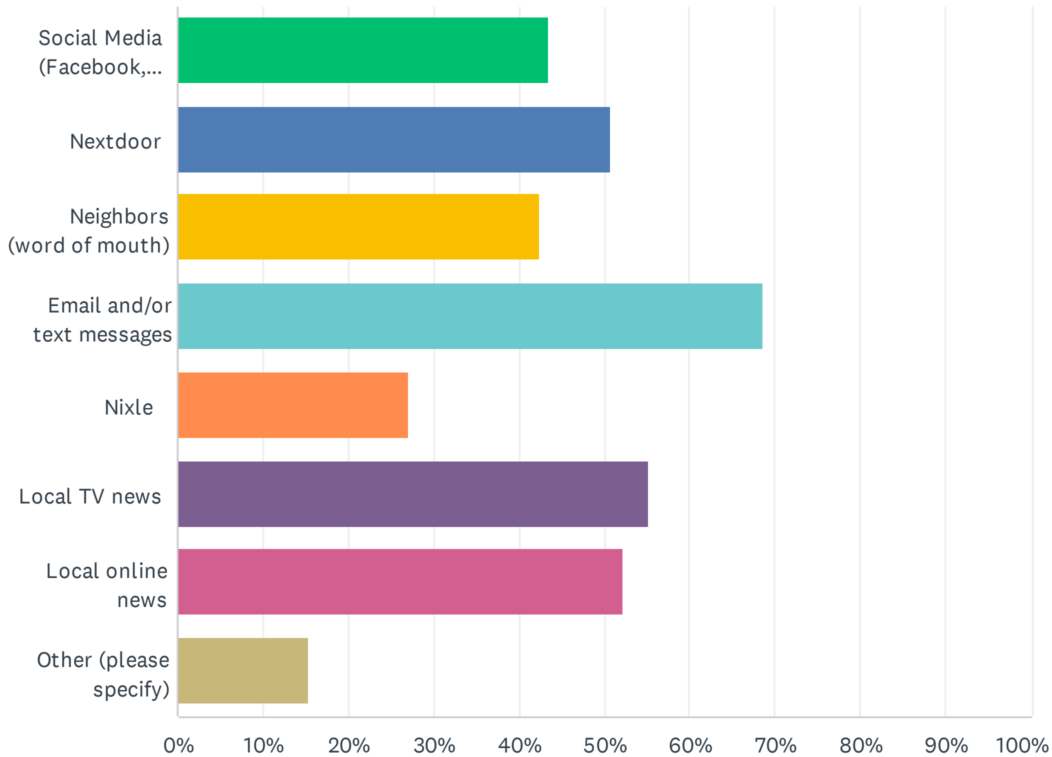
EXHIBIT A

ANSWER CHOICES	RESPONSES	
English	96.06%	537
Spanish	0.54%	3
Mandarin	0.72%	4
Chinese (Traditional)	0.00%	0
Punjabi	0.18%	1
Hindi	0.36%	2
Tagalog	0.18%	1
Vietnamese	0.00%	0
Korean	0.18%	1
Other (please specify)	1.79%	10
TOTAL		559

EXHIBIT A

Q14 Which of the following resources do you use to receive news and information about the Tri-Valley area?

Answered: 558 Skipped: 27

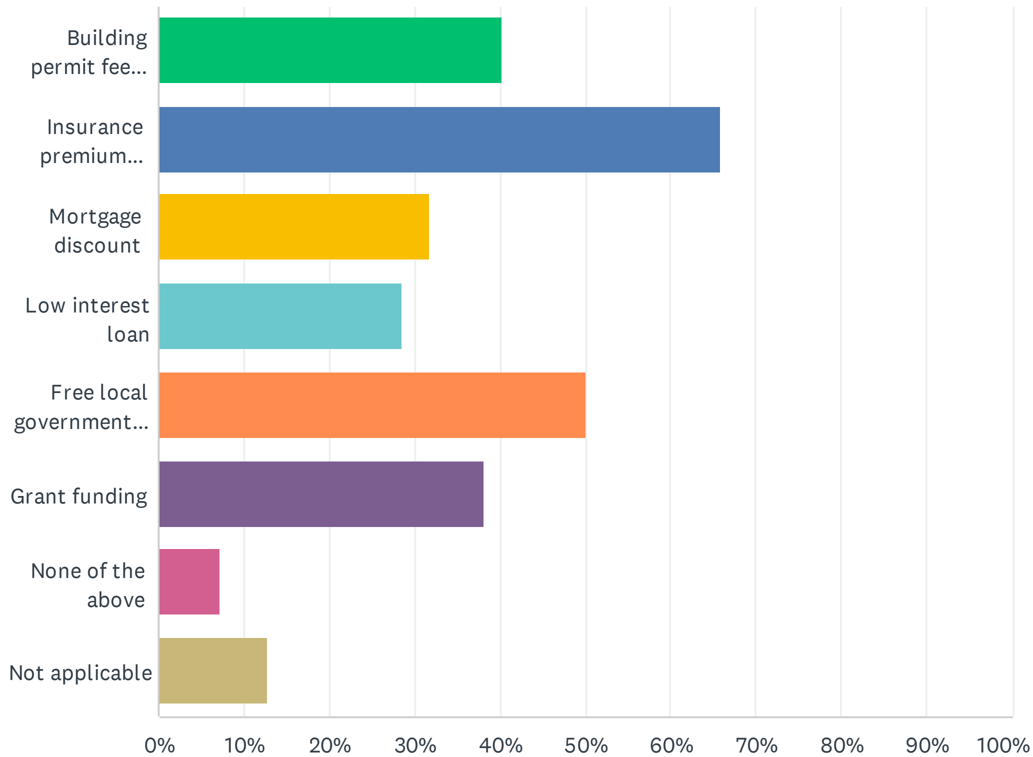


ANSWER CHOICES	RESPONSES	
Social Media (Facebook, Twitter)	43.55%	243
Nextdoor	50.72%	283
Neighbors (word of mouth)	42.47%	237
Email and/or text messages	68.64%	383
Nixle	27.06%	151
Local TV news	55.20%	308
Local online news	52.15%	291
Other (please specify)	15.41%	86
Total Respondents: 558		

EXHIBIT A

Q15 Which incentives would encourage you to retrofit your home to protect against natural disasters? (Check all that apply)

Answered: 546 Skipped: 39

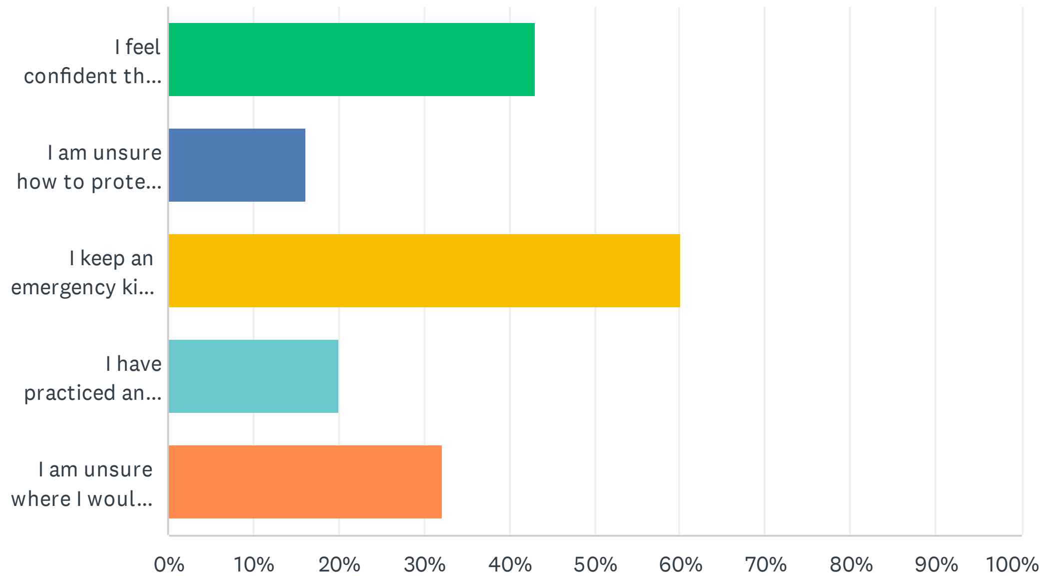


ANSWER CHOICES	RESPONSES	
Building permit fee waiver	40.29%	220
Insurance premium discount	65.93%	360
Mortgage discount	31.87%	174
Low interest loan	28.57%	156
Free local government technical assistance	50.18%	274
Grant funding	38.10%	208
None of the above	7.33%	40
Not applicable	12.82%	70
Total Respondents: 546		

EXHIBIT A

Q16 If a natural disaster such as a large earthquake were to strike tomorrow... (Check all that apply)

Answered: 542 Skipped: 43

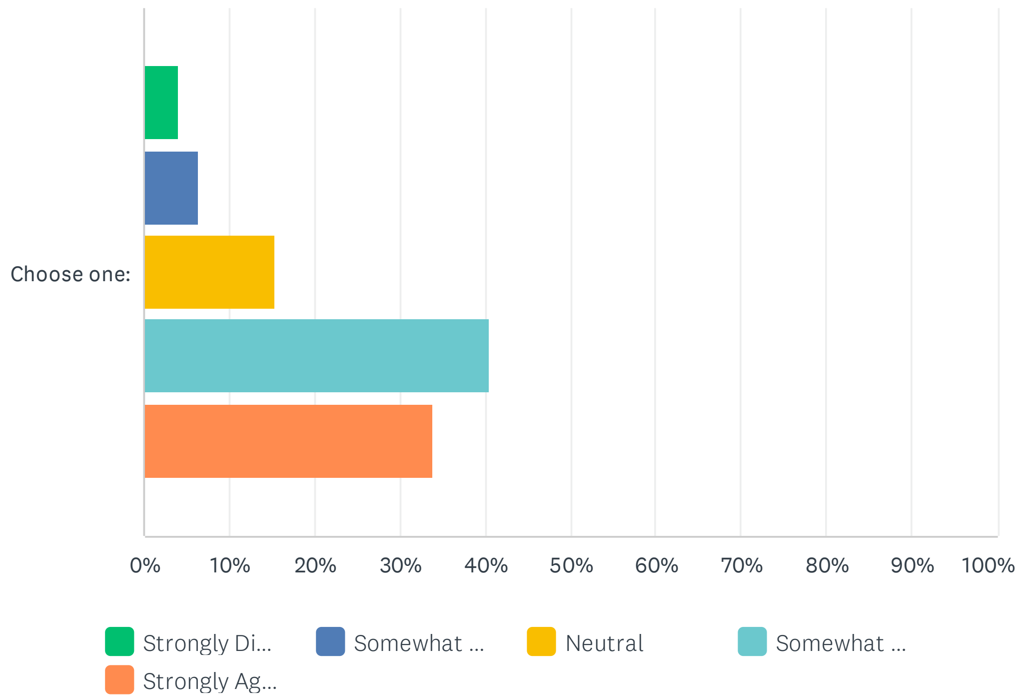


ANSWER CHOICES	RESPONSES	
I feel confident that I know how to protect myself	42.99%	233
I am unsure how to protect myself	16.24%	88
I keep an emergency kit with spare food and water for myself and my family	60.15%	326
I have practiced an evacuation plan and/or know where I and my family would go if we needed to evacuate our home	20.11%	109
I am unsure where I would go if I needed to evacuate my home	32.29%	175
Total Respondents: 542		

EXHIBIT A

Q17 Please indicate how you feel about the following statement: (Check one)"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 associated with natural hazards."

Answered: 556 Skipped: 29



	STRONGLY DISAGREE	SOMEWHAT DISAGREE	NEUTRAL	SOMEWHAT AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
Choose one:	4.14% 23	6.29% 35	15.29% 85	40.47% 225	33.81% 188	556	3.94

EXHIBIT A

Q18 OPTIONAL: If you want to receive information regarding emergency preparedness classes in the Tri-Valley area, please provide your email address.

Answered: 214 Skipped: 371

EXHIBIT A

Appendix B. Summary of Federal and State Agencies, Programs and Regulations

B. SUMMARY OF FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

Existing laws, ordinances, plans and programs at the federal and state level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). The following federal and state programs have been identified as programs that may interface with the actions identified in this plan. Each program enhances capabilities to implement mitigation actions or has a nexus with a mitigation action in this plan. Information presented in this section can be used to review local capabilities to implement the actions found in the jurisdictional annexes of Volume 2. Each planning partner has individually reviewed existing local plans, studies, reports, and technical information in its jurisdictional annex, presented in Volume 2.

FEDERAL

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all community members have all necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or other visual alerts. Two technical documents for shelter operators address physical accessibility needs of people with disabilities, as well as medical needs and service animals.

The ADA intersects with disaster preparedness programs in regard to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of community members. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for community members who may require more assistance.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Bureau of Land Management

The U.S. Bureau of Land Management (BLM) funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands. BLM works closely with the Forest Service and state and local governments to coordinate fire safety activities. The Interagency Fire Coordination Center in Boise, Idaho serves as the center for this effort.

Civil Rights Act

The Civil Rights Act of 1964 prohibits discrimination based on race, color, religion, sex or nation origin and requires equal access to public places and employment. The Act is relevant to emergency management and hazard mitigation in that it prohibits local governments from favoring the needs of one population group over another. Local government and emergency response must ensure the continued safety and well-being of all community members equally, to the extent possible. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, and pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. Numerous issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

The CWA is important to hazard mitigation in several ways. There are often permitting requirements for any construction within 200 feet of water of the United States, which may have implications for mitigation projects identified by a local jurisdiction. Additionally, CWA requirements apply to wetlands, which serve important functions related to preserving and protecting the natural and beneficial functions of floodplains and are linked with a community's floodplain management program. Finally, the National Pollutant Discharge Elimination System is part of the CWA and addresses local stormwater management programs. Stormwater management plays a critical role in hazard mitigation by addressing urban drainage or localized flooding issues within jurisdictions.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Community Development Block Grant Disaster Resilience Program

In response to disasters, Congress may appropriate additional funding for the U.S. Department of Housing and Urban Development Community Development Block Grant programs to be distributed as Disaster Recovery grants (CDBG-DR). These grants can be used to rebuild affected areas and provide seed money to start the recovery process. CDBG-DR assistance may fund a broad range of recovery activities, helping communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration, and the U.S. Army Corps of Engineers. Housing and Urban Development generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other federal disaster assistance programs. To be eligible for CDBG-DR funds, projects must meet the following criteria:

- Address a disaster-related impact (direct or indirect) in a presidentially declared county for the covered disaster
- Be a CDBG-eligible activity (according to regulations and waivers)
- Meet a national objective.

Incorporating preparedness and mitigation into these actions is encouraged, as the goal is to rebuild in ways that are safer and stronger. CDBG-DR funding is a potential alternative source of funding for actions identified in this plan.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The discount partially depends on location of the property. Properties outside the special flood hazard area receive smaller discounts: a 10-percent discount if the community is at Class 1 to 6 and a 5-percent discount if the community is at Class 7 to 9. The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation’s flood risk; over 66 percent of the NFIP’s policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

Emergency Relief for Federally Owned Roads Program

The U.S. Forest Service's Emergency Relief for Federally Owned Roads Program was established to assist federal agencies with repair or reconstruction of tribal transportation facilities, federal lands transportation facilities, and other federally owned roads that are open to public travel and have suffered serious damage by a natural disaster over a wide area or by a catastrophic failure. The program funds both emergency and permanent repairs. Eligible activities under this program meet some of the goals and objectives for this plan and the program is a possible funding source for actions identified in this plan.

Emergency Watershed Program

The USDA Natural Resources Conservation Service (NRCS) administers the Emergency Watershed Protection (EWP) Program, which responds to emergencies created by natural disasters. Eligibility for assistance is not dependent on a national emergency declaration. The program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. EWP is an emergency recovery program. Financial and technical assistance are available for the following activities (Natural Resources Conservation Service, 2018):

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded banks
- Correct damaged drainage facilities
- Establish cover on critically eroding lands
- Repair levees and structures
- Repair conservation practices.

This federal program could be a possible funding source for actions identified in this plan.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- Endangered means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- Threatened means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- Critical habitat means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- Section 4: Listing of a Species—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or community members may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- Section 7: Consultation—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- Section 9: Prohibition of Take—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- Section 10: Permitted Take—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- Section 11: Citizen Lawsuits—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors seismic research and applies it in performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication Engineering Guidelines for the Evaluation of Hydropower Projects guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected community members and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

Federal Wildfire Management Policy and Healthy Forests Restoration Act

Federal Wildfire Management Policy and Healthy Forests Restoration Act (2003). These documents call for a single comprehensive federal fire policy for the Interior and Agriculture Departments (the agencies using federal fire management resources). They mandate community-based collaboration to reduce risks from wildfire.

National Dam Safety Act

Potential for catastrophic flooding due to dam failures led to passage of the National Dam Inspection Act in 1972, creation of the National Dam Safety Program in 1996, and reauthorization of the program through the Dam Safety Act in 2006. National Dam Safety Program, administered by FEMA requires a periodic engineering analysis of the majority of dams in the country; exceptions include the following:

- Dams under jurisdiction of the Bureau of Reclamation, Tennessee Valley Authority, or International Boundary and Water Commission
- Dams constructed pursuant to licenses issued under the Federal Power Act

- Dams that the Secretary of the Army determines do not pose any threat to human life or property.

The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect lives and property of the public. The National Dam Safety Program is a partnership among the states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States.

National Environmental Policy Act

The National Environmental Policy Act requires federal agencies to consider the environmental impacts of proposed actions and reasonable alternatives to those actions, alongside technical and economic considerations. The National Environmental Policy Act established the Council on Environmental Quality, whose regulations (40 CFR Parts 1500-1508) set standards for compliance. Consideration and decision-making regarding environmental impacts must be documented in an environmental impact statement or environmental assessment. Environmental impact assessment requires the evaluation of reasonable alternatives to a proposed action, solicitation of input from organizations and individuals that could be affected, and an unbiased presentation of direct, indirect, and cumulative environmental impacts. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

National Fire Plan

The 2001 National Fire Plan was developed based on the National Fire Policy. A major aspect of the National Fire Plan is joint risk reduction planning and implementation carried out by federal, state and local agencies and communities. The National Fire Plan presented a comprehensive strategy in five key initiatives:

- Firefighting—Be adequately prepared to fight fires each fire season.
- Rehabilitation and Restoration—Restore landscapes and rebuild communities damaged by wildfires.
- Hazardous Fuel Reduction—Invest in projects to reduce fire risk.
- Community Assistance—Work directly with communities to ensure adequate protection.
- Accountability—Be accountable and establish adequate oversight, coordination, program development, and monitoring for performance.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities that enact floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act.

Flood Study and Mapping

For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent-annual-chance flood and the 0.2-percent-annual-chance flood.

Base flood elevations and the boundaries of the flood hazard areas are shown on Flood Insurance Rate Maps, which are the principle tool for identifying the extent and location of the flood hazard. Flood Insurance Rate Maps are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under the local floodplain management program. Structures permitted or built in a jurisdiction before its first flood map was approved are called “pre-FIRM” structures, and structures built afterwards are called “post-FIRM.” The insurance rate is different for the two types of structures. In recent years, Flood Insurance Rate Maps have been digitized as Digital Flood Insurance Rate Maps, which are more accessible to community members, local governments and stakeholders.

Requirements for Development Regulations

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

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 1-percent-annual-chance flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

NFIP participation is limited to local governments that possess permit authority and have the ability to adopt and enforce regulations that govern land use. This does not typically apply to special purpose districts.

Repetitive Loss Properties and Areas

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property.

Repetitive loss properties make up 1 to 2 percent of flood insurance policies in force nationally, yet they account for 40 percent of the nation’s flood insurance claim payments. The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. A recent report on repetitive losses by the National Wildlife Federation found that 20 percent of these properties are outside any mapped 100-year floodplain. The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by the policies.

FEMA-sponsored programs, such as the CRS, require participating communities to identify repetitive loss areas. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as meeting the definition of repetitive loss. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures because no flood insurance policy was in force at the time of loss.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In some cases, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency responder disciplines. These cases necessitate coordination across a spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, technological hazards, and human-caused hazards) regardless of size or complexity.

Although participation is voluntary, federal departments and agencies are required to make adoption of NIMS by local and state jurisdictions a condition to receive federal preparedness grants and awards. The content of this plan is considered to be a viable support tool for any phase of emergency management. The NIMS program is considered as a response function, and information in this hazard mitigation plan can support the implementation and update of all NIMS-compliant plans within the planning area.

National Landslide Preparedness Act

The 2021 National Landslide Preparedness Act authorized a national landslide hazards reduction program and a 3D elevation program within the USGS. This broadened the existing Landslide Hazards Program (under the Natural Hazards Mission Area) and the 3D Elevation Program (under the National Geospatial Program). The act required coordination among federal agencies through an Interagency Coordinating Committee on Landslide Hazards representing USGS and other agencies. The act calls for development of a national strategy for landslide loss reduction and a publicly accessible national landslide database of landslide hazard and risk.

Presidential Executive Order 11988, Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. It requires federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values of floodplains. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

Presidential Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

All actions identified in this plan will seek full compliance with all applicable presidential executive orders.

Rural Development Program

The mission of the U.S. Department of Agriculture (USDA) Rural Development Program is to help improve the economy and quality of life in rural America. The program provides project financing and technical assistance to help rural communities provide the infrastructure needed by rural businesses, community facilities, and households. The program addresses rural America’s need for basic services, such as clean running water, sewage and waste disposal, electricity, and modern telecommunications and broadband. Loans and competitive grants are offered for various community and economic development projects and programs, such as the development of essential community facilities including fire stations. This program is a potential source of funding for actions identified in this plan.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers operates and maintains approximately 700 dams nationwide. It is also responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency’s capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety. The Corps maintains the National Inventory of Dams, which contains information about a dam’s location, size, purpose, type, last inspection and regulatory status.

U.S. Army Corps of Engineers Flood Hazard Management

The following U.S. Army Corps of Engineers authorities and programs related to flood hazard management:

- The Floodplain Management Services program offers 100-percent federally funded technical services such as development and interpretation of site-specific data related to the extent, duration and frequency of flooding. Special studies may be conducted to help a community understand and respond to flood risk. These may include flood hazard evaluation, flood warning and preparedness, or flood modeling.
- For more extensive studies, the Corps of Engineers offers a cost-shared program called Planning Assistance to States and Tribes. Studies under this program generally range from $25,000 to $100,000 with the local jurisdiction providing 50 percent of the cost.

- The Corps of Engineers has several cost-shared programs (typically 65 percent federal and 35 percent non-federal) aimed at developing, evaluating and implementing structural and non-structural capital projects to address flood risks at specific locations or within a specific watershed:
  - The Continuing Authorities Program for smaller-scale projects includes Section 205 for Flood Control, with a $7 million federal limit and Section 14 for Emergency Streambank Protection with a $1.5 million federal limit. These can be implemented without specific authorization from Congress.
  - Larger scale studies, referred to as General Investigations, and projects for flood risk management, for ecosystem restoration or to address other water resource issues, can be pursued through a specific authorization from Congress and are cost-shared, typically at 65 percent federal and 35 percent non-federal.
  - Watershed management planning studies can be specifically authorized and are cost-shared at 50 percent federal and 50 percent non-federal.
- The Corps of Engineers provides emergency response assistance during and following natural disasters. Public Law 84-99 enables the Corps to assist state and local authorities in flood fight activities and cost share in the repair of flood protective structures. Assistance is provided in the flowing categories:
  - Preparedness—The Flood Control and Coastal Emergency Act establishes an emergency fund for preparedness for emergency response to natural disasters; for flood fighting and rescue operations; for rehabilitation of flood control and hurricane protection structures. Funding for Corps of Engineers emergency response under this authority is provided by Congress through the annual Energy and Water Development Appropriation Act. Disaster preparedness activities include coordination, planning, training and conduct of response exercises with local, state and federal agencies.
  - Response Activities—Public Law 84-99 allows the Corps of Engineers to supplement state and local entities in flood fighting urban and other non-agricultural areas under certain conditions (Engineering Regulation 500-1-1 provides specific details). All flood fight efforts require a project cooperation agreement signed by the public sponsor and the sponsor must remove all flood fight material after the flood has receded. Public Law 84-99 also authorizes emergency water support and drought assistance in certain situations and allows for "advance measures" assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.
  - Rehabilitation—Under Public Law 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The flood system would be restored to its pre-disaster status at no cost to the federal system owner, and at 20-percent cost to the eligible non-federal system owner. All systems considered eligible for Public Law 84-99 rehabilitation assistance have to be in the Rehabilitation and Inspection Program prior to the flood event. Acceptable operation and maintenance by the public levee sponsor are verified by levee inspections conducted by the Corps on a regular basis. The Corps has the responsibility to coordinate levee repair issues with interested federal, state, and local agencies following natural disaster events where flood control works are damaged.

These authorities and programs are all available to the planning partners to support any related mitigation actions.

U.S. Bureau of Reclamation Safety Evaluation of Existing Dams Program

The U.S. Bureau of Reclamation's Safety Evaluation of Existing Dams Program was officially implemented in 1978 with passage of the Reclamation Safety of Dams Act (Public Law 95-578). This act was amended in 1984 under Public Law 98-404, in 2000 under Public Law 106-377, in 2002 under Public Law 107-117, and in 2004 under Public Law 108-439. Program development and administration of dam safety activities is the responsibility of the Bureau of Reclamation's Dam Safety Office located in Denver, Colorado.

Dams must be operated and maintained in a safe manner, ensured through inspections for safety deficiencies, analyses utilizing current technologies and designs, and corrective actions if needed based on current engineering practices. In addition, future evaluations should include assessments of benefits foregone with the loss of a dam. For example, a failed dam can no longer provide needed fish and wildlife benefits.

The primary emphasis of the Safety Evaluation of Existing Dams program is to perform site evaluations and to identify potential safety deficiencies on Bureau of Reclamation and other Interior Department dams. The basic objective is to quickly identify dams which pose an increased threat to the public, and to quickly complete the related analyses in order to expedite corrective action decisions and safeguard the public and associated resources.

The program focuses on evaluating and implementing actions to resolve safety concerns at Bureau of Reclamation dams. Under this program, the Bureau of Reclamation completes studies and identifies and implements needed corrective action on Bureau of Reclamation dams. The selected course of action relies on assessments of risks and liabilities with environmental and public involvement input to the decision-making process.

U.S. Fire Administration

There are federal agencies that provide technical support to fire agencies/organizations. For example, the U.S. Fire Administration, which is a part of FEMA, provides leadership, advocacy, coordination, and support for fire agencies and organizations.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service fire management strategy uses prescribed fire to maintain early successional fire-adapted grasslands and other ecological communities throughout the National Wildlife Refuge system.

STATE

AB 9: Fire safety: wildfires: fire adapted communities.

This bill establishes the Regional Forest and Fire Capacity Program to support regional leadership, build local and regional capacity, and develop, prioritize, and implement strategies and projects that create fire-adapted communities by improving watershed health, forest health, community wildfire preparedness, and fire resilience.

AB 32: The California Global Warming Solutions Act

This bill identifies the following potential adverse impacts of global warming:

> "… the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems."

AB 32 establishes a state goal of reducing greenhouse gas emissions to 1990 levels by 2020 (a reduction of approximately 25 percent from forecast emission levels), with further reductions to follow. The law requires the state Air Resources Board to do the following:

- Establish a program to track and report greenhouse gas emissions.
- Approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions from sources of greenhouse gas emissions.
- Adopt early reduction measures to begin moving forward.
- Adopt, implement and enforce regulations—including market mechanisms such as "cap and-trade" programs—to ensure that the required reductions occur.

The Air Resources Board has adopted a statewide greenhouse gas emissions limit and an emissions inventory, along with requirements to measure, track, and report greenhouse gas emissions by the industries it determined to be significant sources of greenhouse gas emissions.

AB 38: Fire Safety: Low-Cost Retrofits: Regional Capacity Review: Wildfire Mitigation

Requires the seller of any real property located in a high or very fire hazard severity zone to provide a disclosure notice, as specified, to the buyer with information relating to fire hardening improvements on the property.

Requires the California Natural Resources Agency, in consultation with the State Fire Marshal and the Forest Management Task Force, to review the regional capacity of each county that contains a very high fire hazard severity zone to improve forest health, fire resilience, and safety.

Requires the California Office of Emergency Services to enter into a joint powers agreement with the Department of Forestry and Fire Protection to administer a comprehensive wildfire mitigation and assistance program to encourage cost-effective structure hardening and facilitate vegetation management, contingent upon appropriation by the Legislature.

AB 70: Flood Liability

This bill provides that a city or county may be required to contribute a fair and reasonable share to compensate for property damage caused by a flood to the extent that it has increased the state's exposure to liability for property damage by unreasonably approving new development in a previously undeveloped area that is protected by a state flood control project, unless the city or county meets specified requirements.

AB 162: Flood Planning

This California State Assembly Bill passed in 2007 requires cities and counties to address flood-related matters in the land use, conservation, and safety and housing elements of their general plans. The land use element must identify and annually review the areas covered by the general plan that are subject to flooding as identified in floodplain mapping by either FEMA or the state California Department of Water Resources. During the next revision of the housing element on or after January 1, 2009, the conservation element of the general plan must identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for the purpose of groundwater recharge and stormwater management. The safety element must identify information regarding flood hazards, including:

- Flood hazard zones

- Maps published by FEMA, the California Department of Water Resources, the U.S. Army Corps of Engineers, the Central Valley Flood Protection Board, and the Governor's Office of Emergency Services (Cal OES)
- Historical data on flooding
- Existing and planned development in flood hazard zones.

The general plan must establish goals, policies and objectives related to flooding risks, including:

- Avoiding or minimizing the risks of flooding new development
- Evaluating whether new development should be located in flood hazard zones
- Identifying construction methods to minimize damage.

AB 162 establishes goals, policies and objectives related to flooding risks. It establishes procedures for the determination of available land suitable for urban development, which may exclude lands where FEMA or the California Department of Water Resources has concluded that the flood management infrastructure is not adequate to avoid the risk of flooding.

AB 267: California Environmental Quality Act: Exemption: Prescribed Fire, Thinning, and Fuel Reduction Projects

Current law, until January 1, 2023, exempts from the requirements of CEQA prescribed fire, thinning, or fuel reduction projects undertaken on federal lands to reduce the risk of high-severity wildfire that have been reviewed under the federal National Environmental Policy Act of 1969. Current law requires the Department of Forestry and Fire Protection, beginning December 31, 2019, and annually thereafter until January 1, 2023, to report to the relevant policy committees of the Legislature the number of times the exemption was used. This extends the exemption from CEQA and the requirement on the department to report to the relevant policy committees of the Legislature to January 1, 2026.

AB 380: Forestry: Priority Fuel Reduction Projects

On March 22, 2019, the Governor issued a proclamation of a state of emergency directing the Department of Forestry and Fire Protection to implement fuel reduction projects for communities at greatest risk of wildfire to reduce the risk of catastrophic wildfire. The proclamation of a state of emergency exempts the identified fuel reduction projects from various legal requirements, including, among others, requirements regarding public contracting for those projects, requirements for environmental review under the California Environmental Quality Act for those projects, and licensure requirements for individuals conducting certain activities for those projects.

This bill requires the department, before December 31, 2022, and before December 31 of each year thereafter, to identify priority fuel reduction projects, as provided. The bill exempts the identified priority fuel reduction projects from legal requirements in a similar manner as provided in the proclamation of a state of emergency described above.

AB 431: Forestry: Timber Harvesting Plans: Defensible Space: Exemptions

The Z'berg-Nejedly Forest Practice Act of 1973 prohibits a person from conducting timber operations, as defined, unless a timber harvesting plan prepared by a registered professional forester has been submitted to, and approved by, the Department of Forestry and Fire Protection. The act authorizes the State Board of Forestry and Fire Protection to exempt from some or all of those provisions of the act a person engaging in specified forest management activities, as prescribed, including, only until January 1, 2022, the cutting or removal of trees on the person's property in compliance with specified defensible space requirements. This bill extends to January 1, 2026, the board's authorization to exempt a person engaging in the cutting or removal of trees on the person's property in compliance with the specified defensible space requirements.

AB 497: Forestry and Fire Protection: Local Assistance Grant Program: Fire Prevention Activities: Street and Road Vegetation Management

Under existing law, the Department of Forestry and Fire Protection is required to develop, implement, and administer forest improvement and fire prevention programs in the state. Existing law requires the department to establish a local assistance grant program for fire prevention activities in California. Existing law requires the department to prioritize, to the extent feasible, projects that are multiyear efforts and to prioritize grant applications from specified local agencies.

This bill appropriated $25,000,000 to provide the local assistance grants. It requires the department to prioritize projects that manage vegetation along streets and roads to prevent the ignition of wildfire and that require the funds for purposes of purchasing equipment necessary for the project.

AB 575: Civil Liability: Prescribed Burning Activities: Gross Negligence

This bill provides that a private entity engaging in a prescribed burning activity that is supervised by a person certified as burn boss is liable for damages to a third party only if the prescribed burning activity was carried out in a grossly negligent manner.

AB 642: Wildfires

This omnibus fire prevention bill makes changes to support cultural and prescribed fire, including the creation of a Cultural Burning Liaison at the Department of Forestry and Fire Protection, and requires a proposal for creating a prescribed fire training center in California. The Act requires the Director of Forestry and Fire Protection to identify areas in the state as moderate and high fire hazard severity zones and to classify areas into fire hazard severity zones based on additional factors including possible lightning caused ignition. The bill requires a local agency, within 30 days of receiving a transmittal from the director that identifies fire hazard severity zones, to make the information available for public comment.

AB 747: Required Information for General Plan Safety Elements

This bill requires California communities with general plans to address evacuation routes in the safety element of the general plan. Information on the evacuation routes and their capacity, safety and viability under a range of emergency scenarios must be provided. For communities that have not adopted a local hazard mitigation plan, the safety element must be updated with this information by January 1, 2022. For those with a local hazard mitigation plan, the requirement applies upon the next revision of the hazard mitigation plan on or after January 1, 2022. Communities that have adopted a local hazard mitigation plan, emergency operations plan, or other document that fulfills the goals and objectives of this law may comply with this requirement by summarizing and incorporating by reference the other plan or document in the safety element.

In subsequent revisions to the safety element, communities also will be required to identify new information relating to flood and fire hazards and climate adaptation and resiliency strategies applicable to the city or county that was not available during the previous revision of the safety element. These subsequent updates must occur upon each revision of the general plan housing element or local hazard mitigation plan and not less than once every eight years.

AB 800: Wildfires: Local General Plans: Safety Elements: Fire Hazard Severity Zones

Existing law requires the Director of Forestry and Fire Protection to identify areas of the state as very high fire hazard severity zones, and requires each planning agency to prepare, and the legislative body of each county and city to adopt, a comprehensive, long-term general plan, including a safety element, for the physical development of the county or city. Existing law requires each city or county that contains a very high fire hazard severity zone to submit the draft element of, or draft amendment to the safety element its general plan to the State Board of Forestry and Fire Protection and to every local agency that provides fire protection to territory in the city or county at least 90 days before adoption or amendment.

This requires the director to also identify areas of the state as moderate and high fire hazard severity zones. It requires the draft element of, or draft amendment to, the safety element of a county or city's general plan to be submitted to the state board and to every local agency that provides fire protection to territory in the city or county at least 90 days before the adoption or amendment to the safety element of its general plan for each city or county that contains a moderate or high fire hazard severity zone.

Existing law requires the state board and authorizes a local agency to review the draft or an existing safety element and recommend changes to the planning agency regarding uses of land and policies in state responsibility areas and very high fire hazard severity zones and regarding methods and strategies for wildland fire risk reduction and prevention within state responsibility areas and very high fire hazard severity zones.

This bill also requires the state board and authorizes a local agency to review the draft or an existing safety element and recommend changes to the planning agency regarding uses of land and policies in moderate and high fire hazard severity zones and regarding methods and strategies for wildland fire risk reduction and prevention within moderate and high fire hazard severity zones.

The existing Subdivision Map Act vests the authority to regulate and control the design and improvement of subdivisions in the legislative body of a local agency, and sets forth procedures governing the local agency's processing, approval, conditional approval, or disapproval, and filing of tentative, final, and parcel maps, and the modification thereof. The act generally requires a subdivider to file a tentative map or vesting tentative map with the local agency, and requires the local agency to approve, conditionally approve, or disapprove the map within a specified time period. Before approving a tentative map, or a parcel map for which a tentative map was not required, for an area located in a state responsibility area or a very high fire hazard severity zone, existing law requires a legislative body of a county to make specified findings. Existing law requires a legislative body of a county to transmit these findings to the State Board of Forestry and Fire Protection.

This requires a legislative body of a county to make specified findings before approving a tentative map, or a parcel map for which a tentative map was not required, for areas located in moderate and high fire hazard severity zones, and requires these findings to be transmitted to the state board.

By requiring new duties on a county, the bill imposes a state-mandated local program. The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement. This bill provides that, if the Commission on State Mandates determines that the bill contains costs mandated by the state, reimbursement for those costs shall be made pursuant to statutory provisions.

AB 1255: Fire Prevention: Fire Risk Reduction Guidance: Local Assistance Grants

This bill requires the Department of Forestry and Fire Protection, in coordination with the Secretary of the Natural Resources Agency, to facilitate regional, habitat-specific, and area-specific approaches to fire risk reduction, prevention, and restoration of projects that improve community safety, protect sites and structures, restore burned habitat, reduce catastrophic wildfires, and protect natural resources. It requires the department to develop policies, funding programs for which the funding shall be contingent upon subsequent appropriation in the annual Budget Act or a similar statute for this purpose, and relevant program guidelines that promote specified objectives. The bill requires various state entities to establish grant programs, for which funding shall be contingent upon subsequent appropriation, to fulfill the specified objectives.

AB 1295: Residential Development Agreements: Very High Fire Risk Areas

Current law requires the Director of Forestry and Fire Protection to identify areas in the state as very high fire hazard severity zones based on the severity of fire hazard that is expected to prevail in those areas and requires each local agency to designate, by ordinance, the very high fire hazard severity zones in its jurisdiction. Current law additionally requires the director to classify lands within state responsibility areas into fire hazard severity zones. This bill prohibits the legislative body of a city or county from entering into a residential development agreement for property in a very high fire risk area. The bill defines “very high fire risk area” for these purposes to mean a very high fire hazard severity zone designated by a local agency or a fire hazard severity zone classified by the director.

AB 1439: Property Insurance Discounts

This bill requires a residential property insurance policy to include a discount if a local government of the jurisdiction where the insured property is located funds a local wildfire protection or mitigation program. Because the bill mandates discounts for specified residential property insurance policies, thus affecting the Insurance Commissioner’s consideration of a rate, the bill would amend Proposition 103.

AB 1500: Safe Drinking Water, Wildfire Prevention, Drought Preparation, Flood Protection, Extreme Heat Mitigation, and Workforce Development Bond Act of 2022

If approved by the voters, this bill would authorize the issuance of bonds in the amount of $6,700,000,000 pursuant to the State General Obligation Bond Law to finance projects for safe drinking water, wildfire prevention, drought preparation, flood protection, extreme heat mitigation, and workforce development programs.

AB 2140: General Plans—Safety Element

This bill provides that the state may allow for more than 75 percent of public assistance funding under the California Disaster Assistance Act only if the local agency is in a jurisdiction that has adopted a local hazard mitigation plan as part of the safety element of its general plan. The local hazard mitigation plan needs to include elements specified in this legislation. In addition, this bill requires Cal OES to give preference for federal mitigation funding to cities and counties that have adopted local hazard mitigation plans. The intent of the bill is to encourage cities and counties to create and adopt hazard mitigation plans.

AB 2800: Climate Change—Infrastructure Planning

This California State Assembly bill passed in 2016 and until July 1, 2020, requires state agencies to take into account the current and future impacts of climate change when planning, designing, building, operating, maintaining, and investing in state infrastructure. The bill, by July 1, 2017, and until July 1, 2020, requires an agency to establish a Climate-Safe Infrastructure Working Group to examine how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act’s main purpose is to prevent construction of buildings used for human occupancy on the surface trace of active faults. Before a new project is permitted, cities and counties require a geologic investigation to demonstrate that proposed buildings will not be constructed on active faults. The act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as liquefaction or seismically induced landslides. The law requires the State of California Geologist to establish regulatory zones around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. All seismic hazard mitigation actions identified in this plan will seek full compliance with the Alquist-Priolo Earthquake Fault Zoning Act.

Board of Forestry and Fire Protection Fire Safe Regulations

California’s Board of Forestry and Fire Protection is authorized to adopt regulations to implement specified programs. To become effective, the Office of Administrative Law must approve these regulations. Once adopted, Board regulations are placed in Title 14 of the California Code of Regulations. The Department of Forestry and Fire Protection then implements the regulations.

Since 1991, the Board’s Fire Safe Regulations have set the floor for fire safety standards for perimeters and access to all residential, commercial, and industrial building construction in state responsibility areas. They address road standards for fire equipment access, standards for road and building signs, minimum private water supplies for emergency fire use, and fuel breaks and greenbelts. Starting on July 1, 2021, these requirements will also apply in the local responsibility areas and will address construction on ridgelines.

California Department of Forestry and Fire Protection

CAL FIRE has responsibility for wildfires in areas of the county that are not under the jurisdiction of the Forest Service or a local fire organization, including lands designated as State Responsibility Areas. CAL FIRE also has fire protection responsibilities by contract and mutual aid agreements. For example, CAL FIRE provides year-round fire protection under Amador Plan agreements with certain local government agencies (Public Resources Code §4144). Through these agreements, CAL FIRE provides local structural and wildfire protection or dispatch services to a community and maintains a staffing level that otherwise would be available only during the fire season. The local entity pays the additional cost of the service.

California Department of Parks and Recreation (State Parks)

State Parks manages portions of the California coastline including coastal wetlands, estuaries, beaches, and dune systems. The State Parks Resources Management Division has limited wildfire protection resources available to suppress fires on State Park lands.

California Department of Water Resources

In California, the Department of Water Resources is the coordinating agency for floodplain management. The department works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, participating in statewide flood hazard mitigation planning, and facilitating annual statewide workshops. Compliance is monitored by FEMA regional staff and by the Department of Water Resources.

California Division of Safety of Dams

California's Division of Safety of Dams (a division of the Department of Water Resources) monitors the dam safety program at the state level and maintains a working list of dams in the state. When a new dam is proposed, Division engineers and geologists inspect the site and the subsurface. Upon submittal of an application, the Division reviews the plans and specifications prepared by the owner to ensure that the dam is designed to meet minimum requirements and that the design is appropriate for the known geologic conditions. After approval of the application, the Division inspects all aspects of the construction to ensure that the work is done in accordance with the approved plans and specifications. After construction, the Division inspects each dam to ensure that it is performing as intended and is not developing problems. The Division periodically reviews the stability of dams and their major appurtenances in light of improved design approaches and requirements, as well as new findings regarding earthquake hazards and hydrologic estimates in California. Over 1,200 dams are inspected by Division engineers on a yearly schedule to ensure performance and maintenance of dams (California Department of Water Resources 2021b).

California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970, shortly after the federal government enacted the National Environmental Policy Act, to institute a statewide policy of environmental protection. CEQA requires state and local agencies in California to follow a protocol of analysis and public disclosure of the potential environmental impacts of development projects. CEQA makes environmental protection a mandatory part of every California state and local agency's decision-making process.

CEQA establishes a statewide environmental policy and mandates actions all state and local agencies must take to advance the policy. Jurisdictions conduct analysis of the project to determine if there are potentially significant environmental impacts, identify mitigation measures, and possible project alternatives by preparing environmental reports for projects that requires CEQA review. This environmental review is required before an agency takes action on any policy, program, or project. Any project action identified in this plan will seek full CEQA compliance upon implementation.

California Fire Alliance

The California Fire Alliance (CFA) was established in response to directives from the 2001 National Fire Plan. The CFA pursues four strategies to deal with the National Fire Plan’s community assistance initiative:

- Work with communities at risk from wildfires to develop community-based planning leadership and facilitate the development of community fire loss mitigation plans, which transcend jurisdiction and ownership boundaries.
- Assist communities in development of fire loss mitigation planning, education and projects to reduce the threat of wildfire losses on public and private lands.
- Develop an information and education outreach plan to increase awareness of wildfire protection program opportunities available to communities at risk.
- Work collaboratively to develop, modify and maintain a comprehensive list of communities at risk.

California Fire Plan

The State Board of Forestry and CAL FIRE have prepared a comprehensive update of the California Fire Plan for wildfire protection. The planning process included defining a level of service measurement; considering assets at risk; incorporating the cooperative interdependent relationships of wildfire protection providers; providing for public stakeholder involvement; and creating a fiscal framework for policy analysis. The California Fire Plan’s overall goal is to reduce costs and losses from wildfire in the state by protecting assets at risk through pre-fire management and by reducing the spread of fire through more successful initial response.

California Fire Safe Council

In 1993, the statewide Fire Safe Council, consisting of private and public membership, was formed to educate and encourage Californians to plan and prepare for wildfires by reducing the risk of fire to property, communities, and natural/structural resources. In 2002, this group created a nonprofit organization and board of directors, called the California Fire Safe Council. The Council works with the California Fire Alliance to facilitate the distribution of National Fire Plan grants for wildfire risk reduction and education (www.grants.firesafecouncil.org). The Council also provides assistance to local Fire Safe Councils through its website (www.firesafecouncil.org), the distribution of educational materials, and technical assistance, primarily through regional representatives. More than 130 local Fire Safe Councils have formed in California to plan, coordinate, and implement fire prevention activities.

California Fire Service and Rescue Emergency Mutual Aid Plan

The Governor’s Office of Emergency Services Fire and Rescue Branch administers the California Fire Service and Rescue Emergency Mutual Aid Plan. The agency provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support, primarily to overall emergency service organizations and urban search and rescue teams.

California General Planning Law

California state law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for community development. The general plan expresses the community's goals, visions, and policies relative to future land uses, both public and private. The general plan is mandated and prescribed by state law (Cal. Gov. Code §65300 et seq.), and forms the basis for most local government land use decision-making.

The plan must consist of an integrated, internally consistent set of goals, policies, and implementation measures. In addition, the plan must focus on issues of the greatest concern to the community and be written in a clear and concise manner. City and county actions, such as those relating to land use allocations, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with the plan.

California Multi-Hazard Mitigation Plan

Under the DMA, California must adopt a federally approved state multi-hazard mitigation plan to be eligible for certain disaster assistance and mitigation funding. The intent of the State of California Multi-Hazard Mitigation Plan is to reduce or prevent injury and damage from hazards in the state through the following:

- Documenting statewide hazard mitigation planning in California
- Describing strategies and priorities for future mitigation activities
- Facilitating the integration of local and tribal hazard mitigation planning activities into statewide efforts
- Meeting state and federal statutory and regulatory requirements.

The plan is an annex to the State Emergency Plan, and it identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. It also establishes hazard mitigation goals and objectives. The plan will be reviewed and updated annually to reflect changing conditions and new information, especially information on local planning activities.

Under 44 CFR Section 201.6, local hazard mitigation plans must be consistent with their state's hazard mitigation plan.

California Residential Mitigation Program

The California Residential Mitigation Program was established in 2011 to help Californians strengthen their homes against damage from earthquakes. The program is a joint powers authority created by Cal OES and the California Earthquake Authority, which is a not-for-profit, publicly managed, privately funded provider of home earthquake insurance to California homeowners and renters.

Earthquake Brace + Bolt was developed to help homeowners lessen the potential for damage to their houses during an earthquake. A residential seismic retrofit strengthens an existing older house, making it more resistant to earthquake activity such as ground shaking and soil failure. The seismic retrofitting involves bolting the house to its foundation and adding bracing around the perimeter of the crawl space. Most homeowners hire a contractor to do the retrofit work, and owners of houses in ZIP Codes with house characteristics suitable for this type of retrofit are eligible for up to $3,000 toward the cost. A typical retrofit by a contractor may cost between $3,000 and $7,000, depending on the location and size of the house, contractor fees, and the amount of materials and work involved. If the homeowner is an experienced do-it-yourselfer, a retrofit can cost less than $3,000.

California State Building Code

California Code of Regulations Title 24 (CCR Title 24), also known as the California Building Standards Code, is a compilation of building standards from three sources:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes adopted to address particular California concerns.

The state Building Standards Commission is authorized by California Building Standards Law (Health and Safety Code Sections 18901 through 18949.6) to administer the processes related to the adoption, approval, publication, and implementation of California's building codes. These building codes serve as the basis for the design and construction of buildings in California. The national model code standards adopted into Title 24 apply to all occupancies in California, except for modifications adopted by state agencies and local governing bodies. Since 1989, the Building Standards Commission has published new editions of Title 24 every three years.

On January 1, 2014, California Building Code Accessibility Standards found in Chapter 11B incorporated the 2010 Americans with Disabilities Act (ADA) Standards as the model accessibility code for California. The purpose was to ensure consistency with federal guidelines. As a result of this incorporation, the California standards will fully implement and include 2010 ADA Standards within the California Building Code while maintaining enhanced levels of accessibility already provided by existing California accessibility regulations. All planning partners that have building code and permit authority have adopted building codes that are in full compliance with the California State Building Code.

Disadvantaged and Low-income Communities Investments

Senate Bill (SB) 535 directs state and local agencies to make investments that benefit California's disadvantaged communities. It also directs the California Environmental Protection Agency to identify disadvantaged communities for the purposes of these investments based on geographic, socio-economic, public health, and environmental hazard criteria. Assembly Bill (AB) 1550 increased the percent of funds for projects located in disadvantaged communities from 10 to 25 percent and added a focus on investments in low-income communities and households. This program is a potential alternative source of funding for actions identified in this plan.

Division of the State Architect's AB 300 List of Seismically At-Risk Schools

In 2002, California's Division of the State Architect completed an inventory of public school buildings built before 1978 that identifies buildings with characteristics that might make them unsafe in future earthquakes. This inventory provides a list of potentially at-risk schools known as the AB 300 list (the inventory was authorized by Assembly Bill 300 in 1999). Using available information on school buildings' dates of construction, seismic retrofits, and structural systems (wood-frame, concrete shear wall, or steel moment frame, etc.), the inventory categorized California public school buildings into one of two categories: those expected to perform well in future earthquakes; and those that are not expected to perform well and require more detailed seismic evaluation.

The Division of the State Architect recommends that public schools on this list undergo detailed seismic evaluations to determine if they pose life safety risks, but the state has neither required nor funded school districts to do this.

Governor's Executive Order S-13-08

Governor's Executive Order S-13-08 enhances the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation and extreme weather events. There are four key actions in the executive order:

- Initiate California's first statewide climate change adaptation strategy to assess expected climate change impacts, identify where California is most vulnerable, and recommend adaptation policies. This effort will improve coordination within state government so that better planning can more effectively address climate impacts on human health, the environment, the state's water supply and the economy.
- Request that the National Academy of Science establish an expert panel to report on sea level rise impacts in California, to inform state planning and development efforts.
- Issue interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects.
- Initiate a report on critical infrastructure projects vulnerable to sea level rise.

Office of the State Fire Marshal

The Office of the State Fire Marshal is a division of CAL FIRE that has a wide variety of fire safety and training responsibilities and provides technical support to fire agencies/organizations.

Senate Bill 92: Public Resources Portion of Biennial Budget Bill

The State of California updated its requirements regarding emergency action plans (EAPs) via Senate Bill 92, which became effective in June 2017 as part of the state Legislature's biennial budget process. The bill required dam owners to submit EAPs to Cal OES and the Department of Water Resources for approval by January 1, 2018 (for extremely high hazard dams), January 1, 2019 (for high-hazard dams), and January 1, 2021 (for significant hazard dams). The EAPs were to include the following (California Government Code Section 8589.5; Cal OES, 2018):

- Emergency notification flow charts
- Information on a four-step response process
- Description of agencies' roles and actions in response to an emergency incident
- Description of actions to be taken in advance of an emergency
- Inundation maps
- Additional information such as revision records and distribution lists.

After the EAPs are approved by the state, the law requires dam owners to send the approved EAPs to relevant stakeholders. Local public agencies can then adopt emergency procedures that incorporate the information in the EAP in a manner that conforms to local needs and includes methods and procedures for alerting and warning the public and other response and preparedness related items (State of California, 2018).

SB 92 also requires dams other than low-risk dams to have current inundation mapping, which must be updated every 10 years, or sooner if specific circumstances change. EAPs also must be updated every 10 years. It provides the Department of Water Resources with enforcement tools, including fines and operational restrictions for failure to comply. Cal OES is required by the law to work with state and federal agencies, dam owners, planners, and the public to make dam failure inundation maps available to community members interested in learning their dam failure inundation risk.

Senate Bill 97: Guidelines for Greenhouse Gas Emissions

Senate Bill 97, enacted in 2007, amends CEQA to clearly establish that greenhouse gas emissions and the effects of greenhouse gas emissions are appropriate subjects for CEQA analysis. It directs the Governor's Office of Planning and Research to develop draft CEQA guidelines for the mitigation of greenhouse gas emissions or their effects by July 1, 2009, and directs the California Natural Resources Agency to certify and adopt the CEQA Guidelines by January 1, 2010.

Senate Bill 99: Evacuation Route Planning

Senate Bill 99, enacted in 2019, requires that cities' and counties' general plans address evacuation routes from any hazard area identified in the safety element. Under this law, the safety element must include information to identify residential developments in hazard areas that do not have at least two emergency evacuation routes. Each city or county must update its safety element with the new information upon the next revision of its housing element on or after January 1, 2020.

Senate Bill 182 Local Government: Planning and Zoning: Wildfires

California Senate Bill 182 made a number of changes to state law regarding planning for and permitting development in areas designated as very high fire risk areas. The bill requires a local jurisdiction to do the following:

- Include a comprehensive retrofit strategy in its safety element to reduce the risk of property loss and damage during wildfires.
- Amend its land use element to identify all very high fire risk areas and to establish measures to protect lives and property from unreasonable risk of wildfire.
- Adopt a very high fire risk overlay zone for its zoning ordinance.
- Allocate a lower portion of projected future housing to very high fire hazard severity zones

This bill prohibits local governments from entering into a development agreement for property in a very high fire risk area, approving a permit for a project in a very high fire risk area, or approving a tentative map for a subdivision in a very high fire risk area, unless the jurisdiction makes specified findings based on substantial evidence.

Senate Bill 379: General Plans: Safety Element—Climate Adaptation

Senate Bill 379 builds upon the flood planning inclusions into the safety and housing elements and the hazard mitigation planning safety element inclusions in general plans outlined in AB 162 and AB 2140, respectively. SB 379 focuses on a new requirement that cities and counties include climate adaptation and resiliency strategies in the safety element of their general plans beginning January 1, 2017. In addition, this bill requires general plans to include a set of goals, policies and objectives, and specified implementation measures based on the conclusions drawn from climate adaptation research and recommendations.

Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements

In 2016, Senate Bill 1000 amended California's Planning and Zoning Law in two ways:

- The original law established requirements for initial revisions of general plan safety elements to address flooding, fire, and climate adaptation and resilience. It also required subsequent review and revision as necessary based on new information. Senate Bill 1000 specifies that the subsequent reviews and revision based on new information are required to address only flooding and fires (not climate adaptation and resilience).
- Senate Bill 1000 adds a requirement that, upon adoption or revision of any two other general plan elements on or after January 1, 2018, an environmental justice element be adopted for the general plan or environmental justice goals, policies and objectives be incorporated into other elements of the plan.

Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts

In 2012, Senate Bill 1241 passed requiring that the safety elements of all future general plans address fire risk in state responsibility areas and very high fire hazard severity zones. The bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.

Standardized Emergency Management System

CCR Title 19 establishes the Standardized Emergency Management System (SEMS) to standardize the response to emergencies involving multiple jurisdictions. SEMS is intended to be flexible and adaptable to the needs of all emergency responders in California. It requires emergency response agencies to use basic principles and components of emergency management. Local governments must use SEMS by December 1, 1996, to be eligible for state funding of response-related personnel costs under CCR Title 19 (Sections 2920, 2925 and 2930). The roles and responsibilities of Individual agencies contained in existing laws or the state emergency plan are not superseded by these regulations. This hazard mitigation plan is considered to be a support document for all phases of emergency management, including those associated with SEMS.

Western Governors Association Ten-Year Comprehensive Strategy

The *Western Governors Association Ten-Year Comprehensive Strategy: A Collaborative Approach for Reducing Wildfire Risks to Communities and the Environment* (August 2001) is strategy implementation plan prepared by federal and Western state agencies that outlines measures to restore fire-adapted ecosystems and reduce hazardous fuels.

EXHIBIT A

Tri-Valley Local Hazard Mitigation Plan

Appendix C. Risk Assessment Mapping Methodology

C. Risk Assessment Mapping Methodology

DAM FAILURE INUNDATION MAPPING

Dam breach inundation maps, including inundation boundaries and depth grids, were downloaded from the California Department of Water Resources' (DWR) website - https://fmds.water.ca.gov/maps/damim/. As required by California Water Code section 6161, the Division of Safety of Dams (DSOD) at DWR reviews and approves inundation maps prepared by licensed civil engineers and submitted by dam owners for extremely high, high, and significant hazard dams and their critical appurtenant structures. Inundation maps are based on a hypothetical failure of a dam or critical appurtenant structure and the information depicted on the maps is approximate. The dams and failure scenarios are as follows:

- 1.056—Del Valle (National Dam ID CA00043): Scenario shows inundation extents for sunny day failure of the Main Dam and of Outlet 1. Files downloaded from DSOD website generated on 9/27/2019.
- 1.062—Patterson (National Dam ID CA00048): Scenarios show a composite inundation extent for individual sunny day failures at the Northwest, West, and Southeast sections of Patterson Dam. Files downloaded from DSOD website generated on 12/6/2019.

EARTHQUAKE MAPPING

Liquefaction Susceptibility

The liquefaction dataset used in this analysis was created by the Association of Bay Area Governments.

National Earthquake Hazard Reduction Program (NEHRP) Soils

NEHRP soils information is derived from a shear wave velocity (Vs30) data produced by the California Geological Survey in 2015. The Vs30 data represents simplified geologic units that have been correlated to the time-averaged shear-wave velocity in the upper 30 meters of the earth's surface. The geologic units were compiled from published maps that range in scale from 1:250,000 to 1:24,000. (Wills, et. al., 2015)

Shake Maps

A shake map is designed as a rapid response tool to portray the extent and variation of ground shaking throughout an affected region immediately following significant earthquakes. Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on estimated amplitudes where data are lacking, and site amplification corrections. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. For this plan, shake maps were prepared by the USGS for five earthquake scenarios:

- An earthquake on the Calaveras (No) fault with the following characteristics:
  - Magnitude: 6.86
  - Epicenter: N 37.65 W 121.93
  - Depth: 10.4 km

- An earthquake on the Greenville (No) fault with the following characteristics:
  - Magnitude: 6.86
  - Epicenter: N 37.70 W 121.68
  - Depth: 11.3 km

- An earthquake on the Hay Wired fault with the following characteristics:
  - Magnitude: 7.05
  - Epicenter: N 37.80 W 122.18
  - Depth: 8.0 km

- An earthquake on the Las Positas fault with the following characteristics:
  - Magnitude: 6.5
  - Epicenter: N 37.65 W 121.74
  - Depth: 9.6 km

- An earthquake on the Mount Diablo Thrust South fault with the following characteristics:
  - Magnitude: 6.5
  - Epicenter: N 37.82 W 121.79
  - Depth: 9.0 km

FLOOD MAPPING

Flood hazard areas are from the Alameda County countywide effective FEMA Digital Flood Insurance Rate Map (DFIRM) dated December 21, 2018. The latest Letters of Map Revision were updated on February 9, 2022, and have been incorporated since the effective date.

LANDSLIDE MAPPING

Data on susceptibility to deep-seated landslides was provided by the California Geological Survey. The map and associated data show the relative likelihood of deep-seated landsliding based on regional estimates of rock strength and steepness of slopes. On the most basic level, weak rocks and steep slopes are most likely to generate landslides. The map uses detailed information on the location of past landslides, the location and relative strength of rock units, and steepness of slope to estimate susceptibility to deep-seated landsliding (0 to X, low to high). This landslide susceptibility map is intended to provide infrastructure owners, emergency planners and the public with a general overview of where landslides are more likely to occur. (Wills, et. al., 2011)

WILDFIRE MAPPING

Wildfire hazard areas are from the California Department of Forestry and Fire Protection. The data shows the moderate, high, and very high wildfire hazard severity zones.

REFERENCES

Wills, C.J., Gutierrez, C.I., Perez, F.G., and Branum, D.B., 2015, A next-generation Vs30 map for California based on geology and topography: Bulletin of the Seismological Society of America.

Wills C.J., Perez, F., Gutierrez, C. 2011. Susceptibility to deep-seated landslides in California: California Geological Survey Map Sheet 58.

Tri-Valley Local Hazard Mitigation Plan

Appendix D. Plan Adoption Resolutions from Planning Partners

D. PLAN ADOPTION RESOLUTIONS FROM PLANNING PARTNERS

To Be Provided With Final Draft

EXHIBIT A

Appendix E. Progress Report Template

E. PROGRESS REPORT TEMPLATE

Reporting Period: *(Insert reporting period)*

Background: The Cities of Dublin, Livermore and Pleasanton, the Dublin San Ramon Services District, and participating local jurisdictions, developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the participating planning partners organized resources, assessed risks from natural hazards, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, these jurisdictions maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed on-line at:

INSERT LINK

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2023, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before ______, 2028. As of this reporting period, the performance period for this plan is considered to be __% complete. The Hazard Mitigation Plan has targeted __ hazard mitigation actions to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- __ out of __ actions (__%) reported ongoing action toward completion.
- __ out of __ actions (__%) were reported as being complete.
- __ out of __ actions (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the Hazard Mitigation Plan. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of the planning partners. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Hazard Mitigation Plan Steering Committee: The Hazard Mitigation Plan Steering Committee, made up of planning partners and other stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on _____, 20XX. It was determined through the plan's development process that a steering committee would remain in service to oversee maintenance of the plan. At a minimum, the Steering Committee will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in Table 1.

Table 1. Steering Committee Members

Name	Title	Jurisdiction/Agency

Natural Hazard Events within the Planning Area: During the reporting period, there were __ natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- ______________________________
- ______________________________

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each action. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each action and the prioritization process.

Address the following in the "status" column of the following table:

- Was any element of the action carried out during the reporting period?
- If no action was completed, why?
- Is the timeline for implementation for the action still appropriate?
- If the action was completed, does it need to be changed or removed from the action plan?

Table 2. Action Plan Matrix

Action Taken? (Yes or No)	Timeline	Priority	Status	Status (X, O,✓)
Action #__ —____________________[description]				
Action #__ —____________________[description]				
Action #__ —____________________[description]				
Action #__ —____________________[description]				
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Action #__ —____________________[description]				
Action #__ —____________________[description]				
Action #__ —____________________[description]				

Completion status legend:
✓= Project Completed
O = Action ongoing toward completion
X = No progress at this time

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Steering Committee, the following recommendations will be noted for future updates or revisions to the plan:

- ______________________________
- ______________________________
- ______________________________
- ______________________________
- ______________________________
- ______________________________

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets. The report is posted on the Tri-Valley Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

Insert Contact Info Here

EXHIBIT A

Appendix F. Steering Committee Meeting Materials

Tri-Valley Local Hazard Mitigation Plan Update

FINAL STEERING COMMITTEE GROUND RULES

August 1, 2022

PURPOSE

As the title suggests, the role of the Steering Committee is to guide the Tri-Valley Planning Partners (Cities of Dublin, Livermore, and Pleasanton and the Dublin San Ramon Service District) through the process of updating the 2018 Tri-Valley Local Hazard Mitigation Plan. This process will result in a plan that can be embraced both politically and by the constituency within the planning area. The Committee will provide guidance and leadership, oversee the planning process, and act as the point of contact for all partners and the various interest groups in the planning area. The makeup of this committee was selected to provide the best possible cross section of views to enhance the planning effort and to help build support for hazard mitigation.

CHAIRPERSON

The Steering Committee selected Susan Frost to be chairperson. The role of a chair is to:

1) lead meetings so that agendas are followed and meetings adjourn on-time,
2) allow all members to be heard during discussions,
3) moderate discussions between members with differing points of view,
4) be a sounding board for the Core Planning Team (CPT) in the preparation of agendas and how to best involve the full Committee in work plan tasks,

Cary Fukada, was selected as vice chairperson to take the chair's role when the chair is not available.

The Committee chose to adopt a rule that requires either the chair or the vice chair to be present at any given meeting.

ATTENDANCE

Participation of all Committee members in meetings is important and members should make every effort to attend each meeting. If Committee members cannot attend, they should inform one or more of the following CPT members (Susan Frost smfrost@LivermoreCA.gov, Shweta Bonn sbonn@cityofpleasantonca.gov, John Stefanski john.stefanski@dublin.ca.gov, Sean O'Reilly oreilly@dsrsd.com) before the meeting is conducted. If a member misses two meetings *without an explanation*, the Committee may choose to write a letter to the member to confirm interest and may ultimately seek to replace the member.

QUORUM

A minimum attendance at each meeting often is needed to ensure that the different viewpoints of Committee members are adequately represented.
Since there is an odd number of Committee members, a quorum for this committee will be eight (8) of the Committee membership and the chair or vice chairperson must be present.

ALTERNATES

A specific list of Committee members was selected for the Steering Committee. These members have made a commitment to attend the meetings and gain the understanding of the issues and each other's viewpoints needed to reach agreement on plan recommendations. However, there may be circumstances when regular members cannot attend. To address these circumstances, alternate members may be identified for each active committee member. The Committee decided the role of alternates is fully interchangeable with that of regular Committee members. Alternates will be able to voice opinions and vote, in the place of the absent committee member they represent.

DECISION-MAKING

As the Committee provides advice and guidance on the Plan, it will reach its recommendations through consensus. Consensus is defined as a recommendation that may not be ideal for each Committee member, but that every member can live with (using the consensus continuum as a gauge). The Steering Committee will strive for consensus. If consensus cannot be achieved, a majority vote will determine the decision. Minority dissent will be recorded in the meeting summaries and the Committee chose to note such opinions in their final recommendations.

RECOMMENDATIONS

The Committee's recommendations will be recorded in the meeting summaries and reflected in the plan as appropriate. The Committee may also assist in the presentation of the Plan to the elected bodies of participating organizations.

SPOKESPERSONS

Ideally the Committee will present a united recommendation after considering the different viewpoints of its members, recognizing that each member might have made a somewhat different recommendation as an individual. To consistently represent the Committee's united recommendations to participating organizations, the public, and the media, the Committee spokesperson will be the Committee Chairperson or a designee from the CPT.

In addition, each member should have a responsibility to represent the Committee's recommendation when speaking on Plan-related issues as a Committee member. Any differing personal or organizational viewpoints should be clearly distinguished from the Committee's work. Finally, Committee members will need to help with presentations given to governing bodies, especially the governing body that a Committee member is affliatiated with.

STAFFING

The Core Planning Team for this project includes appropriate personnel from each Planning Partner along with staff from Tetra Tech, Inc. The Planning Team will schedule meetings, distribute agendas, prepare information/presentations for Committee meetings, write meeting summaries, and generally seek to facilitate the Committee's activities.

PUBLIC INVOLVEMENT

As they conduct Committee work, members will seek to keep the public and the groups to which they are affiliated informed about the Plan. Committee meetings will be open to the public and agendas and minutes will be posted on the project web page. The preferred method of public input will be via written or emailed documents to CPT or Committee members. However, comments will be taken at the beginning and end of meetings, and on each agenda item, with a 2-minute limit per person.

Public Outreach strategies will likely include social media, and a website for the Plan update with a link to Steering Committee meetings, etc.

COURTESY

Committee members should treat each other with respect, listen to each other, work cooperatively, and allow all members to voice their opinions.

MEETINGS

Meetings generally will be conducted virtually, once per month as needed.

EXHIBIT A

Tri-Valley
Meeting Minutes

Purpose of Meeting:	Tri-Valley Local Hazard Mitigation Plan Steering Committee Meeting #1
Location of Meeting:	Virtual
Date of Meeting:	7.11.2022

Steering Committee Members and Alternates:

☒ **Shweta Bonn**, Senior Planner, City of Pleasanton
☐ **Lincoln Casimere**, Emergency Manager, Alameda County Fire Department
☒ **Michael Cass**, Principal Planner, City of Dublin (Alternate)
☒ **Herbert Cole**, Emergency Manager, City of Livermore
☒ **Stephanie Egidio**, Management Analyst, City of Livermore (Alternate)
☒ **Susan Frost**, Special Projects Coordinator, City of Livermore
☒ **Cary Fukada**, CERT
☒ **Matt Fuzie**, General Manager RPD, City of Livermore
☒ **Tracy Hein**, Emergency Preparedness Manager, Livermore-Pleasanton Fire Department
☐ **Aaron Lacey**, Deputy Chief, Livermore-Pleasanton Fire Department
☐ **Christine Martin**, Assistant City Manager, City of Livermore
☒ **Franc Moufarrej**, Permit Center Manager, City of Livermore
☐ **Adam Nelkie**, Assistant Director of Engineering, City of Pleasanton
☒ **Sean O'Reilly**, Associate Engineer, Dublin San Ramon Services District
☒ **Jerry Paulson**, Emergency Manager, Lawrence Livermore National Laboratory
☒**Tricia Pontau**, Associate Planner, City of Livermore
☒ **Jake Potter**, Associate Planner, City of Livermore (Alternate)
☒ **John Stefanski**, Assistant to the City Manager, City of Dublin

Other Attendees:

Ben Murray, City of Livermore
Stephen Riley, City of Livermore
Ken Henneman (Public)
Rob Flaner, Program Manager, Tetra Tech
Bart Spencer, Lead Project Planner, Tetra Tech
Megan Brotherton, Support Planner, Tetra Tech
Carol Baumann, Risk Assessment Lead, Tetra Tech

Meeting Summary: Introduce Steering Committee to the HMP update process, discuss project coordination, roles and responsibilities, hazards of concern/hazards of interest, public outreach and engagement.

Item No.	Description	Action/Decision item(s):
1	**Welcome & Introductions** 10:00 am	
2	**Project Overview** (Bart Spencer & Rob Flaner) • Tetra Tech was selected to update the Tri-Valley Local Hazard Mitigation Plan for a second time. • The update is following guidance from the Disaster Mitigation Act (DMA). • Mitigation is an element of emergency management. • Earthquakes, Wildfires, Drought, and Climate Change are the main hazards in the Bay Area. Each of them will be included in the plan update, along with other natural hazards that impact	

	the planning area. Select non-natural hazards will be discussed qualitatively. • The update incorporates new guidance from FEMA and best practices.	
3	**Project Coordination** (Bart) • A Core Planning Team (CPT) drives the plan update. This includes looking at hazard modeling and engaging in ongoing public outreach. The CPT meets biweekly and is made up of representation from the four planning partners: o City of Dublin o City of Livermore o City of Pleasanton o Dublin San Ramon Services District (DSRSD) • The Steering Committee (SC) is an advisory board made up of representatives from government and non-government organizations (NGOs) in the planning area. o Susan Frost offered to be the chair for the SC. o A vice-chair is needed from the NGO members. The vice-chair will conduct the meeting if Susan is absent. o Rob recommended Cary Fukada as the vice-chair. Cary accepted the recommendation. o The SC will meet about five times during the planning process. Meetings will be scheduled once a month as needed; tentatively planned on the second Monday of each month. Virtual meetings are preferred. o 15 Steering Committee members. Quorum is 50% plus one. No objections. o Meetings must be open to the public for Community Rating System (CRS) compliance. o Ground Rules for participation will be accepted at the August SC meeting. o Q: Franc Moufarrej—What is the time commitment? ▪ A: Bart—Each meeting is scheduled for 2 hours. Meeting agendas and supplementary meeting materials will be sent out to review before each meeting. About 10-12 hours will be needed during the planning process. o Mission Statement, Goals, and Objectives ▪ Minor modifications were made to the previous plan mission statement, goals and objectives to align with new FEMA guidance for climate change and social vulnerability. ▪ Goals are the "swim lanes" for the plan. Objectives are stand-alone components that support the goals.	**Decisions:** Steering Committee Chair—Susan Frost Steering Committee Vice-chair—Cary Fukada Quorum is 8 No objections **Action Items:** SC to review Mission Statement, Goals, and Objectives before accepting them at the August meeting. CPT to determine document sharing protocol.

	Action items in the plan are tied to one or more objectives. ○ Q: Cary Fukada—How will documents be shared with the Steering Committee? ▪ A: Bart—The CPT will make a decision and circle back.	
	Hazards Assessment & Risk Assessment (Bart & Carol Baumann) • Critical facilities definition (accept at August meeting) • Natural Hazards: ○ Earthquake ○ Wildfire ○ Mass movement/landslide ○ Flood ○ Drought (qualitative assessment) ○ Climate change ○ Severe weather (qualitative assessment) ○ Dam Failure • Hazards of Interest ○ Public health (e.g., pandemic) ○ Terrorism ○ Threats (active, biological, chemical, explosive, cyber) ○ Cyberterrorism ○ Civil unrest ○ Hazardous material ○ Pipeline ○ Utility failure ○ Transportation accident • Q: Tricia Pontau—What is meant by climate change? How is it defined? ○ A: Bart—It's an accelerator. Each natural hazard is analyzed in relation to climate change. Additionally, some hazards are interconnected, and the linkage is defined in the profiles. • Q: Jerry Paulson—The National Risk Index identifies 18 natural hazards. Will they all be addressed in the plan? ○ A: Rob—The NRI is a guide but not the benchmark for local HMPs. Local plans are obligated to be consistent with the state HMP and are under state guidance. According to statutory requirements, we must address natural hazards that impact the planning area. The NRI looks at social vulnerability, but it is at a national census tract level which does not apply well to California due to the higher cost of living in the state.	**Decision:** Recommend accepting the natural hazard list: Matt Fuzie: Moved to accept as written Cary Fukada: Seconded the motion 11 ayes 0 noes **Action Item:** Herbert Cole to share information with Tetra Tech on Livermore / California DWR dam failure and flood response exercise.

	• Hazards of interest are included in the plan with a qualitative discussion, but FEMA does not provide grant funding for these hazards. The objective is to assess hazards and qualify for grants. Natural hazards qualify for FEMA grant funding.
	
	• Q: Michael Cass—Why “utility failure” and not “utility and infrastructure failure” such as roads and bridges?
	  ○ A: Rob—An extensive risk analysis is done for all roads and bridges for natural hazards. Community lifelines, which include roads and bridges, will be assessed under each profiled hazard of concern.
	  ○ A: Susan Frost—There is a difference between how a natural hazard affects a utility and how a utility may fail on its own such as a gas line bursting.
	
	• Q: Tricia: Why is dam failure listed as a natural hazard?
	  ○ A: Bart—A dam can fail from natural causes like erosion or earthquake.
	  ○ Rob—Every dam has a protection level. A spillway event is considered a dam failure event. A spillway event can occur when a natural event (extreme precipitation) exceeds levels the dam was built for.
	
	• Accept natural hazards so the risk analysis can begin but discuss and accept non-natural hazards at the August meeting.
	
	• Ken Henneman (Public): Del Valle dam needs to be considered in relation to increased storm intensities.
	
	• Q: Herbert—Livermore is working with California DWR on an exercise for the Livermore area regarding dam failure and flood response. Can these plans coordinate with the HMP?
	  ○ Rob—Yes, we use DSOD data in our Hazus modeling, which will inform emergency response planning. We want to use the best available data, so any information that Livermore can share is appreciated.	

3	**Outreach and Engagement** (Bart) • A public hazard awareness and preparedness survey is being developed. It will be open for responses during most of the planning process. • The City of Livermore will host the HMP website content. • A 2-week public comment period at the end of the planning process will allow for comments on the draft plan.	

	Requests from Committee Members • Q: Cary—What does social vulnerability mean? Can you send guidance out in advance to facilitate the discussion? ○ Bart: Every area can define social vulnerability. The CPT is looking at different options and inputs to help define it. When jurisdictions develop action items, they will consider how the action addresses social vulnerability. • Critical facilities/lifelines definition will be sent out for SC review	**Action Items:** • Tetra Tech to inform SC of state social vulnerability definition when available. • Tetra Tech to send critical facilities/lifelines definition to the SC with the agenda for the August meeting
4	**Public comments** No additional	
5	Adjourned at 11:17 am by Susan.	

Tri-Valley
Meeting Minutes

EXHIBIT A

Purpose of Meeting:	Tri-Valley Local Hazard Mitigation Plan Steering Committee Meeting #2
Location of Meeting:	Virtual
Date of Meeting:	8.01.2022

Steering Committee Members and Alternates:

☒ **Shweta Bonn**, Senior Planner, City of Pleasanton
☐ **Lincoln Casimere**, Emergency Manager, Alameda County Fire Department
☐ **Michael Cass**, Principal Planner, City of Dublin (Alternate)
☒ **Herbert Cole**, Emergency Manager, City of Livermore
☒ **Stephanie Egidio**, Management Analyst, City of Livermore (Alternate)
☒ **Susan Frost**, Special Projects Coordinator, City of Livermore
☒ **Cary Fukada**, CERT
☐ **Matt Fuzie**, General Manager RPD, City of Livermore
☒ **Tracy Hein**, Emergency Preparedness Manager, Livermore-Pleasanton Fire Department
☒ **Aaron Lacey**, Deputy Chief, Livermore-Pleasanton Fire Department
☐ **Christine Martin**, Assistant City Manager, City of Livermore
☒ **Franc Moufarrej**, Permit Center Manager, City of Livermore
☒ **Adam Nelkie**, Assistant Director of Engineering, City of Pleasanton
☒ **Sean O'Reilly**, Associate Engineer, Dublin San Ramon Services District
☒ **Jerry Paulson**, Emergency Manager, Lawrence Livermore National Laboratory
☒**Tricia Pontau**, Associate Planner, City of Livermore
☐ **Jake Potter**, Associate Planner, City of Livermore (Alternate)
☐ **John Stefanski**, Assistant to the City Manager, City of Dublin

Other Attendees:

Ben Murray, City of Livermore
Rob Flaner, Program Manager, Tetra Tech
Bart Spencer, Lead Project Planner, Tetra Tech
Megan Brotherton, Support Planner, Tetra Tech

Meeting Summary: Discuss project coordination; approve Ground Rules; approve Mission Statement, Goals, Objectives; approve lifelines definition; approve hazards; discuss outreach and engagement.

Item No.	Description	Action/Decision item(s):
1	**Welcome & Introductions** 1:01 pm	N/A
	Public Comments None	N/A

2	**Project Coordination** (Bart Spencer)
	• Acceptance of Steering Committee #1 Summary
	  ○ Tricia Pontau: Change meeting quorum to 8
	  ○ Cary Fukada: Definition of social vulnerability was discussed, but not listed as an action item
	• CPT meets every other week as needed for this update. Currently ahead of schedule.
	• Steering Committee
	  ○ Ground Rules
	    ▪ Choose consensus or vote to accept
		Decisions:
		
		Recommend accepting the 07.11. 2022 Steering Committee Meeting summary as corrected.
		Cary Fukada: Moved to approve as corrected
		Jerry Paulson: Seconded the motion
		Consensus achieved

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Cary: Does consensus mean a yes vote from everyone?
Rob Flaner: The only time consensus is not achieved is if someone says “no”. Any dissenting vote can be noted. Add to ground rules: “The Steering Committee will strive for consensus. If consensus cannot be achieved, a majority vote will determine the decision.”

Public comment, when and how?

Bart Spencer: No requirement for SC to follow the Brown Act.
Rob: At the start of each meeting, we need to convey when the public can comment.
Susan Frost: City Council meetings have public comment after agenda items. At the beginning of each meeting, public can bring up items not on the agenda, but the items will not be discussed at that meeting.
Rob: Add a bullet item under each agenda item for public comment. No public comments will be accepted from prior meetings.
Cary: Allow comments after each agenda item to show transparency. Limit to 2 minutes.
Franc Moufarrej: Can public comment on other things besides the current agenda?
Bart: The public can submit comments on the HMP website.
Susan: The public can bring up items for future discussion at the end of each meeting.
Tricia Pontau: Add General comments should be allowed at the beginning of each meeting on items related to hazard mitigation, then on every agenda item. 2 minute limit. Submit written comments in advance.

Mission Statement, Goals, Objectives

Potential Goal #9 based on the State HMP: “Prioritize and direct resources to increase disaster resiliency among historically underserved populations, individuals with access and functional needs, and in communities disproportionately impacted by disasters.”
Herbert Cole: The definition for social vulnerability seems too broad.
Cary: Turn the goal into focused objectives. The objectives should be updated in 5 years to acknowledge gentrification in the planning area.

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Ground Rules as revised:

Decision making:
The Steering Committee will strive for consensus. If consensus cannot be achieved, a majority vote will determine the decision.

Public comment:
General comments related to hazard mitigation will be allowed before the meeting and on each agenda item, with a 2-minute limit. Written comments may be submitted via the plan website.

Consensus achieved

Mission Statement, Goals, Objectives as revised:

Add Goal 9
Revisions to Objectives 8, 9, 12

Consensus achieved
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	○ Rob: The purpose of this plan is to qualify for funding. The goal of the Justice 40 Initiative is that 40 percent of the overall benefits of the funding must benefit socially vulnerable populations. Indicate in the plan that the definition in not clearly defined, data is lacking to define social vulnerability, but the definition will be revised over the next 5 years. If the plan does not define social vulnerability, FEMA will use the National Risk Index (NRI). The NRI census block resolution does not accurately represent social vulnerability. ○ Cary: Are other metrics available to use as a proxy? ○ Rob: The state is going to recommend a dataset. ○ Cary: Recommend using the state's definition and improve upon it over the next five years. ○ Tricia: Current objectives use *encourage* and *consider*. Suggest using stronger language. *Hazards, all hazards,* or *natural hazards* in the objectives? Objective 12, *social vulnerability* seems tacked on, suggest removing it. ○ Bart: FEMA will fund natural hazards but does not fund non-natural hazards. ○ Herbert: Emergency managers plan for all hazards, not just natural hazards. Social vulnerability ties to all hazards. Use the term *all hazards*. ○ Aaron Lacey: Fire uses *all hazards*. ○ Susan: Should there be a separate objective to address social vulnerability, or work it into another one? ○ Herbert: Use objective #9 as an opportunity to educate the community. ○ Bart: Change #9 to "underrepresented *and marginalized* communities" ○ Cary: Diversity, equity, and inclusion (DEI) is not defined in a standard way. Projects should be assessed and prioritized in an equitable way considering the language and culture of the community. ○ Susan: #12 remove *and promote social equity* ○ Susan: Remove *natural* from #9 ○ Cary: A*ll hazards* or *hazards*? ○ Susan: All is too encompassing. Use *hazards*. ○ Tricia: Remove *natural* from #8	
	Hazards Assessment & Risk Assessment (Bart) • Critical facilities definition • Natural Hazards: ○ Earthquake ○ Wildfire ○ Mass movement/landslide	**Decisions:** Lifelines Definition *Consensus achieved* Natural Hazards and Hazards of Interest *Consensus achieved*

	○ Flood ○ Drought (qualitative assessment) ○ Climate change ○ Severe weather (qualitative assessment) ○ Dam Failure • Hazards of Interest ○ Public health (e.g., pandemic) ○ Terrorism ○ Threats (active, biological, chemical, explosive, cyber) ○ Cyberterrorism ○ Civil unrest ○ Hazardous material ○ Pipeline ○ Utility failure ○ Transportation accident • Susan: Public may question why hazards of interest are not addressed in more detail in the plan. • Bart: Threats (hazards of interest) are discussed in a THIRA or by other agency plans and programs (AWIA, NTSB, CPUC, etc.) FEMA makes a distinction between a hazard and a threat. Threats cannot be analyzed for frequency or severity. • Susan, Cary, Adam Nelkie: The HMP needs to cite the other agencies and plans that provide analysis on threats. • Cary: Why is public health in the lower section? • Bart: FEMA does not acknowledge public health (pandemic) as a natural hazard. It cannot be analyzed the same way earthquake can. No mitigation funding is available for pandemic. • Rob: FEMA will not even look at the non-natural hazards. Most hazards of interest are response, not mitigation. The HMP is not an emergency management plan. It only addresses actionable actions to reduce risk. • Cary: Awareness of an action for the fairgrounds to be better prepared for max vaccinations. • Rob: $3.54 billion was allotted for mitigation of natural hazards due to COVID because of the declared disaster declaration under the Stafford Act. Pandemic may become a FEMA requirement for HMPs in the future.	**TT Action Item:** Include citations in the HMP for each hazard of interest to indicate which agency or plan addresses the threat/hazard.
3	**Outreach and Engagement** (Bart) • Website ○ Livermore is hosting the HMP website with links to the other planning partners • Social Media • Public Survey	**SC Action Item:** Promote the public hazard awareness survey.

	○ Begin promoting the public hazard awareness survey	
	Requests from Committee Members • Cary: Can school districts still join this plan? • Rob: No, the plan is too far along for additional partners to come in and catch up.	N/A
4	**Public comments** None	N/A
	No Steering Committee Meeting in September	N/A
5	Adjourned at 2:36 pm by Susan.	N/A

EXIMBIT A

Tri-Valley
Meeting Minutes

Purpose of Meeting:	Tri-Valley Local Hazard Mitigation Plan Steering Committee Meeting #3
Location of Meeting:	Virtual
Date of Meeting:	10.03.2022

Steering Committee Members and Alternates:

☒ **Shweta Bonn**, Senior Planner, City of Pleasanton
☒ **Lincoln Casimere**, Emergency Manager, Alameda County Fire Department
☐ **Michael Cass**, Principal Planner, City of Dublin (Alternate)
☐ **Herbert Cole**, Emergency Manager, City of Livermore
☒ **Stephanie Egidio**, Management Analyst, City of Livermore (Alternate)
☒ **Susan Frost**, Special Projects Coordinator, City of Livermore
☒ **Cary Fukada**, CERT
☒ **Matt Fuzie**, General Manager RPD, City of Livermore
☒ **Tracy Hein**, Emergency Preparedness Manager, Livermore-Pleasanton Fire Department
☐ **Aaron Lacey**, Deputy Chief, Livermore-Pleasanton Fire Department
☐ **Christine Martin**, Assistant City Manager, City of Livermore
☒ **Franc Moufarrej**, Permit Center Manager, City of Livermore
☐ **Adam Nelkie**, Assistant Director of Engineering, City of Pleasanton
☐ **Aaron Johnson**, GIS, Dublin San Ramon Services District
☒ **Jerry Paulson**, Emergency Manager, Lawrence Livermore National Laboratory
☒**Tricia Pontau**, Associate Planner, City of Livermore
☒ **Jake Potter**, Associate Planner, City of Livermore (Alternate)
☒ **John Stefanski**, Assistant to the City Manager, City of Dublin

Other Attendees:

Rob Flaner, Program Manager, Tetra Tech
Bart Spencer, Lead Project Planner, Tetra Tech
Megan Brotherton, Support Planner, Tetra Tech

Meeting Summary: Discuss project coordination, hazard assessment, and outreach and engagement.

Item No.	Description	Action/Decision item(s):
1a	**Welcome** 1:03 pm	N/A
1b	**Public Comments** None	N/A

2a	**Project Coordination**
	• Acceptance of Steering Committee #2 Summary (Susan Frost)
	  ○ No adjustments to the August summary
	• Project update (Bart Spencer)
	  ○ Planning progress is being made on the risk assessment
	  ○ The Tri-Valley plan will incorporate new FEMA guidance for social vulnerability and climate change
	• Social vulnerability discussion/guidance (Bart & Rob Flaner)
	  ○ Rob: FEMA doesn't define social vulnerability. The planning process needs to define the terminology.
		Decisions:
		Accepted 08.01.2022 Steering Committee Meeting summary as written.
		Consensus achieved
		Continuing the social vulnerability conversation at the next SC meeting.
		Action Item:
		Tetra Tech to send state's draft definition and slides from APA conference presentation.

	Available datasets include: CDC SOVI (health focus), CalEnviroScreen (transportation focus), NRI (emergency management focus, but based on old data) The State HMP is using the terminology: Equity, Environmental Justice, and Social Vulnerability Once Tri-Valley identifies which terminology to use, the hazard risk data can be analyzed through an equity lens. The equity lens brings out the inherent differences to draw attention to what is typically not seen as risk in a traditional context. Risk analysis will be qualitative. Loss estimates will be in dollars. ○ Cary Fukada: Vulnerability does not indicate fault but identifies those who may be more at risk. ○ Susan: Livermore has an equity and inclusion committee. Recommend consolidating the definition from the planning partners to form a term that the communities are familiar with. ○ Stephanie Egidio: Council Subcommittee convened on equity and inclusion in Livermore, but there is no official equity lens in the city. ○ John Stefanski: Dublin does not have a social vulnerability framework yet. Define at the staff level. ○ Rob: The definition must be politically and publicly acceptable. Options for defining social vulnerability for this planning effort: ▪ Table the discussion until the planning partners define it. ▪ Use the state definition. ○ Cary Fukada: Recommend following state guidance. Look at a people-focused damage assessment. Those with higher income may have more ability to recover than a family with lower income. ○ Matt Fuzie: Use the state's language for best planning practices. ○ Shweta: Use the state's language. ○ Franc Moufarrej: Mirror the state's vision. ○ Susan: Consider using the state's definition but discuss other options as the planning process continues. The definition in the plan will not set policy for the community.	
2b	**Public Comments** None	N/A
3a	**Hazards Assessment and Risk Assessment**	

	• Some hazards are addressed with numbers (quantitative), while others are analyzed with words (qualitative). • In recent years, wildfire has been more concern statewide than flooding. • Flash flooding is increasing in California due to the dry, hard-packed ground from years of drought. Water sheets off in flash floods. This type of flooding is being considered in the risk assessment.	
3b	**Public Comments** None	

4a	**Outreach and Engagement**
	• Website
	  ○ Livermore is hosting the HMP website with links to the other planning partners
	• StoryMap (Bart and Megan Brotherton)
	  ○ The StoryMap is a tool that will be hosted on the Livermore website. It will contain hazard data, interactive hazard maps, and public outreach information.
	• Public Survey (Megan)
	  ○ More than 550 responses to date
	  ○ Nearly half of the respondents are from Pleasanton
	  ○ Most speak English
	  ○ The majority are retirement age
	  ○ Consider promoting the survey in all communities, among other language groups, and to a younger working-age audience for the broadest representation of the communities.
	  ○ Steering committee members should document any outreach and send it to the CPT (social media posts, email blasts, etc.)
		SC Action Item:
		Promote the public hazard awareness survey.
		https://www.surveymonkey.com/r/Tri-ValleyHazardAwareness

4b	**Public Comments** None	N/A
5a	**Requests from Committee Members** None	N/A
5b	**Public comments** None	N/A
6	Next Steering Committee Meeting TBD	N/A
7	Adjourned at 2:06 pm by Susan.	N/A

EXHIBIT A

Tri-Valley
Meeting Minutes

Purpose of Meeting:	Tri-Valley Local Hazard Mitigation Plan Steering Committee Meeting #4
Location of Meeting:	Virtual
Date of Meeting:	12.05.2022

Steering Committee Members and Alternates:

☐ **Shweta Bonn**, Senior Planner, City of Pleasanton
☒ **Lincoln Casimere**, Emergency Manager, Alameda County Fire Department
☐ **Michael Cass**, Principal Planner, City of Dublin (Alternate)
☐ **Herbert Cole**, Emergency Manager, City of Livermore
☐ **Stephanie Egidio**, Management Analyst, City of Livermore (Alternate)
☐ **Susan Frost**, Special Projects Coordinator, City of Livermore
☒ **Cary Fukada**, CERT
☐ **Matt Fuzie**, General Manager RPD, City of Livermore
☐ **Tracy Hein**, Emergency Preparedness Manager, Livermore-Pleasanton Fire Department
☒ **Aaron Lacey**, Deputy Chief, Livermore-Pleasanton Fire Department
☐ **Christine Martin**, Assistant City Manager, City of Livermore
☐ **Franc Moufarrej**, Permit Center Manager, City of Livermore
☒ **Adam Nelkie**, Assistant Director of Engineering, City of Pleasanton
☒ **Aaron Johnson**, GIS, Dublin San Ramon Services District
☐ **Jerry Paulson**, Emergency Manager, Lawrence Livermore National Laboratory
☒**Tricia Pontau**, Associate Planner, City of Livermore
☒ **Jake Potter**, Associate Planner, City of Livermore (Alternate)
☒ **John Stefanski**, Assistant to the City Manager, City of Dublin

Other Attendees:

Bart Spencer, Lead Project Planner, Tetra Tech
Megan Brotherton, Support Planner, Tetra Tech
Stephen Riley, City of Livermore
Melinda Denis, City of Pleasanton Planning and Permit Center Manager/Deputy Director of Community Development

Meeting Summary: Discuss project coordination, hazard assessment, and outreach and engagement.

Item No.	Description	Action/Decision item(s):
1a	**Welcome** 1:05 pm	N/A
1b	**Public Comments** None	N/A

2a	**Project Coordination**
	• Acceptance of Steering Committee #3 Summary (Cary Fukada)
	  ○ No adjustments to the October summary
	• Project update (Bart Spencer)
	  ○ Project is moving forward and is on schedule.
	  ○ Mitigation action development is in progress
	• Social vulnerability definition discussion (Bart)
	  ○ Cary Fukada: Recommend going with the state for continuity
	  ○ Adam Nelkie: Update as needed when the state recommends any changes
	  ○ Jake Potter: How would the social vulnerability definition affect the plan?
		Decisions:
		
		Accepted 10.03.2022 Steering Committee Meeting summary as written.
		Motion to accept: John Stefanski
		Second: Tricia Pontau
		Accepted by consensus
		
		State definition of social vulnerability
		Accepted by consensus

	▪ Bart: Planning partners will incorporate the definition to develop at least one action item to address social vulnerability. Do not exclude other parts of the community to focus exclusively on social vulnerability.	
2b	**Public Comments** None	N/A

3a	**Hazards Assessment**
	
	• Updated Risk Rankings
	  ○ Rankings are developed for each jurisdiction
	  ○ Jurisdictions must develop one action item for each high-ranked hazard
	  ○ The ranking does not affect funding or action prioritization
	  ○ Flood mitigation actions should be included for CRS compliance
		N/A

3b	**Public Comments** None	N/A

4a	**Outreach and Engagement**
	
	• Public Survey (Megan Brotherton)
	  ○ 585 responses to date
	  ○ Steering committee members should document any outreach and send it to the CPT (social media posts, email blasts, etc.)
	• StoryMap (Megan)
	  ○ The StoryMap contains hazard data, interactive hazard maps, and public outreach information
	  ○ Use the magnifying glass icon to enter an address
	  ○ Turn hazard layers off and on to determine which hazards impact the location
		SC Action Item:
		Promote the public hazard awareness survey and the StoryMap
		
		https://www.surveymonkey.com/r/Tri-ValleyHazardAwareness
		
		Tri-Valley StoryMap (arcgis.com)

4b	**Public Comments** None	N/A
5a	**Requests from Committee Members** None	N/A
5b	**Public comments** None	N/A
6	Next Steering Committee Meeting TBD	N/A
7	Adjourned at 2:15 pm by Cary.	N/A

EXHIBIT A

Tri-Valley
Meeting Minutes

Purpose of Meeting:	Tri-Valley Local Hazard Mitigation Plan Steering Committee Meeting #5
Location of Meeting:	Virtual
Date of Meeting:	5.15.2023

Steering Committee Members and Alternates:

☒ **Shweta Bonn**, Senior Planner, City of Pleasanton
☒ **Lincoln Casimere**, Emergency Manager, Alameda County Fire Department
☒ **Herbert Cole**, Emergency Manager, City of Livermore
☒ **Stephanie Egidio**, Management Analyst, City of Livermore (Alternate)
☒ **Susan Frost**, Special Projects Coordinator, City of Livermore
☒ **Cary Fukada**, CERT
☐ **Matt Fuzie**, General Manager RPD, City of Livermore
☒ **Tracy Hein**, Emergency Preparedness Manager, Livermore-Pleasanton Fire Department
☒ **Aaron Lacey**, Deputy Chief, Livermore-Pleasanton Fire Department
☐ **Christine Martin**, Assistant City Manager, City of Livermore
☒ **Franc Moufarrej**, Permit Center Manager, City of Livermore
☐ **Adam Nelkie**, Assistant Director of Engineering, City of Pleasanton
☒ **Aaron Johnson**, GIS, Dublin San Ramon Services District
☐ **Jerry Paulson**, Emergency Manager, Lawrence Livermore National Laboratory
☒**Tricia Pontau**, Associate Planner, City of Livermore
☒ **Jake Potter**, Associate Planner, City of Livermore (Alternate)
☐ **John Stefanski**, Assistant to the City Manager, City of Dublin

Other Attendees:

Bart Spencer, Lead Project Planner, Tetra Tech
Megan Brotherton, Support Planner, Tetra Tech
Diego Mora, City of Pleasanton
Ben Murray, City of Livermore

Meeting Summary: Discuss project coordination, hazard assessment, and outreach and engagement.

Item No.	Description	Action/Decision item(s):
1a	**Welcome** 1:04 pm	N/A
1b	**Public Comments** None	N/A

2a	**Project Coordination**
	• Acceptance of Steering Committee #4 Summary (Susan Frost)
	  ○ No adjustments to the December summary
	• Project update / overview (Bart Spencer)
	  ○ Project is in its final phases
	  ○ We are currently in the public comment period
	  ○ The CPT will review comments for potential incorporation in the draft plan
	  ○ Then the plan will be submitted to Cal OES for review
	
	Social Vulnerability and Wildfire Data Discussion
		Decisions:
		
		Accepted 12.05.2022 Steering Committee Meeting summary as written.
		Motion to accept: Aaron Johnson
		Second: Cary Fukada
		Accepted by consensus

	• Why is the discussion about social vulnerability limited in the draft?
	  ○ Early in the planning process, the Steering Committee chose to use a 0.70 threshold for the vulnerability analysis
	  ○ No tracts within the Tri-Valley area met that threshold for vulnerability so a numerical analysis was not possible
	  ○ Instead, a qualitative discussion is included in each hazard section
	  ○ Performing a spatial analysis of vulnerable populations is relatively new to the hazard mitigation planning process and will be refined in coming years
	  ○ Each municipal planning partner included a mitigation action to address the gap in social vulnerability datasets
	• How does the wildfire hazard reflect best available data?
	  ○ CAL FIRE is in the process of updating wildfire mapping throughout the state
	  ○ Those maps are not available yet
	  ○ When the data and mapping is released by CAL FIRE, it can be incorporated in future updates of the plan
	  ○ Tetra Tech and the Tri-Valley planning partners will continue to coordinate throughout the performance period of the plan to ensure that any new data that becomes available will be shared for future planning efforts	

2b	**Public Comments** None	N/A
3a	**Outreach and Engagement** ○ The public comment period will be open until May 22, 2023.	**SC Action Item:** Encourage constituents to comment on the draft plan. Linked here: [Tri-Valley Local Hazard Mitigation Plan | Livermore, CA (livermoreca.gov)](livermoreca.gov)
3b	**Public Comments** None	N/A
5	**Concluding Comments** Thank you to all the Steering Committee members and the Core Planning Team for participating in the planning process!	N/A
6	Adjourned at 1:39 pm by Susan.	N/A