City of San Leandro

2015 Local Hazard Mitigation Plan

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December 1, 2015

Access this plan online at:
www.cityofsanleandro.org/mitigation

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1. Introduction

1.1 Background

San Leandro is a vibrant and thriving community, but every aspect of the city – its economic prosperity, social and cultural diversity, and historical character – could be dramatically altered by a serious earthquake or fire. While we cannot predict or protect ourselves against every possible hazard that may strike the community, we can anticipate many impacts and take steps to reduce the harm they will cause.

The City has been working for years to address certain aspects of the risk – such as strengthening structures, growing the City's emergency management procedures and infrastructure, and training city staff. The 2005 Disaster Mitigation plan formalized this process, ensuring that these activities continued to be explored and improved over time.

Over many years, this constant focus on disasters has made San Leandro, and its residents and businesses, much safer. This 2015 Local Hazard Mitigation Plan continues this ongoing process to evaluate the risks that different hazards pose to San Leandro, and to engage the community in dialogue to identify the most important steps that the City and its partners should pursue to reduce these risks. The federal Disaster Mitigation Act of 2000 called for all communities to prepare mitigation plans.

1.2 Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000 (DMA 2000) requires that each State develop a hazard mitigation plan in order to receive future funding following a disaster. The new requirement provides some funding to each State to engage in planning activities to prepare the plan. The requirements also call for the development of local or county plans for that particular jurisdiction to be eligible for post-disaster funding. The purpose of these requirements is to have programs and projects in place that will help minimize the loss of life, property, environment, and total cost of disasters.

DMA 2000 §201.6 (c) (3) of the requirements outlines the process for localities in developing their mitigation strategies. Specifically, the Local Hazard Mitigation Plan must "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." These strategies should be built on an assessment of hazard risks and vulnerabilities. The plans should include measures to mitigate hazard risks and demonstrate the benefit of these activities. They should also identify gaps in knowledge and data and a strategy to maintain and update the data, projects, information, and the overall mitigation plan.

1.3 Purpose

The City of San Leandro is located in an urban area and is subject to earthquakes, landslides, urban/wildland fires, urban creek flooding, and major transportation accidents. The City has sustained millions of dollars in damages from earthquakes, flooding and landslides. As a result, in 1991, the Federal Emergency Management Agency (FEMA) named the City of San Leandro as a Project Impact City which called for the City to:

- Identify and delineate hazards, and assess risk and vulnerability within the City
- Develop a comprehensive risk reduction program for the community that includes information, education, prevention and policy/legislation
- Develop technical and financial assistance for safety efforts that can be made available (including incentives) to facilitate loss-reduction projects
- Document and broadcast the successes of Project Impact

This Hazard Mitigation Plan (HM Plan) wraps in the many hours of work and outreach devoted to the Project Impact initiative as well as current planning efforts in order to comply with the Disaster Mitigation Act of 2000 requirements.

The Hazard Mitigation Plan, adopted on July 5, 2005 by the City Council, was reviewed and commented by the State Hazard Mitigation Officer in the Governor's Office of Emergency Services, FEMA, and the public. Upon acceptance by FEMA, the City will gain eligibility for Hazard Mitigation Grant Program funds.

The Hazard Mitigation Plan is a living document which will continually evolve as the City of San Leandro continues to progressively implement identified mitigation strategies.

1.4 Authority

Federal Laws

1. " The Federal Civil Defense Act of 1950"
2. Public Law 96-342 "The Improved Civil Defense Act of 1980"
3. Public Law 91-606 "Disaster Relief Act"
4. Public Law 93-288 "The Robert T. Stafford Disaster Relief Act of 1974"
5. Section 322, Mitigation Planning of the Robert T. Stafford Disaster Relief and Emergency Assistance Act
6. Public Law 106-390 enacted by Section 104 of the Disaster Mitigation Act of 2000 (DMA)
7. Interim Final Rule for DMA 2002 as published in the February 26, 2002, at 44 CFR Part 201

State Laws

1. State of California Emergency Services Act, Chapter 7 of Division 1 of Title 2 of the Government Code
    a. Article 2 General Definitions. 8558 - § c. Local Emergency
    b. Article 10 Local Disaster Councils. 8610 – Creation by Ordinance; Plan Development
    c. Article 14 Local Emergency.
        i. 8630 – Proclamation by Local Governing Body; Duration: Review
        ii. 8631 – Provision of mutual aid by political subdivisions
        iii. 8632 – Provision of mutual aid by state agencies
        iv. 8633 – Costs incurred in executing mutual aid agreements as charge against state
        v. 8634 – Promulgation of orders and regulations; Curfew
        vi.
    d. Article 15 Preservation of Local Government
        i. 8635 – Need for local governments to preserve law and order and to continue and restore local services in case of enemy attack
            1. 8636 – Unavailable officer
            2. 8637 – Succession of department heads
            3. 8638 – Stand-by Officers
            4. 8639 – Investigation of qualifications of stand-by officers
            5. 8640 – Oath of Office and tenure of stand-by officers
            6. 8641 – Duties of stand-by officers
            7. 8642 – Meeting of governing body whatever emergency exists
            8. 8643 – Duties of local governing body during state of emergency
            9. 8644 – Appointment of temporary officers
2. Natural Disaster Assistance Act, Chapter 7.5 of Division 1 of the Government Code.

Local Laws

Local building codes are modeled after the:

- 2001 California Building Code (1997 UBC and as amended by City Ordinance)
- 2001 California Fire Code (2000 UFC)
- 2001 California Mechanical Code (2000 UMC)
- 2001 California Plumbing Code (2000 UPC)
- 2001 California Electrical Code (1999 NEC)
- 2001 California Housing Code (2000 UHC)

1.5 City of San Leandro General Plan

San Leandro is currently revising the City's General Plan. The City is committed to the safety and wellbeing of all San Leandro residents, businesses, and the ability of the Government to provide essential functions after a major disaster. To reflect the importance of emergency preparedness and hazard mitigation the San Leandro has placed two specific sections into the 2016 General Plan pertaining to Hazard Mitigation and emergency preparedness.

1.5.1 GOAL EH-1 Mitigation of Natural Hazards

Reduce the potential for injury, property damage, and loss of life resulting from earthquakes, landslides, floods and other natural disasters.

Related Policy and Actions:

- **Policy EH-1.2: Earthquake Retrofit**
  Action EH-1.2.A: Residential Retrofit program
  Action EH-1.2.B: Change of Occupancy Upgrade
  Action EH–1.2.C Soft-Story Buildings

- **Policy EH-1.3: Off-site Impacts of Hillside Development**

- **Policy EH -1.4: Code Revisions**

- **Policy EH –1.5: Public Awareness**
  Action EH-1.5.A: Educational Materials

- **Policy EH- 1.6: Construction of Flood Plain**
  Action EH -1.6.A: FIRM Amendments

- **Policy EH –1.7.A: Reduce Flood Hazards**
  Action EH - 1.7.A: Coordination with ACFCWCD
  Action EH – 1.7.B: Increase Flood Channel Capacity

- **Policy EH - 1.8: Sea Level Rise**
  Action EH – 1.8.A: Adaptation Plans

1.5.2 GOAL EH - 6: Emergency Preparedness

Attain and sustain comprehensive and highly effective emergency preparedness and recovery programs.

Related Policy and Actions:

- **Policy EH – 6.1:** **Preparedness as a Top Priority**
  Action EH – 6.1.A Essential Service Facility Upgrades
- **Policy EH – 6.2.** **SEMS Planning**
  Action EH – 6.2.A Emergency Operations Plan Update
  Action EH – 6.2.B Local Hazard Mitigation Plan Update
- **Policy EH – 6.7.** **Schools and Hospitals**
- **Policy EH – 6.10** **Funding Sources**
  Action EH - 6.10.A Brace and Bolt Program
- **Policy EH – 6.11:** **Climate Change**

2. The Planning Process

2.1 Planning Committee

The City of San Leandro's Planning Team was developed to achieve the requirements as outlined in Section 1.1 Disaster Mitigation Act of 2000 Requirements. The planning team members were chosen based on their ability to provide detailed information regarding hazards with in San Leandro and due to their subject matter expertise within their field, develop mitigation strategies related to identified hazards. The Planning Committee participated in multiple group meetings.

Planning Committee Members:

Chief Sandra Spagnoli	San Leandro Police Department
Captain Luis Torres	Emergency Services Manager, SLPD
Chief Terence Carey	Division Chief Alameda County Fire Department
Heidi DeRespini	Emergency Services Specialist, City of San Leandro
Debbie Pollart	Director of Public Works, City of San Leandro
Cynthia Battenberg	Director of Community Development
Jerome A. Smith Jr.	Chief Building Official, Community Development
Nick Thom	City Engineer, Engineering and Transportation
Tony Batalla	Manager of Information Technology

2.1.2 Goals

The following goals are the foundation for the objectives detailed below and are considered the basis for hazard mitigation in the City of San Leandro.

- Protection of life, property and environment before, during and after the occurrence of emergencies and disasters
- Continue to identify vulnerabilities of the city
- Maintain and enhance the ability to provide emergency response services

2.1.3 Objectives

The following objectives are meant to serve as a "measuring stick" upon which individual hazard mitigation projects can be evaluated.

Project Criteria Objectives may include, but are not limited to the following:

- Assuring the Hazard Mitigation Plan is a functional document that identifies short- and long-term strategies and describes each measure including:
    - Identification of person, agency or organization responsible for implementation
    - Projecting a time frame for implementation.
    - Explanation of how the project will be financed including the conditions for financing and implementation as information is available
    - Identifying alternative measures, should financing not be available
- Be consistent with, support and help implement the goals and objectives of hazard mitigation plans already in place for the geographic area in question
- Be based on the City of San Leandro's Hazard Vulnerability Analysis
- Have significant potential to reduce damages to public and/or private property or reduce the cost of local, state and federal recovery from future disasters
- Be the most practical, cost-effective and environmentally sound alternative after consideration of the options

- Address a repetitive problem, or one that has the potential to have a major impact on an area, reducing the potential for loss of life, loss of essential services and personal property, damage to critical facilities, economic loss, hardship, or human suffering

- Meet applicable permit requirements

- Develop mitigation standards for development in hazardous areas

- Contribute to both the short-and long-term solution to the hazard vulnerability risk problem

- Assuring the benefits of a mitigation measure is equal to or exceeds the cost of implementation

- Have manageable maintenance and modification costs

- When feasible, be designed to accomplish multiple objectives including improvement of life-safety risk, damage reduction, restoration of essential services, protection of critical facilities, security of economic development, recovery, and environmental enhancement

- Whenever feasible, use existing resources, agencies, and programs to implement the project

- Include regional hazard mitigation concerns and strategies

- Identification of Community Local Background

- Other Factors Impacting Community

2.1.4 Timeline

The Planning Team (PTM) had its kickoff meeting in July of 2015. During this meeting members were introduced to the Hazard Mitigation process and asked to review the 2005 and 2010 Hazard Mitigation plan and if needed assign other employees to the team.

August – Risk Assessment Meeting: PTM were tasked with determining hazards of local concern, summarizing vulnerability, and develop community engagement strategies.

August – December Public Outreach: PTM designed a multi-tiered outreach plan that included information on the City's website, printed information at city facilities, and a survey online, and also at city facilities and events. City Emergency Services staff also presented the plan at a community outreach meeting on November 19th as well as presenting information at the December 7th San Leandro City Council meeting.

October – Mitigation and Adaptation Strategies: PTM identified mitigation strategies and adaptation goals. Once strategies and goals were identified PTM were tasked with prioritizing the strategies based on the City's ability to accomplish.

December- January Review Process: PTM members were given the opportunity to review the mitigation strategies and make changes to plan.

March – Plan submitted to State Office of Emergency Services.

2.2 Regional Planning Process

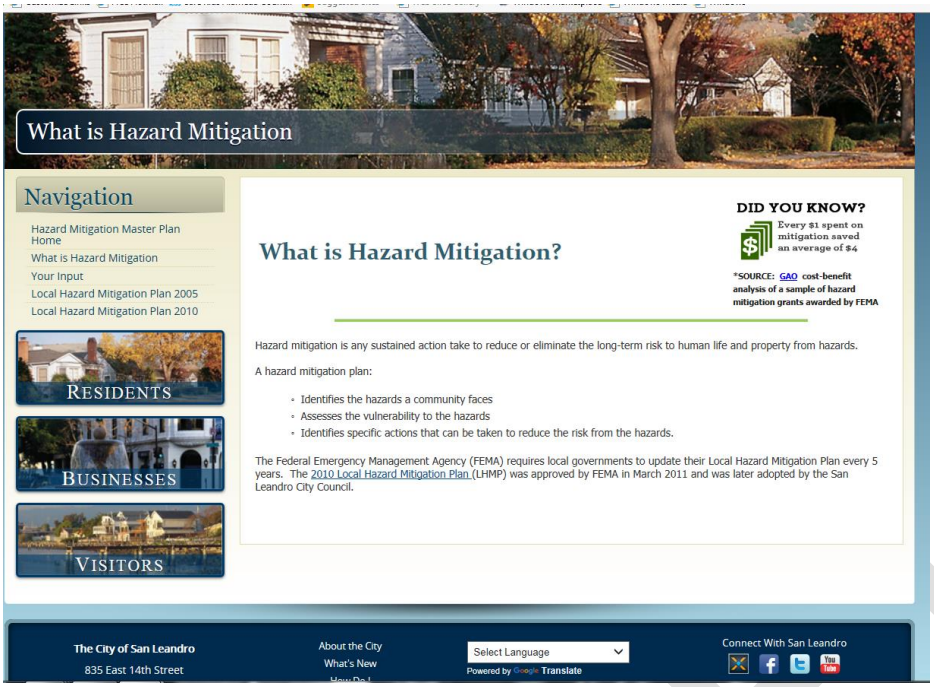
The City of San Leandro participated in the regional planning process by attending all ABAG workshops, conferences, and meetings. City representatives also took part in regional meetings with agencies such as BART, EBMUD, and PG&E to discuss hazard mitigation planning and efforts on their part. In addition to regional meetings, utilities, public agencies and both the San Leandro and San Lorenzo school districts were invited to 2 Disaster Council meetings, hosted by the City to discuss regional partnerships and Hazard Mitigation.

2.3 The Community Engagement Process

The involvement and opinion of the City's residents was very important to the hazard mitigation planning process, because of this the Planning Committee devised multiple opportunities for the public to learn about the Hazard Mitigation process, the hazards in San Leandro, and provide their input.

1. Public review of San Leandro's 2005, and 2010 Hazard Mitigation plan on the City's website www.sanleandro.org/mitigation. Interested parties could also request a hardcopy of the 2005 and 2010 Hazard Mitigation plan via email or phone call. Hardcopies were at several public outreach venues for people to access if so requested. The draft copy of the 2015 Hazard Mitigation plan will be placed on the City's website in late February 2016.

City of San Leandro Hazard Mitigation page with links to 2005 and 2010 LHMP



City of San Leandro Hazard Mitigation page with link to Hazard Mitigation Survey

2. Interested parties could complete the City's Hazard Mitigation survey. The City's LHMP survey was available on the City's website, as well as various locations in the City. The survey was also distributed at the LHMP public hearings, workshops, and public outreach events. The Survey is attached to this document as Appendix item number 8.5.

3. The public was invited to attend a public forum where representatives from the City's Emergency Services Division presented on Hazard Mitigation in the City of San Leandro. The Public Forum took place on November 19th, 2015 and was advertised in the paper. See Appendix item number 8.3, and 8.4.

2.4 Preparing the 2015 Update – Procedure, for the plan update.

As part of the 2005 plan update, this 2015 plan includes an updated analysis of San Leandro's hazards and their potential impacts. Hazard vulnerabilities identified in Section 5 and mitigation strategies presented in Section 6.

General Changes and Updates
The 2015 plan contains numerous updates to facts, figures and descriptions. The City has incorporated the newest-available hazard data, including impact maps for particular scenarios. The City and its partners have provided additional descriptions, details and definitions to explain the science of these hazards and their potential impacts. Advances in GIS mapping technology have enabled the City to present maps that help to visualize information. Institutional community partners have updated information regarding their vulnerabilities to the described hazards, as well as significant mitigation activities that they have completed, in progress, or planned for the coming five years. Appendix A describes San Leandro's progress on the hazard mitigation actions identified in 2005.

Hazards Described in the 2015 Plan
The 2015 plan now specifically highlights San Leandro's hazard of greatest concern as earthquake coupled with all of the potential side effects of an earthquake such as a tsunami or landslide, and followed by climate change risks such as flooding and sea level rise. These hazards are underscored because of their history in San Leandro, their potential to occur, our community's extensive exposure and many vulnerabilities to these hazards, and the cascading impacts that could result from one of these hazards.

Earthquakes (Section 5.1)

• Three new Hayward Fault earthquake scenario maps illustrate the Bay Area's exposure to seismic shaking, and San Leandro's exposure to liquefaction and seismically-triggered landslides.

• A new map overlays the areas of San Leandro potentially exposed to liquefaction, fault rupture and earthquake-induced landslides. The 2015 plan also contains a new scenario map for seismically-triggered landslide.

• The 2015 plan addresses fire following earthquake in greater detail: the plan describes significant fires resulting from past earthquakes, causes of fire following earthquake, and how earthquake impacts can impede firefighting efforts and promote fire spread.

• The seismic stability of City-owned and leased buildings has been updated to reflect significant retrofit efforts since 2005. (This information is provided in greater detail in Section 4.3 *List of City Owned and Leased Buildings*.)

• The City has updated the plan to describe San Leandro's progress on mitigating earthquake vulnerabilities in soft-story buildings.

Tsunami (Section 5.1.2)

The tsunami section describes recent tsunami events and their impacts on San Leandro. It outlines the latest information about the tsunami hazard within the San Francisco Bay, and provides an inundation map showing San Leandro's tsunami exposure.

Rainfall-Triggered Landslide (Section 5.1.3)

Rainfall-triggered landslide is addressed separately of earthquake-induced landslide. Additional information has been provided to describe rainfall-triggered landslide and debris flow.

Floods (Section 5.1.4)

The floods section has been rewritten for clarity. The 2015 plan also provides additional information about floods caused by storm drain overflow.

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Climate Change (Section 5.16, 5.1.7)

Climate change is a newly-introduced hazard of concern for the 2015 plan. The climate change section describes the anticipated impacts to San Leandro from climate change. It also outlines how climate change exacerbates other hazards identified in this plan.

Manmade Hazards

The focus of this mitigation plan is on natural hazards as emphasized in the Disaster Mitigation Act of 2000 (DMA 2000).3 However, the plan also addresses several manmade hazard such as climate change, and hazardous materials release newly-available maps and information now allow us to identify potential climate change impacts, and to consider related mitigation actions. Hazardous materials release is addressed in this mitigation plan as a potential impact from a natural hazard. Terrorism is identified as a hazard of concern

but is not analyzed in-depth. Other manmade hazards that could occur in San Leandro, such as ground water contamination, are not included in this plan, but may be addressed by other City programs in ongoing regulatory processes, such as activities of the Environmental Protection Division.

Hazards Not Considered in the Plan

Other natural hazards that are rare in San Leandro are not included in this plan; these include severe storms, which can produce prolonged low temperatures, heavy rainfall and hail; severe heat; high winds; and small tornados and waterspouts. This plan does not focus on these hazards because they are not as likely to occur as the hazards addressed in detail. San Leandro's geographic location and moderate climate shelters it from prolonged storms and extremes of cold and heat. Ocean temperatures moderate the power of tropical storms, lessening the effects of low barometric pressure and storm surge.

Naturally-occurring communicable disease outbreaks (e.g. a flu pandemic; SARS) do pose a significant risk to the San Leandro community, but are not addressed in this plan. Mitigation activities for communicable disease are not yet well-defined, but they could include, for example, measures to assure a high baseline level of immunization in the community, both for routine childhood immunizations and for annual seasonal flu vaccination. The City of San Leandro continues to work closely with the Alameda County Public Health Department on establishing best practice protocols and training for City staff and public outreach training for the public.

2.5 Components *of the Hazards Analysis*

The analysis of hazards in this plan has the following components:

• Historical Events: Within recent history the city has experienced the effects of all hazards addressed in this plan. Descriptions of the impacts of these disasters help illustrate some of the types of damage they can cause.

• Hazard: Describes the ways that each hazard can damage the community, and maps the locations in San Leandro that are particularly prone to specific hazards, such as the "100-year" floodplain. Areas that could experience secondary hazards, such as liquefaction following earthquakes, are also discussed.

• Exposure and Vulnerability: This plan identifies the people, buildings and infrastructure that exist in hazard zones. Vulnerability refers to the susceptibility to physical injury, harm, damage, or economic loss of the exposed people, buildings and infrastructure. City elements exposed to each hazard are listed and mapped, and their vulnerability is discussed.

3. Capability Assessment

The City of San Leandro conducted an analysis of its hazards and developed a hazard mitigation master plan which is located in Section 6: Mitigation Strategies. To address existing local capabilities to aid in mitigation of natural and man-made hazards of non-emergency and emergency situations, the following capabilities and services exist:

3.1 Codes, Laws and Ordinances

The building codes of San Leandro are contained in the San Leandro Municipal Code. The codes that are currently in effect were formally adopted and went into effect on November 5, 2002. The City's Building Division has additional details on the current status of each code.

These codes are modeled after the:

2001 California Building Code (1997 UBC and as amended by City Ordinance)

2001 California Fire Code (2000 UFC)

2001 California Mechanical Code (2000 UMC)

2001 California Plumbing Code (2000 UPC)

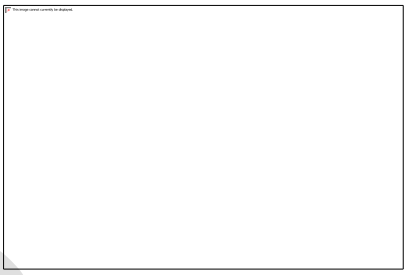
2001 California Electrical Code (1999 NEC)

2001 California Housing Code (2000 UHC)

It should be noted that these model codes are amended by the State of California and the City of San Leandro to include various additional requirements. For instance, the plumbing code is amended to prohibit the use of plastic pipe within the drain, waste and vent system of a building.

The best place to view these codes is the San Leandro Permit Center or the Library. Because of the vast amount of information contained in these codes and their technical nature, they can be difficult to navigate. Standard questions can be answered by the City of San Leandro permit center staff. However, more complex design issues should be referred to a design professional such as an architect or engineer.

3.1.2 Environmental Services



The City of San Leandro's Environmental Services Division is a full service environmental agency serving the community of San Leandro. The division is one of a handful of agencies in California to oversee such a broad range of environmental programs at the local level. The Environmental Services Division takes pride in serving as a one-stop environmental contact point for the city's residents and businesses.

The Environmental Division is responsible for

- Contaminated Site Cleanup - overseeing the cleanup and remediation of contaminated sites within San Leandro.
- Hazardous Materials - regulating the storage, use and disposal of hazardous materials and hazardous wastes above and below ground.
- Recycling - promoting recycling, pollution prevention and waste reduction programs.
- Refuse - overseeing the city's refuse collection program.
- Sewer/Pretreatment - monitoring and regulating discharges of wastewater into the City's sanitary sewer system.
- Site Information & Review - maintaining and making available files and information about businesses that handle hazardous materials and contaminated sites.
- Storm Water Program - safeguarding the City's storm water system through regular inspections, and responding to reports of spills and illegal discharges of hazardous materials or other potentially harmful substances

3.1.3 Earthquake Retrofit Programs

The City of San Leandro includes earthquake safety as one of the top priorities in its public safety mission. There are currently two retrofit programs in effect within the city. One program addresses the seismic strengthening of older unreinforced masonry buildings, while the other program addresses the strengthening of older wood-frame homes.

The retrofitting of unreinforced masonry buildings throughout the city is nearly complete thanks to the diligence and commitment of the building owners. This retrofit work has improved the earthquake resistance of these buildings, thus enhancing the safety of the occupants. The owners are to be commended for their efforts.

The seismic strengthening of older wood-frame homes throughout the city is progressing with the help of the HOME EARTHQUAKE STRENGTHENING PROGRAM. This is a comprehensive residential seismic strengthening program that provides property owners with simple and cost-effective methods for strengthening their wood-frame houses for earthquake survival. San Leandro's Home Earthquake Strengthening Program includes six fundamental elements, each of which is described below.

Earthquake Strengthening Workshops - This popular workshop series, provided to homeowners on a quarterly basis, reviews common residential construction weaknesses and introduces the average citizen to basic repair techniques that can significantly improve a home's performance in earthquakes. The course is offered through the City's Building Division and consists of four evening sessions for homeowners who wish to learn how to "do-it-yourself" or learn how to get the best service if they hire a contractor.

The City also offers similar classes for contractors. A major obstacle to homeowner participation in earthquake strengthening is the difficulty in hiring qualified retrofit contractors. To increase homeowner confidence in finding a qualified retrofit professional, another element of San Leandro's Home Earthquake Strengthening Program is the Contractor Workshop. This quarterly 8-hour course is aimed at optimizing and regulating the quality of services that retrofit contractors provide to San Leandro homeowners.

The San Leandro Earthquake Handbook - This is a high-impact, full-color, 16-page booklet that provides residents with a plain-English explanation about earthquake risks in the community. It contains easy-to-follow illustrations and step-by-step instructions for evaluating and strengthening a wood-frame house against earthquakes (anchor-bolting, plywood shear-paneling, nailing, blocking, etc.), guidance for strapping a water heater, as well as preventing the collapse of a brick chimney. It also contains information about the City's over-the-counter permit for home-earthquake strengthening, references to other resources in the community, and frequently asked questions and answers.

A Prescribed Retrofit Standard & Free Plan Set - Improving upon a concept that originated with the City of Santa Barbara, San Leandro developed a recommended standard for regulating the quality of home retrofit procedures undertaken in the San Leandro community. This standard, published as a Prescriptive Plan Set for Strengthening Wood-frame Houses for Earthquakes, provides San Leandro homeowners or their contractors with a simple and rapid procedure for obtaining a

permit to bolt and brace a typical home foundation system. The Prescriptive Standards are similar to those published in the Uniform Code for Building Conservation and are based on standards which were developed by the "Residential Retrofit and Repair Committee" of the California Building Officials. This committee consisted of structural engineers, building officials and architects, and was organized and supported by both the California Seismic Safety Commission and the California Governor's Office of Emergency Services. The Prescriptive Plan Set - free to any San Leandro resident - is actually a blueprint showing the seismic retrofit details needed for typical wood-frame houses in San Leandro neighborhoods. Once the easy-to-use Plan Set is filled out, the homeowner can take it to the City's "one-stop" permit center, get a few tips from the plan-check engineer (if appropriate), pay a fixed home-retrofit permit fee, and be out the door ready to start work.

Homeowner's List of Earthquake Contractors - Because of potential liability, municipal agencies generally will not certify or recommend private contractors for residents. For homeowners concerned about earthquakes, however, this lack of local guidance adds yet another obstacle in the way of home strengthening. In San Leandro, residents interested in finding qualified contractors to bid on their home-retrofit job can obtain the Homeowner's List of Earthquake Contractors. This is a reference file, maintained by the City's Building Regulations Division, that lists general contractors who have "successfully completed" the City's home-retrofit Contractor Workshop. Homeowners who would like to hire a contractor to perform their seismic upgrades now have ready access to detailed references and background information about contractors which simplifies the hiring process. Contractors must maintain top quality standards in order to remain on file with the City. The Association of Bay Area Government (ABAG) also maintains a list of contractors that have attended the ABAG One Day Workshop on Seismic Retrofit of Wood-Frame Buildings.

Tool-Lending Library - As an incentive to "do-it-yourselfers" who want to strengthen their own homes - but who lack the necessary tools - the City maintains a Tool Lending Library. This resource, administered by the City's Building Regulations Division, allows residents who use the Prescriptive Home-Strengthening Plan Set to borrow, free of charge, most of the tools they may need to complete the retrofit job.

Limited Financial Assistance Available - Strengthening single-family homes is a "private property issue" that cannot easily be paid for through local tax measures or encouraged through penalties. At the present time, the City is exploring options for a community-wide financial incentive program to encourage home earthquake strengthening. In the meantime, low-income residents are already benefiting from a financial assistance program. The City's Housing Division has set aside a portion of its block-grant funding from the U.S. Department of Housing and Urban Development for grants and low-interest loans to low-income homeowners specifically for home earthquake strengthening. For San Leandro homeowners in the Earthquake Strengthening Workshop, materials used for retrofitting are provided for a number of lucky homeowners chosen through a drawing.

By taking similar steps, communities across the country are duplicating San Leandro's efforts to establish their own community-based, home seismic retrofitting programs. San Leandro's program is one of the most extensive of its kind ever developed. With the help of private industry, it encourages all homeowners to protect their investment, protect their family and protect their future as quickly and efficiently as possible.

3.2 Emergency Operations Plan

In compliance with the State of California Emergency Services Act, Chapter 7 of Division 1 of Title 2 of the Government Code, the City of San Leandro has an emergency plan that is based on the State Emergency Management System and addresses all of the requirements of the law to safely respond to emergencies and to protect life, property and the environment

3.3 Hazardous Materials Area Plan

The City of San Leandro is the administering agency for Health and Safety Code Division 20, Chapter 6.95, Article 1 which mandates that the administering agency develop and maintain an Area Plan which describes the jurisdiction's plan for the prevention of, preparation for and response to hazardous materials incidents and threatened incidents.

The City entered into a contract with the Alameda County Fire Department (ACFD) for fire and hazardous materials services on July 1, 1995 and is the primary and firm emergency responder for the control of hazardous materials incidents in the city of San Leandro.

The area plan and its components were based upon the nature of the community, the businesses located in it, the transportation routes traversing it, and the resources available for addressing hazardous materials issues. The information contained in the Hazardous Materials Business Plans and the Risk Management Plans was utilized in this process.

The plan contains the following sections: purpose and objectives, administration, agency coordination and other plans, planning and the community right to know, reporting and notification, finance and cost recovery, communication, training, supplies and equipment, emergency response procedures, post incident analysis and follow-up, incident investigation, medial interface, and baseline medical monitoring.

4. Community Profile

4.1 Area at a Glance

Geography

Approximately 15.4 square miles, the city is located 8 miles south of Downtown Oakland, 15 miles southeast of San Francisco, and 30 miles north of San Jose. It is bounded on the north by Oakland and on the south by the unincorporated communities of San Lorenzo and Ashland. The western edge of the city is defined by San Francisco Bay, while the East Bay hills define the eastern edge.

San Leandro is well connected to the region's transportation system, with three freeways (I-880, I-580, and I-238) passing through the city and Metropolitan Oakland International Airport two miles away. The city is served by two Bay Area Rapid Transit (BART) stations, three freight rail lines, and an extensive network of bus routes. These transportation advantages have helped define San Leandro's economic base and were a key factor in its development during the second half of the 20th century.

Over the past 50 years, San Leandro has developed a reputation as a diverse, hard-working, business-friendly city. Much of the city's identity dates from the post-war era, when the community was at the leading edge of the Bay Area's development. Many of the city's residents arrived during this era, and they and/or their descendants continue to make San Leandro their home today. Today, San Leandro offers many of the positive qualities of an older suburb, such as walk able neighborhoods and convenience, with few of the negative qualities of either the inner-city or the distant suburban fringe. The city has a strong identity within the Bay Area as a stable community of solid neighborhoods, a manufacturing center with an industrious labor force, and a town that has found strength in its growing diversity.

4.1.2 History

Following some 3,000 years of Native American settlement, the area now known as San Leandro was divided through Spanish land grants between 1829 and 1842. Most of modern-day San Leandro was contained within the vast cattle ranches of Ignacio Peralta (north of San Leandro Creek) and Don Jose Joaquin Estudillo (south of San Leandro Creek). The ranches gave way to farms as settlers, squatters and "49ers" arrived in the early 1850s. The town of San Leandro was laid out in 1855 and became the seat of Alameda County in 1856. The original town plan established a grid of streets, with sites set aside for prominent buildings such as the County Courthouse and City Hall.

After a catastrophic earthquake destroyed the Courthouse in 1868 and the transcontinental railroad reached Oakland in 1869, the county seat was relocated from San Leandro to Oakland. However, San Leandro continued to prosper as a

small agricultural town. The City incorporated in 1872 and had grown to about 2,300 residents by 1900. Farms and orchards surrounding San Leandro produced a variety of fruits and vegetables, including cherries, tomatoes, onions, potatoes, asparagus, sugar beets, rhubarb, and apricots.

San Leandro continued to grow at a moderate pace during the first 40 years of the 20th Century. Many of the neighborhoods in the northeast part of the City, such as Broadmoor and Estudillo Estates, were developed during this time period. The railroad corridors running through the City were developed with industry, while Downtown was the center for commerce and civic life. By 1940, San Leandro had 14,000 residents. Still, the town covered just a few square miles and was surrounded by farms and orchards.

The 1940s and 50s were a time of transformation for the city. A development boom, initially created by the need for wartime housing and then sustained by returning veterans and their families, brought about a 350 percent increase in the city's population in just 20 years. Much of San Leandro's current form and character were defined during this era and nearly half of the City's current housing stock was added. Most of the neighborhood shopping centers and the commercial strips along East 14th Street and other arterials date from this period.

Despite the suburban character of the development, San Leandro emerged from the boom period as much more than a "bedroom community." The city was among the fastest growing industrial centers in the Bay Area during the post-war years, adding 6,000 manufacturing jobs between 1947 and 1954 alone. Much of West San Leandro was developed with industry, and numerous warehousing and distribution facilities were built south of Marina Boulevard. At the same time, shopping centers such as Pelton Center and Bayfair Center made the city a thriving retail destination. The favorable balance between jobs and housing enabled San Leandro to offer a competitive tax rate and a high level of City services.

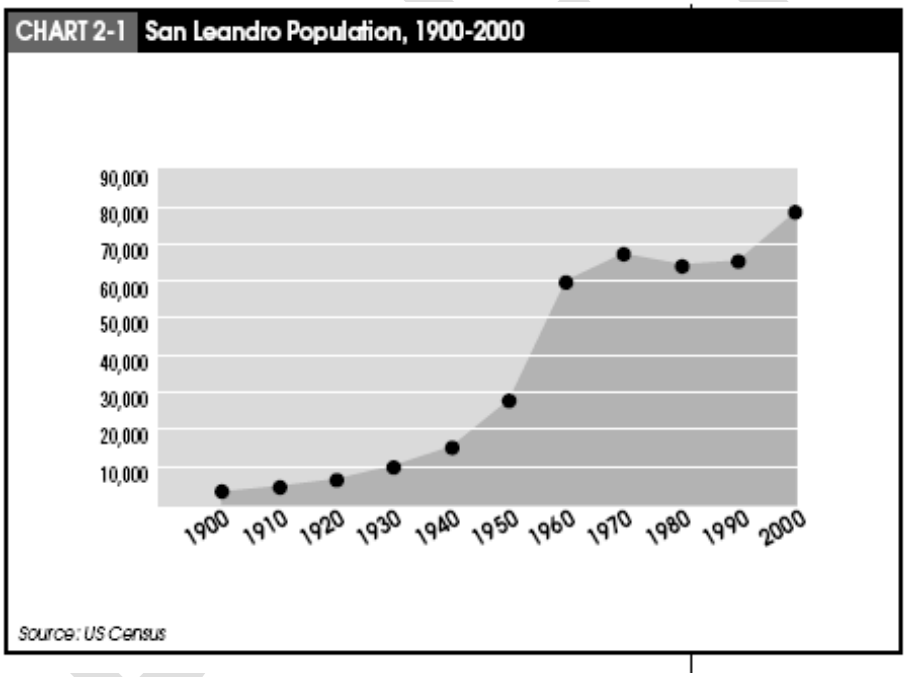
The pace of growth slowed as the city reached its natural limits during the 1960s. On the east, steep hills created a barrier to large-scale development. On the west, most of the shoreline had been acquired for park uses. Established communities lay to the north and south. The focus of new development shifted to smaller infill sites, including abandoned greenhouses and nurseries, and other properties that had been bypassed during the boom years.

By the 1980s, other factors had begun to shape the San Leandro. The Bay Area's economic base shifted from manufacturing to services and technology, and many traditional industries left the city. As the thousands of families who moved to San Leandro during the 1940s and 50s matured, school enrollment dropped and several schools were closed and redeveloped with housing. The percentage of senior citizens in the city increased from six percent in 1960 to 20 percent by 1990, giving San Leandro the highest median age in Alameda County. Local retailers were impacted by these changes and further by competition from new suburban malls.

These demographic and economic forces continued to have significant impacts on the development of the city during the 1990s.

4.2 DEMOGRAPHICS

The 2000 Census placed the population of San Leandro at 79,462 residents. The city's population increased 16 percent during the 1990s, the largest ten-year percentage increase since the 1950s. Two factors have been behind the recent growth spurt. First, about 1,100 new dwelling units were built in San Leandro during the 1990s, bringing the citywide total to about 31,300 units. Second, the average number of persons per household rose from 2.33 in 1990 to 2.57 in 2000. The latter trend is particularly significant, since it marks the reversal of a trend toward smaller households that began in the 1960s.



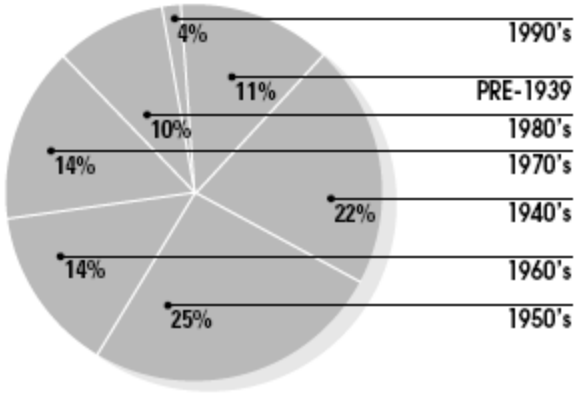
San Leandro has become much more ethnically diverse over the past two decades. The number of Asian, African-American, and Hispanic residents rose from 21 percent of the City's population in 1980 to 54 percent in 2000. This diversity is mirrored in the demographics of local schools and cultural institutions. In 2000, a language other than English was spoken in more than 25 percent of the city's households.

The median age in the city is 37.7, slightly lower than it was in 1990 but still among the highest in Alameda County. Between 1990 and 2000, the number of San Leandro residents aged 19 and under increased by 36 percent. This growth has had dramatic

impacts on school enrollment, as well as demand for childcare, youth services, and recreation. While the number of residents aged 65 to 74 actually declined during the 1990s, the number of persons over 75 increased by 32 percent. Other fast growing segments of the city's population during the 1990s included baby boomers (ages 45 – 54) whose numbers increased from 6,900 residents in 1990 to 10,900 residents in 2000.

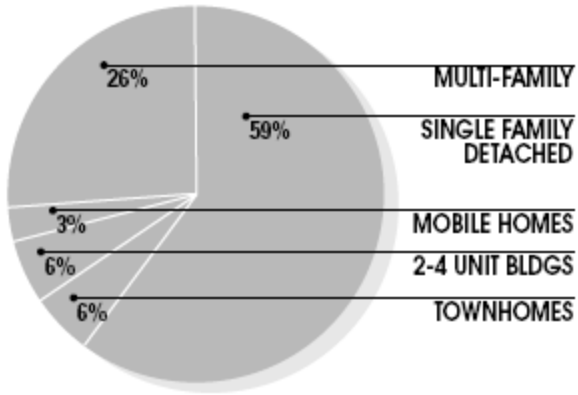
In 2000, the mean household income in San Leandro was estimated to be about $71,400. Although this represents a substantial increase over 1990, it is still about 15 percent below the Alameda County median. Many of the city's elderly residents are on fixed incomes and about 9 percent of those over 75 are classified by the federal government as living below the poverty line. The cost of housing is particularly vexing for lower income households, with some San Leandro families spending more than 50 percent of their monthly incomes on their housing costs. The Housing Element of the General Plan addresses this issue in detail.

CHART 2-2 Year of Construction of San Leandro's Housing Stock

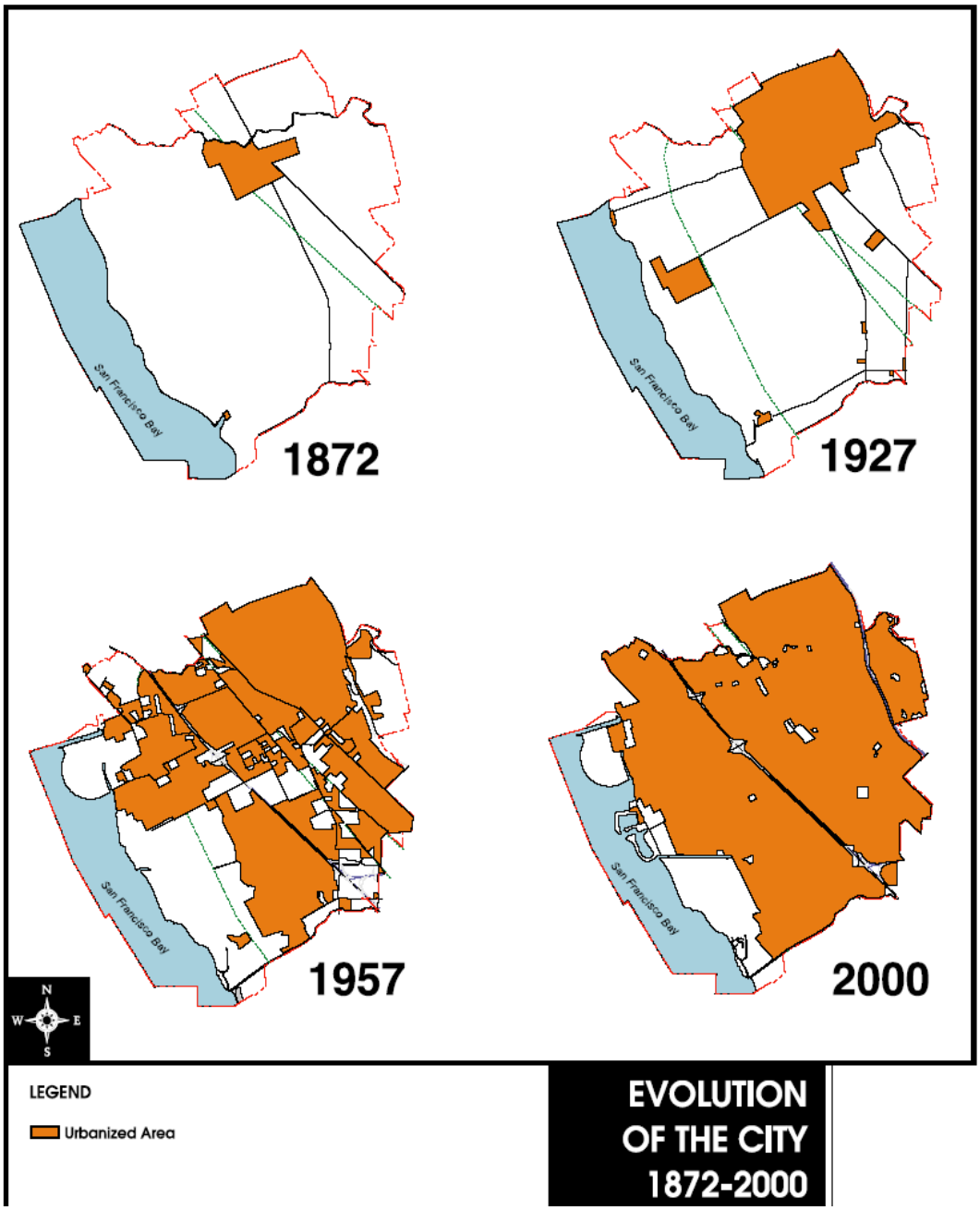


Source: US Census, 1990
CA Department of Finance, 2000

CHART 2-3 Composition of San Leandro's Housing Stock



Source: CA Department of Finance, 2000



Charts 2-2 and 2-3 illustrate the characteristics of San Leandro's housing stock. Nearly half of the housing in San Leandro was built during the 1940s and 50s. However, the city also contains more than 3,500 dwelling units which pre-date 1940. About two-thirds of San Leandro's dwelling units are single-family homes and about a quarter are in multi-family buildings.

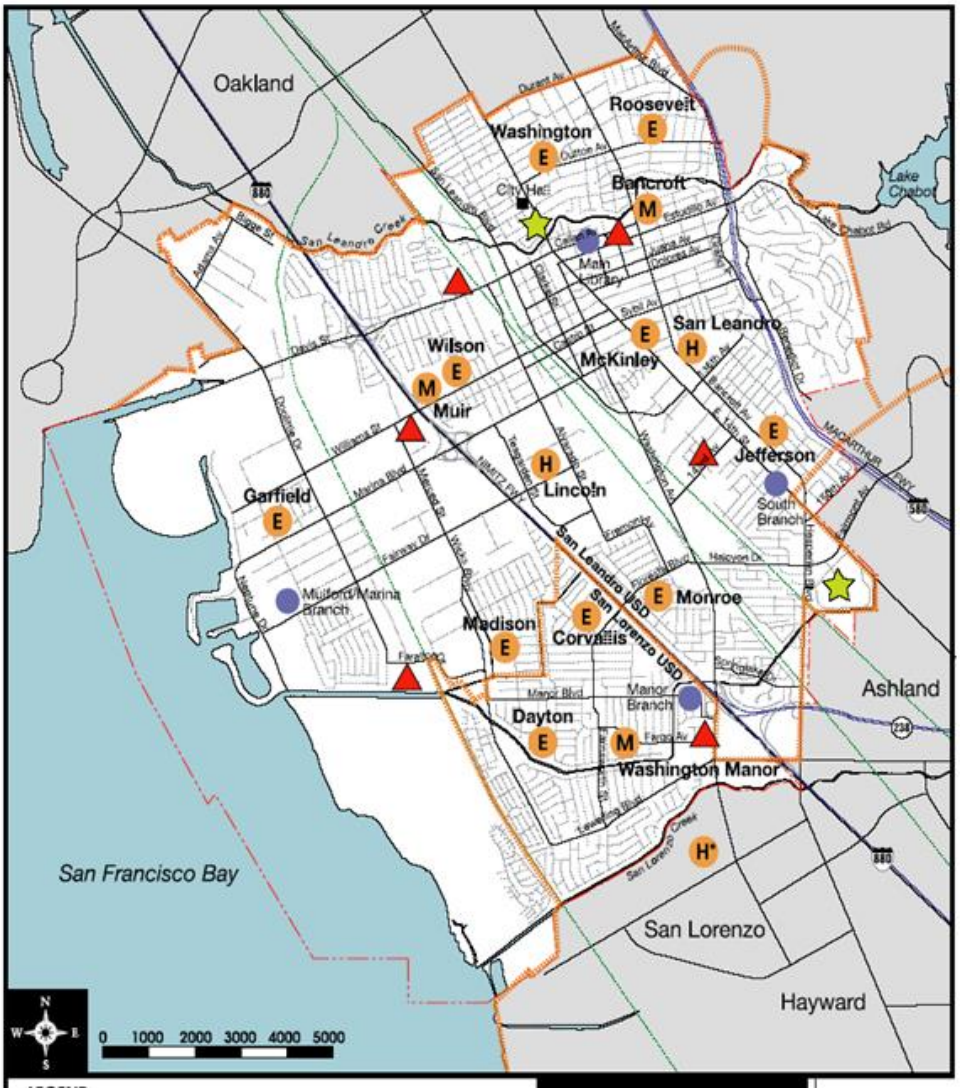
San Leandro is more affordable than other East Bay communities, but home prices and rents have risen steeply during the past three years. In April 1998, the California

Association of Realtors reported that the median price of a home in the City was $184,500. By January 2001, the median price for a three bedroom two bath house had soared to $340,000. Although this is still lower than the Alameda County median, the percentage increase in San Leandro during this two year period was among the highest in the County. Roughly 60 percent of the dwellings in San Leandro are occupied by owners and about 40 percent are occupied by renters.

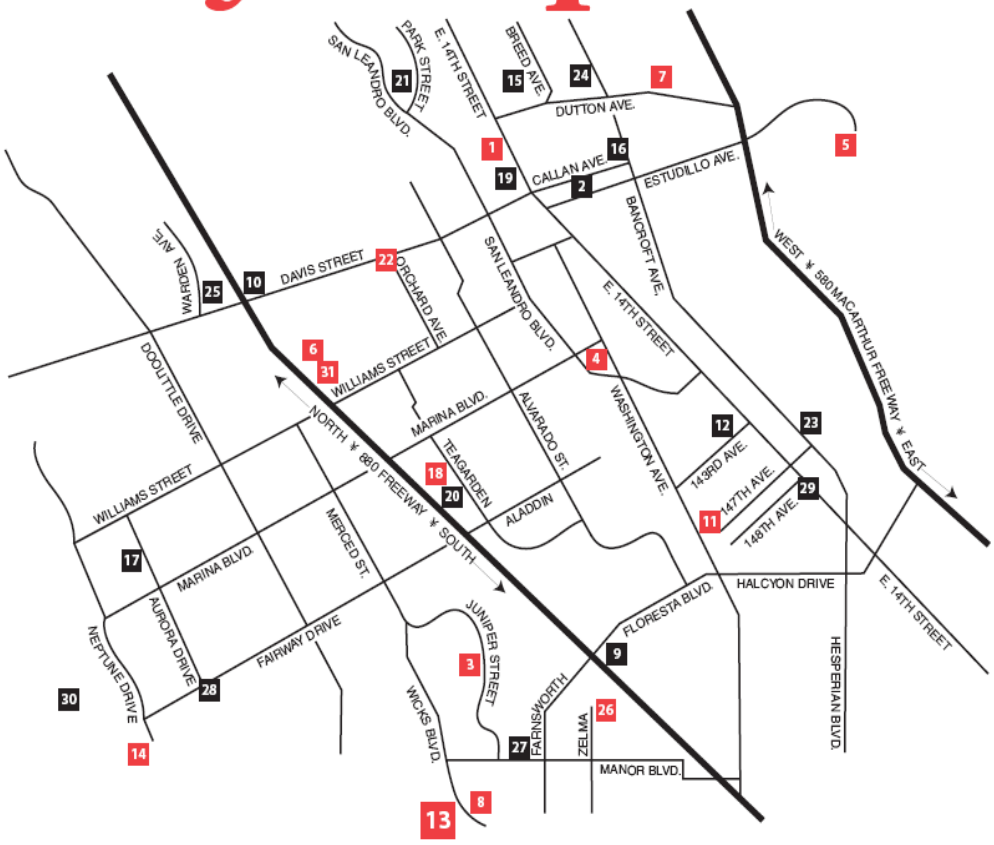
The Association of Bay Area Governments (ABAG) projects that the Bay Area's population will increase by nearly one million residents over the next 15 years. While much of this growth will take place in outlying cities and towns, the region's older suburbs are also expected to absorb a substantial share. ABAG's Projections 2000 forecasts that San Leandro will add over 1,500 new households between 2000 and 2015. The General Plan accommodates this growth, primarily through infill and redevelopment of underutilized parcels.

4.3 ASSETS

After a disaster, community vitality is dependent upon people, buildings, and utility and transportation infrastructure. Each of these assets contributes unique benefits to the community, and each has specific vulnerabilities to disasters. Without this understanding of the asset's role, there is no basis to understand what damage means for the community.


Oakland
Rooseveit
Washington
Bancroft
Lake Chabot
City Hall
Main Library
San Leandro
McKinley
Wilson
Muir
Jefferson
South Branch
Lincoln
Garfield
Milford/Marina Branch
Monroe
Madison
Corvallis
San Leandro USD
San Lorenzo USD
Manor Branch
Ashland
Dayton
Washington Manor
San Francisco Bay
San Lorenzo
Hayward
0 1000 2000 3000 4000 5000
LEGEND
Elementary School
Middle/Jr High School
High School
School District Boundary
Library
Fire Station
Police Station
*Arroyo High School is outside of the San Leandro City limits but serves San Leandro students from the Manor-Bonaire neighborhoods
COMMUNITY FACILITIES
FIGURE 8-1
San Leandro General Plan Update, 2002

City Map



1 Civic Center/City Hall
835 E. 14th Street

2 Main Library
300 Estudillo Ave.

3 Bonaire Park
Juniper & Sagewood

4 Boys & Girls Club Pool
401 Marina Blvd.

5 Chabot Park
1698 Estudillo Ave.

6 Cherry Grove Park
Leonard Dr. at Williams St.

7 Farrelly Pool
864 Dutton Ave.

8 F.J. Stenzel Park
15300 Wicks Blvd.

9 Floresta Park
3750 Monterey Blvd.

10 Grover Cleveland Park
O'Donnell & Wrin

11 Halcyon Park
1245 147th Ave.

12 Heath Park
1220 143rd Ave. at Rose

13 Marina Community Center
15301 Wicks Blvd.

14 Marina Park
13801 Neptune Dr.

15 McCartney Park
Breed Ave. & Sunnyside

16 Memorial Park
Bancroft & Callan

17 Mulford Park
13051 Aurora Dr.

18 Pacific Recreation Complex
Teagarden & Marina Blvd.

19 Root Park
East 14th & Hays St.

20 San Leandro Ball Park
Teagarden & Marina Blvd.

21 Siempre Verde Park
Park St. & San Leandro Blvd.

22 Thrasher Park
1300 Davis St.

23 Toyon Park
1500 Bancroft Ave.

24 Victoria Park
Victoria & Bancroft

25 Warden Ave. Park
Warden Ave. & Tudor Rd.

26 Washington Manor Park & Pool
14900 Zelma

27 Manor Branch Library
1307 Manor Blvd.

28 Mulford Marina Branch Library
13699 Aurora Drive

29 South Branch Library
14799 E. 14th Street

30 San Leandro Marina Office
40 San Leandro Marina

31 Muir Soccer Field
Leonard Dr. at Williams St.

32 Girls Inc.
13666 E. 14th St.

4.3.1 People

People experience hazards through damage to buildings and interruption of infrastructure services. While some people will be directly injured or killed by hazards, this is a small portion of the impacts on people. The vast majority of impacts will be felt through a person's ability to manage the secondary impacts from the hazard. The character of San Leandro residents is responsible for the strong community vitality, distinctive culture, and its unique economy. San Leandro is especially diverse, showcasing many different lifestyles, cultures, and languages that provide a wide variety of cultural experiences. Longtime residents of the San Leandro have special knowledge, social networks, and cultural memories that make them strong stewards for neighborhoods, parks, and trails. If a disaster forces San Leandro residents from their homes, social networks will be broken, and the diverse culture of the region will change.

San Leandro's economy relies on service, labor, creative, and professional workers. The Bay Area economy is unique in that it is home to one of the fastest growing and most innovative economic sectors in the world. If a disaster impedes the ability of employees of any sector to stay in the region or get to work, the impact will cascade beyond individual businesses and be felt not just across the region, but globally. Employees from all sectors are needed to support one of the strongest and most specialized economies in the world.

People are a critical asset for the functioning of a community and the economy; without residents a jurisdiction loses its tax base and employers lose employees and customers. More importantly, jurisdictions lose the culture, vibrancy, and sense of cohesiveness that make it unique. People are the nexus of a resilient community, and many other assets are designed to serve and support people.

4.3.2 Social Vulnerability

Social vulnerability describes characteristics that make people less able to adequately withstand and adapt to a hazard, such as limited mobility, income, and educational attainment. Social vulnerabilities are largely independent of the hazard type and can be applied similarly to any type of disaster.

Unlike other asset classes like buildings and infrastructure, the vulnerability of people is not just due to physical characteristics but rather social characteristics that make them less able to adequately withstand and adapt to a hazard. People are also highly dependent upon the physical environment that they are surrounded by; community members are much more vulnerable if the buildings and infrastructure that they live in, work in, and rely upon fail.

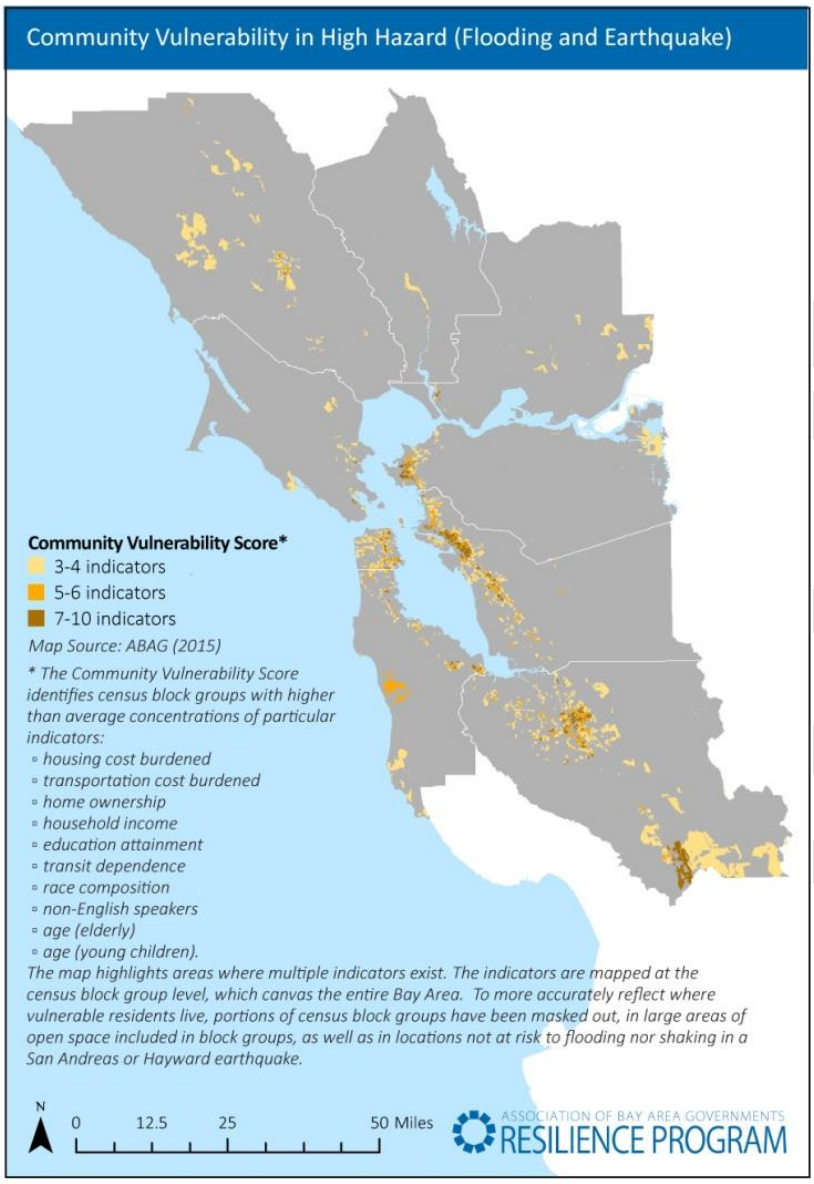
In 2015, ABAG and BCDC published *Stronger Housing, Safer Communities*, a report that identified ten primary indicators that represent characteristics of individuals and households that affect their ability to prepare for, respond to, and recover from a disaster.[1] These indicators collectively present a picture of a community's vulnerability to stressors. Concentration of these indicators, or areas with multiple indicators, can inhibit the recovery of a community. Key themes that emerged included age-related vulnerabilities, language and ethnicity vulnerabilities, cost-burdened residents, housing tenure issues, and access to resources. Indicators were measured and scored using the method developed by the Metropolitan Transportation Commission (MTC) to identify Communities of Concern (CoC). This is meant to identify block groups with higher than average concentrations of the particular indicator and therefore may have higher concentrations of vulnerability. The following table includes the ten indicators that contribute to the vulnerability of people and households.

Table 1: Community Vulnerability Characteristics

Indicator	Measure
Housing cost burden	% household monthly housing >50% of gross monthly income
Transportation cost burden	% household monthly transportation costs >5% of gross monthly income
Home ownership	% not owner occupied housing
Household income	% households with income less than 50% AMI
Education	% persons without a high school diploma >18 years
Racial/Cultural Composition	% non-white
Transit dependence	% households without a vehicle
Non-English speakers	% households where no one ≥ 15 speaks English well
Age – Young children	% young children under 5 years
Age – Elderly	% elderly, over 75 years

[1] ABAG and BCDC, 2015

Figure 1: Community Vulnerability in High Hazard Areas



4.3.3. Income

Residents who are resource constrained are more vulnerable to the impacts of a disaster. Resource-constrained residents include households that are low- and very low-income, households of all income levels that spend large percentages of their income on housing and transportation, and transit-dependent households that do not own a car. Resource-limited households are less able to prepare for natural disasters, and if displaced from damaged homes, will likely struggle to find housing that is affordable and near to the jobs, schools, medical facilities, and other services on which they rely.

Update on numbers - In 2000, there were approximately 54,000 jobs in San Leandro. The city has a large proportion of manufacturing and wholesale jobs relative to Alameda County and the

Bay Area as a whole. In 1995, approximately 34 percent of San Leandro's jobs were in these two sectors, compared to 20 percent countywide. About 26 percent of the jobs in the city were classified as being in the service sector, compared to 36 percent countywide.

The City's manufacturing base consists primarily of food processing, multimedia, transportation equipment, medical instruments, and metal fabrication. San Leandro is home to Ghirardelli Chocolate, Otis Spunkmeyer, Mi Rancho, and several sausage manufacturers. There are also a number of large transportation and distribution facilities. Although San Leandro has not traditionally been known as a technology or financial center, professional services is among the fastest growing sectors of the city's economy. Among companies with an established presence in San Leandro are Alpha Innotech, Kaiser Permanente, Jansport, Sensant, The North Face, Trinet ICO, and World Mortgage. San Leandro also provides many support services to the technology sector, ranging from the manufacture of packaging to commercial printing.

Largest Employers in San Leandro

Business	Employees	Business Type
San Leandro Hospital	625	Service – Hospital
World Mortgage	480	Financial Services
Wal-Mart Store	425	Retail
Safeway Stores	391	Retail/Manufacturing – Milk Processing
Ghirardelli Chocolate Co.	348	Manufacturing – Chocolate Plant/Offices
Costco Wholesale	316	Retail & Wholesale
Target Stores	300	Retail
Macy's	280	Retail
Home Depot	280	Retail
Kindred Hospital	252	Service – Acute Care Hospital
Peterson Tractor Co.	244	Retail – Tractor Equipment
Otis Spunkmeyer, Inc.	240	Manufacturing & Distributing Baked

Business	Employees	Business Type
		Goods
Vertis Inc.	225	Manufacturing – Commercial Printing
MV Transportation	205	Service – Para transit Co/Admin. Office
Kennerley-Spratling, Inc.	189	Manufacturing – Custom Plastic Molds
Simmons Co.	180	Manufacturing – Bed Springs
Wyman Gordan Co.	176	Manufacturing – Castings
Unisource Office Services	173	Service – Furniture Delivery/Sales
North Face, Inc.	165	Wholesale – Outdoor Clothing & Equipment
Tri Net Employer Group, Inc.	162	Service – Job Placement/Office
Enterprise Rent-A-Car	160	Service – Administrative Office
Olson Steel Company	152	Manufacturing – Structural Steel
Simpson Strong-Tie Inc.	147	Manufacturing – Framing
Cintas Corporation	146	Service – Uniform Rental
Tandem Staffing	143	Service – Temporary Staffing

San Leandro's economy also includes a large number of community service jobs, including some 7,000 jobs in health care, education, and government. There are also nearly 9,000 retail jobs in the city, with retail activity concentrated at shopping centers such as Bayfair Center, Marina Square, Greenhouse Marketplace, and Westgate.

Over the years, the local economy has shifted from one that was primarily based on manufacturing to one that is more diverse. Relative to other cities in the central East Bay, San Leandro has experienced strong employment growth in light

manufacturing, food-related industries, construction and building services, community services, transportation, distribution, and storage. Growth in the technology and office sectors has been slower in San Leandro than in nearby cities such as Fremont and Hayward. Land prices and prices per square foot of leasable space tend to be more competitive in San Leandro than in other parts of the central Bay Area. The city's well-established neighborhoods and more moderately priced housing stock also make it an attractive option for businesses.

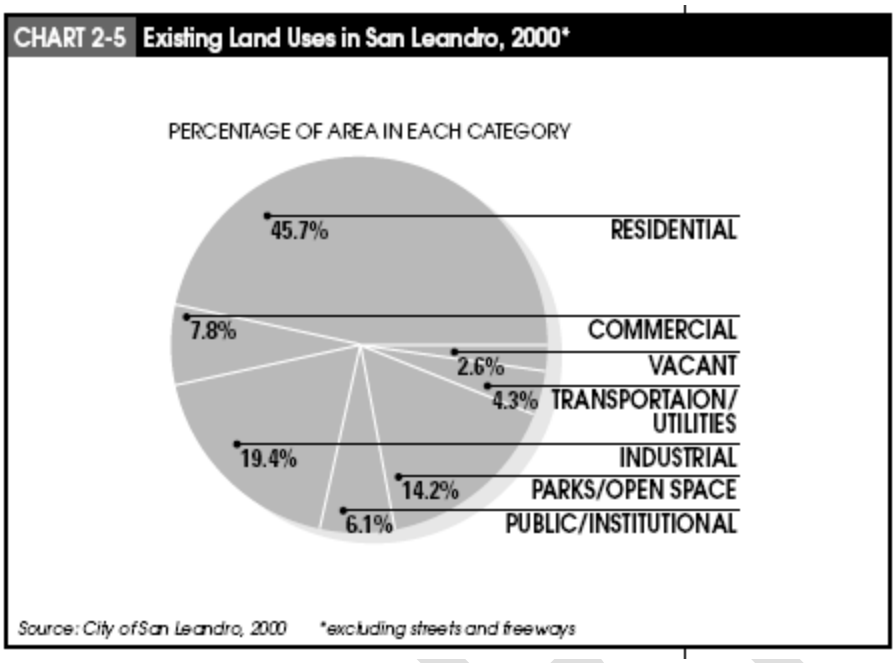
4.3.4 Access to Housing

Unaffordable housing also contributes to the vulnerability of residents and will become significantly exacerbated after a disaster. After a disaster, if many housing units are lost, a constrained market may drive up the cost of housing even further. Loss or damage of housing that results in increased costs to either renters or home-owners will likely increase the number of permanently displaced San Leandro residents as finding housing that is affordable and near jobs, schools, medical facilities, and other services on which they rely will be challenging.

It is generally more difficult for residents in multi-family housing (either renters or owners) to retrofit their housing and many do not have insurance to protect themselves and their belongings in case of a disaster. In many communities, renters are also more likely to be resource-limited (low income, cost burdened, or lacking savings) and will need assistance both during a disaster (e.g., with shelter-in-place facilities), as well as post-disaster with finding interim, affordable housing to avoid the permanent displacement of low income or cost-burdened renters from communities due to damaged housing.

4.3.4.1 Land Use

The city of San Leandro encompasses 15.4 square miles, including 13.3 square miles (about 8.500 acres) of land and 2.1 square miles of water. There are approximately 25,000 parcels of land in the city, about three-quarters of which contain single family detached homes; Chart 2-5 and illustrates the existing composition of land uses in San Leandro.



Excluding streets and freeways, about 46 percent of San Leandro's neighborhoods include about 2,600 acres of single family detached homes, 260 acres of townhomes and duplexes, 300 acres of apartments and condominiums, and 70 acres of mobile homes. These areas contain about 31,000 housing units, for an average residential density of 9.5 units per acre. This density creates a more urban character than the newer communities of the East Bay (like Dublin and Fremont) but a more suburban character than Berkeley, Oakland and other cities closer to San Francisco. In fact, many of San Leandro's neighborhoods have a comfortable "small town" quality that is created in part by mixed density housing.

The mean single family lot size in the city is 6,250 square feet. Rectangular lots measuring about 60' x 100' comprise most of the city's post-war neighborhoods (such as Washington Manor) but are also typical in older areas such as Estudillo Estates and Farrelly Pond. Slightly larger lots prevail in the Bay-O-Vista, Broadmoor, and Mulford Gardens areas, while smaller lots are more common in the newer subdivisions such as Heron Bay and Cherrywood.

Although many San Leandro neighborhoods are perceived as being homogeneous, the housing stock is actually quite diverse. The city's neighborhoods include view-oriented hillside homes, craftsman bungalows and Mediterranean cottages, apartment buildings and garden apartment complexes, mid-rise condominiums, ranch-style tract homes, century-old Victorians, mobile home parks, California contemporaries, and even semi-rural ranchettes. Many single family neighborhoods include pockets of higher-density housing, along with other uses such as parks, schools and churches. Densities as high as 90 units per acre can be found on some blocks around Downtown San Leandro, although most multi-family housing is in the range of 25 to 30 units per acre. The major concentrations of higher density housing are located around Downtown, along East 14th Street and Washington Avenue, in the Springlake Drive area, along Orchard Avenue, at the west end of Marina Boulevard, around San Leandro Hospital, and around the Greenhouse Marketplace Shopping Center.

Commercial (retail, service and office) uses in San Leandro comprise 546 acres, or about 8 percent of the city. Although Downtown is the city's historic retail center, the largest retail uses in the city are the community and regional shopping centers such as Bayfair Center and Westgate. Much of the city's retail acreage is contained in commercial strips along East 14th Street, Washington Avenue, MacArthur Boulevard and Marina Boulevard. The city also contains a number of small neighborhood-oriented shopping centers. About 95 acres of the city's commercial land consists of offices. The largest concentrations are located around the Downtown BART Station, along East 14th Street, and just east of Downtown. Additionally, at the time this Plan was adopted, a 63-acre site which formerly housed the Albertsons Distribution Facility had been put on the market for development as a possible retail or commercial center.

San Leandro contains about 1,360 acres of industrial uses. Industrial areas are generally located in the west and northwest parts of the city, and in the central area just east of I-880 and south of Marina Boulevard. Historically, industry in San Leandro followed the three north-south railroad lines crossing the city. The shift to trucking and decline of heavy manufacturing has changes this pattern. San Leandro's industrial areas now include uses as diverse as wrecking yards and "dot coms." Much of the city's industrial area consists of landscaped office parks and distribution facilities. Other areas continue to fit a more traditional image of manufacturing.

The city also contains 426 acres of public and institutional uses and 300 acres of transportation, communication and utilities land. Public and institutional uses include schools, hospitals, libraries, community centers, municipal buildings, and other civic uses. These uses tend to be scattered around the city within neighborhoods and business districts. The transportation, communication and utilities land consists mostly of railroad rights-of-way. This land also includes the BART stations, PG&E rights-of-way, the Davis Street Transfer Station, and wastewater treatment facilities.

Open space and parks comprise almost 1,000 acres in San Leandro. City parks such as Marina Park and Washington Manor Park represent about 120 acres of this total. Public golf courses and Oyster Bay Regional Shoreline make up another 400 acres. The remainder of the land – about 450 acres – consists mostly of wetlands in the southwestern part of the city.

4.3.5 Access to Information

The ability to reach out to those who live and work in San Leandro is important to the City, therefor the City of San Leandro has multiple information outlets for residents and businesses to access information. The City's website and social media accounts, and the local television and radio channels are all updated with emergency preparedness information as well as timely, safety information in the event of a disaster. In an effort to make sure that information is available and the information is whole community inclusive, the City's preparedness information is translated into multiple languages and distributed through the website, social media, trainings, and public outreach venues. In the event of a disaster the City would translate all critical information and distribute via social media, radio, television and the City's mass notification system.

4.3.6 Transportation System

Interstates 880 and 580 – the Nimitz and MacArthur Freeways – bisect San Leandro in a north-south direction. Interstate 238 – the Castro Valley Freeway – provides an east-west link between I-880 and I-580 in the southern part of the Planning Area. I-880 is one of the busiest freeways in California, carrying 220,000 vehicles a day through San Leandro and serving as the major north-south truck corridor through the East Bay. Traffic volumes on I-580 are about 140,000 vehicles a day. Both of the freeways are four lanes in each direction and both provide several interchanges connecting to local streets in San Leandro. San Leandro is located midway between the Oakland-San Francisco Bay Bridge and the Hayward-San Mateo Bridge, the two major transbay crossings between the San Francisco Peninsula and the East Bay.

The 95-mile Bay Area Rapid Transit (BART) system includes four miles of track within San Leandro. Two of the system's 39 stations are located within the city, at Downtown San Leandro and Bayfair Center. More than 16,000 passengers a day used these two stations in 1997. San Leandro does not currently have an AMTRAK station, although AMTRAK's trains pass through the city between Oakland and San Jose. Most San Leandro residences are within one-half mile of an AC Transit bus route, providing links to the BART station and major destinations within the city and East Bay. The city is also served by three freight-rail lines and is approximately two mile from Metropolitan Oakland International Airport.

4.3.7 Environment

San Leandro is located on the East Bay Plain, a flat area that extends 50 miles from Richmond in the north to San Jose in the south. The Plain is about three miles wide in the San Leandro area. At its eastern edge, the plain transitions into low hills, rising to 526 feet at the highest point in

the city's Bay-O-Vista neighborhood. On its western edge, the Plain slopes down to San Francisco Bay, the largest estuary on the California coast.

San Leandro's rich alluvial soils and temperate climate support a wide variety of plants and animals. Expansive wetlands in the southwest part of the city provide habitat for the salt marsh harvest mouse and other endangered species. San Leandro Creek remains one of the few waterways in the urbanized East Bay that retains its natural character along most of its course. Elsewhere in the city, street trees, parks, large yards, and other open spaces provide both aesthetic and environmental benefits. Just beyond the eastern city limits, thousands of acres of grasslands, woodlands and coastal scrub are protected in regional park and watershed lands. These open spaces have great environmental importance and scenic value and are a significant amenity for San Leandro residents.

The city's environment is vulnerable to the impacts of urban development, particularly air and water pollution. Air quality has been a persistent problem in the Bay Area for decades. Although many steps have been taken toward improvement, automobile, truck and air traffic continue to create problems. Likewise, water quality has improved as a result of stronger controls over point sources such as wastewater plants, but runoff from streets, parking lots and yards still poses a threat to the health of the Bay. Continued efforts to reduce pollution and preserve the environment are necessary, both for the benefit of San Leandro and other communities in the region.

San Leandro's environment also creates a number of natural hazards. The Hayward Fault, considered by some seismologists to be the most dangerous hazard in the Bay Area, traverses the eastern edge of the city. Ground shaking and liquefaction in a major earthquake could cause serious damage and injury. Even in the absence of an earthquake, some of the city's steep hillsides are prone to landslides and erosion. Other parts of the city are subject to shallow flooding. Man-made hazards, such as noise from airplanes, trains and trucks, also exist in the city.

4.3.8 Critical Facilities

Some services such as healthcare, schools, and police and fire, are crucial for the functioning of communities, especially in the immediate post disaster environment. Other essential facilities for community functioning include public buildings that house community services such as libraries, or privately owned grocery stores, gas stations, banks, parks, places of worship, and many others. Understanding where these facilities are, and which communities they serve, is crucial to understanding the consequence if they are damaged. Directly following a disaster, first responders will be called into action. Local fire and police will be supported by mutual aid from California Highway Patrol, Coast Guard, search and rescue units, and other emergency responders. These services help limit the impact of the disaster and reduce community losses.

4.3.8.1 Public Facilities

For small jurisdictions, a single facility may house all fire or police services. Larger jurisdictions may have multiple facilities, each with unique roles. When there are multiple facilities for each department, it is important to know which functions are housed where. All facilities may be reliant on a single station's dispatch center, or one facility may house the only hazardous waste team. Understanding the services each facility is responsible for is crucial when prioritizing mitigation strategies, or when there are decisions on where new equipment or services are housed.

Critical Facilities

Building	Address	Built	Type of Construction	Building	Contents	Assessed Value
City Hall	835 E. 14th	1997	Reinforced Concrete	$ 11,979,143	1,905,174	$13,884,317
EOC – Public Works Office	14200 Chapman	1983	Steel Frame	133,521	29,115	162,655
Fire Station 9	450 Estudillo	1970	Joisted Masonry	1,115,012	6,298	1,121,310
Fire Station 10	2194 Williams	2003	Joisted Masonry	4,240,000	21,200	4,261,200
Fire Station 11	14903 Catalina	2002	Masonry-Non Combustible	3,057,040	218,360	3,275,400
Fire Station 12	1065 143rd Ave.	1953	Joisted Masonry	1,298,972	6,298	1,298,972
Fire Station 13	637 Fargo Ave.	1954	Joisted Masonry	443,335	4,498	447,854
Police Dept.	901 E. 14th	1997	Joisted Masonry	3,537,015	820,604	4,357,619
Water Treatment	3000 Davis	Various	Several structures- Steel Frame and Reinforced Concrete	11,503,347	4,599,455	16,102,802
Main Library	300 Estudillo	1999	Joisted Masonry	17,992,864	5,622,770	23,615,634
		1999	Joisted	2,249,108	1,124,554	3,373,662

Marina Community Center	15301 Wicks	1962	Masonry Wood Frame	3,409,961	65,280	3,594,918

Senior Community Center – EOC 13909 East 14th Street

4.3.8.2 Hospitals and Health Care Facilities

Hospitals and health care buildings are important for two reasons: they treat those injured during the hazard event, and they are housing or serving patients with specific medical needs. In a severe disaster event, there may be thousands of injuries that require immediate health care. Hospitals need to be operational to fulfill this need during the response phase of the disaster. Additionally, hospitals and other health care facilities (general practice, pharmacies, assisted living homes, etc.) must continue to support the patients they were serving before the event. Hospitals and assisted living homes cannot be evacuated like other buildings because of the detrimental impact it could have on patients. Pharmacies and non-acute care facilities must remain functional to provide those with existing health needs with necessary services.

In 1973, as a direct result from the 1971 Sylmar earthquake, during which a hospital collapsed, California passed the Alfred E. Alquist Hospital Seismic Safety Act, to require acute care hospitals be designed to remain standing and operational immediately after an earthquake.[2] The law was amended after the 1994 Northridge earthquake, to include the evaluation and rating of hospital compliance with the law. All hospitals are required to be compliant with the law by 2030. This law is specific to acute care hospital buildings, and only addresses the earthquake hazard. Other health care facilities are not required to be designed or retrofit to a higher level.

San Leandro Hospitals

Jones Convalescent Hospital
524 Callan Ave, San Leandro, CA
510-483-6200

San Leandro Hospital
13855 E 14th St, San Leandro, CA
510-357-6500

San Leandro Hospitals Continued

[2] OSHPD (2005)

Kindred Hospital-SFBay Area
2800 Benedict Dr, San Leandro, CA
510-357-8300

San Leandro Surgery Ctr.
15035 E 14th St, San Leandro, CA
510-276-2800

Kaiser Permanente
2500 Merced Street
San Leandro 94577

4.3.8.3 Schools

Schools are particularly important community assets, as residents highly value the safety and education of their children. Safe schools are important for the safety of children inside. A functional school following a disaster is also important to continue providing educational services during a community's recovery. If they are not operational families may choose to move in order to enroll their children in school. For families that stay, parents may be unable to return to work if schools are not in session.

The important role of a school expands beyond education. Schools can be the center of a community's social fabric. They are not just a space for youth, but a place for the community as a whole. Schools are often where community meetings, performances, and events are held. Following disasters, some schools can serve as temporary shelter sites, while others might house social services to support disaster stricken communities.

While many of the critical facilities already listed may be located in publicly owned buildings, there are a number of other public services and operations that are critical for a jurisdiction to properly recover. City administrative services will be crucial to meet the surging demand for approvals, permits, and financing. Many public services outside the scope of emergency response will also need to be restored and operating soon after an event. Any social services that local governments administer will need to be restored quickly. Lastly, many local governments operate a number of infrastructure systems (local roads, water distribution, sewer, etc.) that will need departments to quickly repair damaged components and restore service to residents. Without a place to continue working, or without the resources or records needed to complete the tasks, a jurisdiction may be ill equipped to meet the increased workload expected in the aftermath of a disaster event.

San Leandro Schools:

- Corvallis Elementary School
  14790 Corvallis Street
  San Leandro 94579

- Garfield Elementary School
  13050 Aurora Drive
  San Leandro 94577

- Jefferson Elementary School
  14300 Bancroft Avenue
  San Leandro 94577

- Madison Elementary School
  14751 Juniper Street
  San Leandro 94577

- McKinley Elementary School
  2150 East 14th Street
  San Leandro 94577

- Monroe Elementary School
  3750 Monterey Boulevard
  San Leandro 94578

- Roosevelt Elementary School
  951 Dowling Boulevard
  San Leandro 94577

- Washington Elementary School
  250 Dutton Avenue
  San Leandro 94577

- Wilson Elementary School
  1300 Williams Street
  San Leandro 94577

- St. Felicitas Catholic School
  1650 Manor Boulevard
  San Leandro 94579

San Leandro Schools Continued

- Assumption Catholic School
  1851 136th Avenue
  San Leandro 94577

- St. Leander's Catholic School
  451 Davis Street
  San Leandro 94577

- Bancroft Middle School
  1150 Bancroft Avenue
  San Leandro 94577

- Washington Manor Middle School
  1170 Fargo Avenue
  San Leandro 94579

- John Muir Middle School
  1444 Williams Street
  San Leandro 94577

- San Leandro High School
  2200 Bancroft Avenue
  San Leandro 94577

- Lincoln High School
  2600 Teagarden Street
  San Leandro 94577

4.4 Critical Infrastructure

4.4.1 Water

Water service to San Leandro is provided by the East Bay Municipal Utility District (EBMUD), a publicly-owned utility. San Leandro comprises about 6 percent of EBMUD's customer base and uses about 5 percent of its water. About 95 percent of the EBMUD water supply originates from the melting snowpack of the Sierra Nevada, with the remaining five percent coming from reservoirs in the East Bay Hills. There are also about 800 private wells in San Leandro, many of which were originally used for agriculture. Most of these wells are dormant, and those that are still active are used for landscape irrigation and industry.

EBMUD distributes its water through a system of pipeline, storage reservoirs and pumping plants. The utility operates and maintains all storage, pumping and distribution facilities within its service area and is responsible for all facilities up to the location of the water meter. In 1999, San Leandro's metered water demand was 12.0 million gallons per day.

Although there are no major water service constraints in the city, regular maintenance and upgrading of the water delivery system is essential to provide adequate firefighting capacity and ensure reliable service delivery. The water system remains vulnerable to disruption in an earthquake. EBMUD's pipelines cross active earthquake faults at 200 locations within the service area. The utility is in the midst of a major seismic improvement program, including upgrades to reservoirs, anchoring of equipment, improvements to water treatment and pumping plants, and retrofitting of pipelines at fault line crossings.

The City of San Leandro and EBMUD have undertaken a number of programs to conserve water and reduce the need for developing new supplies.

4.4.2 Wastewater

San Leandro is served by two different sanitary sewer systems. About two-thirds of the city, including most of northern and central San Leandro, is served by a City-owned and operated system. The remainder of the city, including Washington Manor and most of southern San Leandro, is served by the Oro Loma Sanitary District. The Oro Loma District also includes a large portion of unincorporated Alameda County encompassing Ashland, Cherryland, and San Lorenzo. Most of San Leandro's commercial and industrial land uses are served by the City of San Leandro system.

4.4.2.1 City of San Leandro System

The City of San Leandro constructed its initial wastewater treatment plant at the west end of Davis Street in 1939. The plant has been upgraded substantially over the last 60 years in response to changes in demand and more stringent state and federal water quality standards. Today, the plant has a dry weather capacity of about 7.9 million gallons per day and treats about 5.2 million gallons per day. Flows sometimes exceed capacity during major winter storms, in part due to the infiltration of winter storm run-off into the 130 miles of pipes that comprise the collection system. The City is presently undertaking an extensive program to reduce wet weather infiltration problems by replacing deficient links in the collection system.

Once at the plant, wastewater is treated and dechlorinated. Most of the effluent is discharged to San Francisco Bay through an outfall pipe shared by other communities in Alameda County. Some of the effluent is directed to a recycled water system owned by EBMUD and is used to irrigate golf courses in Oakland and Alameda. Sludge from the treatment plant is used as an agricultural soil conditioner. The treatment system is enhanced by an aggressive industrial waste pre-treatment program serving industrial customers.

The City is in the process of undertaking significant capital improvements to the wastewater system, including the replacement of undersized pipes beneath the I-880 Freeway. Future improvements could include the expansion of the recycled water system to serve the City's Monarch Bay Golf Course. Administrative changes, including the possible transfer of wastewater services to EBMUD or another agency, also have been discussed as a means of achieving greater economies of scale and adding wet-weather capacity to the treatment system.

4.4.2.2 Oro Loma Sanitary District

The Oro Loma Sanitary District was formed in 1911 and today provides wastewater collection and treatment services, garbage collection, and recycling services for the 44,000 customers within its 13 square mile service area. Approximately 20 percent of the District's customers are located within the city of San Leandro. Oro Loma treats approximately 15 million gallons of sewage per day, including flow from the Castro Valley Sanitary District. The District's treatment plant is located at the end of Grant Avenue in San Lorenzo, just south of the San Leandro city limits.

As at the San Leandro plant, wastewater is treated to a secondary level through an activated sludge process. Treated effluent is disposed to the deep waters of San Francisco Bay through the collectively owned East Bay Dischargers Authority pipeline. An average of 230,000 gallons a day of treated effluent is reused for irrigation on the Skywest Golf Course in Hayward. The District has a Renewal & Replacement and Capital spending program which covers ongoing repair and replacement of system components. Revenues for this program are generated through sewer connection fees and user fees.

4.4.3 Drainage

The City of San Leandro Department of Public Works owns and maintains 175 miles of storm drainage conduits. The City's storm drain system feeds into a larger system owned and operated by the Alameda County Flood Control and Water Conservation District (ACFCWCD). This system includes the lower reaches of San Leandro and San Lorenzo Creeks, as well as a number of channels extending into San Leandro neighborhoods west of I-880. The District's drainage facilities include levees, pump stations, erosion control devices, and culverts.

5. Hazard Identification, Analysis, Assessment

5.1 Hazard Characterizations

5.1.1 Earthquake

Earthquakes occur when two tectonic plates slip past each other beneath the earth's surface, causing sudden and rapid shaking of the surrounding ground. Earthquakes originate on fault planes below the surface, where two or more plates meet. As the plates move past each other, they tend to not slide smoothly and become "locked," building up stress and strain along the fault. Eventually the stress causes a sudden release of the plates, and the stored energy is released as seismic waves, causing ground acceleration to radiate from the point of release, the "epicenter."

The Bay Area is in the heart of earthquake country. Major faults cross through all nine Bay Area counties. Every point within the Bay Area is within 30 miles of an active fault, and 97 of the 101 cities in the Bay Area are within ten miles of an active fault.

The total amount of energy released in an earthquake is described by the earthquake magnitude. The moment magnitude scale (abbreviated as M) is logarithmic; the energy released by an earthquake increases logarithmically with each step of magnitude.[3] For example, a M6.0 earthquake releases 33 times more energy than a M5.0, and a M7.0 earthquake releases 1,000 times more energy than a M5.0 event.

The quantified size or measurement of an earthquake is dependent on factors that include the length of the fault and the ease with which the plates slip past one another. In the Bay Area, technical specialists have observed varied fault behaviors, giving some sense of which faults may or may not produce a large, damaging earthquake. Earth scientists are most concerned about the San Andreas and Hayward faults, believed most likely to produce large, regionally damaging earthquakes. There are, however, many other Bay Area faults that can produce localized damage.

Additionally, earthquakes are often not isolated events, but are likely to trigger a series of smaller aftershocks along the fault plane, which can continue for months to years after a major earthquake, producing additional damage.

[3] USGS (2014)

The energy released in earthquakes can produce five different types of hazards:

- Fault rupture
- Ground shaking
- Liquefaction
- Earthquake-induced landslides
- Tsunamis and seiches

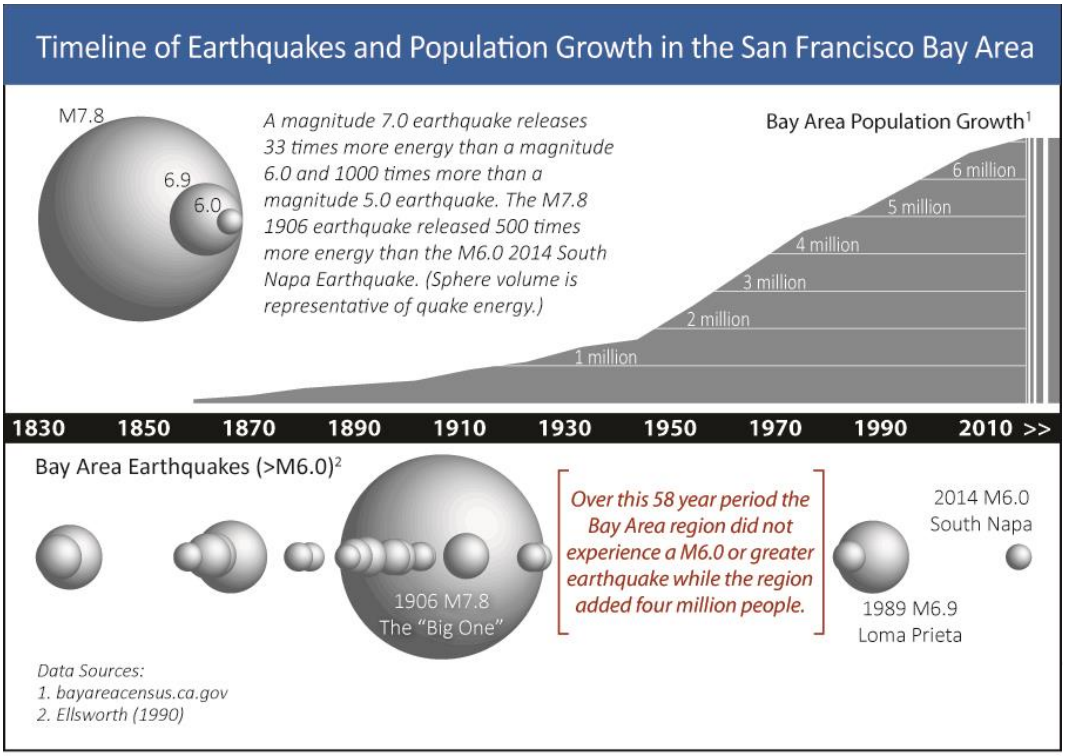
5.1.2 Historic Bay Area Earthquake Occurrences

The Bay Area has experienced significant, well-documented earthquakes. In 1868, a significant earthquake occurred on the Hayward fault with an estimated magnitude of 6.8-7.0. The fault ruptured the surface of the earth for more than 20 miles and significant damage was experienced in Hayward and throughout Alameda County, and as far away as San Francisco, Santa Rosa, and Santa Cruz. The M7.8 1906 earthquake on the San Andreas Fault, centered just off the coast of San Francisco, devastated San Francisco and caused extensive damage in Oakland, San Jose, and Santa Rosa. More recently, the M6.9 1989 Loma Prieta earthquake caused severe damage in Santa Cruz and the surrounding mountains, where it was centered, as well as fatal damage 50 miles away in Oakland and San Francisco. Moderate earthquakes are much more common in the Bay Area; twenty-two have occurred in the last 178 years, averaging every eight years.[4] The 2014 South Napa earthquake is a reminder of the strong shaking that even a moderate magnitude 6.0 earthquake can produce in a localized area. Figure **2** charts Bay Area earthquakes over the past 165 years**.** Because the 1906 earthquake released so much energy and stress on regional faults when it ruptured, the last 100 years have been relatively seismically quiet. As faults restore their stress and energy builds

[1] USGS (2014)

Ellsworth, W.L. (1990)

Figure 2: Timeline of Earthquake and Population Growth in the San Francisco Bay



5.1.3 Probability of Future Earthquakes

A powerfully damaging earthquake similar to the 1906 earthquake or 1989 Loma Prieta earthquake are rare but likely to occur in the next 30 years. The United States Geological Survey (USGS) estimates there is a 72% chance of one or more magnitude 6.7 or larger earthquakes in the next 30 years on one of the Bay Area's faults.[5] Smaller magnitude earthquakes are more likely to occur, potentially producing significant local damage, as experienced in the 2014 South Napa earthquake

Scientists continually study which Bay Area faults are more likely to produce large earthquakes, and how often. In March 2015, the USGS released an update to its 2008 earthquake probabilities for California faults. The Uniform California Earthquake Rupture Forecast 3 (UCERF3) provides detailed assessment on the likelihood of each fault segment producing M6.7, M7.0 and M8.0 and greater earthquakes. These probabilities are based on data such as fault length; how much energy the faults release annually through fault slip; and, known historical return periods for the fault. Table 2 summarizes the probabilities of future earthquakes in California.

[5] Field, E.H., et al, (2013)

Table 2: Likelihood of a M6.7 or greater earthquake over the next 30 years

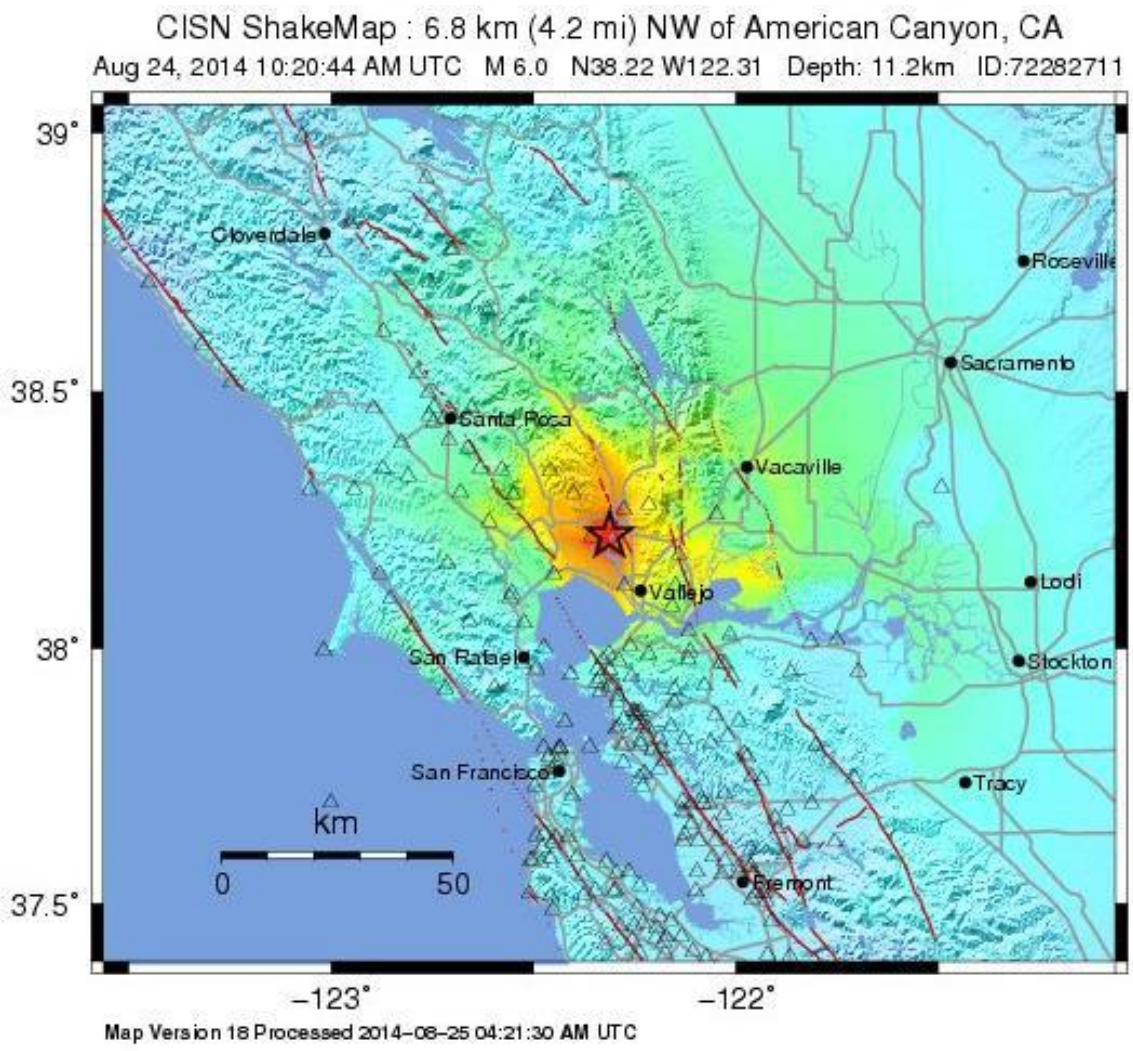
Earthquake Fault	Probability[1]
San Andreas (Mendocino Coast to San Benito County)	33%
Hayward	28%
Calaveras	24%
Hunting Creek, Berryessa, Green Valley, Concord	24%
Maacama	23%
Rodgers Creek	15%
San Gregorio	5%
Greenville	6%
Mt. Diablo	3%
West Napa	2%

[1]*Source: Uniform Earthquake Rupture Forecast, Version 3 (2014)*

Napa Earthquake (August 2014)

A 6.0 magnitude earthquake struck the Bay Area on August 24, 2014. The event, localized approximately six miles southwest of Napa Valley, caused an estimated $360 million in damages and resulted in over 200 casualties, including one fatality. Napa Division Fire Chief John Callanan stated that he event triggered six major fires.

Figure 1 illustrates the extent of shaking felt in and around the Bay Area. The United States Geological Service estimated that some 15,000 people experienced severe shaking, 106,000 persons felt very strong shaking and another 176,000 felt strong shaking.



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

Scale based upon Wald, et al.; 1999

Loma Prieta Earthquake of 1989

The Loma Prieta Earthquake of 1989 is an example of the kind of large-scale disaster which could strike the Bay Area. The event killed 63 persons, injured 3,757, and displaced over 12,000 persons. With over 20,000 homes and businesses damaged and over 1,100 destroyed, this quake caused approximately $6 Billion of damage.

5.1.2 *Surface Fault Rupture*

A fault is a point of displacement along the fractures of the earth's crust caused by shifting tectonic plates. When an earthquake occurs, there is a rupture on a fault as built-up energy is suddenly released. Active faults are those that have ruptured in the past 11,000 years.[6] Often the rupture occurs deep within the earth, but it is possible for the rupture to extend to the surface and create visible above- ground displacement, called "surface rupture." The California Geological Survey (CGS) publishes maps of active Bay Area faults that could produce surface rupture, as required by the Alquist-Priolo Earthquake Fault Zoning Act (1972).[7] These maps show the most comprehensive depiction of fault traces that can rupture the surface, and the zones directly above and surrounding the fault traces. Cities and counties require special geologic studies within these zones to prevent construction of human-occupied structures. For buildings already in these zones, the surface rupture hazard must be disclosed in real estate transactions.

Surface fault rupture varies in size and can change over time. Generally, a large magnitude earthquake can generate a longer rupture and greater displacement, though the surface expression of the displacement can vary widely. The M6.0 2014 South Napa Earthquake resulted in over one foot of displacement in some locations,[8] while the M6.9 1989 Loma Prieta Earthquake had no surface fault rupture. In the 1906 Earthquake along the San Andreas Fault, surface rupture displacements were greater than 20 feet in some locations.[9] Additionally, though the majority of displacement occurs during the actual earthquake event (called "co-seismic slip"), surface displacement can occur in the days, weeks, and even months after the event (called "post-seismic slip"). This was also observed in Napa and can cause additional damage for up to a year after an earthquake. In a large earthquake on the Hayward Fault the fault rupture displacement could reach 8 feet in some areas. Most of the displacement would occur during the shaking, and in the first day following the earthquake, but as much as 20 percent of the total afterslip could occur in the time between one month and 12 months after the quake the fault continuing to displace a full year after the earthquake.[10]

5.1.3 Ground Shaking

When faults rupture, the slip generates vibrations or waves in the earth that are felt as ground shaking. Larger magnitude earthquakes generally cause a larger area of ground to

[6] Bryant, W.A., and Hart, E.W., (2007)
[7] California Public Resources Code, Division 2, Geology, Mines and Mining, Chapter 7.5, Earthquake Fault Zoning, sections 2621-2630
[8] Brocher, T.M., et al, (2015)
[9] Thatcher W., Marshall, G., Lisowski, M., (1997)
[10] Aagaard, B., Lienkaemper, J., Schwartz, D. (2012)

shake, and to shake more intensely. As a result, one principal factor in determining anticipated levels of shaking hazard in any given location is the magnitude of expected earthquakes. The intensity of ground shaking felt in one area versus another, however, is based on the magnitude and other factors including distance to the fault; direction of rupture; and, the type of geologic materials at the site. For example, softer soils tend to amplify ground shaking, while more dense materials limit ground shaking impacts at the site surface.

Ground shaking is commonly characterized using the Modified Mercalli Intensity (MMI) scale, which illustrates the intensity of ground shaking at a particular location by considering the effects on people, objects, and buildings. The MMI scale describes shaking intensity on a scale of 1-12. MMI values less than 5 don't typically cause significant damage; MMI values greater than 10 have not been recorded.

Table 3 MMI Intensity Table[11]

Intensity	Building Contents	Masonry Buildings	Multi-Family Wood-Frame Buildings	1&2 Story Wood-Frame Buildings
MMI 6	Some things thrown from shelves, pictures shifted, water thrown from pools	Some walls and parapets of poorly constructed buildings crack.	Some drywall cracks.	Some chimneys are damaged, some drywall cracks. Some slab foundations, patios, and garage floors slightly crack.
MMI 7	Many things thrown from walls and shelves. Furniture is shifted.	Poorly constructed buildings are damaged and some well-constructed buildings crack. Cornices and unbraced parapets fall.	Plaster cracks, particularly at inside corners of buildings. Some soft-story buildings strain at the first floor level. Some partitions deform.	Many chimneys are broken and some collapse, damaging roofs, interiors, and porches. Weak foundations can be damaged.
MMI 8	Nearly everything thrown down from shelves, cabinets, and walls. Furniture overturned.	Poorly constructed buildings suffer partial or full collapse. Some well-constructed buildings are damaged. Unreinforced walls fall.	Soft-story buildings are displaced out of plumb and partially collapse. Loose partition walls are damaged and may fail. Some pipes break.	Houses shift if they are not bolted to the foundation, or are displaced and partially collapse if cripple walls are not braced. Structural elements such as beams, joists, and foundations are

[11] ABAG, (2013). Modified Mercalli Intensity Scale

				damaged. Some pipes break.
MMI 9	Only very well anchored contents remain in place.	Poorly constructed buildings collapse. Well-constructed buildings are heavily damaged. Retrofitted buildings damaged.	Soft-story buildings partially or completely collapse. Some well-constructed buildings are damaged.	Poorly constructed buildings are heavily damaged, some partially collapse. Some well-constructed buildings are damaged.
MMI 10	Only very well anchored contents remain in place.	Retrofitted buildings are heavily damaged, and some partially collapse.	Many well-constructed buildings are damaged.	Well-constructed buildings are damaged.

5.1.4 Earthquake Shaking Scenarios

In addition to this effort, ABAG and USGS have developed several shaking scenario maps that depict shaking intensity for specific, plausible earthquake scenarios with a given magnitude on a fault. These maps show possible levels of ground shaking throughout the Bay Area in a single likely earthquake, taking into consideration the earthquake magnitude; rupture location and direction; and soil conditions throughout the region. Sixteen scenarios that could cause strong shaking in the Bay Area can be seen side-by-side.

Scenario maps are helpful to model the expected shaking of an individual event, but they do not depict the likelihood of the event occurring or whether it is the most significant event for a particular location. A Probabilistic Seismic Hazard Assessment (PSHA) Map incorporates the likelihood of ground shaking from all nearby fault sources, and accounts for the frequency of each event. The PSHA Map in Figure 3 illustrates the 10 percent or greater chance in a 50 year period that each location on the map will exceed the MMI shown at least once.

In terms of risk characterization, it is equivalent to a 500-year flood. A 10 percent in 50 years hazard level was chosen as it most closely aligns to the levels of shaking used in the current building code. Seismic hazard maps are not intended to be site-specific but depict the general risk within neighborhoods and the relative risk from community to community.

Figure 3: Scenario Earthquake with Greatest Contribution to Seismic Hazard

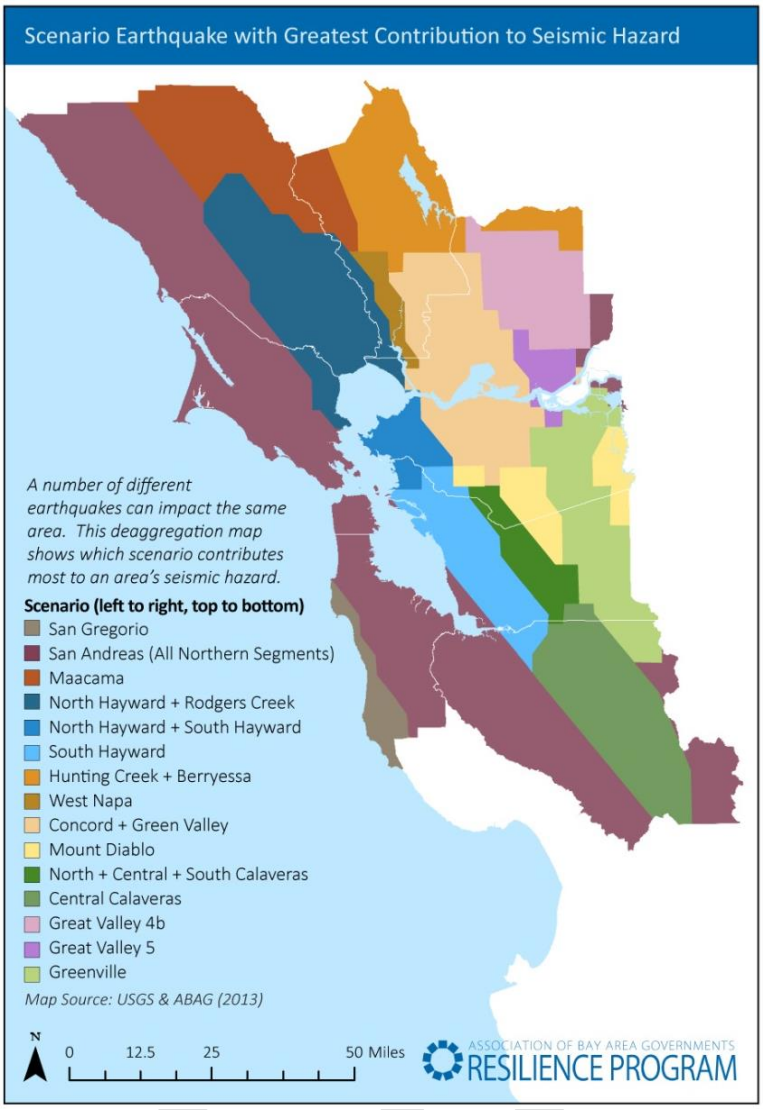
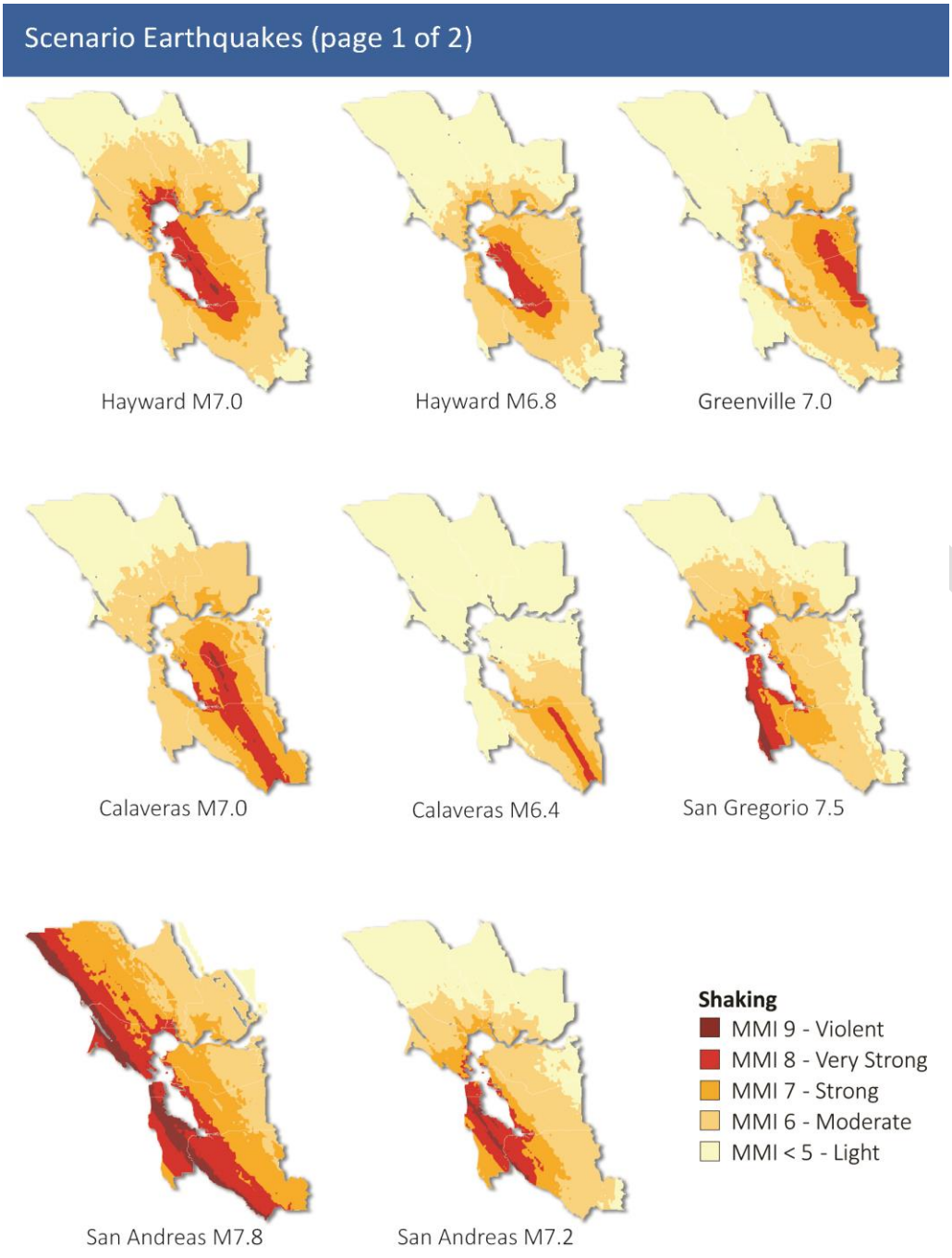
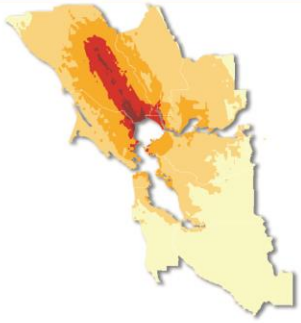


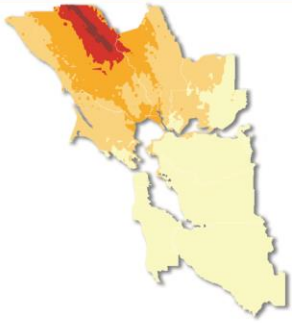
Figure 4: Scenario Earthquakes



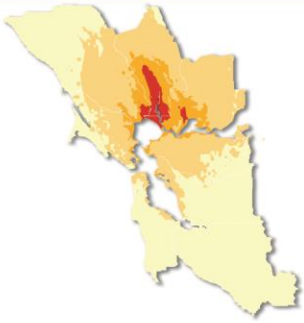
Scenario Earthquakes (page 2 of 2)



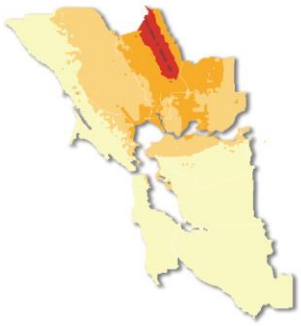
Rodgers Creek 7.1



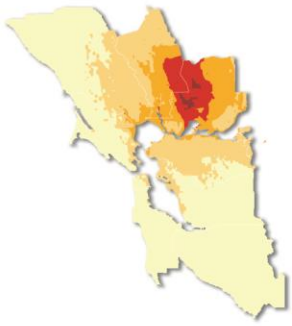
Maacama 7.4



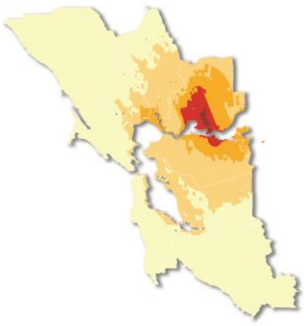
West Napa M6.7



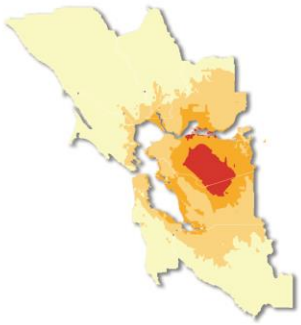
Berryessa 7.1



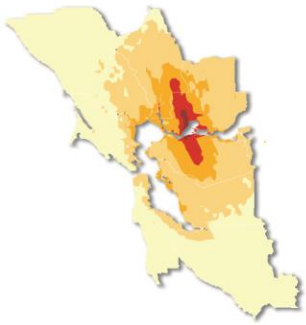
Great Valley(4) 6.8



Great Valley (5) 6.7



Mt. Diablo 6.7



Concord SGV 6.8

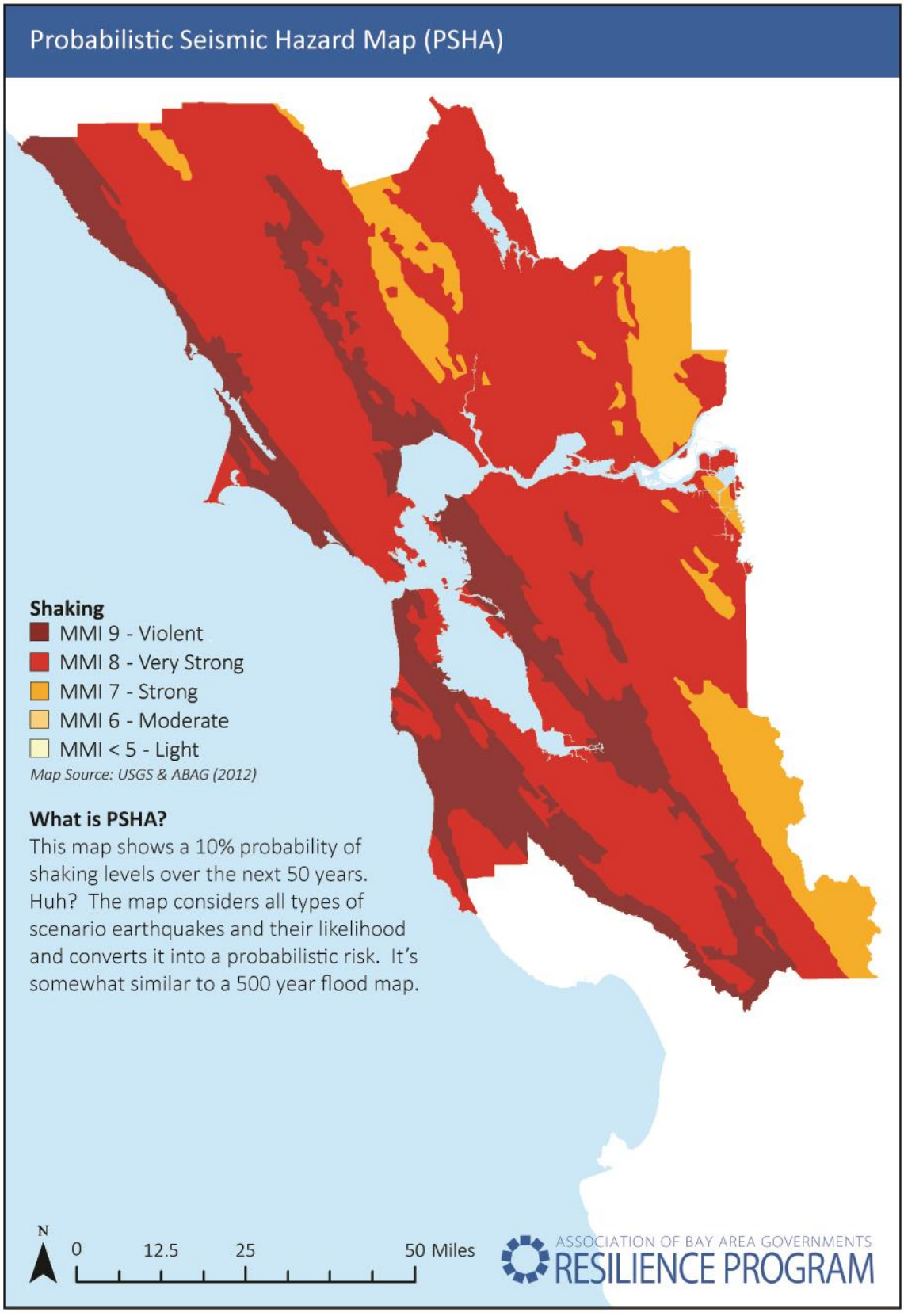
Shaking

- MMI 9 - Violent
- MMI 8 - Very Strong
- MMI 7 - Strong
- MMI 6 - Moderate
- MMI < 5 - Light

Map Source:
California Integrated Seismic Network (CISN, 2012)

ASSOCIATION OF BAY AREA GOVERNMENTS
RESILIENCE PROGRAM

Figure 3: Probablistic Seismic Hazard Map (PSHA)



5.2. Liquefaction

Soil that is loose, sandy, silty, or saturated with water can result in soil liquefaction if it is shaken intensely for an extended period. When ground liquefies in an earthquake, it behaves like a liquid and may sink, spread, or erupt in sand boils. This can cause pipes to break, roads and airport runways to buckle, and building foundations to be damaged. Liquefaction can only occur under certain circumstances:[12]

Loose Soils The soils must be loose, such as uncompacted or unconsolidated sand and silt without much clay. This happens most often in the Bay Area along the Bay shoreline, near creeks or other waterways, on dry creek beds, and in areas of man-made fill, such as the Marina District in San Francisco or parts of Alameda.

Soggy Soils The sand and silt must be soggy and saturated with water due to a high water table.

Ground Shaking The ground must be shaken long and hard enough by the earthquake to trigger liquefaction.

Liquefaction may not necessarily occur even if all three conditions are present. Additionally, if liquefaction does occur, the ground may not move enough to have significant impact on the built environment. As with ground shaking, several types of maps depict liquefaction potential. Liquefaction susceptibility maps show areas with soil types known to have the potential to liquefy with intense shaking.

Unless areas of liquefaction susceptibility are subject to significant ground shaking, they are not likely to liquefy. Liquefaction hazard maps express where the ground is both susceptible to liquefaction, and where the ground is likely to be shaken long and intensely in an earthquake. In 2015, ABAG produced maps that combine liquefaction susceptibility with USGS-generated earthquake scenario maps to identify areas where there is a significant hazard of liquefaction. Figure 5 is a representative example which shows the liquefaction potential in a M7.0 Hayward earthquake. The map combines the liquefaction susceptibility and Hayward shaking information into a scenario-based liquefaction potential map.

[12] Perkins, J.B., (2001)

Figure 4: Earthquake Liquefaction Susceptibility

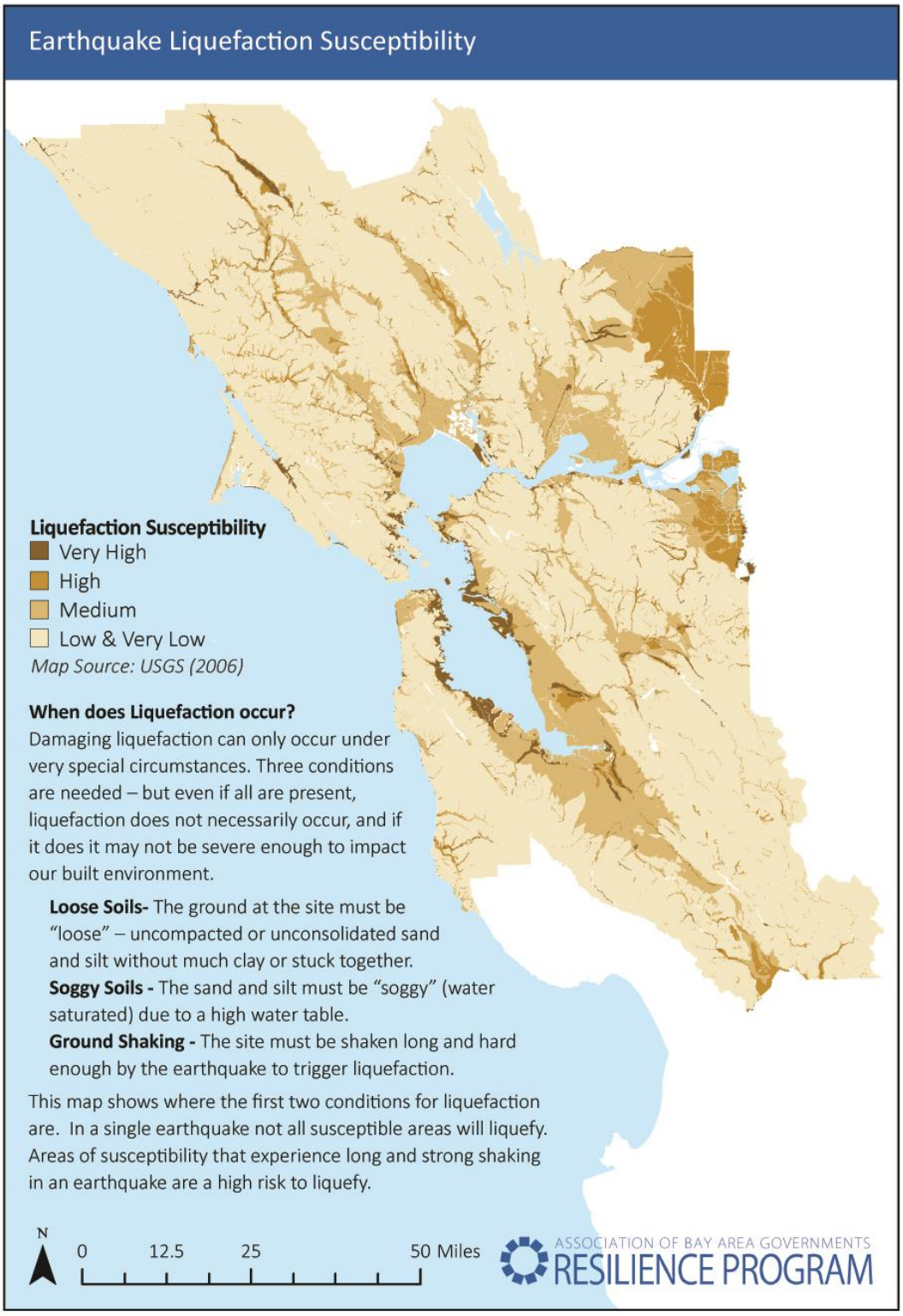


Figure 5: Scenario-based Liquefaction Potential Map- M7.0 Hayward

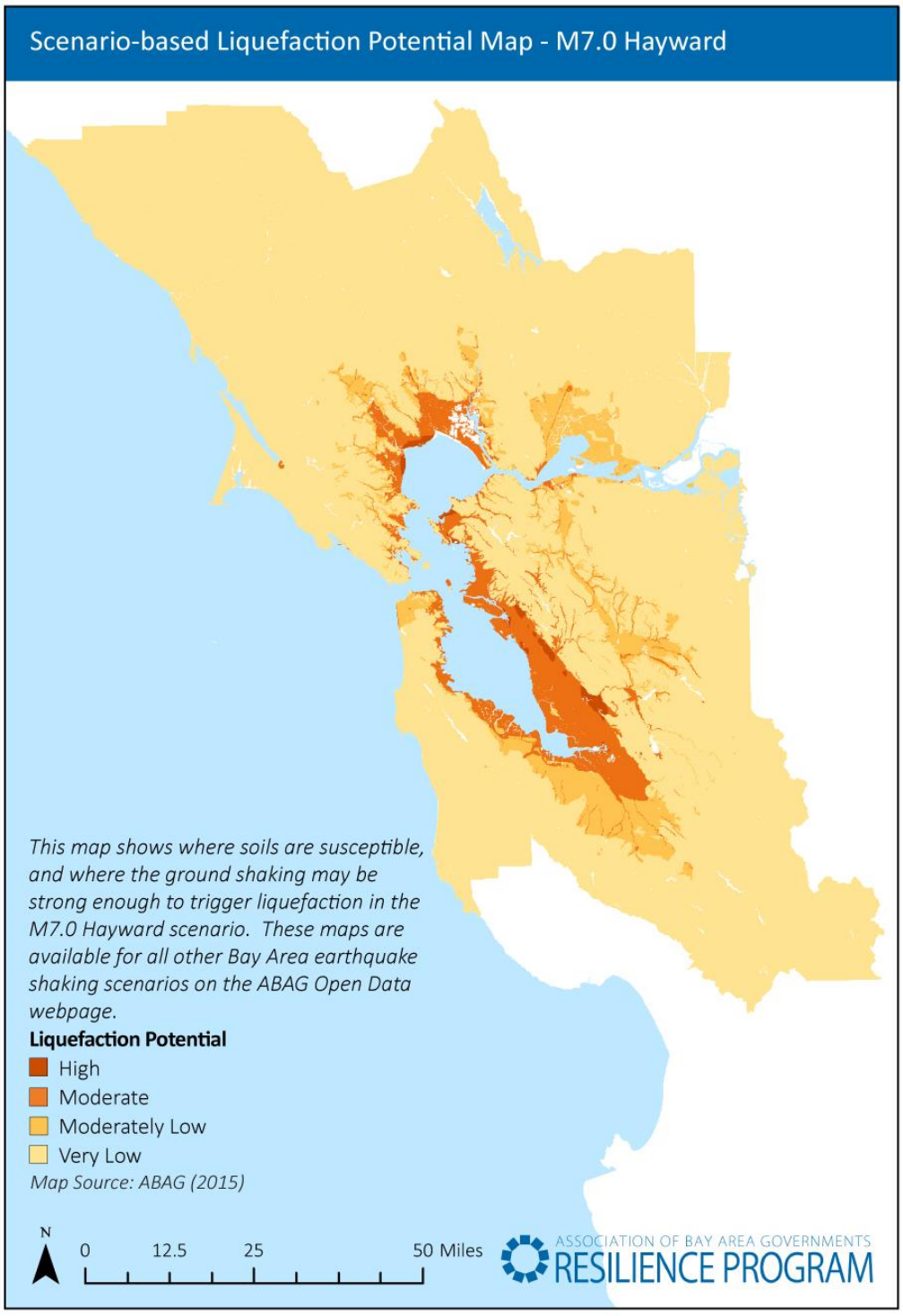
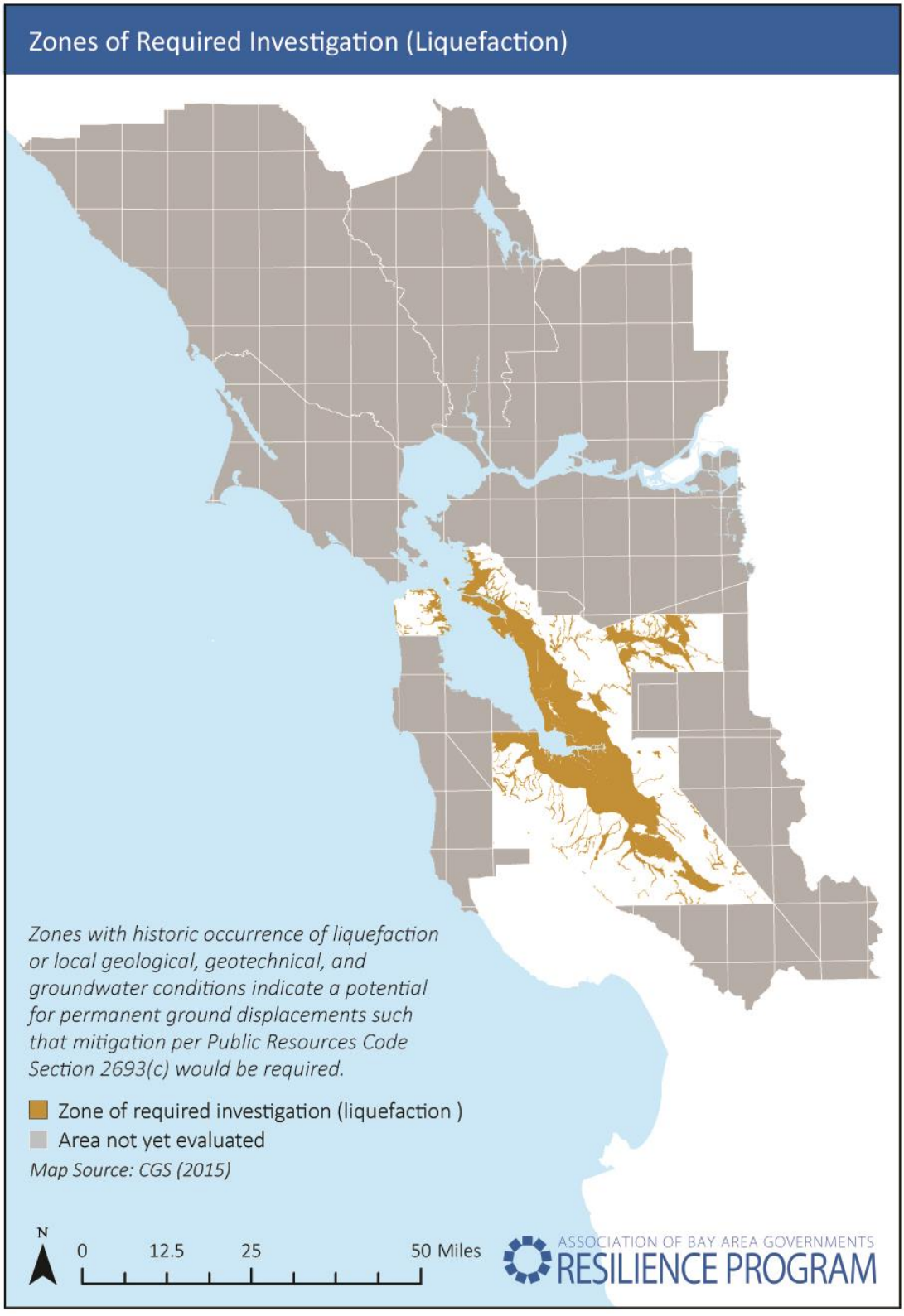


Figure 6: Zones of Required Investigation - Liquefaction



Additionally, Figure 6 is a map of Liquefaction Hazard Zone of Required Investigation for discrete portions of the Bay Area (Alameda, San Francisco, and Santa Clara Counties). This map is produced by CGS as part of its mapping program mandated by the Seismic Hazards Mapping Act. The CGS liquefaction zone maps are based on the presence of shallow historic groundwater in uncompacted sands and silts deposited during the last 15,000 years and sufficiently strong levels of earthquake shaking expected during the next 50 years.[13] Like the fault zone maps, these official seismic hazard map zones require real estate disclosure upon point-of-sale and hazard analysis for new development. The CGS is continually working to expand the areas where their map is available and is currently mapping areas in San Mateo and Contra Costa County; however, these maps are not expected to be completed until 2016.[14]

5. 3. Tsunamis & Seiches

Large underwater displacements from major underwater earthquake fault ruptures or landslides can lead to ocean waves called "tsunamis." Since tsunamis have high velocities, the damage from a particular level of inundation is far greater than in a normal flood event. Similarly, water sloshing in lakes during an earthquake, called "seiche," is also capable of producing damage.

Tsunamis can result from off-shore earthquakes within the Bay Area or from distant events. It is most common for tsunamis to be generated by offshore subduction faults such as those in Washington, Alaska, Japan, and South America. Tsunami waves generated at those far-off sites can travel across the ocean and can reach the California coast with several hours of warning time. Local tsunamis can also be generated from offshore strike-slip faults. Because of their close proximity, we would have little warning time. However, the Bay Area faults that pass through portions of the Pacific coastline or under portions of the Bay are not likely to produce significant tsunamis because they move side to side, rather than up and down, which is the displacement needed to create significant tsunamis. They may have slight vertical displacements, or could cause small underwater landslides, but overall there is a minimal risk of any significant tsunami occurring in the Bay Area from a local fault. The greatest risk to the Bay Area is from tsunamis generated by earthquakes elsewhere in the Pacific.

Though the Bay Area has experienced tsunamis, it has not experienced significant tsunami damage. In 1859, a tsunami generated by an earthquake in Northern California generated 4.6 m wave heights near Half Moon Bay. The M6.8 1868 earthquake on the Hayward fault is reported to have created a local tsunami in the San Francisco Bay. In 1960, California experienced high water resulting from a magnitude 9.5 off the coast of Chile. The tsunami

[13] Department of Conservation, Seismic Hazards Zonation Program Fact Sheet, California Geological Survey
[14] Tim McCrink, CGS, Personal communication, April 3, 2015

generated by the 1964 Alaskan earthquake caused wave heights of up to 1.1 meters along the coasts of San Francisco, Marin and Sonoma Counties. The 2011 tsunami created by the M9.0 Tohoku earthquake did not cause damage inside the Bay, but did cause damage to marinas and ports in both Santa Cruz and Crescent City. California has been fortunate in past distant-source tsunamis (1960, 1964, and 2011) that the events occurred during low tides.[15]

In 2013, the USGS, in partnership with the US Department of the Interior, published a tsunami scenario as part of the Science Application for Risk Reduction (SAFRR) series.[16] In the scenario, the multi-disciplinary team modeled a M9.1 offshore Alaskan earthquake to study impacts to California (Figure 7). Assuming that the tsunami reaches the central coast at high tide, the Bay Area can expect heights ranging from two to seven meters near the shore. The study suggests that this scenario inundation is only likely to occur once in a 100 year period.

In addition to the scenario inundation maps, CalOES developed tsunami evacuation maps indicating areas that should evacuate if a warning is given (Figure 8). The CalOES tsunami maps are not associated with a particular event but instead represent the worst-case scenario at any given location by combining a suite of extreme, but plausible, inundation scenarios. Additionally, the maps include no information about the probability of a tsunami affecting an area at any given time. Because of this, it is not intended to show locations of probable inundation but should be used for evacuation planning only. In general, the CalOES tsunami evacuation map is more conservative than the USGS SAFRR study; however, there are a few locations where the SAFRR study shows greater inundation.

[15] Ross, S.L., and Jones, L.M, eds., (2013)
[16] Ibid

Figure 7: Scenario Tsunami from a M9.1 Alaska Earthquake

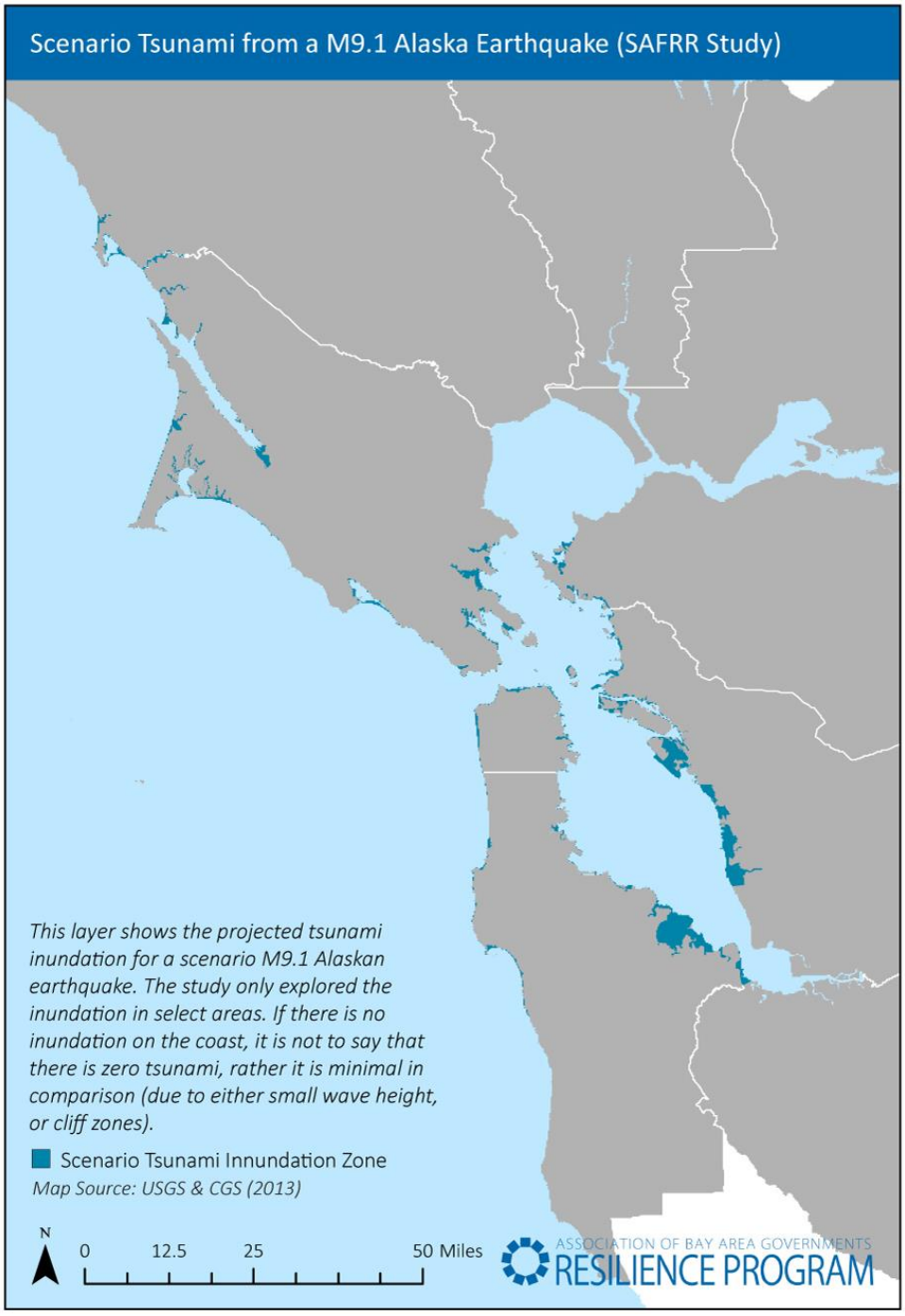
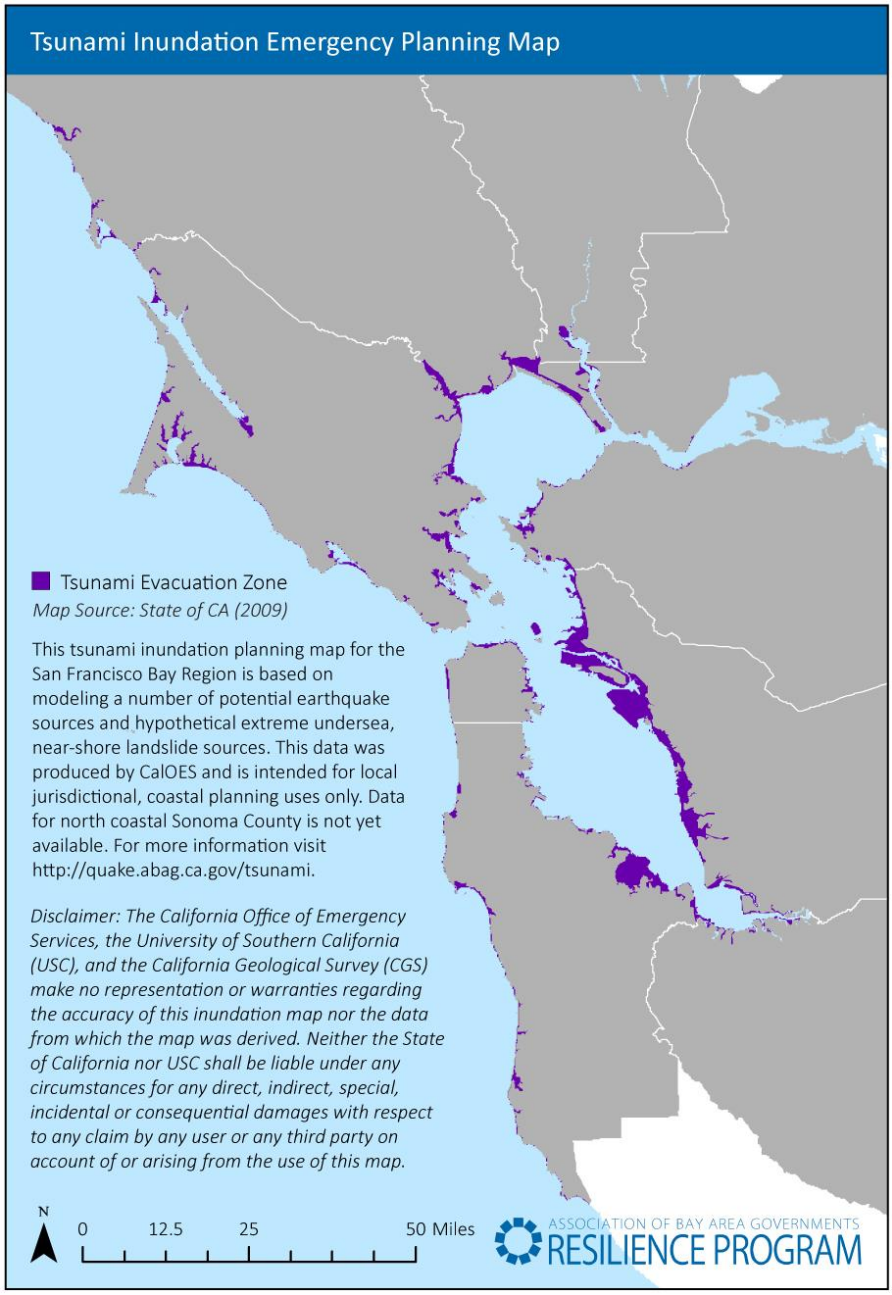


Figure 8: Tsunami Inundation Emergency Planning Map



5.4 Fire Following Earthquake

Earthquakes are often responsible for igniting fires which can contribute to a considerable share of the overall damage in a disaster. The fires can start from a variety of sources: appliances with natural gas pilot lights may tip, damaged electrical equipment may spark, and gas line connections may break. Recently in the South Napa Earthquake a number of mobile homes were destroyed and damaged when the gas connection to a home broke. In the Loma Prieta Earthquake 36 fires broke out in San Francisco alone, but luckily were contained quickly in large part due to the abnormally calm wind that evening, and the fires proximity to the bay which allowed a fire boat to pump water to the fire where the water lines had failed. In the 1906 earthquake over 3.5 square miles of San Francisco burned, representing 80% of San Francisco's property value at the time.

Fire following earthquake is especially tricky because there are often multiple ignitions at once (overwhelming fire crews), typical water supply for fighting fire may be reduced or unavailable, and maneuvering fire crews to the ignition can be difficult if streets are blocked by road damage or by debris that blocks the streets. Fire following earthquake is an issue that could impact any Bay Area community that experiences an earthquake – both urban and rural. The problem is heightened for urban environments, where many simultaneous ignitions can lead to a firestorm, and single fires can more quickly and easily move structure to structure.

A few characteristics can make a specific community more vulnerable to fire following earthquake. If there is a higher likelihood of building damage, there is also a higher likelihood that an ignition occurs. If a building collapses there is a high risk for gas or electrical lines to start "seed" fires that then impact undamaged neighboring structures. Areas of liquefaction are more vulnerable to fire because of the greater potential for underground gas mains to break due to the ground displacements, and because the water lines in the area may also be damaged – preventing the ability to fight a fire with regular water resources. Areas that are largely wood frame or shingle roof may be less prone to earthquake damage, but are a heightened risk for the spread of fires. There is added concern in areas with hazardous materials with the potential for explosion, or with the potential to produce toxic smoke. Industrial facilities and labs are a high concern because of the hazardous and flammable materials they store at their facilities.

5.5 Landslides

The CGS maps Earthquake Induced Landslide Study Zones. The map designates zones in which a landslide study is required before the land can be developed, similar to CGS's Liquefaction Hazard Zone of Required Investigation. The CGS has only mapped portions of Alameda, San Francisco, and Santa Clara Counties. Portions of San Mateo and Contra Costa counties are currently being mapped, but may not be completed until 2016.[17] This CGS map only depicts earthquake induced landslide zones, not areas at risk of landslide from storm events.

Winter rain storms can impact hillsides by triggering fast-moving debris flows, or mudslides, and other slower-moving landslides. In general, landslides are most likely during periods of higher than average rainfall or El Nino winter storms. In addition, the ground must be saturated prior to the onset of a major storm for significant landsliding to occur. But there is currently no method to estimate the scale of individual landslides in terms of size or extent based on these maps, or to assign specific probabilities to these areas in terms of the likelihood of future landslides. The map shows areas where rainfall-induced landslides have occurred in the past, as landslides are most likely to occur in and around areas where they have previously occurred.[18]

5.5.1 Historic Bay Area Landslide Occurrences

Flooding and landslides associated with severe storms have been among the most common disasters in the Bay Area during the period from 1950 to 2009. Extensive landslides have occurred in 24 times since 1950, approximately once every three years.[19]

Losses from landslides are typically lower than those from associated flooding. However, in the El Nino storms of early 1998, USGS documented approximately $150 million in losses due to approximately 300 landslides of varying sizes that occurred in the Bay Area and Santa Cruz County.[20] The greatest number of landslides in the region since 1950 occurred in 1982, when a large storm event preceded by a wet winter triggered over 18,000 landslides in the region, which resulted in 33 deaths and 481 injuries.[21]

[17] Tim McCrink, CGS, Personal communication, April 3, 2015
[18] San Francisco Bay Landslide Mapping Team, (1997)
[19] State of California Multi-Hazard Mitigation Plan, Appendix M, California Governor's Office of Emergency Services,
[20] Godt, J.W., ed., (1999)
[21] Ellen, S.D., and Wieczorek, G.F., eds., (1998)

5.5.2 Probability of Future Landslide – Climate Influenced

As described above, landslides are typically triggered by earthquakes or prolonged severe wet seasons. Climate change is not expected to change the seismic risk, but climate change could change the behavior of winter storms. The regional models project fairly similar precipitation totals in the Bay Area, but the variability season to season may increase. If winters are compressed, with more rain falling in fewer months, or if individual years are more extreme the chance of rainfall-induced landslide will increase. Additionally, if fires burn greater portions of landslide- vulnerable hillsides, removing vegetation and increasing storm runoff, the landslide probability will increase. The increase in future fire risk in the more mountainous regions of the Bay Area is described in Section 0. Currently, there is not enough evidence to suggest with certainty that future landslide probabilities will increase across the region, however local studies that take local conditions into consideration may reveal the potential for greater landslide risks in the future.

5.5.3 Landslide Hazard in the Bay Area

The CGS maps Earthquake Induced Landslide Study Zones. The map designates zones in which a landslide study is required before the land can be developed, similar to CGS's Liquefaction Hazard Zone of Required Investigation. The CGS has only mapped portions of Alameda, San Francisco, and Santa Clara Counties. Portions of San Mateo and Contra Costa counties are currently being mapped, but may not be completed until 2016.[22] This CGS map only depicts earthquake induced landslide zones, not areas at risk of landslide from storm events.

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[22] Tim McCrink, CGS, Personal communication, April 3, 2015
[23] San Francisco Bay Landslide Mapping Team, (1997)

Figure 9: Earthquake Induced Landslides

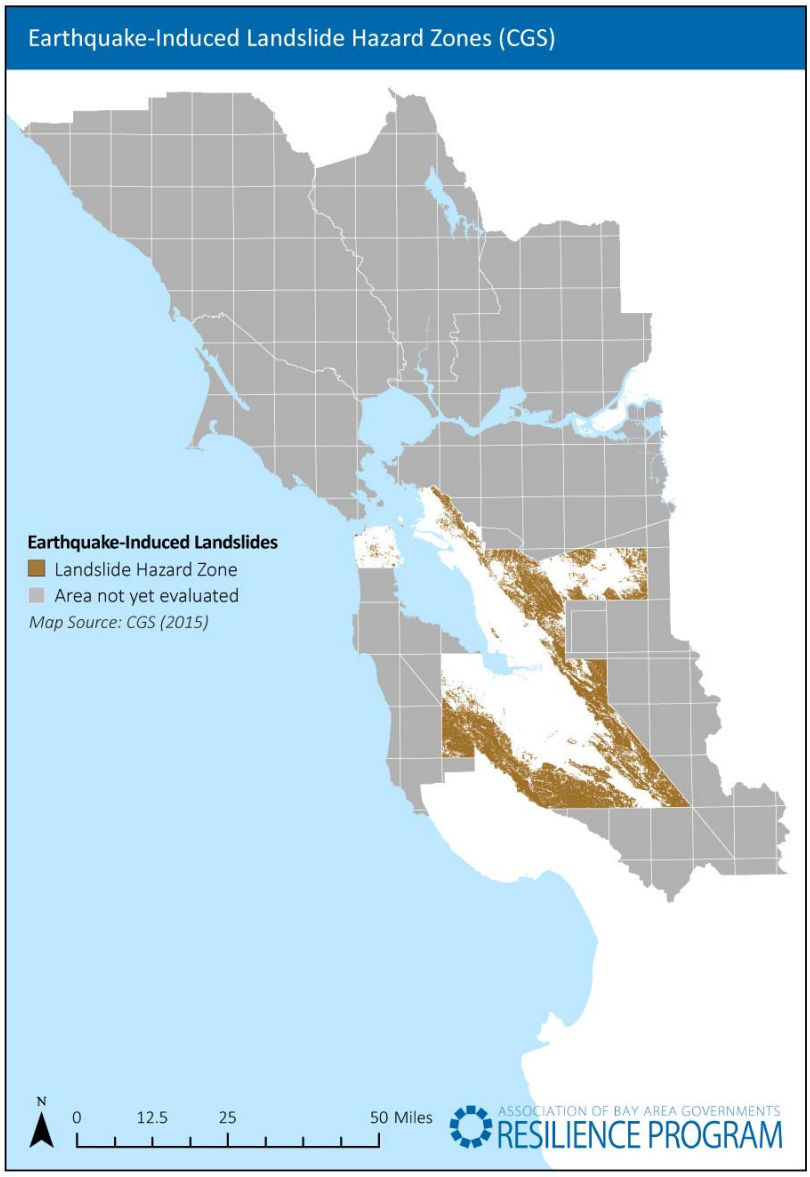
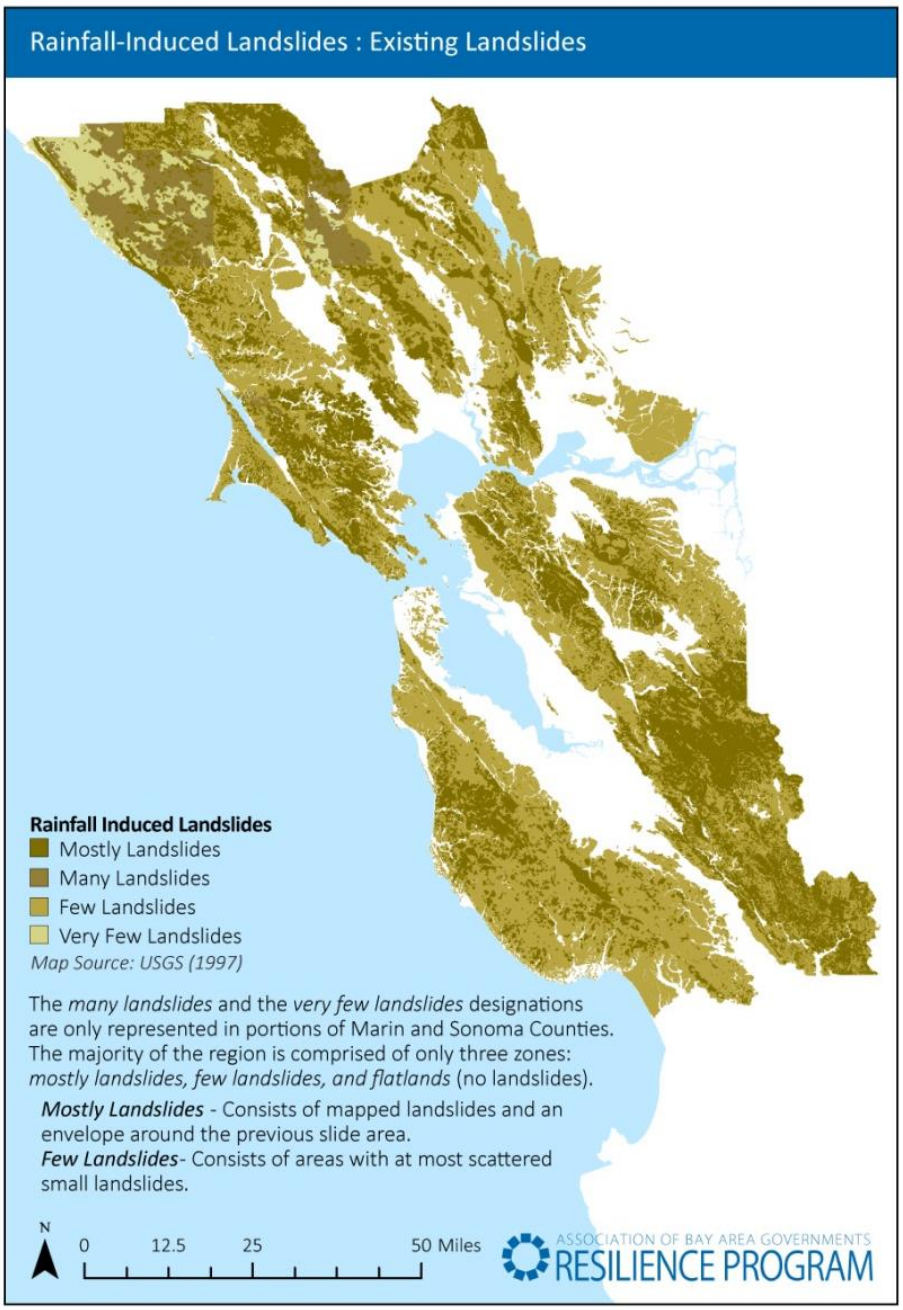


Figure 10: Rainfall-Induced Landslides



5.6 Flood

Flooding is a temporary condition that causes the partial or complete inundation of land that is normally dry. Flooding occurs when streams, rivers, lakes, reservoirs, or coastal water bodies are abnormally high and overflow into adjacent low-lying areas, areas at risk of recurring floods known as floodplains.

Coastal flooding is generally associated with Pacific Ocean storms from November through February when high tides coincide with strong winds both on the outer coast and within the Bay.

Riverine flooding, also known as overbank flooding, can occur if there is excessive rainfall especially in conjunction with high tides and strong winds. Riverine floodplains range from narrow, confined channels in the steep valleys of mountainous and hilly regions to wide, flat areas in plains and coastal regions. The potential for flooding of a floodplain is a function of the size and topography of the contributing watershed, the regional and local climate, and land use characteristics. Flooding in steep, mountainous areas is usually confined, occurs with less warning time, and has a short duration. Larger rivers typically have longer, more predictable flooding sequences and broad floodplains. The lower portions of coastal rivers are more likely to flood during high tides with backwater conditions that lead to overbank flooding.

Localized, or nuisance, flooding can occur in areas that typically do not flood during locally heavy precipitation events, especially if ground water levels are high during extremely wet seasons or if storm water storage or conveyance facilities are inadequate. Localized flooding tends to occur in flat, urbanized areas that are highly impermeable and can result in inundation of basements, low lying roads, and parking lots from street drainage.

5.6.1 Historic Bay Area Flooding

Flooding associated with severe storms has been among the most common disaster in the Bay Area during the period from 1950 to 2015, occurring on average 1.3 times a year over the past 60 years. Often heavy rainfall brings many areas of localized flooding, especially in low lying areas of the region. Many other locally significant floods have occurred during this time period.

Extensive flooding occurred in 1950, 1957, 1958, 1959, 1962, 1963, 1964, 1965, 1966, 1969, 1970, 1973, 1980, 1982, 1983, 1992, 1995, 1996, 1997, 1998, 2005, 2006, and 2008.

5.6.2 Probability of Future Flooding

Globally, sea levels are rising due to thermal expansion caused by the ocean warming and the melting of land-based ice such as glaciers and polar ice caps. Regionally and locally, the rate of sea level rise is affected by other processes, including changes in land elevation (subsidence or uplift), coastal erosion, wind and ocean currents, ocean temperature and salinity, atmospheric pressure, and large-scale climate regimes.[24]

The National Research Council (NRC) *Sea-Level Rise for the Coasts of California, Oregon, and Washington* study, released June 2012, provides regionally specific sea level rise projections for the Coasts of California, Oregon, and Washington. Because there is significant uncertainty in how much sea level will rise, the range in projected values increases over time.

Table 4: Regional Sea Level Rise Projections Relative to Year 2000 for the California Coast South of Cape Mendocino[25]

	Sea Level Rise (inches)		
Year	**NRC 2012 Projection** (mean ± the standard deviation for the A1B Scenario[26])	**Low** (mean of the B1 scenario)	**High** (mean of the A1F1 scenario)
2030	**5.6** (±1.9)	2	12
2050	**11.0** (±3.6)	5	24
2100	**36.1** (±10)	17	66

Sea level rise has the potential to influence the impact of coastal, riverine and localized nuisance flooding. In particular, without intervention rising sea levels may cause:

More frequent floods: Rising sea levels can lead to more frequent flooding of existing flood-prone areas, including more frequent overtopping and overbank flooding of riverine systems that already flood when rainfall coincides with high tides due to the increased backwater effect. In addition, gravity drained and pumped systems that discharge stormwater into flood control channels can have reduced performance, causing backups and flooding of streets and basements.

[24] Committee on Sea Level Rise in California, Oregon, and Washington, and Board on Earth Sciences and Resources and Ocean Studies Board, Division on Earth and Life Studies, (2012)

[25] Committee on Sea Level Rise in California, Oregon, and Washington, and Board on Earth Sciences and Resources and Ocean Studies Board, Division on Earth and Life Studies, (2012).

[26] The A1 scenario family assumes high economic growth, low population growth that peaks mid-century, and the rapid introduction of more efficient technologies (A1B is balanced and A1FI is fossil fuel intensive). The B1 scenario family assumes the same low population growth as the A1 scenarios, but a shift toward a lower-emission service and information economy and cleaner technologies.

More extensive, longer-duration flooding: As sea levels rise there is the potential that storm events will flood larger areas for longer periods of time and that there will be new overtopping and overbank flooding of riverine systems that that do not currently cause flooding.

Shoreline erosion and overtopping: Sea level rise can cause shoreline protection, such as levees, berms and revetments, to be damaged or fail to due to increased tidal and wave energy. There is also the potential that shoreline protection will be overtopped during storm events when there are extreme tide levels and wind-driven waves, flooding inland areas, including homes and community services that are currently protected.

Elevated groundwater and increased salinity intrusion: As sea levels rise, groundwater and salinity levels are also predicted to rise. This will cause damage to below grade living spaces, finished basements, and electrical/mechanical equipment that is below or at-grade. In addition, increasing groundwater levels may increase liquefaction susceptibility, and require the use of pumping of storm water for flood management, which will increase both operations and maintenance costs.

Permanent inundation: Sea level rise can cause areas that are not currently exposed to regular high tide inundation to be flooded, resulting in the need to either protect or move people and infrastructure, and the loss of trails, beaches, vistas, and other shoreline recreation areas. In addition, increased tidal scour due to increased tidal prism in riverine systems can trigger changes in channel geometry and sediment transport processes.

5.6.3 Flood Hazard in the Bay Area

5.6.3.1 Current Flooding

The magnitude of flood used as the standard for floodplain management in the United States is a flood having a probability of occurrence of one percent in any given year, also known as the 100-year flood or base flood. The most readily available source of information regarding the 100-year flood is the system of Flood Insurance Rate Maps (FIRMs) prepared by FEMA. These maps are used to support the National Flood Insurance Program (NFIP) and show 100-year floodplain boundaries for identified flood hazards. These areas are also referred to as Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements under the NFIP. FIRMs also show floodplain boundaries for the 500-year flood, which is the flood having a 0.2 percent chance of occurrence in any given year).

The rivers and streams for which FEMA has prepared detailed engineering studies may also have designated floodways. The floodway is the channel of a watercourse and portion of the adjacent floodplain that is needed to convey the base or 100-year flood event without increasing flood levels by more than 1 foot and without significantly increasing flood velocities. The floodway must be kept free of development or other encroachments.

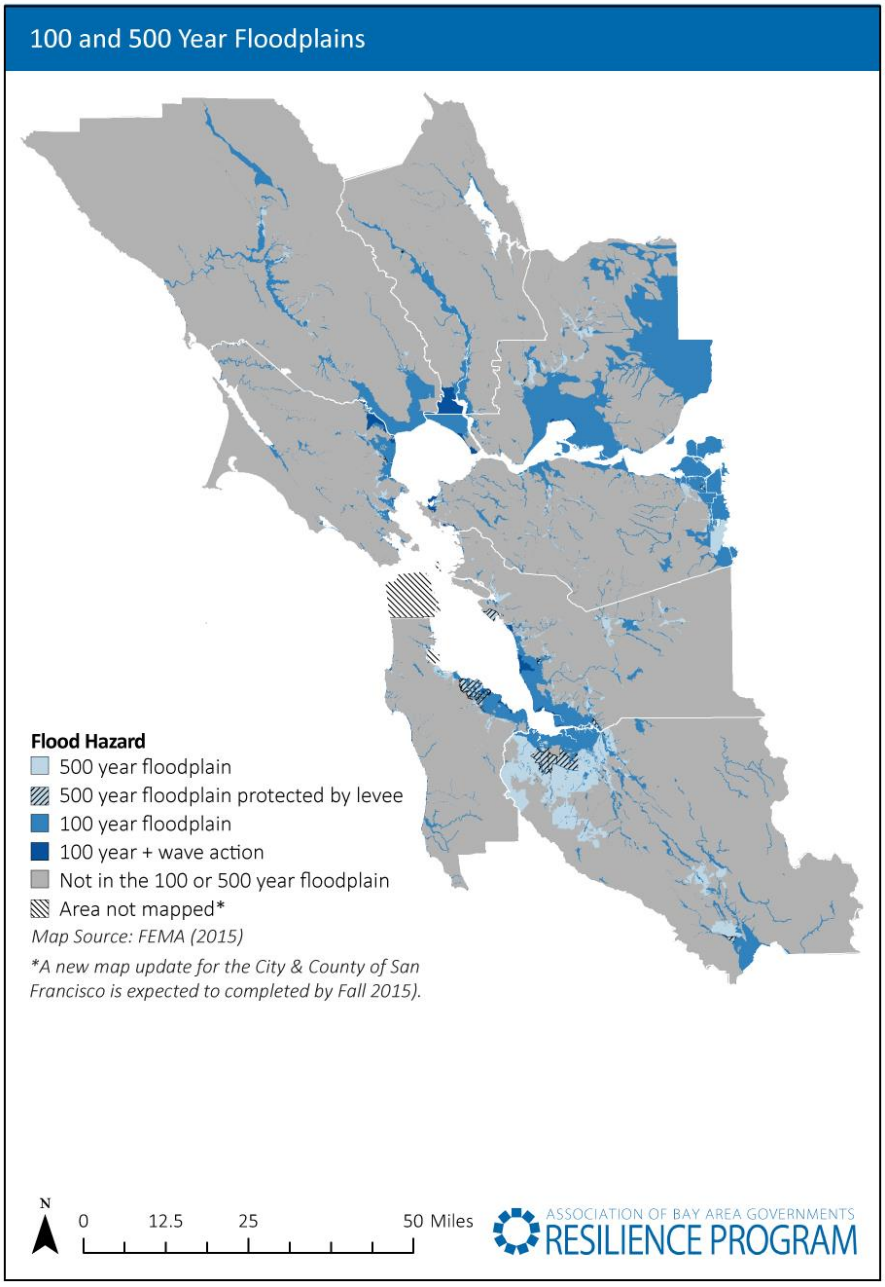
Existing coastal and riverine flood maps are available from FEMA, and including existing and preliminary map products for the San Francisco Bay and the Outer Coast of California.[27]

The following factors contribute to the frequency and severity of coastal flooding:

- Astronomical Tide
- Storm Surge
- Wind Waves
- El Nino Events
- Sea Level Rise

[27] http://www.r9map.org/Pages/California.aspx?choState=California

Figure 11: 100 and 500 Year Floodplains



The following factors contribute to the frequency and severity of riverine flooding:

- Rainfall intensity and duration
- Antecedent moisture conditions
- Watershed conditions, including steepness of terrain, soil types, amount, and type of vegetation, and density of development
- The existence of attenuating features in the watershed, including natural features such as swamps and lakes and human-built features such as dams
- The existence of flood control features, such as levees and flood control channels
- Velocity of flow
- Availability of sediment for transport, and the erodibility of the bed and banks of the watercourse

5.6.3.2 Future Flooding

In the Bay Area, the potential for new or prolonged flooding as sea level rises will not be confined to the shoreline. Sea level rise will increase the likelihood of major flood events around the Bay Area because higher water levels in tidal creeks and flood control channels will reduce capacity to discharge rainfall runoff. While some creeks already flood when rainstorms coincide with high tides, rising sea levels will cause flooding during smaller, more frequent rainfall events.

Sea level rise inundation maps (Figure 12) help to visually assess under what conditions assets may be impacted by sea level rise and storm events and how far reaching the consequences may be if they are impacted. To understand these factors it is helpful to evaluate a range of possible future sea level rise scenarios. The "total water level" approach presented below simplifies this process and reduces the number of maps needed. In this approach each inundation map represents a number of different unique combinations of sea level rise and extreme tide (storm surge) conditions.[28]

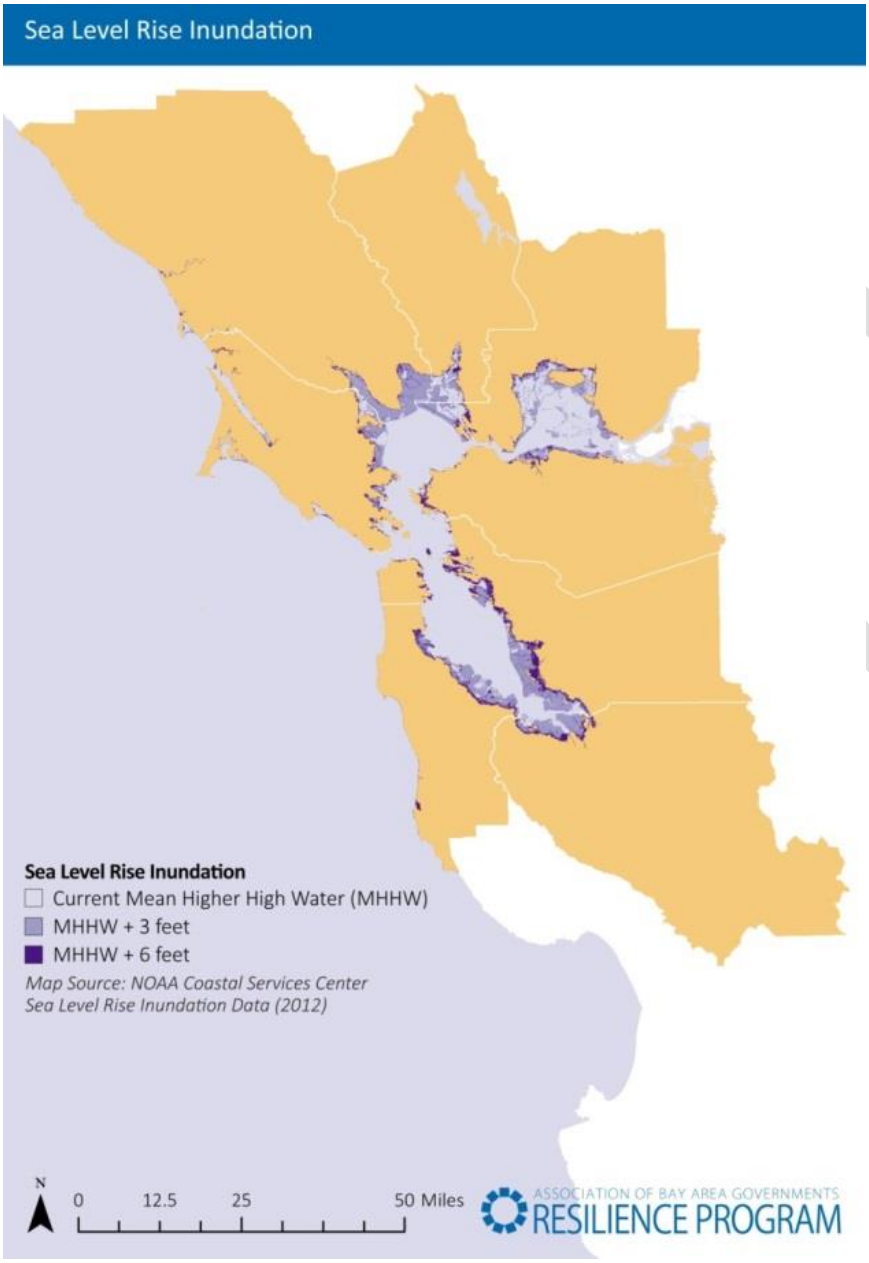
A total water level of 36 inches above mean higher high water (MHHW)[29] can represent a new "daily" high tide with 36 inches of sea level rise. This amount of sea level rise, which is

[28] Extreme tides are the maximum high tide level that has occurred over a specific return period (recurrence interval) that correlates to a specific occurrence probability. For example a 100-year extreme tide has a return period of 100 years, and therefore a one percent chance of occurring in any given year.

[29] Mean higher high water (MHHW) is calculated as the average of the higher of the two daily high tides over a 19-year tidal epoch.

a likely projection for 2100, could result in regular, e.g., permanent, tidal inundation. This total water level can also represent today's 50-year extreme tide level, a one-year extreme

Figure 12: Sea Level Rise Inundation



The matrix of numbers presented in Table 5 can be used to understand a range of total water levels, from 0 to 95 inches above MHHW, represented both in terms of today's tides and future tides as sea level rises. Each total water level represents a combination of sea level rise (0 to 60") and tide levels (MHHW to a 100-year extreme event). As an example, the likely mid-century daily high tide is projected to be 12" above today's high tide, or 12"+MHHW. This water level is color coded in green in Table 5. This total water level is approximately the level observed during King Tide, which is an astronomical tides that occur approximately twice per year when the Moon and the Sun simultaneously exert their gravitational influence on the Earth.

Because of the uncertainties associated with modeling and mapping sea level rise it is reasonable to allow for a +/- 3-inch range when interpreting the total waters in Table 5. As an example, the likely end-century high tide is projected to be 36 inches above today's high tide, or 36"+MHHW. Water levels ranging from 33 to 39 inches can be used to understand what other combination of tides and sea level rise that may result in the same amount of flooding or inundation as 36"+MHHW.

The values presented in Table 5 are generally applicable to central San Francisco Bay[30] and are therefore appropriate for local and regional scale climate adaptation planning, although it may not be as precise for some areas of south and north Bay. In addition, because tide levels do vary around the Bay, additional information about tide levels should be used for site-scale planning. Finally, the values in Table 5 are based on an analysis that does not include the effects of locally wind waves and assumes that future storms will behave like past storms.

[30] Existing condition water levels in the first row of Table 5 are based on FEMA model results for Central San Francisco Bay, http://www.r9map.org/Pages/San-Francisco-Coastal-Bay-Study.aspx, and are being used by Alameda and San Francisco Counties. Existing water level conditions for the other counties in the Bay Area will be available by the end of 2015.

Table 5: Matrix showing combinations of Seal Level Rise and Extreme Tide Level

Time Frame	Sea Level Rise	Total water level above today's daily high tide, MHHW (inches NAVD88), by tide recurrence interval							
		MHHW (≈ daily high tide)	1-yr (≈ King Tide)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr (1% annual chance)
Today		0	12	19	23	27	32	36	41
	+6	6	18	25	29	33	38	42	47
Likely Mid-Century	+12	12	24	31	35	39	44	48	53
	+18	18	30	37	41	45	50	54	59
	+24	24	36	43	47	51	56	60	65
	+30	30	42	49	53	57	62	66	71
Likely End-Century	+36	36	48	55	59	63	68	72	77
	+42	42	54	61	65	69	74	78	83
	+48	48	60	67	71	75	80	84	89

Color Code	Map Scenario (inches above MHHW)
	12
	24
	36
	48

There are a number of online tools that provide regionally relevant sea level rise inundation maps. The most commonly used is the NOAA Sea Level Rise and Coastal Flooding Impacts Viewer. This is a national tool that depicts potential impacts to marshes and human communities from a range of sea level rise projections from zero to six feet coupled with mean higher high water (MHHW). It also illustrates changes in flood frequency and includes visual simulations of flooding at local sites.[31]

5.7. Fire

Fires are typically characterized into three categories: urban fires, wildland-urban interface fires, and wildland fires.

- Urban fires occur within a developed area and pose a direct risk to development.
- Wildland-urban interface (WUI) fires occur where the built environment and natural areas are intermixed (the fringe of urban areas).
- Wildland fires exist in wilderness land.

Fires in the urban environment and in the wildland-urban interface result in direct damage to the built environment and can injure or kill residents. Wildland fires can cause damage to linear infrastructure systems that serve the Bay Area, causing outages downstream of the failure; can impact the air quality in cities during the duration of the fire; and can impact water quality in watersheds impacted by a wildland fire. Wildland and wildland-urban interface fires can also damage natural environments, such as recreational areas, and can cause lasting impacts to slopes and soils In the Bay Area; fire areas generally fall into two categories – State Responsibility Areas, where CALFIRE is responsible for fire protection, and Local Responsibilities, where local fire departments and fire protection districts have responsibility (figure 13).

[31] coast.noaa.gov/slr/

5.7.1 Historic Bay Area Fire Occurrences

Wildfires were common disasters in the Bay Area during the period from 1950 to 2014. Large wildfires occurred in 1961, 1962, 1964, 1965, 1970, 1981, 1985, 1988, 1991, and 2008. The 1991 fire in the Oakland-Berkeley Hills was the largest urban-wildland fire in the Bay Area, and resulted in $1.7 billion in losses. In that fire, 3,354 single-family dwellings and 456 apartments were destroyed, while 25 people were killed and 150 people were injured.[32] Despite the drought conditions locally over the past four years the Bay Area has had very few fires, and few large fires.

[32] State of California Multi-Hazard Mitigation Plan, California Governor's Office of Emergency Services

Figure 13: Fire Responsibility Areas

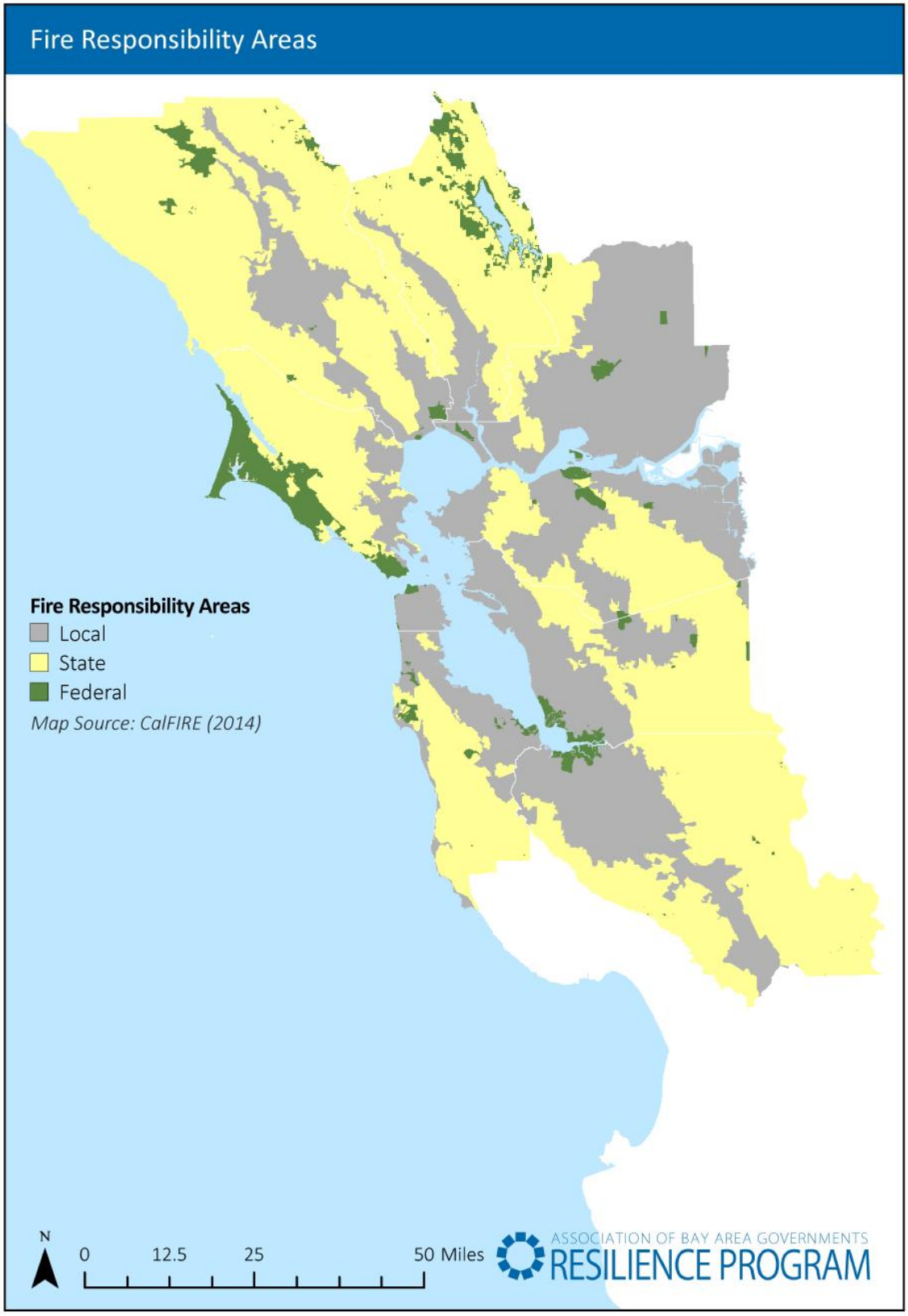
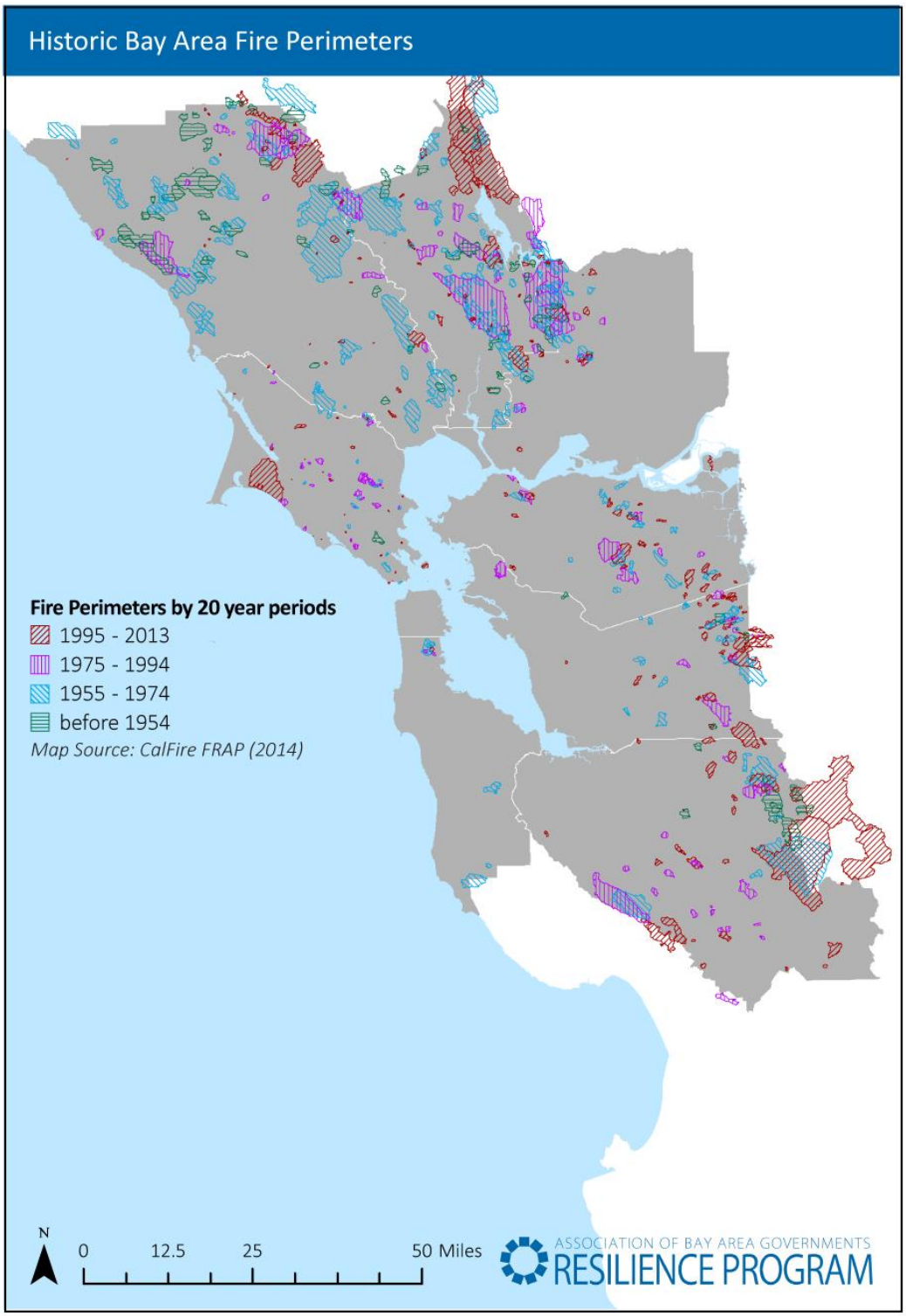


Figure 14: Historic Bay Area Fire Perimeters



5.7.2 Probability of Future Fire – Climate Influenced

Wildfire risk increases due to climate change because of higher temperatures and longer dry periods over a longer fire seasons. Additionally, wildfire risk will also be influenced by potential changes in vegetation.[33]

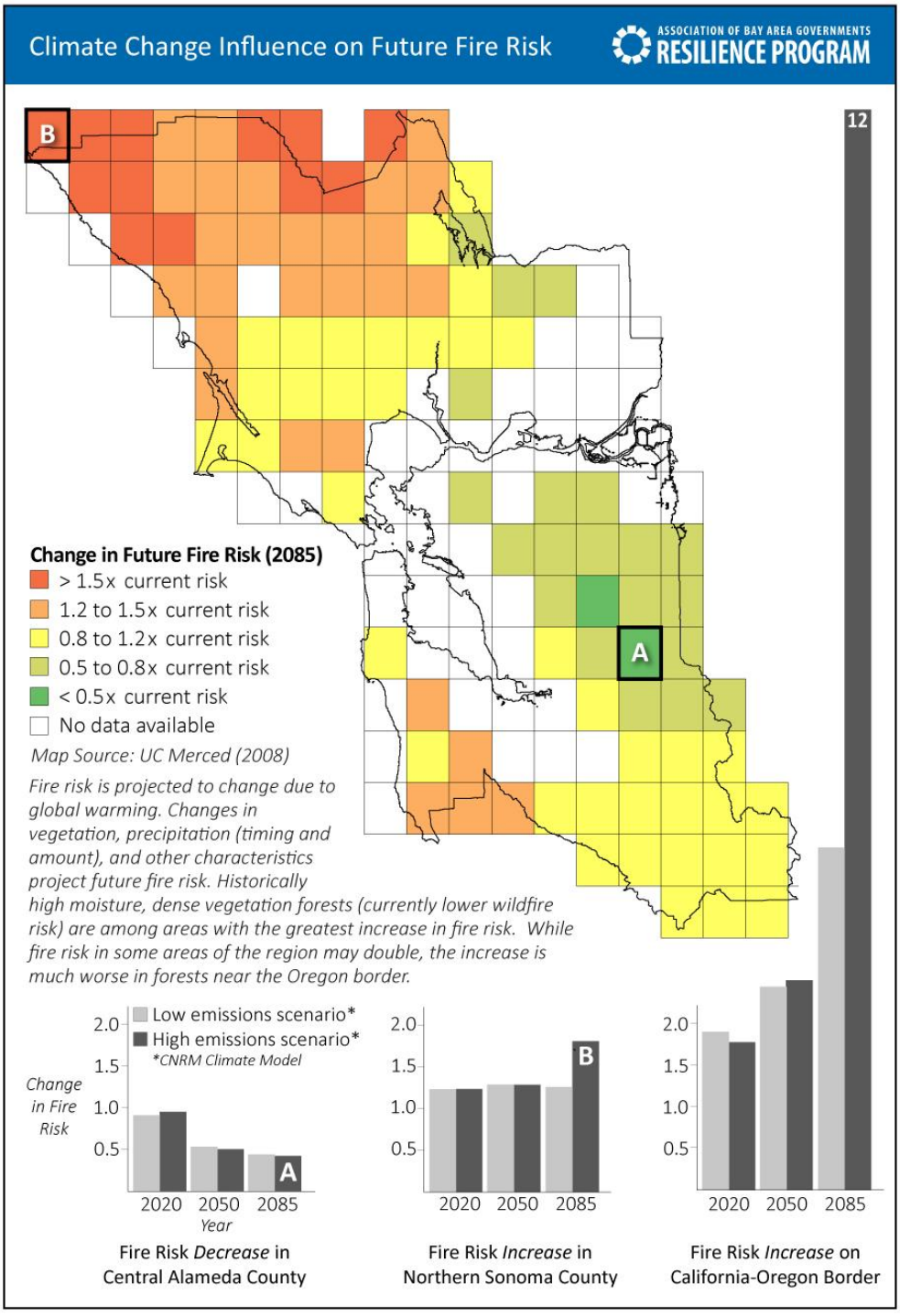
Research out of UC Merced has projected the future fire risk, impacted by climate change, compared to existing fire risk. In the Bay Area the results are mixed. The research projects some locations in the East Bay and South Bay to exhibit decreased fire risk, while areas on the Peninsula and North Bay exhibit a 150 percent increase in fire risk by 2085. Generally, across the Bay Area there is fairly limited change in fire risk in the year 2050, with the greatest change in occurring between 2050 and 2085, especially in the high emission scenario. The Cal Adapt data suggests that some jurisdictions might have to adapt more aggressively compared to others. Figure 15 shows the projected fire risk increase for the Bay Area with the greatest increase and decrease areas highlighted.

The future fire risk model analyzes two primary variables: fuel availability and flammability of fuel. In California the change in fire risk is a result of either a densely forested ecosystem becoming drier, or a dry climate experiencing large vegetation growth after a year of above average precipitation. In the first scenario the suite of climate impacts (higher temperatures, less snow pack, earlier springs) result in previously wet dense fuel ecosystems becoming dry – increasing the fire risk. In the second ecosystem, dominated by grass and low density shrubs, the risk is often unchanged or decreased because the availability of fuel is the governing variable for fire risk, which remains unchanged or decreases as a result of projected precipitation.[34] These modeling characteristics are reflected in the Bay Area's future fire risk map.

The Bay Area, compared with other portions of California, especially those near the Oregon border, have a much lower projected increase in fire risk due to climate change. Near the Oregon border, many areas are expecting a 500 percent increase in fire risk by 2085, with some areas projected to see their fire risk increase more than 10 times.[35]

[33] California Climate Change Center, (2012)
[34] Westerling, A.L., Bryant, B.P. (2008)
[35] Ibid

Figure 15: Climate Change Influence on Future Fire Risk



5.7.3 Fire Hazard in the Bay Area

5.7.3.1 Wildfire

CalFIRE has developed maps depicting wildfire hazard areas. Figure is a map of fire hazard severity in State Responsibility Areas. Fire hazard severity takes into account the amount of vegetation, the topography, and weather (temperature, humidity, and wind), and represents the likelihood of an area burning over a 30-50 year time period.[36] In Figure 16, shadowed portions of the map depict very high fire hazard severity in Local Responsibility Areas. Cal FIRE does not map other levels of fire hazard severity in local responsibility areas. Local Fire Departments and protection districts may have locally available hazard severity information for these areas.

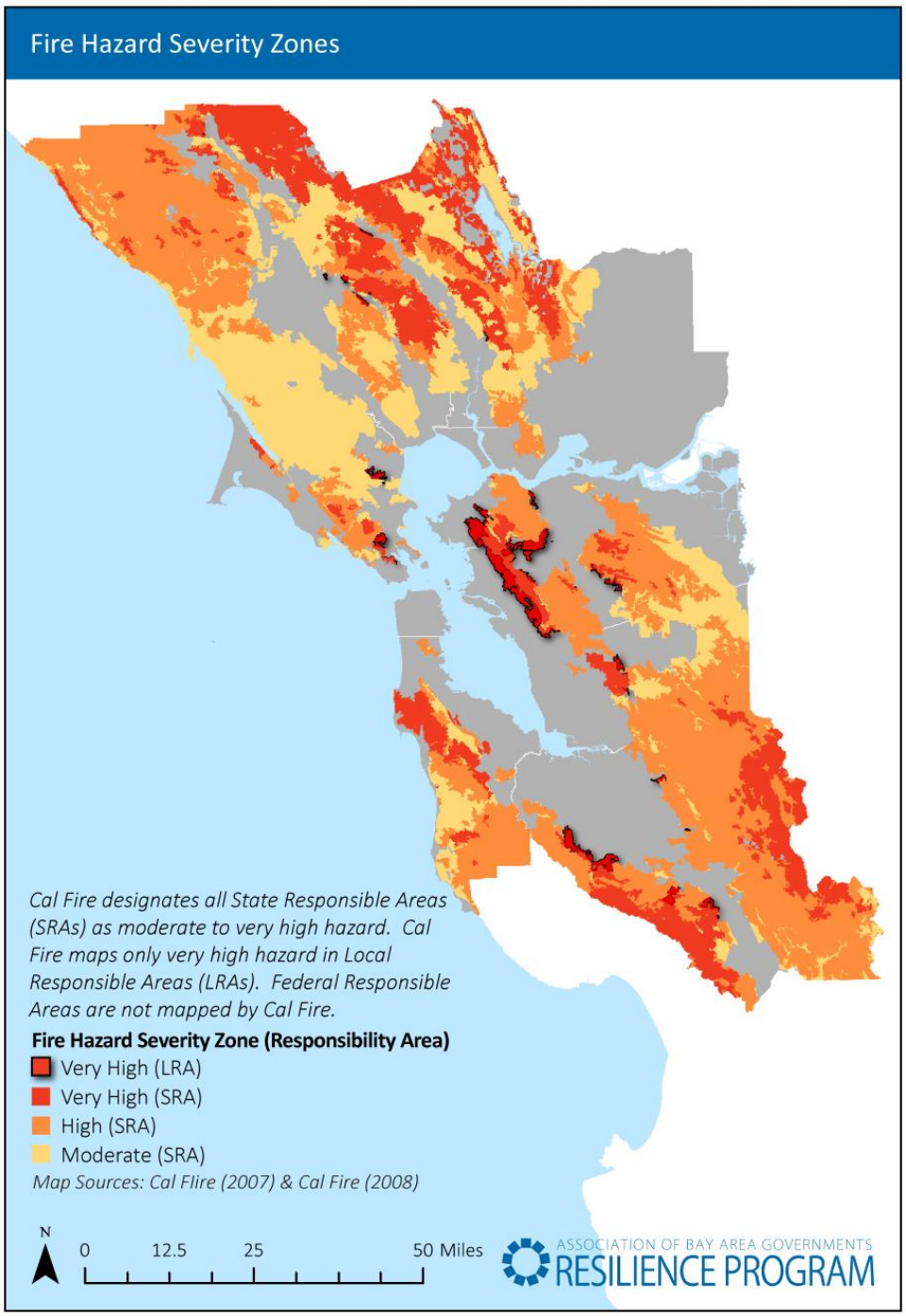
CalFire also produced WUI maps that highlight areas with burnable vegetation and residential density greater than one unit per 20 acres. These zones represent areas of potential fire and high exposure of people and property. Some local fire departments and districts have chosen to identify their own WUI zones based on their local knowledge of the landscape. The City of Santa Rosa is one example of a city with a self-defined WUI Area.[37]

5.7.3.2 Burn Areas

The impacts of a fire are felt long after the fire is extinguished. In addition to the loss of property in fires, the loss in vegetation and changes in surface soils alters the environment. When all supporting vegetation is burned away, hillsides become destabilized and prone to erosion. The burnt surface soils are harder and absorb less water. When winter rains come, this leads to increased runoff, erosion, and landslides in hilly areas.

[36] CDF Fire and Resource Assessment Program
[37] http://ci.santa-rosa.ca.us/departments/fire/prevention/wildland_urban/Pages/default.aspx

Figure 16: Fire Hazard Severity Zones



5.7.3.3 Urban Conflagration

While the primary fire threat in the Bay Area is from wildfire, urban conflagration, or a large disastrous fire in an urban area, as a major hazard that can occur due to many causes such as wildfires, earthquakes, gas leaks, chemical explosions, or arson. The urban fire conflagration that followed the 1906 San Francisco Earthquake did more damage than the earthquake itself. A source of danger to cities throughout human history, urban conflagration has been reduced as a general source of risk to life and property through improvements in community design, construction materials, and fire protection systems.

Although the frequency of urban conflagration fires has been reduced, they remain a risk to human safety. One reason is the current trend toward increased urban density and infill in areas adjacent to the wildland-urban interface. In an effort to keep housing close to urban jobs, areas previously left as open space due to steep slopes and high wildland fire risk may be potentially considered as infill areas for high-density housing. A memorable example of urban conflagration linked to wildland is the 1991 Oakland Hills firestorm. The firestorm occurred within a larger high fire hazard zone that is part of an approximately 60 mile stretch of hills running from the Carquinez Strait to San Jose in the eastern San Francisco Bay Area. The fire happened in an economically well-off, largely built-out residential area that has a long standing fire history linked to hot, dry fall winds and the presence of dense, flammable vegetation. [38]

5.8 Drought

A drought is a gradual phenomenon that occurs over several dry years, depleting reservoirs and groundwater basins without the expected annual recharge from winter precipitation. While drought does not have any primary impacts in the Bay Area, prolonged periods of drought can cause secondary impacts that can affect the region, including:

- Reduced water supply for crops and livestock feed, impacting the economy centered around the agriculture industry
- Increased wildfire hazard, including more fire starts and more prolonged conflagrations fueled by excessively dry vegetation and reduced water supply for firefighting purposes
- Subsidence due to a lowering water table
- May be correlated to high heat conditions.

Drought is not localized, but occurs simultaneously across the region, and may extend statewide or across a larger expanse of western states. This has been the case in California since 2013. While the drought exists in every county, the impacts of the drought are locally

[38] State of California Multi-Hazard Mitigation Plan, California Governor's Office of Emergency Services

unique, based on local water supply systems, soil conditions, and the typical climate and vegetation land covering. The effects of drought are managed in the Bay Area through the importation of water and the storage of water in reservoirs.

The *United States Drought Monitor* is produced by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture. The Monitor releases weekly maps of current drought conditions. NOAA also publishes one year outlook maps for temperature and precipitation.[39] The maps project temperature and precipitation twelve months out – describing the conditions as likely below, above, or average.

5.8.1 Historic Bay Area Drought Occurrences

Major droughts occurred in California that affected the Bay Area in 1973, 1976-77, 1987-1991, and 2007-09. Drought conditions in 1973 led to a state-declared disaster in Glenn, San Benito, and Santa Clara counties, resulting in $8 million in agricultural loss. Between 1976 and 1977, California experienced one of its most severe droughts. 1977 was the state's driest year on record. In the Bay Area, Contra Costa, Napa, San Mateo, and Marin counties were four of the several counties where a state disaster was declared. Statewide, $2.67 billion in damages occurred in the two-year period. Marin, Solano, and Sonoma counties were also affected in the 1987-1991 drought, which caused $1.7 billion in crop losses nationwide. The 2007-2009 drought did not directly affect Bay Area counties, but caused $300 million in crop loss statewide.[40]

In January 2014, the Governor declared a State of Emergency in California in response to current drought conditions, which began in 2012. Thus far, 2015 has surpassed 1977 as the driest year on record in California. As of June 2015, statewide reservoirs are at 18-67 percent of average and Sonoma County has declared a local Emergency Proclamation.[41]

5.8.2 Probability of Future Drought – Climate Influenced

Climate change is likely to increase the number and severity of future droughts. The cumulative impact of climate change impacts will result in drier conditions, and will alter the timing and efficiency of the Bay Area water supply. An increase in temperature and a reduction in snow pack are the two most direct effects of climate change that will result in a drier state with fewer natural water resources than historically have been available.

[39] http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.php
[40] State of California Multi-Hazard Mitigation Plan, California Governor's Office of Emergency Services
[41] California Governor's Office of Emergency Services (2015)

In the Bay Area temperatures are projected to increase between 3 degrees (low emission scenario) and 6 degrees Fahrenheit (high emission scenario).[42] In the eastern regions of the state the increase is 4 to 9 degrees.
The reduction in snowpack does not have direct impacts in the Bay Area as the region does not accumulate meaningful levels of snow. The Bay Area is adversely impacted by the severe reduction in snow pack in the Sierras, the source of two-thirds of the regions water. By the end of the century the spring snow pack in the Sierra could be reduced by as much as 70 to 90percent the historic average.[43]

5.8.3 Water Supply

Drought can impact the entire Bay Area, not just one particular county or a few cities. In addition, shortages in precipitation in the Sierra Nevada can have a more pronounced impact on water supply in the region than a drought in the Bay Area itself because of the reliance of the region on water from the Tuolumne, Mokelumne, Sacramento, and San Joaquin watersheds. Thus, drought is not a hazard that can be depicted by a Bay Area map; rather a map of Northern California is necessary to understand the impact of drought on Bay Area water supply.

Figure 17 illustrates where the largest water districts in the region collect water. Only a third of the water used in the Bay Area is from local rainfall collection and groundwater pumping; the remainder comes from runoff in the Sierra Nevada Mountains. Figure 18 highlights the severity of the current drought in watersheds Bay Area districts are dependent on for their water. In 2015, portions of the Bay Area were downgraded slightly because of average rainfall in micro climates of the region. Other portions of the Bay Area, and most of the area the region relies on for its imported water, remain in exceptional drought, the highest drought designation.[44]

5.8.4 Increased Fire Hazard

Fire hazard increases where drought conditions are high. There are multiple drought related factors that contribute to increased fire hazard: longer fire season, drier vegetation, and hot days. Additionally, drought reduces the water supplies available to fight wildfires, leading to larger and more extended fires. When in a drought, the fire risk is greater, and the impacts remain the same, as those described in Section 0 on fire risk.

[42] Cayan, D., et al. (2009)
[43] Scripps Institute of Oceanography (2012)
[44] National Drought Mitigation Center, (2015)

Figure 17: Water Source Portfolio and Annual Normal Supply

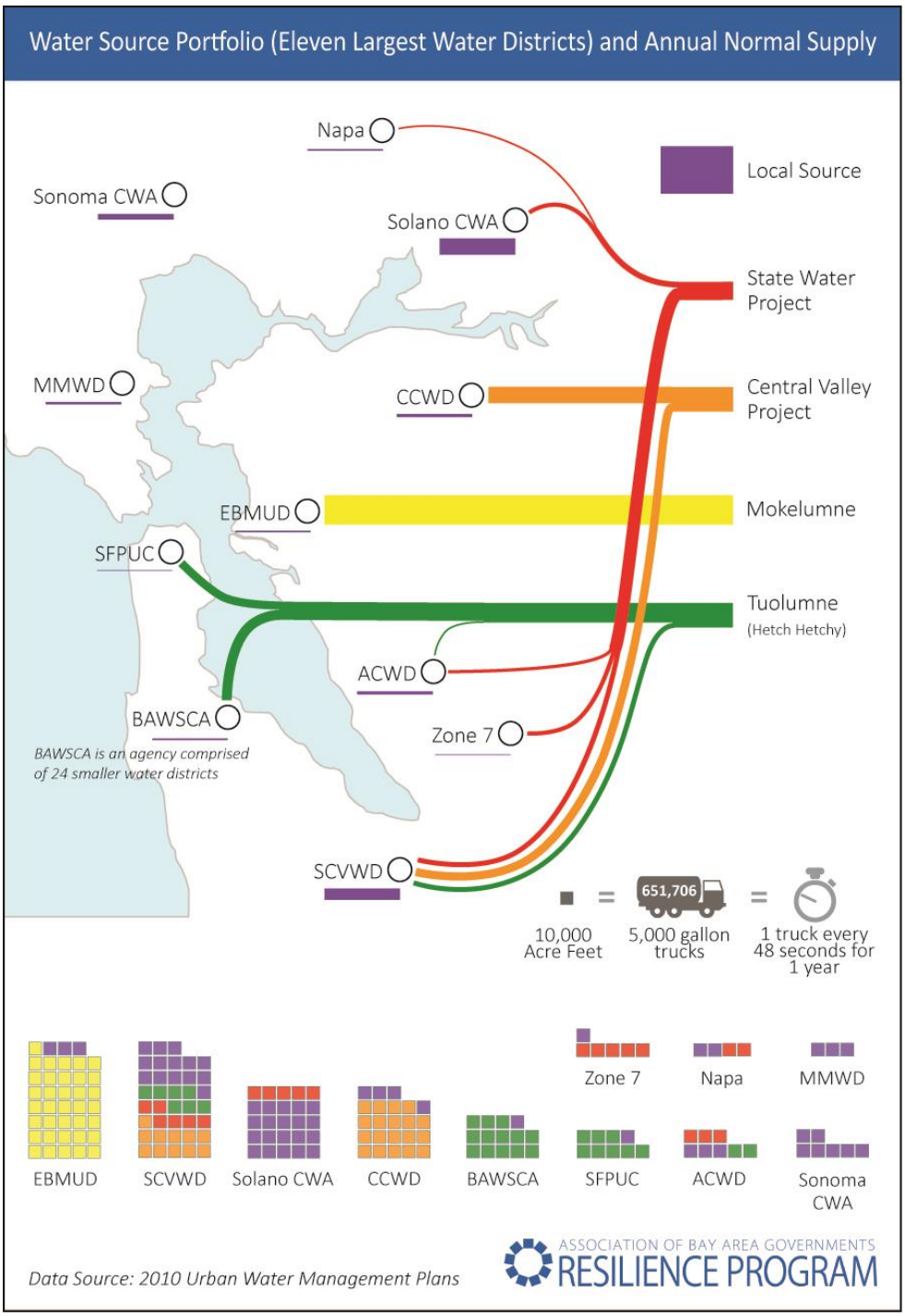
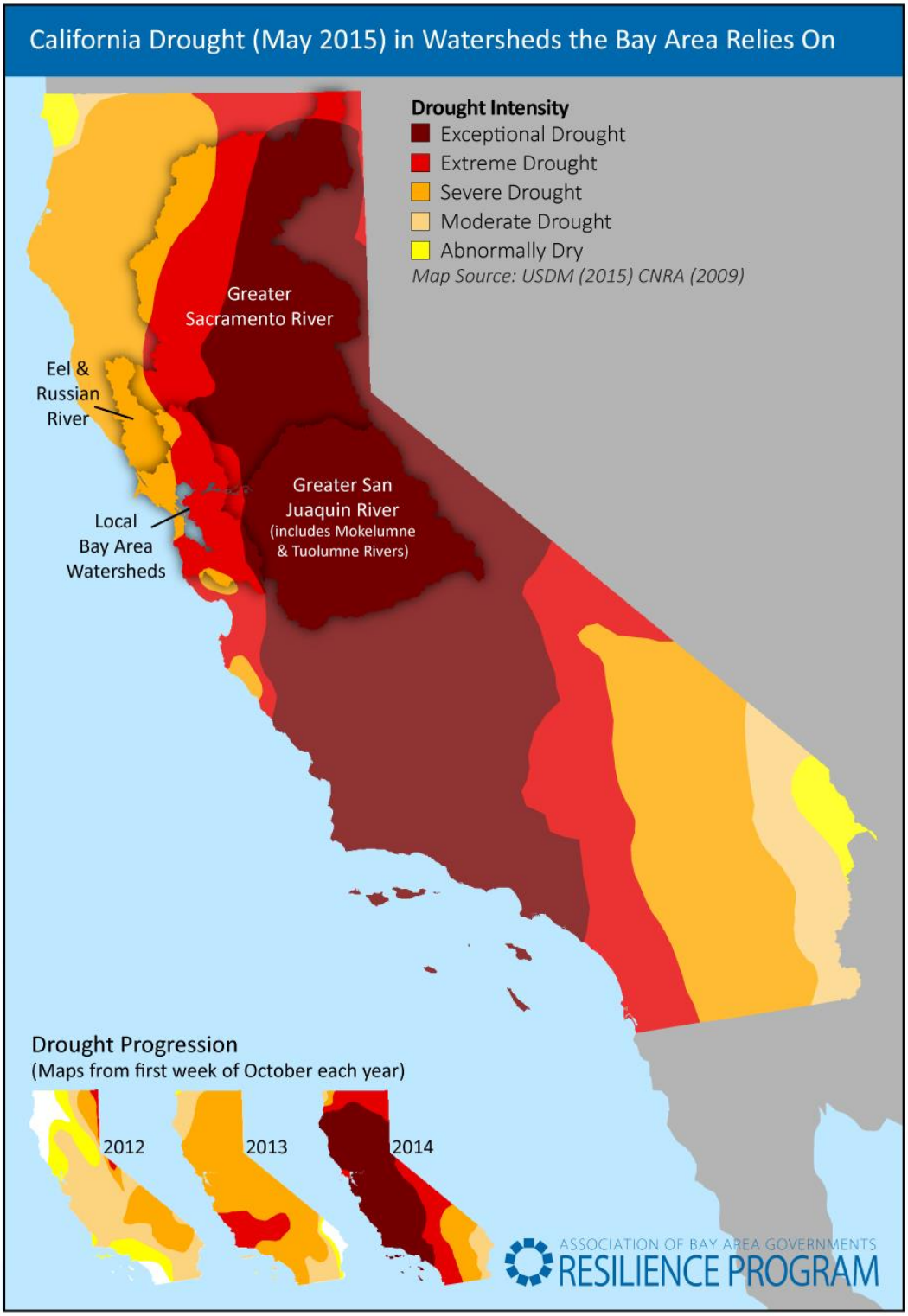


Figure 18: California Drought in Watersheds the Bay Area Relies On



5.9 Extreme Heat

The Bay Area, especially away from the coast and bay, can experience extreme heat days, where the Heat Index, a function of heat and relative humidity, is high. Extreme heat days pose a public health threat, causing symptoms such as exhaustion, heat cramps, and sunstroke if the Heat Index is over 90°F. The National Weather Service has developed a Heat Index Program Alert which gets triggered when high temperatures are expected to exceed 105° to 110° for at least two consecutive days. Heat emergencies occur when residents are subject to heat exhaustion and heatstroke, and are more likely to occur in areas not adapted to heat and without air conditioning, cooling centers, or vegetation to mediate heat impacts in exposed areas. Certain populations are typically the most at risk during extreme heat emergencies, including people with disabilities, chronic diseases, the elderly, and children.[45]

Extreme heat emergencies typically build over time with cumulative effects. Because of this, and the fact that they do not cause substantial physical damage to the built environment, they do not elicit the same immediate response that other hazards do. However, they claim many lives in comparison to other disasters. The California Climate Adaptation Strategy, citing a California Energy Commission Study, states that heat waves have claimed more lives in California than all other disaster events combined.[46]

5.9.1 Historic Extreme Heat

No heat emergencies in California have been declared a disaster at the state or federal level between 1960 and 2008.[47] The Spatial Hazard Events and Loss Data for the United States estimates approximately 47 heat events in California during this time. In 2006 a notable heat wave spread throughout most of the United States and Canada, causing 140 fatalities in California.[48]

5.9.2 Probability of Future Extreme Heat

Climate change is expected to generate an increase in ambient average air temperature, particularly in the summer. The outer Bay Area will likely experience greater temperature increases than coastal or bayside jurisdictions, though likely not as great as in the eastern-

[45] State of California Multi-Hazard Mitigation Plan, California Governor's Office of Emergency Services
[46] Messner, S. et al. (2009)
[47] State of California Multi-Hazard Mitigation Plan, California Governor's Office of Emergency Services
[48] Ibid

most inland communities. The frequency, intensity, and duration of extreme heat events and heat waves are also expected as regional climate impacts.[49]

According to California Climate Change Center, by mid-century, extreme heat in urban centers could cause two to three times more heat-related deaths than occur today.[50] Statewide, temperatures could increase anywhere from 3 to 10.5° depending on CO2 emission levels, leading to more frequent, hotter days throughout the year.

5.9.3 Extreme Heat Hazard in the Bay Area

The Bay Area has historically experienced 4 extreme heat days a year.[51] Depending on low and high emission scenarios, and the location within the region, in the future a city may experience an average of anywhere from 20 to 80 extreme heat days in a year. Cal-Adapt, California's database of climate data and visualization tools provides five different ways to define the extreme heat hazard: (1) number of extreme heat days by year, (2) number of warm nights by year, (3) number of heat waves by year (heat wave is defined as 5 consecutive extreme heat days), (4) timing of extreme heat days by year (i.e. which months do extreme heat hazards occur), (5) the maximum duration of heat wave by year. These metrics are projecting both the intensity and the temporal nature of extreme heat.

Intensity

The intensity of extreme heat is defined differently for each location in the region. In San Francisco County an extreme heat day is defined as a day above 78°, while for inland portions of Solano County extreme heat is defined as a day above 100°. The threshold is the 98th percentile historic maximum temperature. The threshold is set locally to recognize services and buildings in cooler climates may not be designed to handle moderate heat, while those areas where high heat has always been an occurrence, already have measures to address their historic temperatures.

In addition to the number of extreme heat days expected to rise in the Bay Area, the temperature is expected to increase well above thresholds over the next century. In San Francisco County by the end of the century there could be multiple days a year where temperatures reach 95°, while in Solano County there may be multiple days above 115° each year.

5.9.3.1 Temporal

Extreme heat is made worse when it is experienced over a longer stretch of time. The number of heat waves (five or more consecutive days of extreme heat) will increase as will

[49] Drechsler D. M., et al, (2006)
[50] California Climate Change Center (2006)
[51] Cayan, D., et al. (2009)

the length of heat waves.[52] By the end of the century most of the region will average six heat waves a year, with the average longest heat wave lasting ten days. In addition to the more frequent occurrence and duration of heat waves, they are expected to occur in months the region historically hasn't experienced extreme heat. Historically, extreme heat occurs between July and August, but in the future extreme heat will be an issue the region faces in both the Spring and Fall.[53]

Additional Hazards

The hazards outlined in this chapter represent those that pose the greatest impacts to the Bay Area region as a whole. However, there are other hazards that may cause localized impacts or may pose less of a threat to the region due to lesser impacts or have lower likelihoods of occurring. They may be discussed in more detail in Local Hazard Mitigation Plans, as appropriate. These are discussed briefly below. These hazards, and many more, are characterized in the 2013 California State Hazard Mitigation Plan.[54]

5.10. Dam Failure

The dams built in the Bay Area over the last 150 years were built without seismic or government regulation. Dams can be damaged by large storms and the associated runoff, an earthquake, slope failures, or a terrorism event. While dam failure is rare, their failure can be catastrophic, destroying downstream structures and killing people, while reducing water supply to the Bay Area until the dam is rebuilt.

In the 1970s, the state mandated the development of maps showing potential inundation areas due to dam failure. However, the methodology of these maps was limited and they have not been updated since, so they are generally no longer used. Additionally, when a dam is known to have a failure potential, the water level is reduced to allow for partial collapse without loss of water, as required by the State Division of Safety of Dams. Dam owners are required to routinely inspect their facilities and reevaluate their safety in light of current engineering and seismology, and many Bay Area dams have been retrofitted because of this.

There has never been a dam failure in the Bay Area. However, the potential property losses from catastrophic failure are enormous, considering the amount of development within potential inundation zones. Additionally, a dam is most likely to fail as a result of an earthquake, which would lead to its own catastrophic property damage.

[52] Cayan, D., et al. (2009)
[53] California Climate Change Center (2006)
[54] http://hazardmitigation.calema.ca.gov/plan/state_multi-hazard_mitigation_plan_shmp

5.11 Levee Failure

The Sacramento-San Joaquin River Delta and Suisun Marsh are vitally important to the Bay Area economy and environment and contain many levees. The region contains highly fertile agricultural land and provides a unique habitat to many estuarine animals. The Delta region contains critical infrastructure including pipelines, highways, and power and communication lines. The Delta is the hub of the California water system, providing water to 25 million people in the State and 3 million acres of farmland.[55] The probability of levee failure is increasing over time due to sea level rise, increased flooding potential due to early winter snow melts, and the likelihood of an earthquake.

An earthquake is the single biggest risk the Delta Region faces. If an earthquake occurs, levees may fail and as many as 20 or more islands could be flooded instantaneously. This would result in an economic impact of $15 billion or more. Some researchers have estimated the likelihood of a multiple levee failure disaster at about two percent per year. Little is known about the local faults in the Delta. These have only exhibited a low-level pattern of scattered small earthquakes since 1966, but are still believed to be capable of moderate to strong earthquakes (M>6.0). While local Delta faults contribute most significantly to the hazard at longer return periods, and will produce stronger shaking due to their proximity to the levees, the major Bay Area faults pose a greater risk to the Delta levees. While they are farther away and will produce smaller ground motions at Delta sites, earthquakes occur much more frequently on these faults. The Hayward fault, in particular, is the greatest concern for the Bay Area. It is capable of producing large earthquakes that will be devastating to the Bay Area and is close enough to the Delta to damage levees. Other Bay Area faults, such as the Concord and Green Valley, are also likely to produce earthquakes that will damage Delta levees. Additionally, the soils in the western delta are extremely weak and liquefaction will trigger at even low levels of shaking.

Much of the land in the Delta Region is below sea level and is protected by approximately 1,115 miles of levees in the Delta and 230 miles of levees in the Suisun Marsh. The majority of these levees were constructed at heights of three to five feet high and were maintained by local landowners in the last 130 years to protect farm land from flooding inundation. As a result of land subsidence, sea level rise and increased demand for land in the delta, these levees have been raised and increased in length over the years. Today, most of these levees retain water 365 days a year, and carry additional loads during flood events.

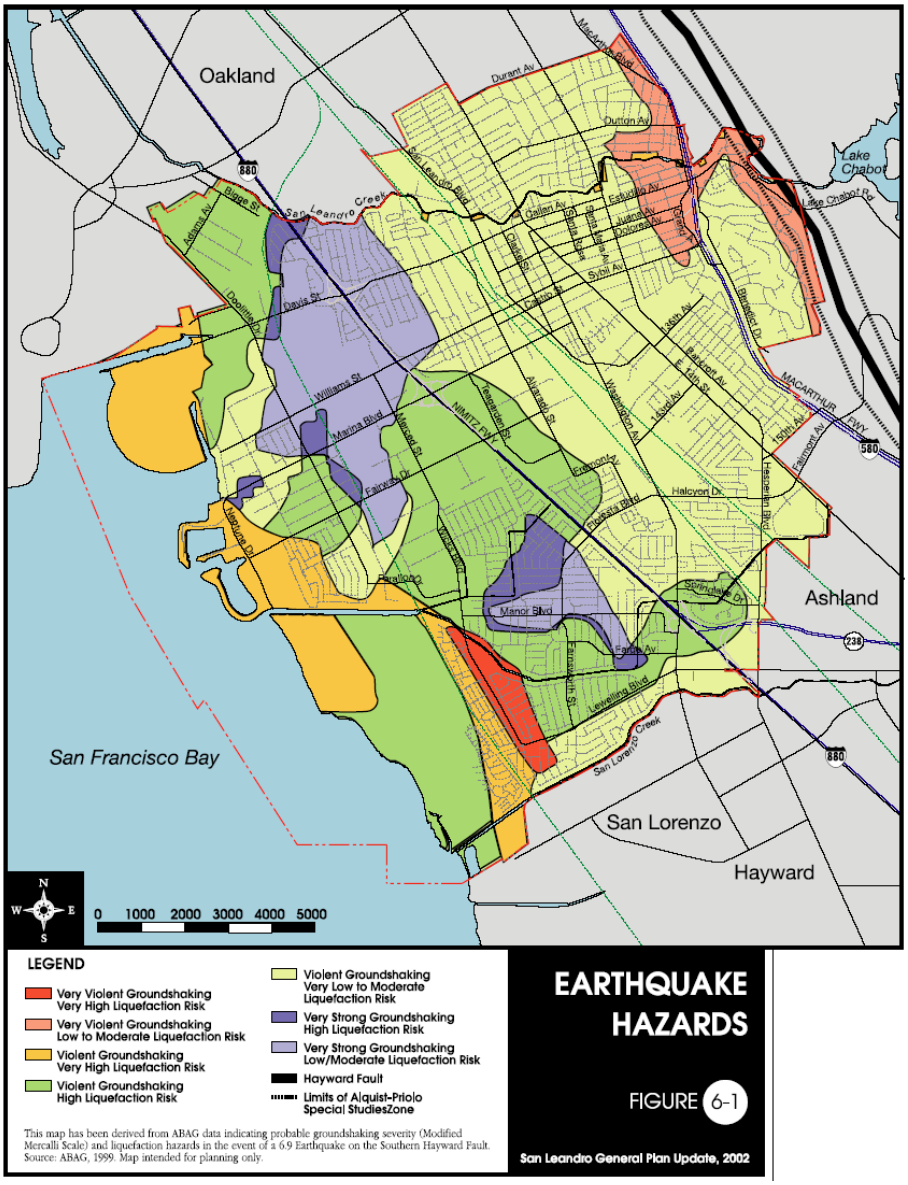
While levees of Delta islands fail frequently, these occurrences typically are not on islands within the nine-county San Francisco Bay Area. If one were to fail, lives and property could

[55] ABAG, (2010)

be lost with major impacts to the Bay Area's drinking water supplies and other Delta infrastructure. Levees are extremely slow to be repaired and economic and social consequences would be protracted.

5.12 Risk Assessment

As mentioned in previous sections, due to research and historical events the hazard that is most threating to the City of San Leandro is a major earthquake along the Hayward Rogers Fault. Many of the associated earthquake events such as Fire, Liquefaction, and Tsunami have been have been considered and categorized as a high threat to the city, and taken into consideration in the City's Mitigation strategies.



5.12.1 Structural Hazards

Enforcement of the Uniform Building Code (UBC) by the San Leandro Building Division helps ensure that new construction will withstand the forces associated with a major earthquake. However, many of the buildings in San Leandro pre-date the modern UBC and are susceptible to damage. The City is nearing completion of a multi-year program to retrofit unreinforced masonry buildings (URMBs), most of which are located in and around downtown.

Several other building types have been identified as vulnerable and have been targeted for future retrofit programs. These include:

- *Concrete tilt-up structures.* About 320 tilt-ups have been identified in San Leandro, with about 50 retrofitted to date. Many of these structures require additional roof-to-wall connections to avoid their collapse during an earthquake.

- *Soft-story buildings*. These are multi-story structures with little or no first floor bracing – 368 soft-story buildings have been identified in San Leandro. Most are two- and three-story apartments or offices constructed over ground-level parking.

- *Older single family homes*. Many older homes in San Leandro have not been bolted to their foundations and would benefit from additional under floor bracing.

Seismic retrofitting can be expensive. The City provides assistance to property owners in the form of classes and seminars, tool lending and guidelines for do-it-yourself retrofit projects. In the past, the City has helped property owners by providing grants, financing support and underwriting of permit fees. Additional assistance programs will be explored in the future.

The City has completed the retrofitting of most public facilities, including City Hall, the Police Station, the Main Library, and all fire stations. Both the San Leandro and San Lorenzo Unified School Districts have also undertaken major seismic retrofit programs during the past few years. Retrofit work by Caltrans and the Bay Area Rapid Transit District (BART) is ongoing, while the East

Bay Municipal Utilities District (EBMUD) is in the midst of a $189 million program to reinforce its reservoirs and major water lines. Some of the freeway overpasses in San Leandro remain vulnerable and will require further strengthening in the coming years.

Costs incurred by the City from previous earthquakes are an estimated $65,000 in emergency response costs. Fortunately, City buildings were not dramatically

impacted. However, homeowners sustained damage such as wall cracks and cracked windows during the 1989 Loma Prieta Earthquake.

5.12.2 San Leandro URMB Status

URMBs Under Construction

			Date	Date	Ordinance	Assessment
			Pre-Const	Last Recd	Effective	District
Permit #	Type	Address	Inspection	Inspection	Date	Date
BURM0012	Repair	571 Bancroft	11/23/92	11/23/92	11/23/95	11/23/96
BURM0014	Repair	14621 E. 14th	11/27/95	11/27/95	11/27/98	11/27/99
BURM0006	Repair	497 E. 14th	5/5/95	1/2/96	5/5/98	5/5/99
BURM0020	Repair	1746 Washington	11/30/95	11/30/95	11/30/98	11/30/99

URMB's Finaled

Permit #	Type	Address	Date Permit Finaled	Date Comp Ltr Sent	Date Cert Comp Recorded	Comments
BURM0015	Repair	401 Bancroft	12/18/96	2/5/97	3/25/97	
BURM0011	Repair	577 Bancroft	1/31/94	2/25/97	3/23/93	
BURM0024	Repair	240 Castro	5/19/98	9/16/98	9/21/98	
BA201244	Demo	350 Davis	5/19/98	9/16/98	9/21/98	
BURM0013	Repair	566 Dutton	9/1/99	10/27/99	11/9/99	
BURM0030	Repair	572 Dutton	10/28/93	11/1/94	1/10/95	
920461	Repair	110 E. 14th	10/22/92	2/25/94	3/23/93	
BURM0016	Repair	445 E. 14th	2/9/93	9/30/93	10/12/93	
BURM0001	Repair	471 E. 14th	11/28/95	11/28/95	1/3/96	
BURM0032	Repair	577 E. 14th	5/23/95	6/2/95	6/6/95	
BURM0005	Repair	601 E. 14th	6/28/93	3/21/94	3/23/93	
921164	Repair	688 E. 14th	1/7/92	3/21/94	3/23/93	
BURM0004	Repair	689 E. 14th	12/25/93	3/21/94	3/23/93	
BURM0010	Repair	770 E. 14th	11/2/98	3/16/01	4/31/01	
BURM0033	Demo	1010 E. 14th	5/19/98	9/16/98	9/21/98	
BURM0002	Repair	1032 E. 14th	6/19/98	9/16/98	9/21/98	
921255	Repair	1443 E. 14th	3/25/93	9/30/93	11/10/93	
BURM0017	Repair	1480 E. 14th	10/8/96	10/31/96	11/26/96	
BURM0027	Repair	1654 E. 14th	8/26/99	10/15/99	11/2/99	
BURM0018	Repair	1672 E. 14th	7/25/93	9/30/93	10/12/93	
913208	Repair	14818 E. 14th	9/18/92	2/25/94	3/23/93	
BURM0034	Repair	227 E. 14th	5/19/97	6/18/97	7/30/97	
BURM0023	Repair	160 Estudillo	3/20/93	3/21/94	3/23/93	
BURM0007	Repair	201 Foothill	5/24/94	12/8/94	12/29/94	
BURM0008	Demo	400 Hudson	2/23/01	3/16/01	4/31/01	Under Permit
BURM0009	Demo	400 Hudson	2/23/01	3/16/01	4/31/01	BLD2000-00346

Permit #	Type	Address	Date Permit Finaled	Date Comp Ltr Sent	Date Cert Comp Recorded	Comments
BURM0019	Demo	400 Hudson	6/18/97	3/16/01	4/31/01	Demolished
BURM0021	Repair	561 Lafayette	6/7/97	3/16/01	4/31/01	
BURM0028	Demo	340 MacArthur	9/8/94	10/21/94	11/10/94	
BURM0026	Repair	397 MacArthur	12/2894	7/25/95	7/27/95	
913033	Demo	709 MacArthur	11/2/93	12/16/94	12/29/94	
BURM0003	Demo	1855 Washington	12/23/96	10/9/01		
912911	Demo	1693 Washington Av	11/12/92	2/15/94	3/23/93	
BA200372	Repair	1850 Williams	4/13/00	4/18/00	5/5/00	
BURM0029	Demo	1057 MacArthur	11/14/95	1/2/96	11/14/98	11/14/99
912516	Repair	421 E. 14th	3/18/93	3/18/93	3/18/96	Will Demo

City of San Leandro – Tilt-up Buildings

111	SAN LEANDRO BL
2040	WILLIAMS ST
2050	WILLIAMS ST
2040	WILLIAMS ST
100	HALCYON DR
1000	MONTAGUE AV
2661	ALVARADO ST
1111	MARINA BL
14000	WASHINGTON AV
785	MONTAGUE AV
1951	FAIRWAY DR
1933	WILLIAMS ST
797	MONTAGUE AV
1786	TIMOTHY DR
1951	WILLIAMS ST
795	ALADDIN AV
1890	WILLIAMS ST
1113	ALADDIN AV
1532	DOOLITTLE DR
830	CASTRO ST
699	CASTRO ST
792	MONTAGUE AV
1035	WILLIAMS ST
13666	EAST 14TH ST
1500	DOOLITTLE DR
1717	DOOLITTLE DR
2428	MERCED ST
399	PREDA ST
591	MONTAGUE AV
833	MONTAGUE AV
2001	WAYNE AV
1815	WILLIAMS ST
828	MONTAGUE AV
1144	MONTAGUE AV
14334	WASHINGTON AV
990	BEECHER ST
2595	ALVARADO ST
2133	ADAMS AV
1188	MONTAGUE AV
901	MONTAGUE AV
855	MONTAGUE AV
401	PREDA ST
2960	MERCED ST
2500	TEAGARDEN ST
1055	MONTAGUE AV
1800	MERCED ST
2502	WILLIAMS ST
1777	TIMOTHY DR
1251	DOOLITTLE DR
150	DOOLITTLE DR
635	143RD AV
635	MARINA BL
14336	WASHINGTON AV
427	HESTER ST
400	HESTER ST
1840	WILLIAMS ST
414	HESTER ST
14332	WASHINGTON AV
1520	DOOLITTLE DR
2002	DAVIS ST
2360	TEAGARDEN ST
1000	MONTAGUE AV
1959	WEST AV 140TH
1980	WEST AV 140TH
1456	136TH AV
2366	ALVARADO ST
72	98TH AV
1501	DOOLITTLE DR
997	MONTAGUE AV
538	LEWELLING BL
552	LEWELLING BL
459	HESTER ST
887	MANOR BL
1981	WEST AV 140TH
440	HESTER ST
14160	WASHINGTON AV
2057	WEST AV 140TH
14110	WASHINGTON AV
1960	LEWELLING BL
1975	WEST AV 140TH
1941	WEST AV 140TH
1941	WEST AV 140TH
2041	WEST AV 140TH
2450	DAVIS ST
2650	ALVARADO ST
2062	WEST AV 140TH
700	MONTAGUE AV
426	HESTER ST
14680	WASHINGTON AV
555	MONTAGUE AV
2192	EAST 14TH ST
1155	BEECHER ST
2756	ALVARADO ST
820	143RD AV
1470	DOOLITTLE DR
999	BEECHER ST
2700	MERCED ST
555	FLORESTA BL
495	HESTER ST
835	FREMONT AV
2800	ALVARADO ST
539	LEWELLING BL
595	MONTAGUE AV
2015	WEST AV 140TH
2150	WILLIAMS ST
2085	WEST AV 140TH
2100	WILLIAMS ST
2065	WEST AV 140TH
751	143RD AV
1661	DOOLITTLE DR
377	PREDA ST
2799	MILLER ST
1785	TIMOTHY DR
2073	WEST AV 140TH
444	DOOLITTLE DR
1465	FACTOR AV
640	143RD AV
777	139TH AV
680	MARINA BL
534	LEWELLING BL
620	MARINA BL
1700	FAIRWAY DR
2613	ALVARADO ST
631	MONTAGUE AV
2460	TEAGARDEN ST
640	MARINA BL
2096	MERCED ST
2003	WEST AV 140TH
2071	WEST AV 140TH
1914	REPUBLIC AV
1588	DOOLITTLE DR
3018	ALVARADO ST
1345	DOOLITTLE DR
2950	ALVARADO ST
2311	MERCED ST
2175	ADAMS AV
534	LEWELLING BL
1111	139TH AV
1940	FAIRWAY DR
1651	ABRAM CT
2303	MERCED ST
3011	ALVARADO ST
2960	ALVARADO ST
1689	ABRAM CT
1366	DOOLITTLE DR
2992	ALVARADO ST
1992	REPUBLIC AV
2410	TEAGARDEN ST
701	FREMONT AV
2855	MILLER ST
3004	ALVARADO ST
661	ALADDIN AV
2580	NICHOLSON ST
14845	EAST 14TH ST
1720	MARINA BL
2031	BURROUGHS AV

List of Tilt-Up Buildings

401	MARINA BL
820	ALADDIN AV
15555	HESPERIAN BL
1950	BURROUGHS AV
2553	NICHOLSON ST
1750	ABRAM CT
2080	PIKE AV
2031	BURROUGHS AV
1777	ABRAM CT
1600	FACTOR AV
1699	EAST 14TH ST
2054	BURROUGHS AV
1947	REPUBLIC AV
2950	MERCED ST
2550	MERCED ST BLGD 9
1959	REPUBLIC AV
2950	MERCED ST
1999	PIKE AV
2077	PIKE AV
1991	REPUBLIC AV
2025	PIKE AV
1915	REPUBLIC AV
1950	WILLIAMS ST
1954	WILLIAMS ST
829	ALVARADO ST
2370	DAVIS ST
2088	BURROUGHS AV
1919	REPUBLIC AV
14295	WICKS BL
1919	WILLIAMS ST
2059	WILLIAMS ST
14472	WICKS BL
900	ALADDIN AV
2035	EDISON AV
1021	ESTUDILLO AV
3199	ALVARADO ST
2851	ALVARADO ST
1088	BEECHER ST
14275	CATALINA ST
2091	FARALLON DR
1688	ABRAM CT
2091	FARALLON DR
512	MARINA BL
14444	GRIFFITH ST
663	MONTAGUE AV
14487	GRIFFITH ST
2596	NICHOLSON ST
14529	GRIFFITH ST
14447	GRIFFITH ST
629	WHITNEY ST
14100	DOOLITTLE DR
1033	MONTAGUE AV
14465	GRIFFITH ST
14550	GRIFFITH ST
2624	NICHOLSON ST
561	WHITNEY ST
1968	WILLIAMS ST
1976	WILLIAMS ST
14496	WICKS BL
693	WHITNEY ST
14493	WICKS BL
14622	WICKS BL
14692	WICKS BL
14072	DOOLITTLE DR
2077	EDISON AV
14066	DOOLITTLE DR
1618	DOOLITTLE DR
1605	ABRAM CT
1550	FACTOR AV
1066	BEECHER ST
2081	ADAMS AV
2085	BURROUGHS AV
2020	FARALLON DR
1599	FACTOR AV
2550	MERCED ST BLDG 8
1701	MARINA BL BLDG 13
1701	MARINA BL
667	MCCORMICK ST
2177	FARALLON DR
2000	MERCED ST
2550	MERCED ST BLDG 10
483	MCCORMICK ST
555	MCCORMICK ST
14422	WICKS BL
14855	WICKS BL ***
14710	WICKS BL
14300	WICKS BL
15555	EAST 14TH ST
2054	BURROUGHS AV
1145	ALADDIN AV
14708	DOOLITTLE DR
2933	ALVARADO ST
950	ALADDIN AV
2099	EDISON AV
2811	TEAGARDEN ST
1000	ALADDIN AV
1400	FACTOR AV
2023	ALVARADO ST
2050	FARALLON DR
13700	CATALINA ST
1970	REPUBLIC AV
1970	REPUBLIC AV
1930	FAIRWAY DR
1970	REPUBLIC AV
14750	WICKS BL
665	WHITNEY ST
14820	WICKS BL
14850	WICKS BL
14725	WICKS BL
555	BANCROFT AV
13756	DOOLITTLE DR
14025	CATALINA ST
14680	DOOLITTLE DR
14570	DOOLITTLE DR
1132	BEECHER ST
14660	DOOLITTLE DR
2781	TEAGARDEN ST
2761	TEAGARDEN ST
2953	TEAGARDEN ST
2971	TEAGARDEN ST
2993	TEAGARDEN ST
537	ESTABROOK ST
1444	FACTOR AV
1990	REPUBLIC AV
3051	TEAGARDEN ST
2435	POLVOROSA AV
14514	WICKS BL
1651	AURORA DR
2950	TEAGARDEN ST
3063	ALVARADO ST
2551	MERCED ST
2109	ADAMS AV
2300	POLVOROSA AV
1977	ADAMS AV
2955	MERCED ST
761	MONTAGUE AV
2021	FARALLON DR
2462	POLVOROSA AV
3081	TEAGARDEN ST
2108	EDISON AV
2505	GRANT AV
2721	TEAGARDEN ST
642	MCCORMICK ST
2194	EDISON AV
3073	TEAGARDEN ST
2434	POLVOROSA AV
14680	WICKS BL
1960	WILLIAMS ST
3041	TEAGARDEN ST
14077	CATALINA ST
2475	POLVOROSA AV
524	MCCORMICK ST
466	MCCORMICK ST
600	MCCORMICK ST
14355	CATALINA ST
2451	POLVOROSA AV
14655	WICKS BL
2091	BURROUGHS AV
2002	EDISON AV
2090	EDISON AV
2701	MERCED ST
1899	MARINA BL
2300	MERCED ST
2300	MERCED ST
2831	MERCED ST

List of Tilt-Up Buildings (Continued)

2300	MERCED ST
2040	FARALLON DR
2300	MERCED ST
1906	REPUBLIC AV
14358	WICKS BL
3007	TEAGARDEN ST
2091	WEST AV 140TH
701	WHITNEY ST
700	WHITNEY ST
730	WHITNEY ST
2000	ADAMS AV
14054	CATALINA ST
2000	ADAMS AV
2000	ADAMS AV
2591	NICHOLSON ST
14275	WICKS BL
519	WHITNEY ST

5.12.3 Flooding

Flood hazards in San Leandro are associated with overbank flooding of creeks and drainage canals, dam failure, tsunamis, and rising sea level.

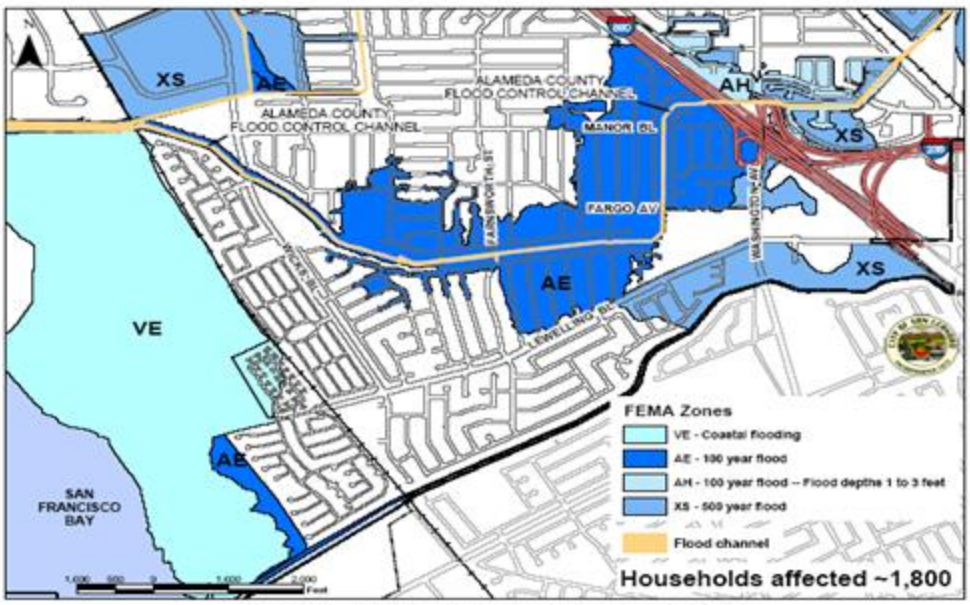
5.12.3.1 Overbank Flooding

At one time, flooding along creeks and streams was relatively common in San Leandro. These hazards were greatly reduced during the 1960s and 1970s when the Alameda County Flood Control and Water Conservation District (ACFCWCD) channelized the lower portions of San Leandro Creek and constructed flood control ditches in the southern part of the City.

Although the flood control channels were effective, they did not eliminate flood hazards entirely. During the last 40 years, urbanization in the watersheds has increased impervious surface area, which has resulted in faster rates of runoff and higher volumes of stormwater in the channels. Recent maps published by the Federal Emergency Management Agency (FEMA) indicate that a 100-year storm (e.g., a storm that has a one percent chance of occurring in any given year) could cause shallow flooding in parts of southwest San Leandro.

In 1999, the City appealed the flood zone boundaries established by FEMA, believing that the number of flood prone properties had been overestimated. Revised maps became effective in February 2000. Although the revised maps show fewer properties in the flood zone than the 1999 maps did, the zones may still be overstated. According to FEMA, there are still 1,870 homes in the Manor, Floresta and Springlake neighborhoods within the 100-year floodplain. Flood insurance costs

for these residents' amounts to over one million dollars a year. The City is presently working with impacted homeowners to verify the elevations of their homes, possibly enabling some residents to have their properties removed from the floodplain boundary. Additional appeals of the boundaries have been filed.



Flooding risk in southern San Leandro

The principal consequence of a property's designation within the 100-year flood zone is that flood insurance is required for federally insured mortgage loans. Insurance also may be required by other mortgage lenders. Moreover, the City's Floodplain Management Ordinance requires that new construction, additions and major home improvement projects are raised at least one foot above the base flood elevation — this can be a significant expense for homeowners making alterations to existing structures.

While the City works with FEMA to improve the accuracy of the flood zone maps, it is also working with the ACFCWCD to increase the carrying capacity of the channels. Measures being pursued include redesign of the channels, replacing undersized culverts, and keeping the channels well-maintained and free of debris. Steps should be taken to identify additional funding sources and expedite the reconstruction of the channels. The most current flood maps have been added to the Appendix of this document as Appendix items 8.6.

5.12.3.2 Dam Failure

Most of San Leandro would be flooded in the event of dam failure at the Lake Chabot or Upper San Leandro Reservoirs. Such a flood could produce catastrophic damage and casualties in the city. The dams at both reservoirs have been seismically strengthened during the last 30 years,

making the risk of failure extremely low. Continued maintenance and seismic reinforcement will take place in the future.

5.12.4 Tsunamis

Tsunamis are long-period waves usually caused by off-shore earthquakes or landslides. Because the San Leandro shoreline does not face the open ocean, the risk is very low. A 100-year frequency tsunami would generate a wave run-up of 4.4 feet at the San Leandro shoreline. Most of the shoreline is protected by rip-rap (boulders) and would not be seriously affected.

5.12.5 Rising Sea Level

Rising sea level is a global issue that could affect San Leandro later in the 21st century. Environmental studies indicate that global warming could lead to a sea level rise of one to eleven feet during the next 100 years. This could have significant effects on the ecology of San Leandro's Shoreline Marshlands. It could also increase erosion along the waterfront and raise the hazard of tidal flooding along Neptune Drive and nearby streets. The City will remain involved in state and regional discussions about this issue and the ways to mitigate its effects on the Bay shoreline.

5.12.6 Terrorism

In 2004, the Terrorism Annex to the City of San Leandro's Emergency Plan was developed which identified potential terrorism targets. The City is traversed by railway lines, a rapid transit system, interstate highways, and flight paths to and from the Oakland International Airport and the San Francisco International Airport. In addition, locations that draw crowds to an event were considered such as the McAfee Coliseum in neighboring Oakland. As acts against innocent populations increase worldwide, we are cognizant of the potential of such events within our community.

Working relationships with other agencies and resources are in place when the City of San Leandro's emergency operations center is activated. There exists an avenue to exchange intelligence and information. Working groups are in place on the federal, state, regional, county, and local levels and internally. On the State level, the California Intelligence Terrorism Center (CITIC) is available. On the regional level, the Bay Area Terrorism Working Group (BATWING) in association with the Federal Bureau of Investigation exists, along with the NEPTUNE Coalition and the Urban Area Security Initiative. The Urban Area Security Initiative involves collaboration between adjoining jurisdictions to arrive at regional solutions to plan and prepared for acts of terrorism.

The WMD/Terrorism Sub-committee meeting objectives were to bring to the forefront those mitigation activities related to WMD/Terrorism that are already in place within the City of San Leandro; to determine what shall be categorized in reactive and proactive activities; and to identify gaps.

On the County level, the City of San Leandro is active in numerous working groups listed below to strengthen coordination between agencies.

Terrorism Working Group

- County OES advisories
- Hazardous Materials working group
- Alameda County Terrorism Working Group
- ALCO-Communications Working Group (Interoperability)
- ALCO-Operational Area Council (makes policies that support WMD response) directs federal funding
- ALCO-CERT

On the local level, the City of San Leandro convenes its Terrorism Working Group and Disaster Council to address local emergency issues with the intent of developing plans and procedures to address the potential for acts of terrorism. Also, the City has a Neighborhood Watch program established in the 1980s which provides communities with the ability to maintain a safe living environment.

The City of San Leandro has strengthened its ability to respond to WMD/Terrorism incidents by implementing the following:

- Hardening of Critical Facilities
- Public Education via media and Public Information Officer
- Alert & Warning/Advisory System
- Specialized Training
  - SWAT for WMD incidents
- Assessments and Planning as outlined in the City of San Leandro's Terrorism Annex
- Equipment
- Exercises performed with a regional approach (Operation Splashdown) incorporating the TSA and mass casualty incident procedures

After careful assessment gaps were identified that, when addressed, can further strengthen the City of San Leandro's ability to respond effectively and swiftly. The identified gaps and/or constraints are:

- Interoperability/Communications.
- Regional Training. Need to train with other response agencies to improve coordination (i.e. fire department, police department, Alameda County Public Health)

- Multi-discipline response team comprised of police, fire, emergency medical services to shorten the response time to an incident. Create an Alameda County terrorism response team.
- Specialized WMD funding to do what needs to be done. Initial & ongoing funding.
- Building Access Accountability/Hardening. Security, badging of City Staff and Accessibility to Public Facilities.
    - Police Department accessibility.
    - City Hall
    - Emergency Operations Center
- Economic Recovery Plan.
- Budget.
- Personal Protection for Police Department. Currently, the police force only has gas masks and bullet-proof vests.
- Force Protective Training for Police Dept.
- Critical Response Partnerships (i.e. Public Health, TSA, Levels of Quarantine)
- Security Advisory.

Terrorism Assessment Priority List

Category 1: Continuity of Government	City Hall Public Works Center
Category 2: Information & Communications	Police Station
Category 3: Emergency Services	Fire Stations Police Station EOC Ambulance Services
Category 4: Institutions	Public and Private Schools Faith-based Organizations
Category 5: Commercial/Industrial Facilities	Food Distribution Center Food Packaging Plant Beverage Bottling Center Chemical Storage Nuclear Research Lab
Category 6: Transportation	BART Stations & Rail Systems Railroad Corridors Transportation Corridors Marina Airport Flight Path
Category 7: Water Supply	Nearby Lake & Dam Municipal Water Systems
Category 8: Banking	None
Category 9: Public Health	Hospitals
Category 10: Recreational Facilities	Marina Community Center City Parks High School Library
Category 11: Miscellaneous	Shopping Mall Sewage Treatment Plant
Category 12: Electric, Power, Oil/Gas Storage	Electrical Plant

5.12.7 Hazardous Materials

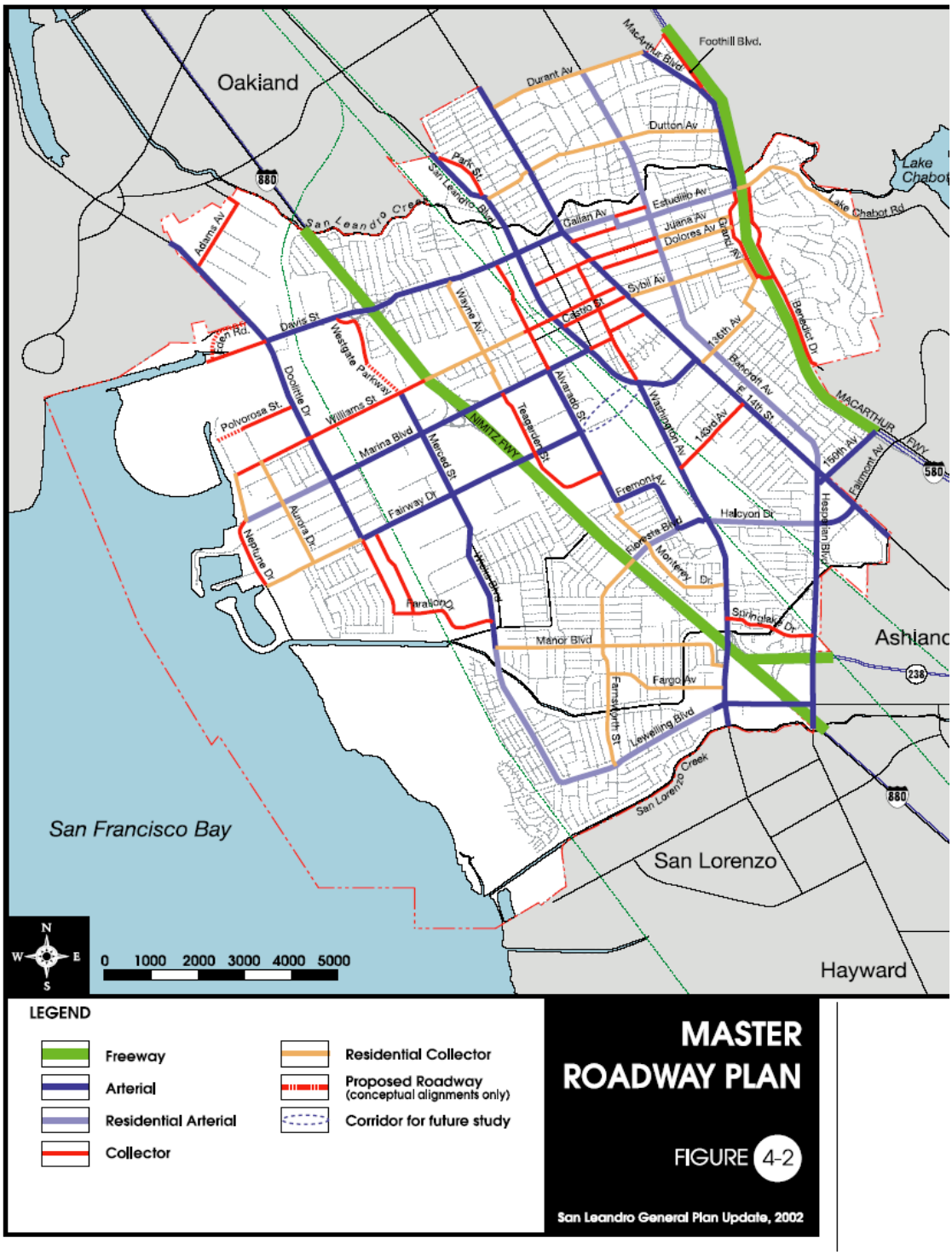
Radiological Incidents

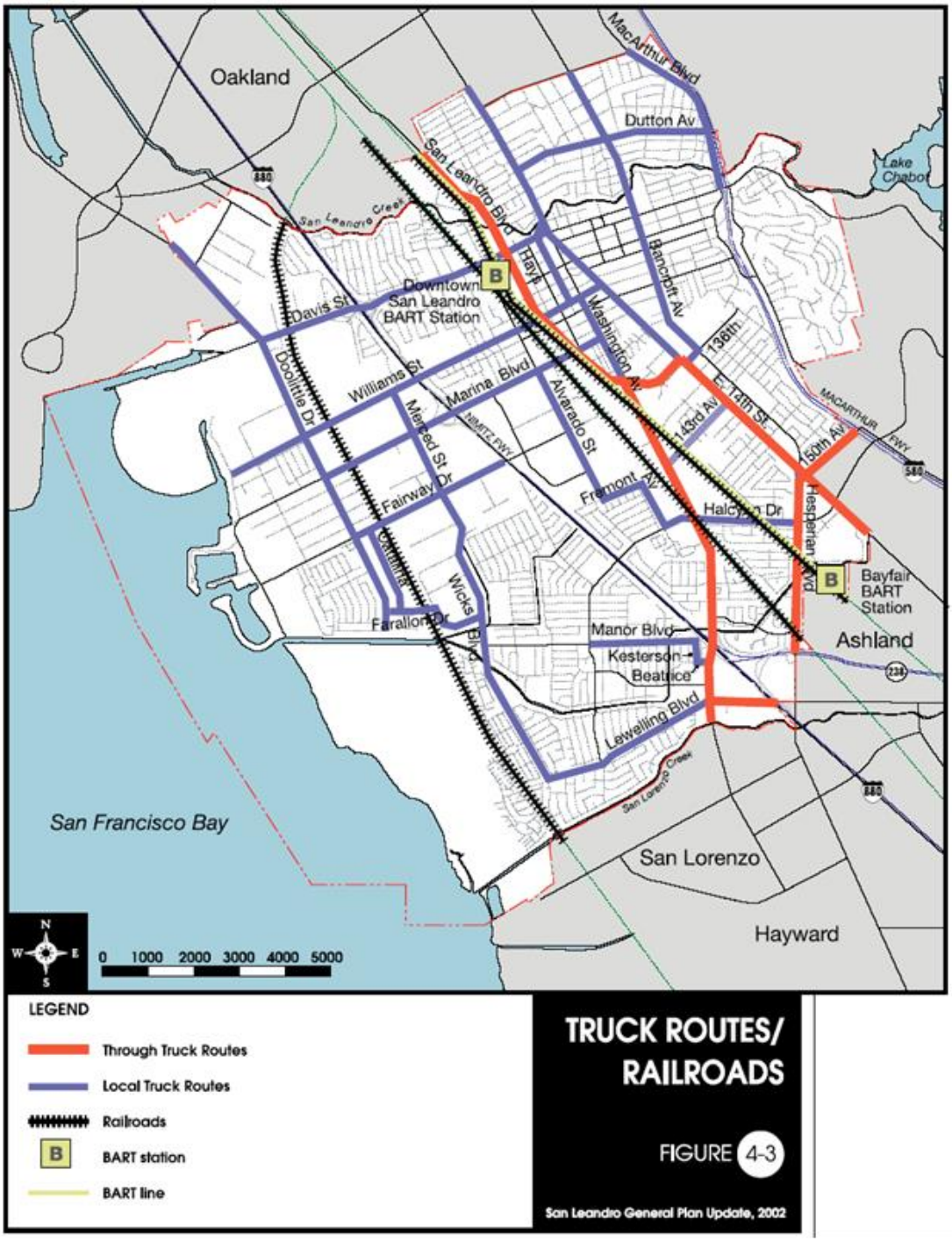
Radiological events may occur in the industrial area of San Leandro as well as along the interstate freeways and railway that course through the city. The maps of San Leandro in the following pages reflect where these incidents may occur. These incidents tend to be accidents. When these accidents occur, the City's Hazardous Materials Area Plan is activated to respond involving the Alameda County Fire Department.

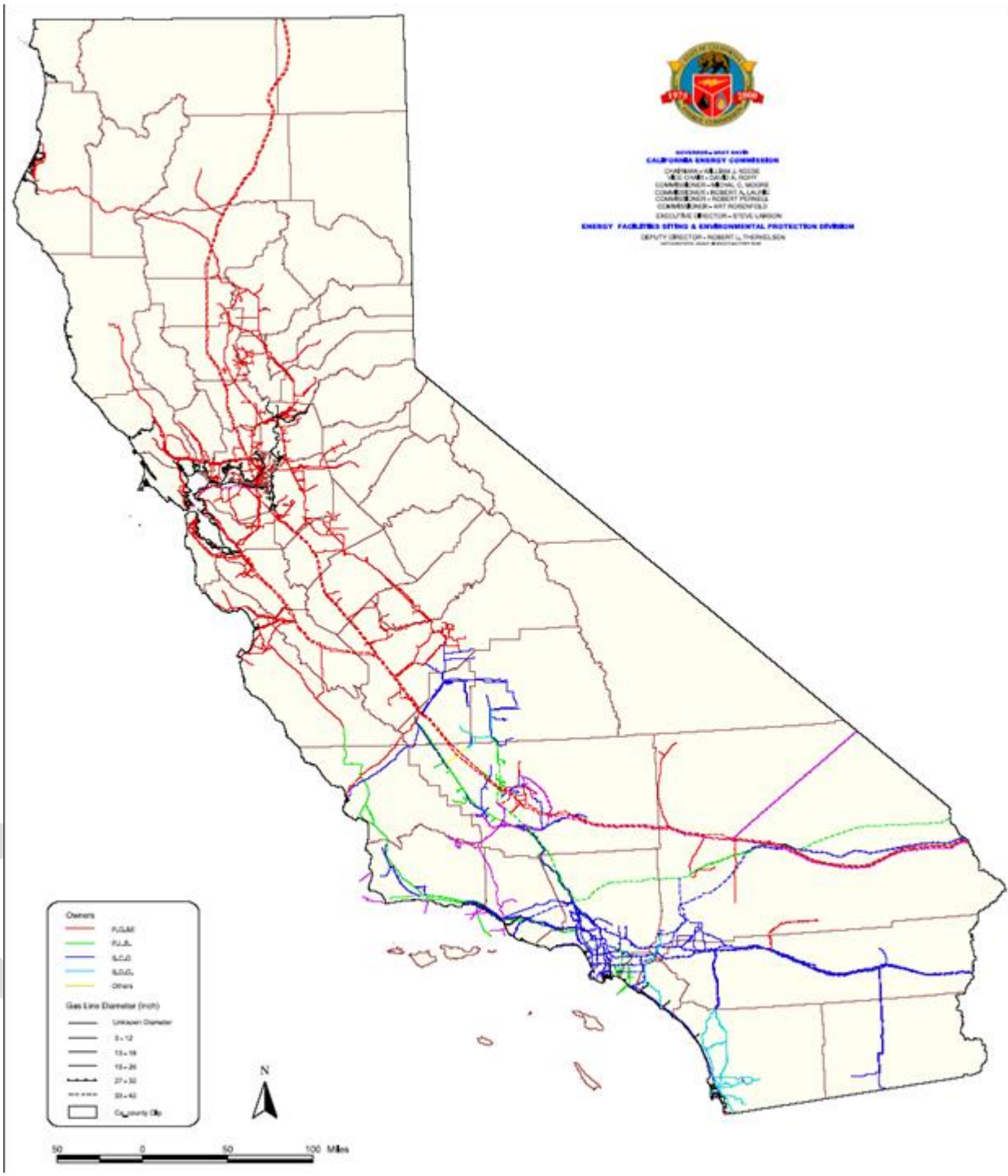
5.12.8 Transportation Accidents/Underground Pipelines

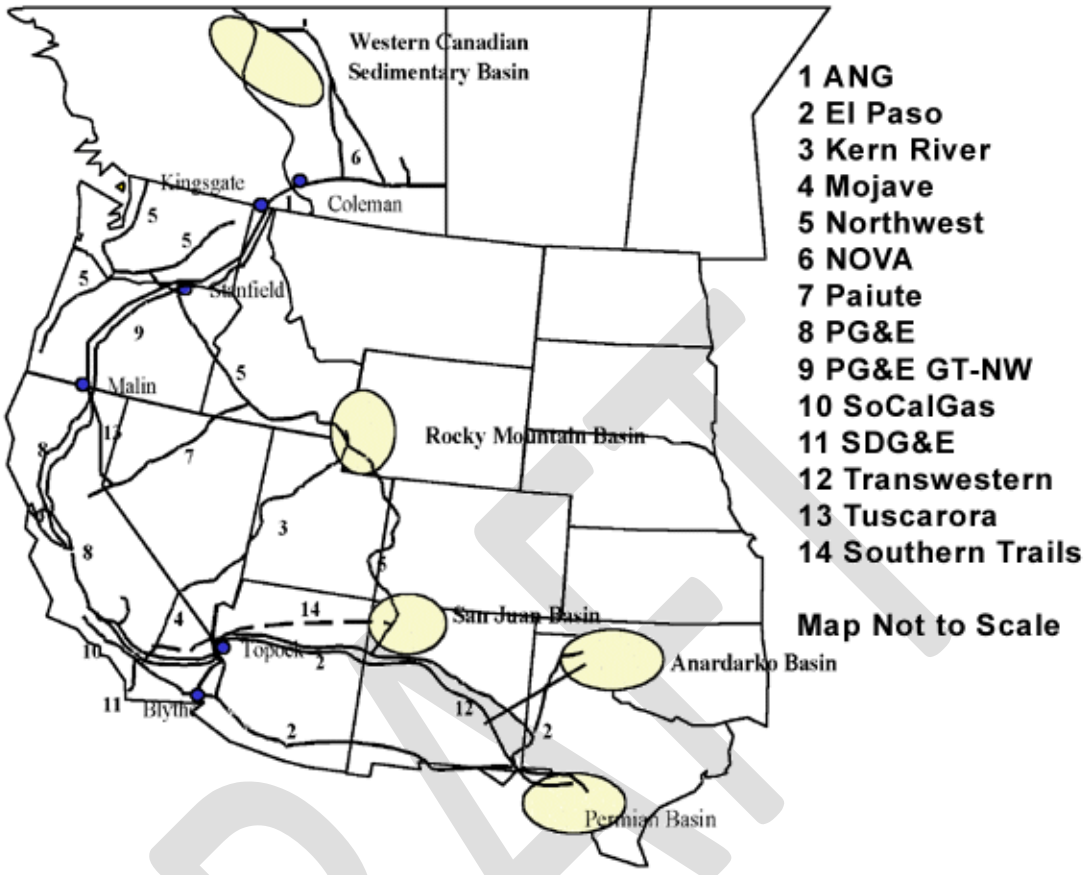
Transportation accidents involving hazardous materials can occur during transportation of explosive materials along freeways and railways. These incidents are very few. If an incident does occur, the Hazardous Materials Area Plan will be activated to respond.

The underground pipelines along railway lines may rupture causing a hazardous material incident. The maps on pages 109 and 110 display the location of pipelines. Generally, pipelines are located along railway right-of-ways. Should a rupture occur, the Hazardous Materials Plan will be activated to initiate any emergency response


Oakland
San Francisco Bay
San Lorenzo
Hayward
Ashland
Foothill Blvd.
MacArthur Blvd
Durant Av
Dutton Av
Lake Chabot
Lake Chabot Rd
Estudillo Av
Juana Av
Dolores Av
Sybil Av
Benedict Dr
Park St
San Leandro Blvd
San Leandro Creek
Adams Av
Davis St
Wayne Av
Castro St
136th Av
Bancroft Av
E 14th St
MACARTHUR FWY
Westgate Parkway
Doolittle Dr
Williams St
Polvorosa St
Marina Blvd
Merced St
NIMITZ FWY
Teagarden St
Alvarado St
Washington Av
143rd Av
150th Av
Fairmont Av
Fairway Dr
Aurora Dr
Neptune Dr
Fremont Av
Halcyon Dr
Hesperian Blvd
Paradise Blvd
Monterey Dr
Manor Blvd
Fargo Av
Farnsworth St
Leewelling Blvd
San Lorenzo Creek
880
580
238
N
W
E
S
0 1000 2000 3000 4000 5000
LEGEND
Freeway
Arterial
Residential Arterial
Collector
Residential Collector
Proposed Roadway
(conceptual alignments only)
Corridor for future study
MASTER
ROADWAY PLAN
FIGURE 4-2
San Leandro General Plan Update, 2002


Oakland
MacArthur Blvd
Dutton Av
San Leandro Blvd
880
San Leandro Creek
Lake Chabot
Hays
Bancroft Av
Downtown San Leandro BART Station
Davis St
Washington Av
136th
Doolittle Dr
Williams St
Marina Blvd
Alvarado St
143rd Av
E 14th St
MACARTHUR FWY
150th Av
Hesperian Blvd
580
Merced St
Fairway Dr
Fremont Av
Halcyon Dr
Bayfair BART Station
Ashland
Farallon Dr
Wicks Blvd
Manor Blvd
Kesterson-Beatrice
238
Lewelling Blvd
San Lorenzo Creek
880
San Francisco Bay
San Lorenzo
Hayward
N
W
E
S
0 1000 2000 3000 4000 5000
LEGEND
Through Truck Routes
Local Truck Routes
Railroads
BART station
BART line
TRUCK ROUTES/ RAILROADS
FIGURE 4-3
San Leandro General Plan Update, 2002


CALIFORNIA ENERGY COMMISSION
ENERGY FACILITIES SITING & ENVIRONMENTAL PROTECTION DIVISION
Owners
Others
Gas Line Diameter (inch)
Unknown Diameter
N
50
0
50
100 Miles



5.12.9 Wildland/Urban Conflagration

The risk of urban wildfire in California has increased dramatically as a result of population growth on fire prone hillsides. The danger is not just limited to rural areas. In fact, one of the costliest wildfires in U.S. history took place just eight miles north of San Leandro in 1991. That fire caused $3 billion in property damage, caused 25 deaths, and resulting in the lost of some 3,000 homes in the Oakland and Berkeley Hills.

Fortunately, the risks are less severe in the San Leandro hills. Within the San Leandro hill area are approximately 1,500 homes valued between $700,000 and over $1,000,000. The area east of I-580 is classified as a "moderate" fire hazard by the California Department of Forestry. The lack of a dense tree canopy is a mitigating factor as are the relatively wide streets, gentle slopes and grassland vegetation. Nonetheless, the city lies adjacent to thousands of acres of potentially flammable coastal scrub and forested open space. There are also a number of locations in the city, particularly along San Leandro Creek, with large eucalyptus trees and other highly flammable vegetation and combustible litter. The Uniform Fire Code specifies additional requirements that are

enforced by the City's Building Division. The City also requires fire-resistant roofing materials in new construction and major remodeling projects.

The City of San Leandro Wildland/Urban Conflagration sub-committee convened to bring to the forefront those mitigation activities related to Wildland/Urban Conflagration that are already in place within the City of San Leandro; to determine what shall be categorized in reactive and proactive activities; and to identify gaps.

Reactive

- EOC resource (have contacts)
- Fire Dept.-minimum staff
- Trained Personnel
- Equipment
- Mutual Aid
- Police Response
    - Security
    - Evacuation
    - Investigation to assist if it is a crime scene
- Care & Shelter

Proactive

- Surveillance
- Police Protection
- Mutual Aid
- Law Enforcement

Gaps

- Communication
- Regional Training
- Economic Recovery Plan
- Fire/Police Coordination & Training

5.12.10 Transportation Accidents/Underground Pipelines

Transportation accidents involving hazardous materials can occur during transportation of explosive materials along freeways and railways. These incidents are very few. If an incident does occur, the Hazardous Materials Area Plan will be activated to respond.

The underground pipelines along railway lines may rupture causing a hazardous material incident. The maps on pages 4-24 and 4-25 display the location of pipelines. Generally, pipelines are located along railway right-of-

ways. Should a rupture occur, the Hazardous Materials Plan will be activated to initiate any emergency response.

5.13 References

5 Aagaard, B., Lienkaemper, J., Schwartz, D. (2012). Probabilistic Estimates of Surface Coseismic Slip and Afterslip for Hayward Fault Earthquakes. Bulletin of the Seismological Soceity of America, Vol. 102, No.3 pp. 961-979. June 2012. ftp://ehzftp.wr.usgs.gov/jlienk/reprints/AagardEtAl2012HF_afterslip.pdf

6 ABAG, (2010). Taming Natural Disasters: Multi-Jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area, http://resilience.abag.ca.gov/2011mitigation/

7 ABAG, (2013). Modified Mercalli Intensity Scale. http://resilience.abag.ca.gov/shaking/mmipopup/

8 Brocher, T.M., et al, (2015) The M6.0 24 August 2014 South Napa Earthquake. https://profile.usgs.gov/myscience/upload_folder/ci2015Jan2212351337182SRL%20Paper%20Brocher%20et%20al.pdf

9 Bryant, W.A., and Hart, E.W., (2007). Fault-Rupture Hazard Zones in California: Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps. California Department of Conservation, California Geological Survey, Supplement No. 1 to Special Publication 42, Interim Revision 2007, ftp://ftp.consrv.ca.gov/pub/dmg/pubs/sp/Sp42.pdf

10 California Climate Change Center (2006). Our Changing Climate: Assessing the Risks to California. A Summary Report from the California Climate Change Center http://meteora.ucsd.edu/cap/pdffiles/CA_climate_Scenarios.pdf

11 California Climate Change Center, (2012). Our Changing Climate 2012: Vulnerability & Adaptation to the Increasing Risks from Climate Change in California. A Summary Report on the Third Assessment from the California Climate Change Center, http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf

12 CDF Fire and Resource Assessment Program, Characterizing the Fire Threat to Wildland–Urban Interface Areas in California, http://frap.cdf.ca.gov/projects/wui/525_CA_wui_analysis.pdf

13 California Governor's Office of Emergency Services (2015), Drought Update, Tuesday, June 2, 2015, http://ca.gov/drought/pdf/archive/WeeklyDroughtUpdate(06-02-15).pdf

14 California Public Resources Code, Division 2, Geology, Mines and Mining, Chapter 7.5, Earthquake Fault Zoning, sections 2621-2630, http://www.conservation.ca.gov/cgs/codes/prc/Pages/chap-7-5.aspx

15 Cayan, D., et al. (2009). Climate Change Scenarios and Sea Level Rise Estimates for California - 2008 Climate Change Scenarios Assessment - Final Report. Scripps Institution of Oceanography - California Nevada Applications Program. http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-500-2009-014-F

16 Committee on Sea Level Rise in California, Oregon, and Washington, and Board on Earth Sciences and Resources and Ocean Studies Board, Division on Earth and Life Studies, (2012). Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, The National Academies Press, http://ssi.ucsd.edu/scc/images/NRC%20SL%20rise%20W%20coast%20USA%2012.pdf

17 Department of Conservation, Seismic Hazards Zonation Program Fact Sheet, California Geological Survey, http://www.conservation.ca.gov/cgs/shzp/Documents/SHZ_FactSheet.pdf

18 Department of Water Resources, (2015). California Department of Water Resources Groundwater Information Center Map Interface. http://gis.water.ca.gov/app/groundwater/

19 Drechsler D. M., et al, (2006). Public health-related impacts of climate change in California. California Climate Change Center, CEC-500-2005-197-SF. http://www.energy.ca.gov/2005publications/CEC-500-2005-197/CEC-500-2005-197-SF.PDF

20 Ellen, S.D., and Wieczorek, G.F., eds., (1998). Landslides, Floods, and Marine Effects of the Storm of January 3-5, 1982, in the San Francisco Bay Region, California, U.S. Geological Survey Professional Paper 1434 Version 1.0, http://pubs.usgs.gov/pp/1988/1434/

21 Ellsworth, W.L. (1990) Earthquake History, 1976-1989, chapter 6 of Wallace, R.E., ed., The San Andreas Fault System, California: U.S. Geological Survey Professional Paper 1515, p. 152-187.

22 Field, E.H., et al, (2013), Uniform California earthquake rupture forecast, version 3 (UCERF3)—The time-independent model: U.S. Geological Survey Open-File Report 2013–1165, California Geological Survey Special Report 228, and Southern California Earthquake Center Publication 1792, http://pubs.usgs.gov/of/2013/1165/

23 Godt, J.W., ed., (1999) Maps showing locations of damaging landslides caused by El Niño rainstorms, winter season 1997-98, San Francisco Bay region, California, Pamphlet to accompany Miscellaneous Field Studies Maps MF-2325-A-J, http://pubs.usgs.gov/mf/1999/mf-2325/

24 Leake, S.A., (2013) Land Subsidence from Ground-Water Pumping, U.S. Geological Survey, http://geochange.er.usgs.gov/sw/changes/anthropogenic/subside/

25 Messner, S. et al. (2009). Climate Change Related Impacts in the San Diego Region by 2050. California Climate Change Center, CEC- 500-2009-027-F. http://www.energy.ca.gov/2009publications/CEC-500-2009-027/CEC-500-2009-027-F.PDF

26 National Drought Mitigation Center, (2015) US Drought Monitor National Drought Summary for February 10, 2015 and December 16, 2014. http://droughtmonitor.unl.edu/MapsAndData/NarrativeArchive.aspx

27 Perkins, J.B., (2001). The Real Dirt on Liquefaction: A Guide to the Liquefaction Hazard in Future Earthquakes Affecting the San Francisco Bay Area, Association of Bay Area Governments, http://resilience.abag.ca.gov/wp-content/uploads/2010/10/Lq_rept.pdf

28 Ross, S.L., and Jones, L.M, eds., (2013). The SAFRR (Science Application for Risk Reduction) Tsunami Scenario, USGS Open-File Report 2013-1170 and CGS Special Report 229, http://pubs.usgs.gov/of/2013/1170/

29 San Francisco Bay Landslide Mapping Team, (1997). San Francisco Bay Region, California, Landslide Folio, California, U.S. Department of the Interior, U.S. Geological Survey, Open-File Report 97-745, http://pubs.usgs.gov/of/1997/of97-745/

30 Schiff, A. (1990). Lifelines, Earthquake Spectra: May 1990, Vol. 6, No. S1, pp.239-338

31 Scripps Institute of Oceanography (2012) Projected Snow Water Equivalent. Scripps Institute of Oceanography - California Nevada Applications Program. http://cal-adapt.org/snowpack/decadal/

32 State of California Multi-Hazard Mitigation Plan, California Governor's Office of Emergency Services, http://hazardmitigation.calema.ca.gov/docs/SHMP_Final_2013.pdf

33 Thatcher W., Marshall, G., Lisowski, M., (1997) Resolution of Fault Slip Along the 470-km-long Rupture of the Great 1906 San Francisco Earthquake and its Implications. Journal of Geophysical Research. Vol. 102, No. B3, p. 5353-5367. March 10 1997.

34 USGS (1999) Land Subsidence in the United States. Circular 1182 U.S. Department of the Interior, U.S. Geological Survey http://pubs.usgs.gov/circ/circ1182/pdf/05SantaClaraValley.pdf

35 USGS (2014) Earthquake Topics for Education: How much bigger calculator. U.S. Department of the Interior, U.S. Geological Survey. September 29, 2014. http://earthquake.usgs.gov/learn/topics/calculator.php

36 Westerling, A.L., Bryant, B.P. (2008). Climate Change and Wildfire in California. Climatic Change Vol. 87. Suppl. 1 s231-s247. http://ulmo.ucmerced.edu/pdffiles/08CC_WesterlingBryant.pdf

6. Mitigation & Adaptation Strategy

6.1 Introduction

San Leandro aims to be a resilient community that can survive, recover from, and thrive after a disaster, while maintaining its unique character and way of life. San Leandro envisions a community in which the people, buildings, and infrastructure, in and serving San Leandro, are resilient to disasters; City government provides critical services in the immediate aftermath of a devastating event of any kind; and basic government and commercial functions resume within a reasonable amount of time, so as to not affect those that reside and conduct business in San Leandro

In 2015, the City is continuing this effort: this plan outlines a five-year strategic plan to bring San Leandro closer to that vision. This plan identifies three disaster mitigation approaches to increase San Leandro's resilience:

1. The City will continue to evaluate and strengthen all City-owned structures, particularly those needed for critical services, to ensure that the community can be served adequately after a disaster.

2. The City will establish and maintain incentive programs and standards to encourage local residents and businesses to upgrade the hazard-resistance of their own properties.

3. The City will actively engage other local and regional groups to collaboratively work towards mitigation actions that help maintain San Leandro's way of life and its ability to be fully functional after a disaster event.

This plan has three objectives for reducing disaster risk in San Leandro:

A. Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts.

B. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.

C. Encourage mitigation activities to increase the disaster resilience of institutions, private companies and lifeline systems that are essential to San Leandro's functioning.

Actions specified in the 2015 mitigation strategy were inspired by multiple elements of the City's General Plan, and specified through collaborative planning processes among City staff and key institutional partners.

2015 mitigation actions are presented in *high*, *medium*, and *low* priority categories. Generally, *high* and *medium* priority actions address San Leandro's hazards of greatest concern—earthquake and flooding . *High* and *medium* priority actions can be completed in the five-year time frame covered by this strategy. Implementation of *medium* and *low* actions is dependent on outside sources of funding becoming available. Resource availability and project funding will strongly influence the pace of achievements.

6.2 Links to City Plans

This plan is part of an ongoing process to build San Leandro's disaster resilience. The City's long-standing commitment and approach to community safety and disaster resilience is demonstrated in the General Plan. The General Plan, currently under revision, directly guides the objectives and actions in this plan. One of the General Plan's major goals is to make San Leandro a disaster-resilient community. Significant effort will be made to ensure that the City's Disaster Preparedness and Safety Element of the General Plan, and disaster issues are also addressed in other elements, including the Land Use, Environmental Management, Transportation and Urban Design and Preservation Elements. The objectives in this mitigation plan are guided by the major goals of the General Plan and the objectives of the Disaster Preparedness and Safety Element.

Many of the actions in this plan are directly taken from the Disaster Preparedness and Safety Element. Section 2.3 identifies specific General Plan Policies guiding this mitigation strategy.

6.3 Prioritization of Actions

The City's Planning Team assigned actions a *High, Medium* or *Low* priority level. Eight key factors were used to determine each action's priority:

1. Support of goals and objectives
2. Cost/benefit relationship
3. Funding availability
4. Hazards addressed
5. Public and political support
6. Adverse environmental impact
7. Environmental benefit
8. Timeline for completion

6.4 Details of Mitigation Strategy

Mitigation strategies identified by the San Leandro Planning Committee are presented in the following pages. Actions are presented per their high, medium- or low-priority designation.

The following information is provided for each strategy:

- ***Action Title*****:** Short title to identify the action

- ***Action*****:** Proposed action

- ***Proposed Activities*****:** Specific projects or efforts that support the action

- ***Related Natural Hazard(s)*****:** Lists hazards whose impacts would be mitigated by the action

- ***Associated LHMP Objective(s)*****:** Mitigation objectives that the action supports

- ***Related Policies from the General Plan****:* policies that the action supports

- ***Special Environmental Concerns*****:** Particular considerations that will be taken into account when the action is implemented

- ***Lead Organization(s) and Staff Lead(s)*****:** City departments and divisions, along with particular City staff positions that will lead implementation of the action

- ***Priority*****:** High, Medium or Low priority assigned to the action using criteria outlined in Appendix E: *Prioritization Structure*

- ***Timeline*****:** Timeline and milestones to implement the action

- ***Additional Resources Required*****:** Identifies if funding is not yet available to complete the action.

- ***Potential Funding Sources*****:** Identifies potential funding sources to complete the action; includes all sources that could possibly fund any element of the action: staff time, vendor contracts, equipment purchase, etc.

Mitigation Strategy: #1

2016 Point Source

Perform analysis of existing point sources of flooding as reflected by FEMA's proposed new FIRM maps as a result of the Bay Area Coastal Study conducted by FEMA and formulate a plan to mitigate the identified sources from potential flooding points.

PROPOSED ACTIVITIES	Identify all point sources of flooding related to the proposed FEMA map changes. Analyze various scenarios to effectively prevent/mitigate the flooding from these point sources of flooding Develop a plan of action to prevent flooding at these points through the most efficient and effective method. Construct the necessary barriers to prevent flooding. Submit all required documentation to FEMA to have properties removed from the newly identified S.F.H.A.
RELATED NATURAL DISASTERS	Flood Tsunami Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	City of San Leandro, E&T Department, City Engineer
PRIORITY	High
TIMELINE	Completed within 3 years of funding
ADDITIONAL RESOURCES REQUIRED	Funding
POTENTIAL FUNDING SOURCES COST	Grant, Property Assessment, General Fund of City of San Leandro

Mitigation Strategy: #2
Shoreline Flood Protection

PROPOSED ACTIVITIES	Reduce the risk of flooding by identifying low points along shoreline with SF Bay. Raise elevation of low points by importing dirt or re-grading existing soil. Install elements to reduce erosion of shoreline.
RELATED NATURAL DISASTERS	Earthquake Tsunami Flooding Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	City of San Leandro, E&T Department, City Engineer
PRIORITY	High
TIMELINE	Completed within 3 years of funding
ADDITIONAL RESOURCES REQUIRED	Funding
POTENTIAL FUNDING SOURCES COST	Grant, Property Assessment, General Fund of City of San Leandro

Mitigation Strategy: #3 Hillside Road Protection

PROPOSED ACTIVITIES	Reduce risk of road failures/closures by assessing slope stability adjacent to collector and arterial roads on hillsides including Lake Chabot Road. Remediate or stabilize high risk slopes.
RELATED NATURAL DISASTERS	Earthquake Flooding Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	City of San Leandro, E&T Department, City Engineer
PRIORITY	High
TIMELINE	Completed within 3 years of funding
ADDITIONAL RESOURCES REQUIRED	Funding
POTENTIAL FUNDING SOURCES **COST**	None Grant, Property Assessment, General Fund of City of San Leandro

Mitigation Strategy: #4

State of the Art Wireless Network at Emergency Operations Center (EOC)

PROPOSED ACTIVITIES	Deploy high powered wireless network system at EOC Current wireless network at EOC is underpowered and fails when too many client devices connect. This plan would include designing, procuring, and implementing new wireless system based on 802.11AC technology for maximum strength and range with ability to handle thousands of client devices. Internet accessibility has become critical for EOC operations.
RELATED NATURAL DISASTERS	Earthquake Wild land Urban Interface Flooding Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	Information Technology – Anton D. Batalla Emergency Services Division
PRIORITY	High
TIMELINE	Completed by end of 2016
ADDITIONAL RESOURCES REQUIRED	Consulting from technology vendors
POTENTIAL FUNDING SOURCES AND COST	$15,000 - $25,000 capital costs, depending on complexity of design $5,000 annual maintenance

Mitigation Strategy: #5

Redundant Phone System at Emergency Operations Center (EOC)

PROPOSED ACTIVITIES	Enable full redundancy of City phone system at Emergency Operations Center (EOC) Current phone system is based on Cisco technology and requires City Hall to be online and operational (the "primary location"). This plan would include designing, procuring, and implementing a second, fully redundant phone system at the Emergency Operations Center (EOC) (the "secondary location") and configuring and testing the necessary hardware, software, systems, and processes to enable a complete failover of the primary location to the secondary location in the event of a disaster.
RELATED NATURAL DISASTERS	Earthquake Wild land Urban Interface Flooding Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	Information Technology – Anton D. Batalla Emergency Services Division
PRIORITY	Medium
TIMELINE	Completed by end of 2018
ADDITIONAL RESOURCES REQUIRED	Consulting from technology vendors
POTENTIAL FUNDING SOURCES AND COST	$100,000 - $250,000 capital costs, depending on complexity of design $25,000 - $30,000 annual maintenance

Mitigation Strategy: #6

Redundant Computer Aided Dispatch (CAD) and Law Enforcement Systems

PROPOSED ACTIVITIES	Enable full redundancy of Computer Aided Dispatch (CAD) and related Law Enforcement information systems (Records, Corrections, Data Entry and Sharing) at Emergency Operations Center (EOC) Current CAD and related Law Enforcement information systems are operational on information technology infrastructure in a datacenter on site at the City of San Leandro Police Department (the "primary location"). This plan would include designing, procuring, and implementing a second, fully redundant information technology infrastructure at the Emergency Operations Center (EOC) (the "secondary location") and configuring and testing the necessary hardware, software, systems, and processes to enable a complete failover of the primary location to the secondary location in the event of a disaster.
RELATED NATURAL DISASTERS	Earthquake Wild land Urban Interface Flooding Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	Information Technology – Anton D. Batalla Police Department – Ron Clark Emergency Services Division
PRIORITY	High
TIMELINE	Completed by end of 2017
ADDITIONAL RESOURCES REQUIRED	Consulting from technology vendors
POTENTIAL FUNDING SOURCES AND COST	$100,000 - $250,000 capital costs, depending on complexity of design $10,000 - $20,000 annual maintenance

Mitigation Strategy: #7
Create redundant City wide radio system

PROPOSED ACTIVITIES	In efforts to ensure that City has emergency communications and a clear operating picture after a major disaster, in the event that our digital network were to fail, create a back-up radio system for emergency divisions of the city such as Public Works, Police Dispatch, and Police Department. Radio system will also be interoperable with School District radio system that is currently in place and allow the City to communicate with the local schools. Included in this proposed mitigation strategy would be additional Amateur Radio (HAM) equipment for the EOC.
RELATED NATURAL DISASTERS	Earthquake Wild land Urban Interface Flooding Climate Change
ASSOCIATED LHMP OBJECTIVES	Reduce the potential for loss of life, injury and economic damage to San Leandro residents and businesses from earthquakes, wildfires, landslides, floods, tsunamis, climate change, and their secondary impacts. Increase the ability of the City government to serve the community during and after hazard events by mitigating risk to key city functions such as response, recovery and rebuilding.
RELATED POLICIES FROM THE GENERAL PLAN	GP Goal 29: Mitigation of Natural Hazards
LEAD ORGANIZATION AND STAFF LEAD	Police Department, Public Works Emergency Services Division
PRIORITY	Medium
TIMELINE	Completion by 2018
ADDITIONAL RESOURCES REQUIRED	Partnership with School Districts
POTENTIAL FUNDING SOURCES AND COST	$50,000 - 150,000 mitigation grants, Cost dependent upon how many departments request radios. $5000 potential annual cost.

* This mitigation plan does not focus on disaster preparedness actions, which are undertaken to facilitate response to a disaster once it has occurred. Preparedness actions include planning response mechanisms, purchasing equipment to use in emergency response, or conducting drills. The City has a strong plan focused on emergency response outlined in the Emergency Operations Plan and plans to increase preparedness throughout the city through public outreach and the creation of a San Leandro Community Emergency Response Team C.E.R.T. These plans and programs are coordinated with, but separate from, this mitigation plan.

7. Plan Maintenance

7.1 Implementing, Monitoring and Updating the Plan

This Plan will be well-integrated into the City's existing plans and planning mechanisms. Upon its adoption, it will be an appendix to the City's Disaster Preparedness and Safety Element of the City's General Plan. For upcoming budget cycles, the City's newly-established Emergency Services Specialist (ESS) position in the City Manager's Office will be responsible for working with Department leaders to further incorporate funded actions from this Mitigation Strategy into the Citywide Work Plan. City staff indicated under "Lead Organizations and Staff Leads" will be responsible for further developing the project plans, schedules and budgets outlined for actions in the Mitigation Strategy. Additionally, each year, the City assesses potential capital improvement projects and available funding as it implements its Five-Year Capital Improvement Plan. Capital improvement actions in this Plan will be assessed as part of this annual process. Implementation of many of these actions will be dependent on outside funding sources.

7.2 Implementing Actions and Reporting on Progress

The ESS will coordinate monitoring, evaluation and updates to the mitigation plan on an annual basis within the five-year cycle. Lead staff identified in each action will meet with the ESS at the beginning of each calendar year to address the City's overall progress on this Mitigation Strategies. In these meetings, staff will:

- Provide qualitative and quantitative performance data related to actions
- Identify any necessary changes to existing Plan actions
- Identify new Plan actions to be incorporated into the Strategy

The City's Disaster Council will serve as the advisory body for implementation of this Plan. This group was created by ordinance to advise the City Council on Disaster-related issues. All meetings of this Commission are held in public. Staff will present progress on mitigation strategy implementation to this group on an annual basis.

The City will maintain the www.sanleandro.org/Mitigation website. Additionally, community members are able to email and mail or hand-deliver feedback to the

City Manager's Office at any time. The City will also use the website as one means of reporting implementation progress to the community.

7.3 *Updating the Plan*

Per federal regulations, this Plan must be updated once every five years. To ensure future compliance with these regulations, the 2019 mitigation strategy meeting will commence the comprehensive process to create the 2020 Plan update. This process will be similar to the annual plan update as described in Section 6.2 above Implementing, Monitoring and Updating the Plan City of San Leandro Local Hazard Mitigation Plan 6-1 but will be expanded to address all sections of the Plan:

1. City staff will consult with subject matter experts, and ABAG to conduct a thorough evaluation and update of this Plan's hazard analysis. The update will include any new scientific research about San Leandro's hazards, the city's exposure and vulnerabilities, as well as a thorough review of all loss estimates.

2. City staff will measure and report progress on actions since the Plan's inception.

3. Items 1 and 2 together will inform the assessment of the updated mitigation strategy.

- City staff will assess incomplete actions to determine if they should be removed, retained or rewritten
- City staff will propose new actions for the updated Plan.

4. City staff will perform another community review process, including input opportunities for institutional community partners and individual members of the public.

5. City staff will incorporate appropriate public feedback and will conduct an outreach and adoption process, involving City commissions and City Council.

8.0 Appendix

8.1 Appendix Item I:

Public Presentation of FEMA Flood Maps on November 16, 2015 at San Leandro City Council meeting. Announced in November 12, 2015 San Leandro Times City Corner add, Volume 25, No. 46.

VOL. 25 NO. 46 SLTIMES 11/12.

CITY CORNER

CURRENT ISSUES AND INFORMATION FROM THE CITY OF SAN LEANDRO

FEMA's Presentation of San Leandro's Flood Hazard Area on FEMA's Flood Insurance Rate Map

The City of San Leandro is sponsoring a community meeting for those property owners that may be affected by the special flood hazard area on FEMA's Flood Insurance Rate Map. FEMA will be giving a presentation to the City Council and residents on November 16th. Please attend to learn more about FEMA's Flood Insurance Rate Map and the impact it may have on your property. Officials from the City of San Leandro, Alameda County, FEMA and other agencies will be available to answer your questions.

Monday, November 16 • 7:00 p.m.
Council Chambers, San Leandro City Hall
835 E. 14th St.

DEPARTMENT OF HOMELAND SECURITY FEDERAL EMERGENCY MANAGEMENT AGENCY Proposed Flood Hazard Determinations for Alameda County, California and Incorporated Areas

The Department of Homeland Security's Federal Emergency Management Agency has issued a preliminary Flood Insurance Rate Map (FIRM), and where applicable, Flood Insurance Study (FIS) report, reflecting proposed flood hazard determinations within Alameda County, California and Incorporated Areas. These flood hazard determinations may include the addition or modification of Base Flood Elevations, base flood depths, Special Flood Hazard Area boundaries or zone designations, or the regulatory floodway. Technical information or comments are solicited on the proposed flood hazard determinations shown on the preliminary FIRM and/or FIS report for Alameda County, California and Incorporated Areas. These flood hazard determinations are the basis for the floodplain management measures that your community is required to either adopt or show evidence of being already in effect in order to qualify or remain qualified for participation in the National Flood Insurance Program. However, before these determinations are effective for floodplain management purposes, you will be provided an opportunity to appeal the proposed information.

Property owners that may be affected were sent information in the mail notifying them of such. For information on the statutory 90-day period provided for appeals, as well as a complete listing of the communities affected and the locations where copies of the FIRM are available for review, please visit FEMA's website at www.fema.gov/plan/prevent/fhm/bfe, or call the FEMA Map Information eXchange (FMIX) toll free at 1-877-FEMA MAP (1-877-336-2627).

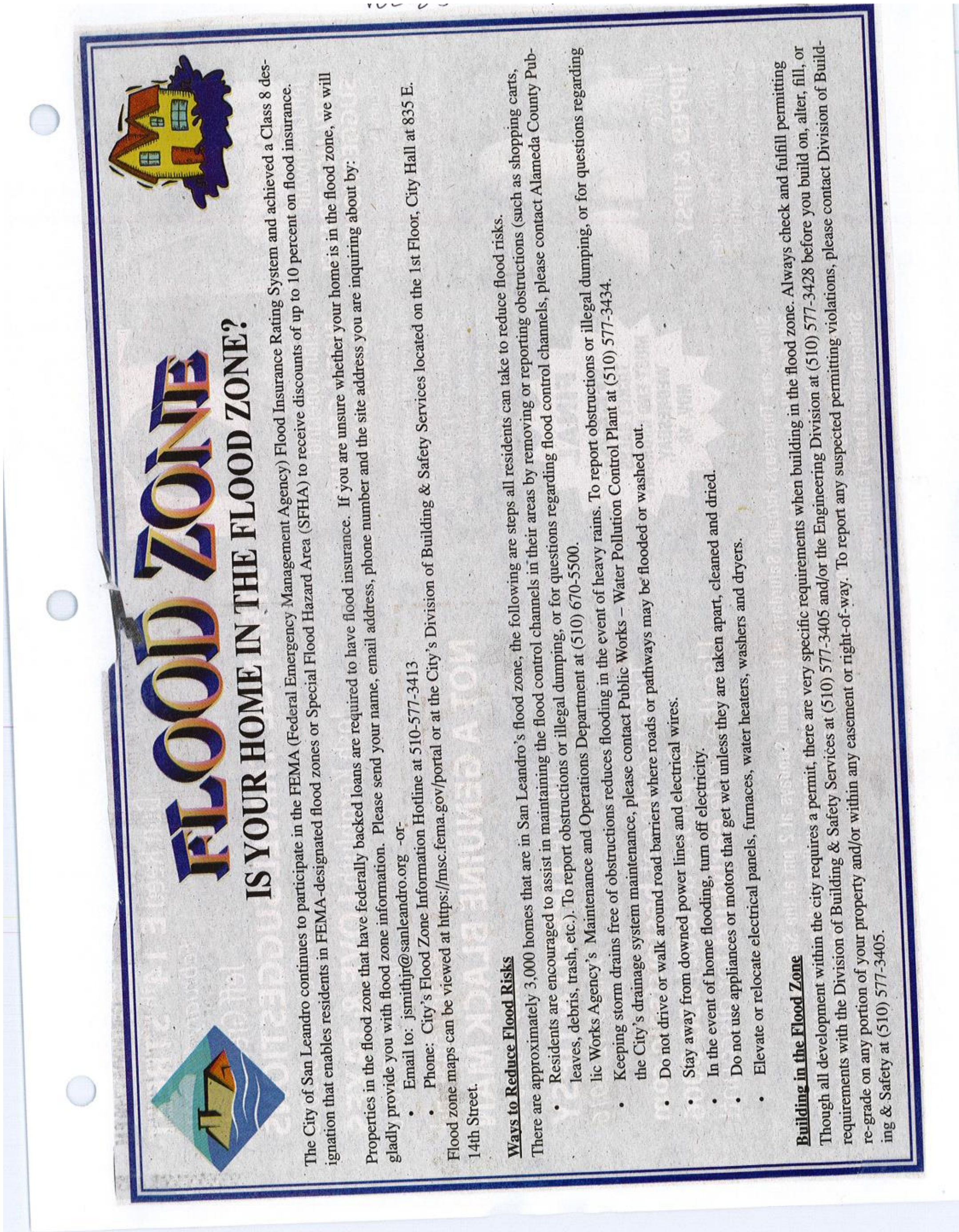
Si require servicios de traducción, por favor comuniquese a la Oficina del City Clerk en el (510) 577-3351.

如果您需要翻译服务，请联系市秘书办公室在 510-577-3351.

TDD 510-577-3343.

8.2 Appendix Item II

Information regarding City of San Leandro's participation in the FEMA Flood Map program. Presented in San Leandro Times November 12, 2015, Volume 25, No. 46.



FLOOD ZONE

IS YOUR HOME IN THE FLOOD ZONE?

The City of San Leandro continues to participate in the FEMA (Federal Emergency Management Agency) Flood Insurance Rating System and achieved a Class 8 designation that enables residents in FEMA-designated flood zones or Special Flood Hazard Area (SFHA) to receive discounts of up to 10 percent on flood insurance.

Properties in the flood zone that have federally backed loans are required to have flood insurance. If you are unsure whether your home is in the flood zone, we will gladly provide you with flood zone information. Please send your name, email address, phone number and the site address you are inquiring about by:

- Email to: jsmithjr@sanleandro.org -or-
- Phone: City's Flood Zone Information Hotline at 510-577-3413

Flood zone maps can be viewed at https://msc.fema.gov/portal or at the City's Division of Building & Safety Services located on the 1st Floor, City Hall at 835 E. 14th Street.

Ways to Reduce Flood Risks

There are approximately 3,000 homes that are in San Leandro's flood zone, the following are steps all residents can take to reduce flood risks.

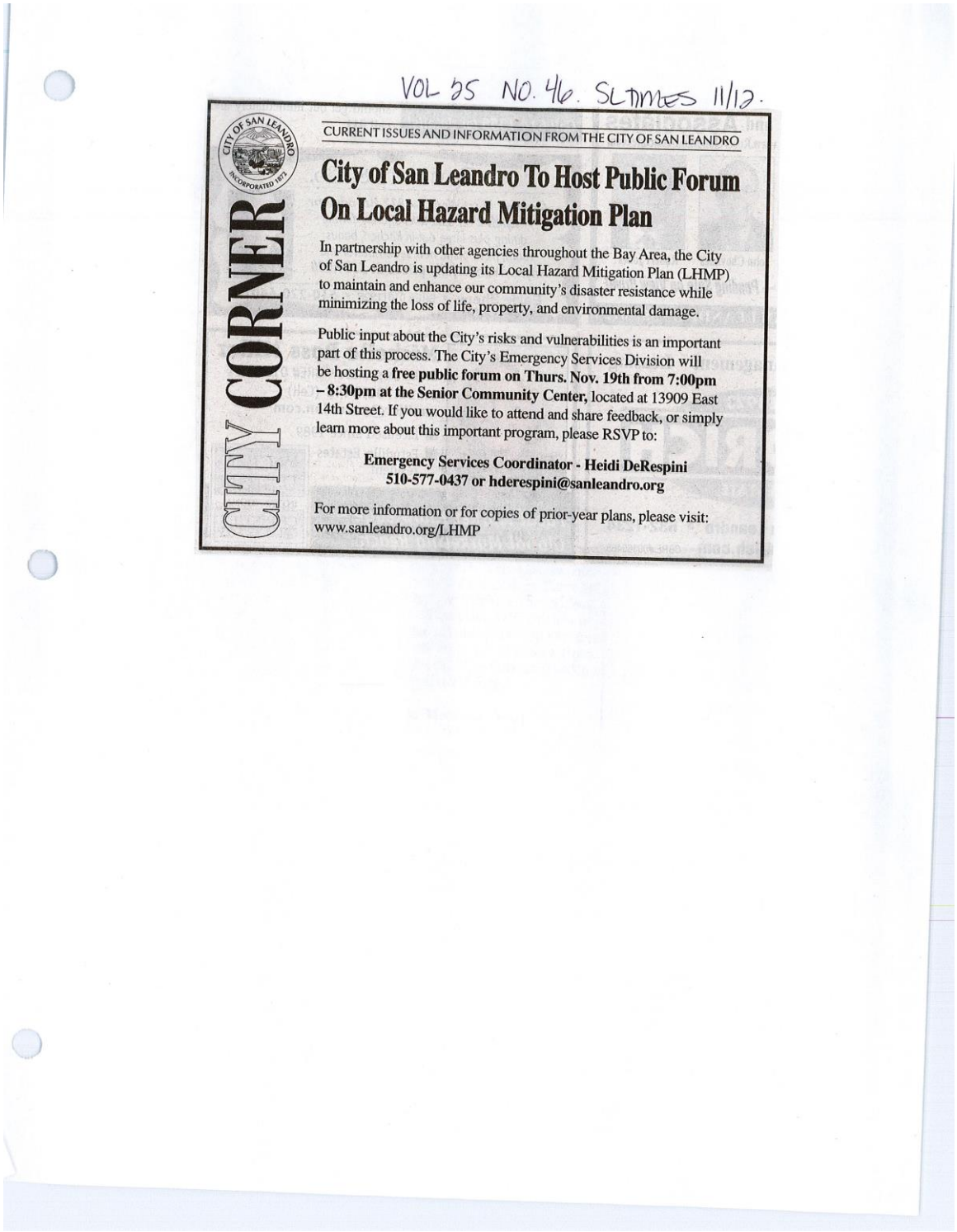
- Residents are encouraged to assist in maintaining the flood control channels in their areas by removing or reporting obstructions (such as shopping carts, leaves, debris, trash, etc.). To report obstructions or illegal dumping, or for questions regarding flood control channels, please contact Alameda County Public Works Agency's Maintenance and Operations Department at (510) 670-5500.
- Keeping storm drains free of obstructions reduces flooding in the event of heavy rains. To report obstructions or illegal dumping, or for questions regarding the City's drainage system maintenance, please contact Public Works – Water Pollution Control Plant at (510) 577-3434.
- Do not drive or walk around road barriers where roads or pathways may be flooded or washed out.
- Stay away from downed power lines and electrical wires.
- In the event of home flooding, turn off electricity.
- Do not use appliances or motors that get wet unless they are taken apart, cleaned and dried.
- Elevate or relocate electrical panels, furnaces, water heaters, washers and dryers.

Building in the Flood Zone

Though all development within the city requires a permit, there are very specific requirements when building in the flood zone. Always check and fulfill permitting requirements with the Division of Building & Safety Services at (510) 577-3405 and/or the Engineering Division at (510) 577-3428 before you build on, alter, fill, or re-grade on any portion of your property and/or within any easement or right-of-way. To report any suspected permitting violations, please contact Division of Building & Safety at (510) 577-3405.

8.3 Appendix III:

Add announcing City of San Leandro Hazard Mitigation Public Forum. Announced in November 12, 2015 San Leandro Times City Corner add, Volume 25, No. 46.



VOL 25 NO. 46. SLTIMES 11/12.

CITY CORNER

CURRENT ISSUES AND INFORMATION FROM THE CITY OF SAN LEANDRO

City of San Leandro To Host Public Forum On Local Hazard Mitigation Plan

In partnership with other agencies throughout the Bay Area, the City of San Leandro is updating its Local Hazard Mitigation Plan (LHMP) to maintain and enhance our community's disaster resistance while minimizing the loss of life, property, and environmental damage.

Public input about the City's risks and vulnerabilities is an important part of this process. The City's Emergency Services Division will be hosting a **free public forum on Thurs. Nov. 19th from 7:00pm – 8:30pm at the Senior Community Center,** located at 13909 East 14th Street. If you would like to attend and share feedback, or simply learn more about this important program, please RSVP to:

Emergency Services Coordinator - Heidi DeRespini
510-577-0437 or hderespini@sanleandro.org

For more information or for copies of prior-year plans, please visit: www.sanleandro.org/LHMP

8.4 Appendix Item IV

Article in San Leandro Times on November 12, 2015 regarding City's Hazard Mitigation Public Forum. Vol. 25 No. 46

VOL. 25 NO. 47 11/19

City Disaster Planning Meeting Tonight

The city is hosting a meeting on disaster plans tonight (Thursday) from 7 p.m. to 8:30 p.m. to go over San Leandro's hazard mitigation plan at the Senior Center, 13909 East 14th Street.

If you would like to provide feedback, but are unable to attend the meeting, a hazard mitigation survey is available on the city's website as well as in paper format at City Hall.

For more information, or to RSVP for the public forum, please contact emergency services coordinator Heidi DeRespini at 577-0437.

8.5 Appendix Item

San Leandro Hazard Mitigation Survey

The City of San Leandro and other cities in Alameda County are required, in response to the Federal Disaster Mitigation Act of 2000, to complete and review their Hazard Mitigation Plan once every 5 years. The act calls for San Leandro, to develop a comprehensive plan illustrating how communities will identify, manage, and reduce the risk of potential hazards in a disaster.

The purpose of San Leandro's plan is to ensure that programs and projects are in place that will help minimize the loss of life, property, and environmental damage. This will allow the City to continue operations after a major emergency.

Your input about the City's risks and vulnerabilities is an important component of San Leandro's Hazard Mitigation Plan. If you are interested in reviewing the City's existing Mitigation Plans, they are available for review on the City's website under "Hazard Mitigation Planning" www.sanleandro.org

Thank you for taking this survey. Your opinions will be used to better prepare the City of San Leandro for a major disaster.

Please return this survey to the front desk staff.

Or

Mail/drop off to:

San Leandro Police Department
901 E. 14th Street
San Leandro, CA 94579
Attention: Heidi DeRespini

Natural and Other Hazards

***1. What hazards in San Leandro most concern you?**

- [ ] Dam/Levee Failure
- [ ] Drought
- [ ] Earthquake
- [ ] Flood
- [ ] Tsunami
- [ ] Hazardous Material event
- [ ] Landslide
- [ ] Sea Level Rise
- [ ] Wildland Fire
- [ ] Other (please specify)

Community Assets

In order to assess community hazard risk, we need to understand which community hazards may be vulnerable. Community assets are features, characteristics, or resources that either made the community unique or allow it to function.

2. In your opinion, which of the following categories of assets are most vulnerable to natural hazards in San Leandro? Please rank the community assets in order of vulnerability, with 1 being the most vulnerable and 6 being the least vulnerable.

	Cultural/Historic: Damage or loss of libraries, museums, historic properties, etc.
	Economic: Business interruptions or closures, loss of jobs, etc.
	Environmental Damage: contamination or loss of property, such as wetlands, and waterways.
	Governmental: Ability to maintain order and continue providing public services, etc.
	Infrastructure: Damage or loss of roads, bridges, utilities, schools, etc.
	People: Loss of life and or/injuries.

Mitigation Activities

Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from hazards. It includes a variety of possible activities that can be implemented by public agencies, the private sector, or individuals.

3. Which of the following actions do you think should be taken in order to reduce damage and disruption from hazardous events within the City of San Leandro? Please rank each option as high, medium, or low priority.

	High	Medium	Low
Strengthen building codes and regulations to include higher standards for new developments in known hazard areas.	◯	◯	◯
Install or improve protective structures (ex: levees)	◯	◯	◯
Provide better public information about hazard risks and available mitigation measures	◯	◯	◯
Strengthen infrastructure (ex: roads, bridges, water/wastewater and electric power supply facilities)	◯	◯	◯
Develop climate adaptation plans, policies, or projects to minimize potential negative impacts from climate change.	◯	◯	◯
Protect cultural and/or historic resources (ex: monuments, museums, historic landmarks, etc.)	◯	◯	◯

Preparedness Activities

4. In your household, has anyone done any of the following preparedness activities?

	Have Done	Plan to Do	Have not Done	Unable to Do	Not Applicable
Anchored service utilities to your home (water heater, furnace, wood stove, etc.)	○	○	○	○	○
Established a defensible space around your home.	○	○	○	○	○
Purchases hazard insurance (flood, earthquakes, etc.)	○	○	○	○	○
Strengthened your home through mitigation retrofits from when your home was constructed.	○	○	○	○	○
Made an emergency kit or assembled emergency supplies.	○	○	○	○	○
Prepared a family emergency plan.	○	○	○	○	○
Talked about what to do in case of an emergency or natural disaster.	○	○	○	○	○
Attended a course dealing with emergency preparedness (e.g. Get Ready, CERT, PEP, First Aid, CPR)	○	○	○	○	○
Identified and understand how and when to shut off utilities.	○	○	○	○	○

Preparedness Activities

5. Do you think you are well informed about the dangers of the hazards affecting the City of San Leandro?

- ◯ Yes
- ◯ No

6. How do you plan to get important information from the City of San Leandro after a major disaster?

- ☐ Nixle 360
- ☐ City of San Leandro website
- ☐ Twitter
- ☐ Facebook
- ☐ Nextdoor
- ☐ Radio Station 1610 AM
- ☐ UVerse - Channel 99
- ☐ Comcast - Channel 13

Other (please specify)

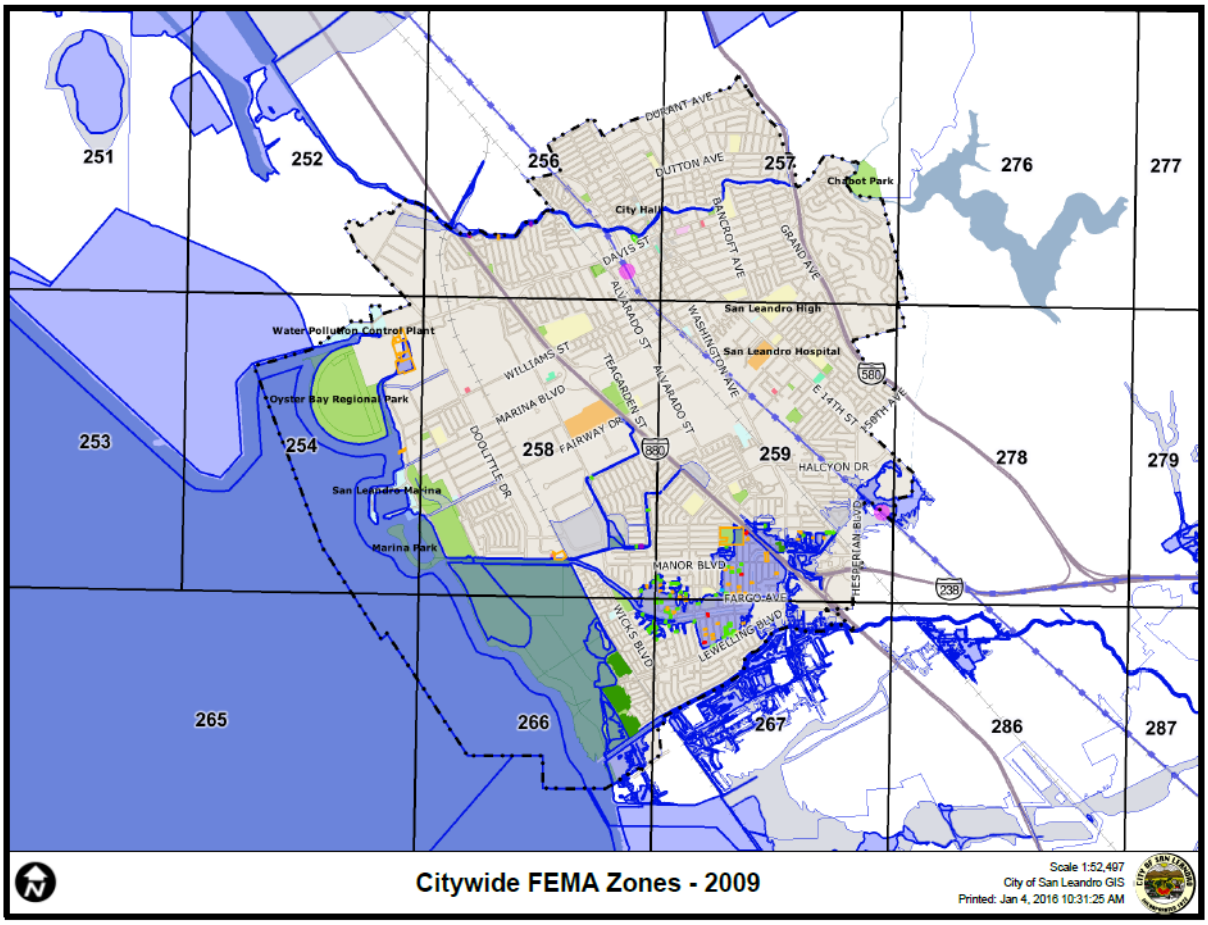
Preparedness Activities

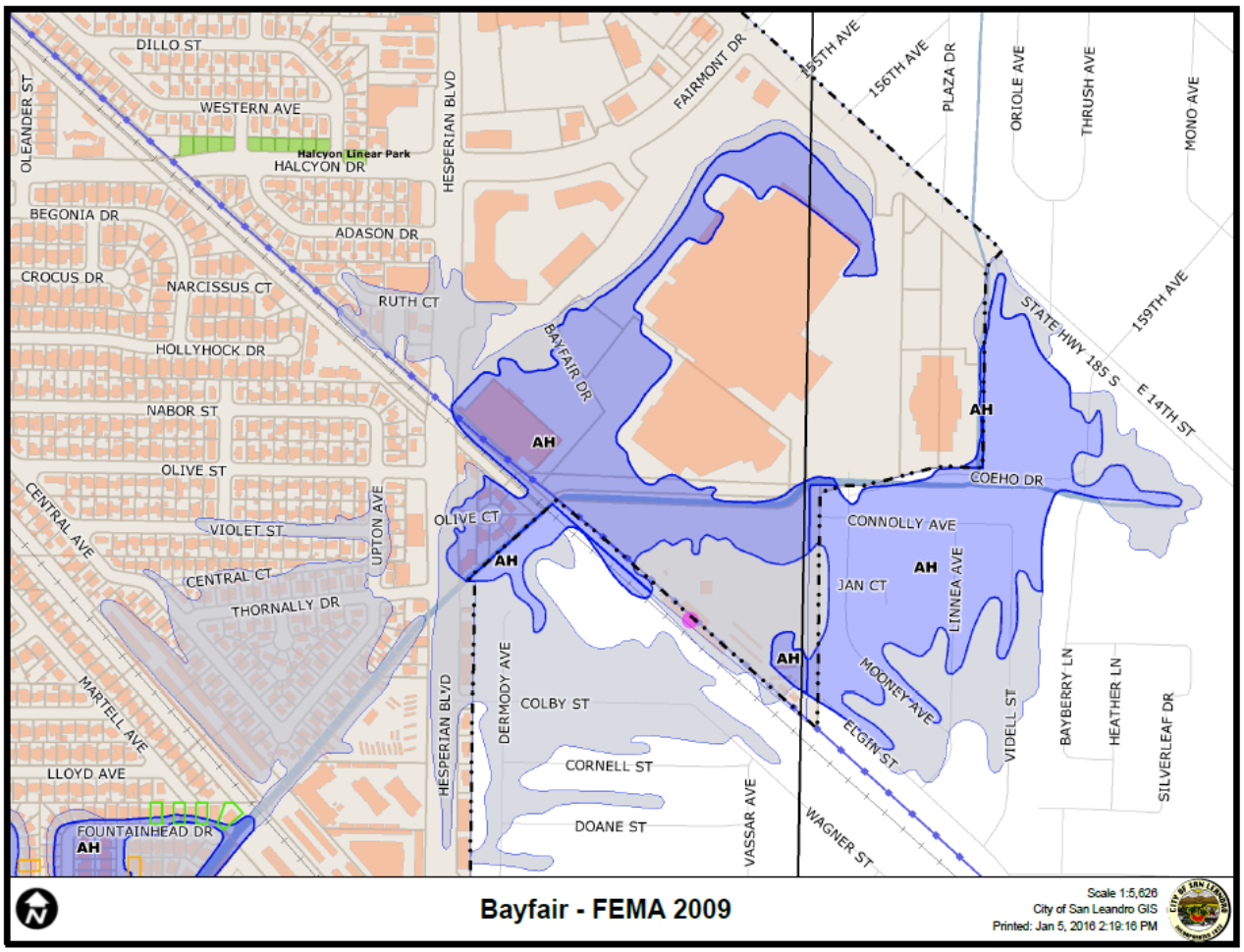
8. Would you attend public education classes dealing with emergency preparedness and hazard awareness if they were offered?

- ◯ Yes
- ◯ No
- ◯ Unsure

8.5 Appendix Item X

FEMA Flood Maps for City of San Leandro

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ORIOLE AVE
THRUSH AVE
MONO AVE
BEGONIA DR
ADASON DR
CROCUS DR
NARCISSUS CT
RUTH CT
BAYFAIR DR
159TH AVE
STATE HWY 185 S
E 14TH ST
HOLLYHOCK DR
NABOR ST
AH
OLIVE ST
COEHO DR
CENTRAL AVE
VIOLET ST
UPTON AVE
OLIVE CT
CONNOLLY AVE
CENTRAL CT
JAN CT
LINNEA AVE
THORNALLY DR
MOONEY AVE
MARTELL AVE
DERMODY AVE
COLBY ST
ELGIN ST
VIDELL ST
BAYBERRY LN
HEATHER LN
LLOYD AVE
CORNELL ST
SILVERLEAF DR
FOUNTAINHEAD DR
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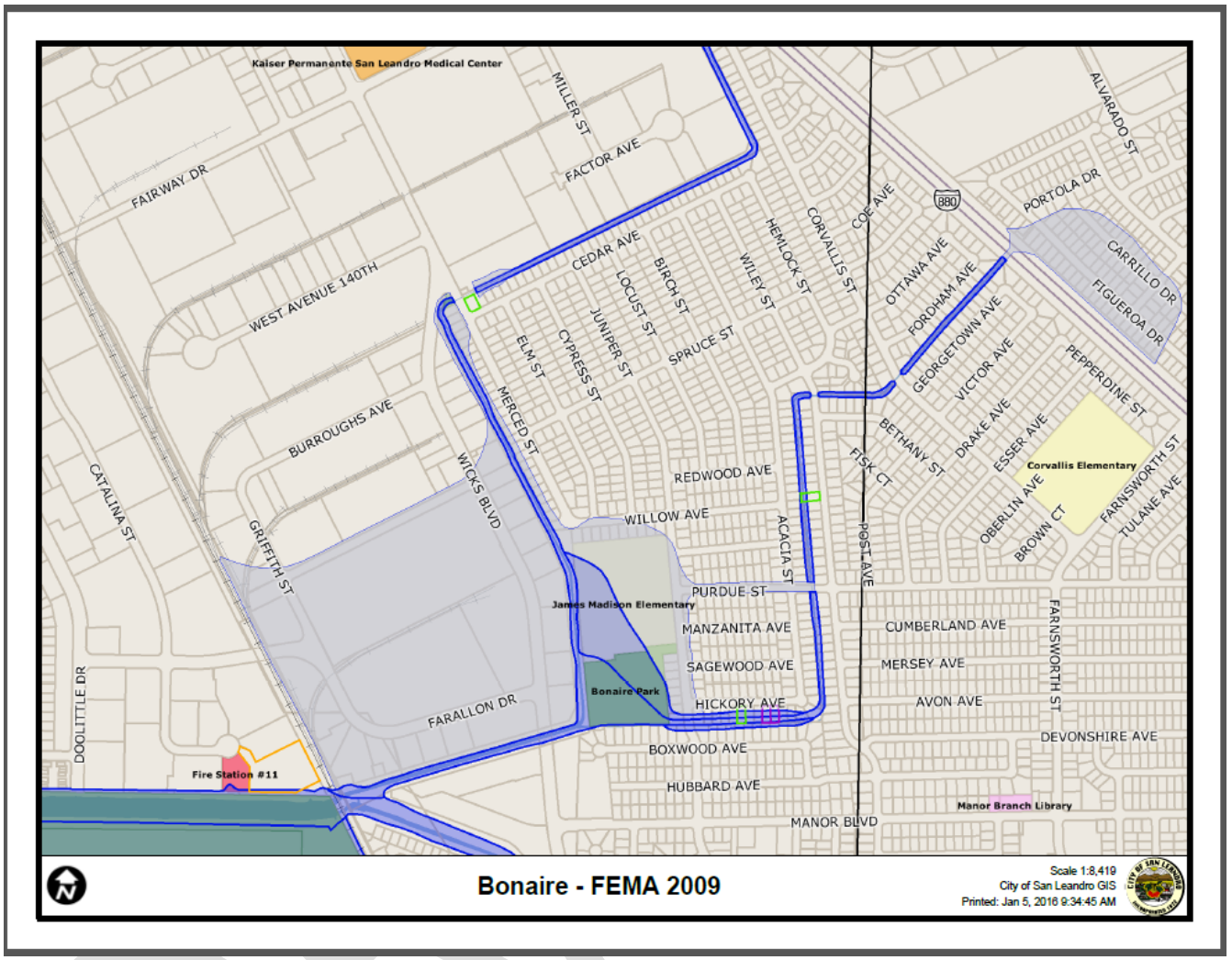
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WICKS BLVD
MERCED ST
ELM ST
CYPRESS ST
JUNIPER ST
LOCUST ST
BIRCH ST
CEDAR AVE
SPRUCE ST
WILEY ST
HEMLOCK ST
CORVALLIS ST
COE AVE
880
ALVARADO ST
PORTOLA DR
CARRILLO DR
FIGUEROA DR
OTTAWA AVE
FORDHAM AVE
GEORGETOWN AVE
VICTOR AVE
PEPPERDINE ST
DRAKE AVE
ESSER AVE
Corvallis Elementary
OBERLIN AVE
BROWN CT
FARNSWORTH ST
TULANE AVE
BETHANY ST
FISK CT
POST AVE
REDWOOD AVE
WILLOW AVE
ACACIA ST
PURDUE ST
James Madison Elementary
MANZANITA AVE
SAGEWOOD AVE
Bonaire Park
HICKORY AVE
CUMBERLAND AVE
MERSEY AVE
AVON AVE
FARNSWORTH ST
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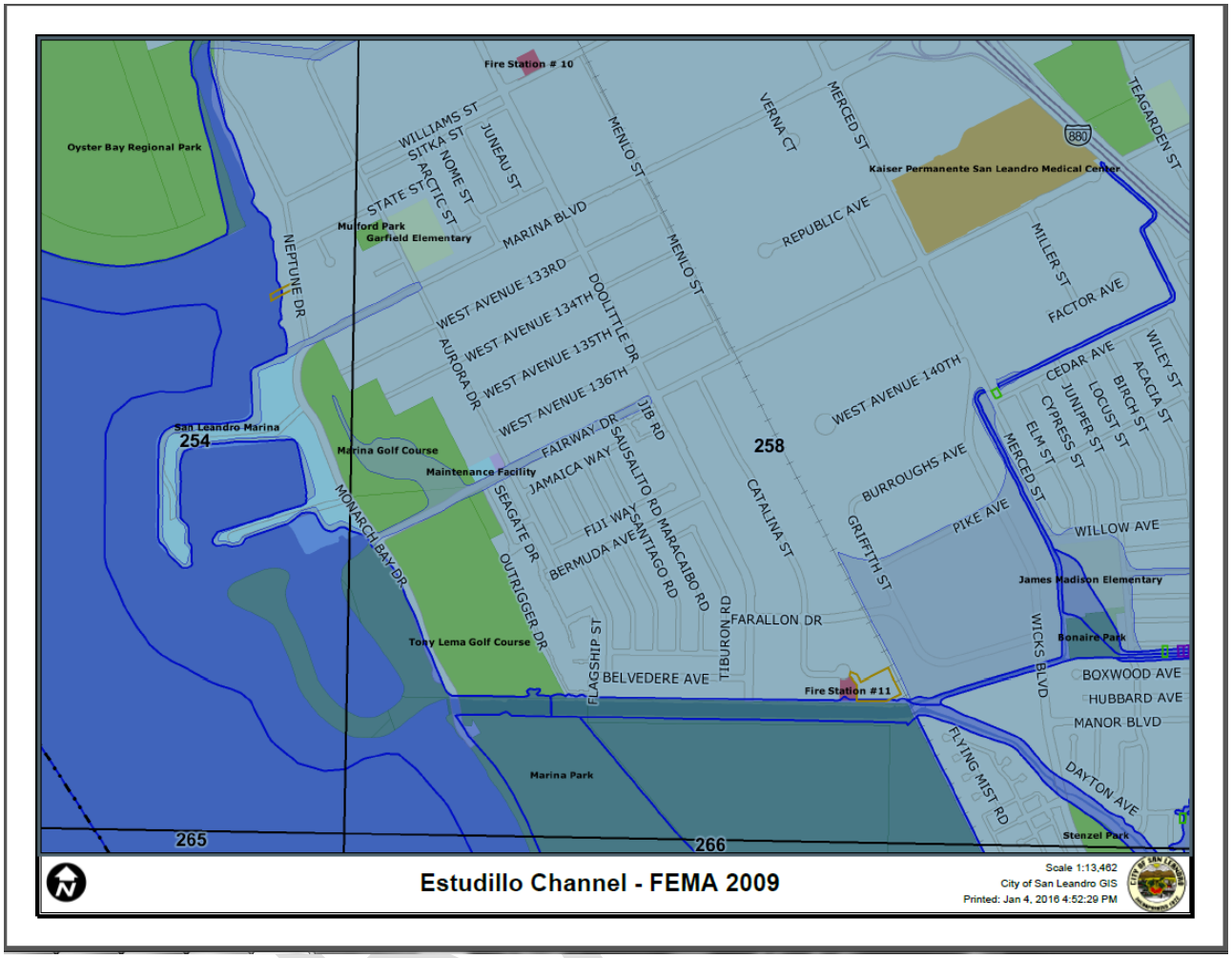
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TEAGARDEN ST
880
Kaiser Permanente San Leandro Medical Center
Mulford Park
Garfield Elementary
MARINA BLVD
REPUBLIC AVE
MILLER ST
FACTOR AVE
NEPTUNE DR
WEST AVENUE 133RD
WEST AVENUE 134TH
WEST AVENUE 135TH
WEST AVENUE 136TH
DOOLITTLE DR
AURORA DR
WEST AVENUE 140TH
CEDAR AVE
JUNIPER ST
CYPRESS ST
LOCUST ST
BIRCH ST
ACACIA ST
WILEY ST
ELM ST
MERCED ST
San Leandro Marina
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Marina Golf Course
Maintenance Facility
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JAMAICA WAY
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JIB RD
258
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PIKE AVE
WILLOW AVE
MONARCH BAY DR
SEAGATE DR
OUTRIGGER DR
FIJI WAY
BERMUDA AVE
SANTIAGO RD
MARACAIBO RD
CATALINA ST
GRIFFITH ST
James Madison Elementary
Bonaire Park
FARALLON DR
TIBURON RD
WICKS BLVD
Tony Lema Golf Course
FLAGSHIP ST
BELVEDERE AVE
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HUBBARD AVE
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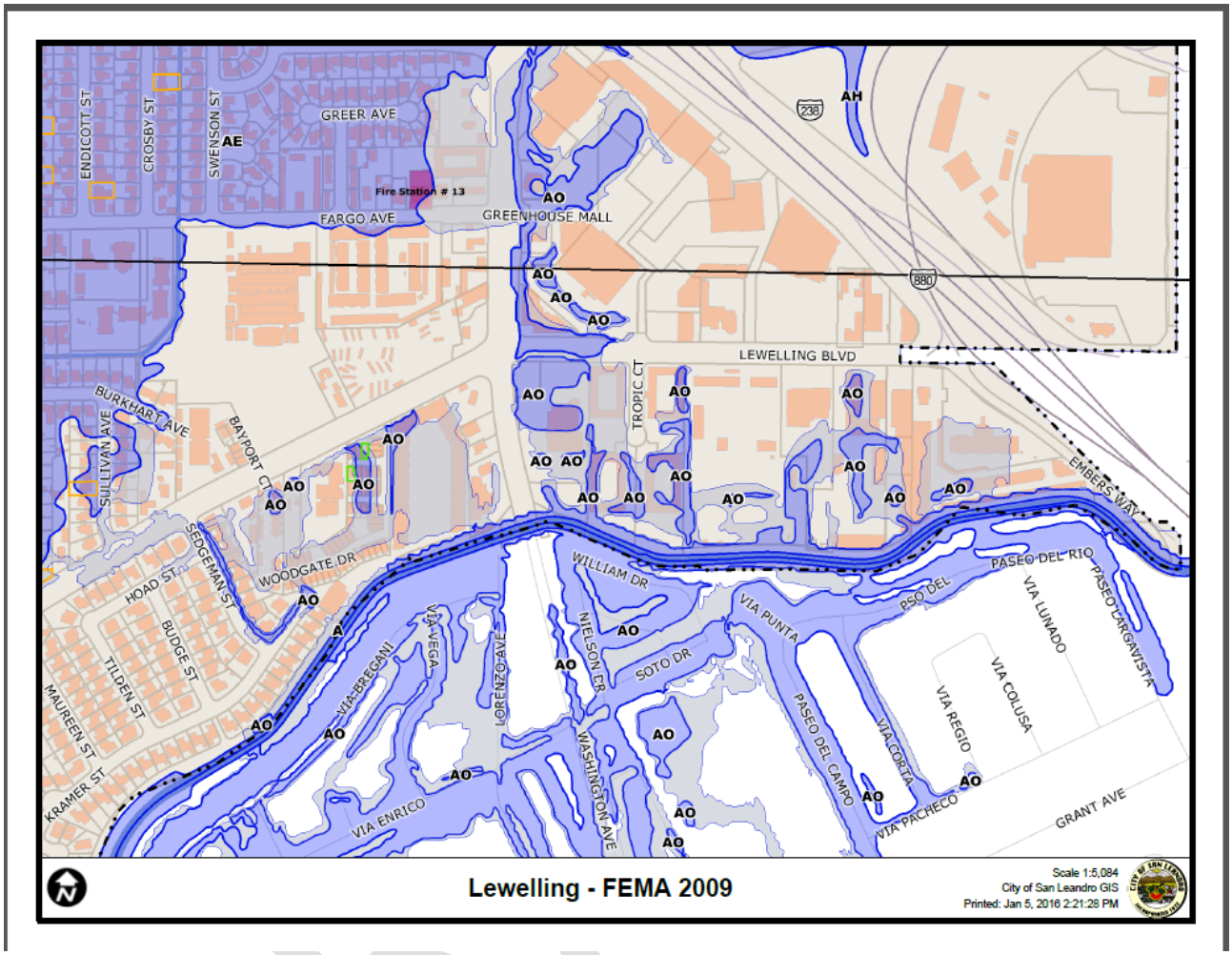
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TROPIC CT
BURKHART AVE
SULLIVAN AVE
BAYPORT CT
EMBERS WAY
SEDGEMAN ST
HOAD ST
WOODGATE DR
WILLIAM DR
PASEO DEL RIO
PSO DEL
VIA LUNADO
PASEO LARGAVISTA
VIA PUNTA
VIA COLUSA
VIA REGIO
VIA CORITA
PASEO DEL CAMPO
VIA PACHECO
GRANT AVE
SOTO DR
NIELSON CR
WASHINGTON AVE
LORENZO AVE
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VIA BREGANI
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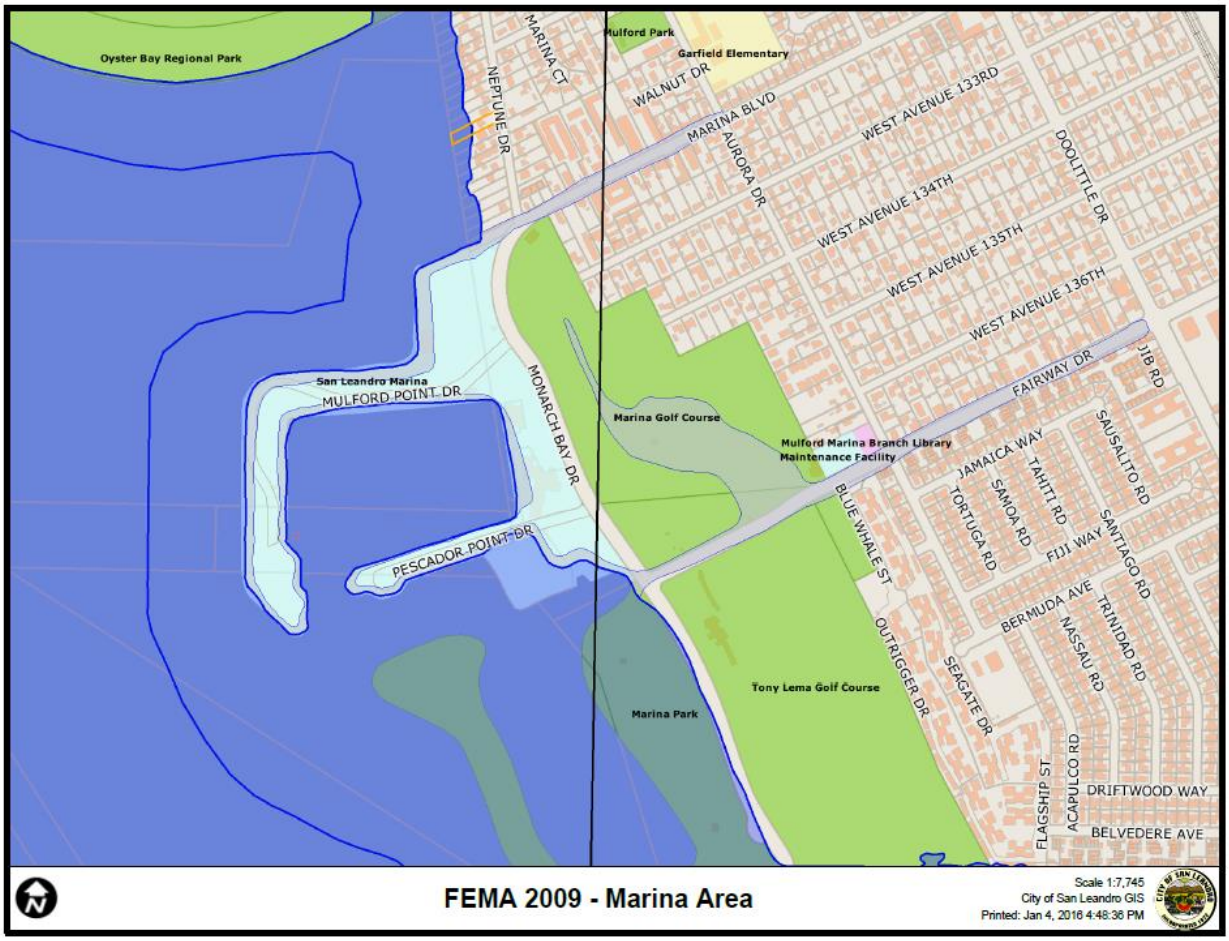
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WEST AVENUE 135TH
WEST AVENUE 136TH
DOOLITTLE DR
FAIRWAY DR
JIB RD
San Leandro Marina
MULFORD POINT DR
MONARCH BAY DR
Marina Golf Course
Mulford Marina Branch Library
Maintenance Facility
JAMAICA WAY
TAHITI RD
SAMOA RD
TORTUGA RD
SAUSALITO RD
FIJI WAY
SANTIAGO RD
BLUE WHALE ST
PESCADOR POINT DR
BERMUDA AVE
TRINIDAD RD
NASSAU RD
OUTRIGGER DR
SEAGATE DR
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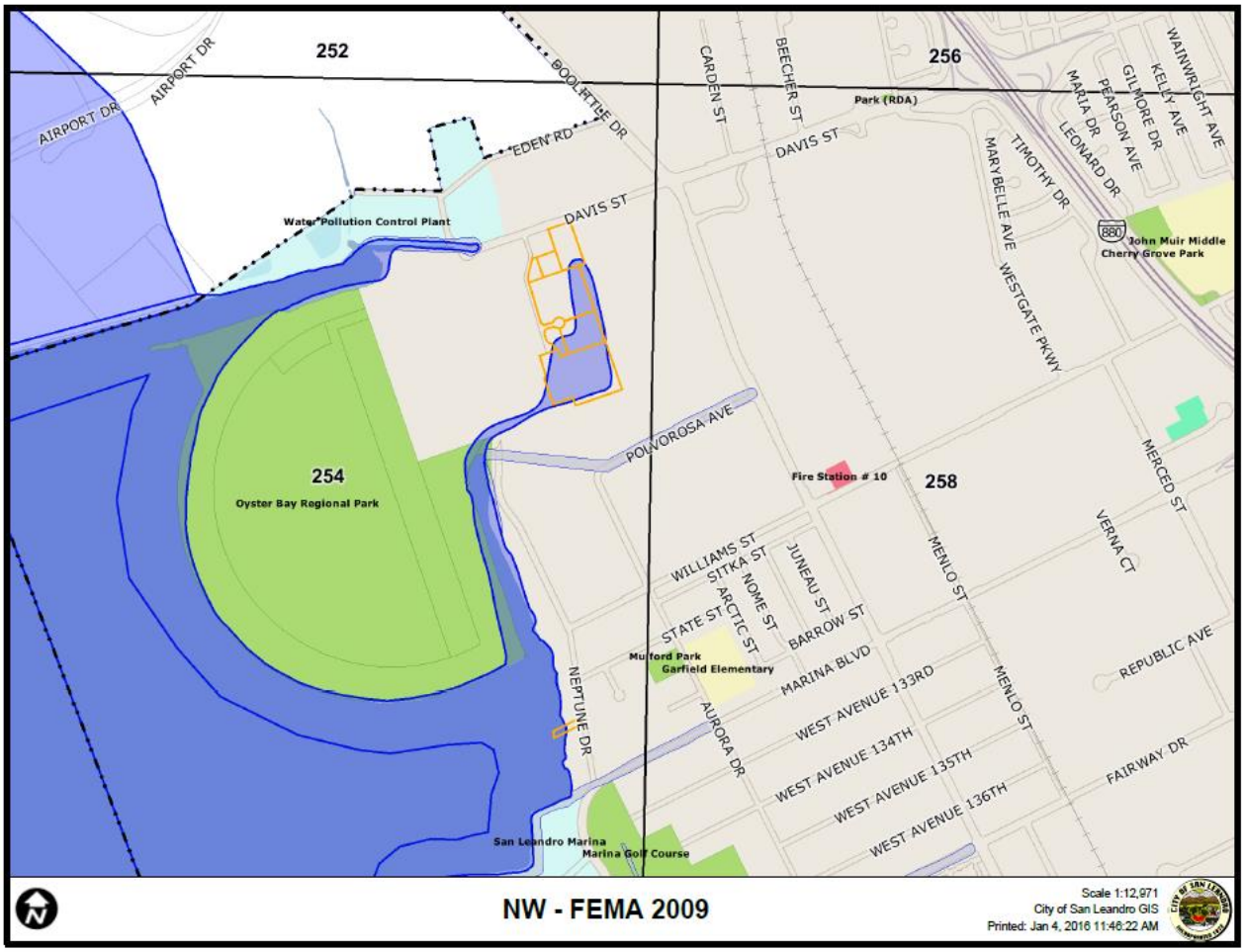
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Marina Golf Course
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BOOLARTHE DR
EDEN RD
DAVIS ST
CARDEN ST
BEECHER ST
MARIA DR
PEARSON AVE
GILMORE DR
KELLY AVE
WAINWRIGHT AVE
LEONARD DR
TIMOTHY DR
MARY BELLE AVE
WESTGATE PKWY
POLVOROSA AVE
MERCED ST
VERNA CT
WILLIAMS ST
SITKA ST
NOME ST
ARCTIC ST
JUNEAU ST
BARROW ST
STATE ST
MENLO ST
MARINA BLVD
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Memorial Park
City Hall
Fire Station # 9
Main Library
Parking Lot
Parking Garage
Pedestrian Mall
Parking
Vacant Building (RDA)
Open Space - Creek Walk
S.L. Creek
Casa Peralta, Museum/Gallery
Parking (RDA)
Estudillo Post Office
Thrasher Park
Thrasher Park/Skateboard Park
APRICOT ST
LEXINGTON AVE
FARRELLY DR
W BROADMOOR BLVD
GARCIA AVE
LAFAYETTE AVE
BELLEVIEW DR
PERSHING DR
STOAKES AVE
SUNNYSIDE DR
GEORGIA WAY
EUCLID AVE
BREED AVE
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DUTTON AVE
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WOODLAND AVE
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ARBOR DR
PALA AVE
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RAMONA WAY
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LEO AVE
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TOLER AVE
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JUBILEE LN
BURIAT ST
BLOOM ST
BIXCO ST
TIVOLI ST
TULIP LN
LOLA ST
ANTONIO ST
CAMELLIA CT
MINERVA ST
LUCILLE ST
PREDA ST
DABNER ST
ALVARADO ST
DAVIS ST
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ORCHARD AVE
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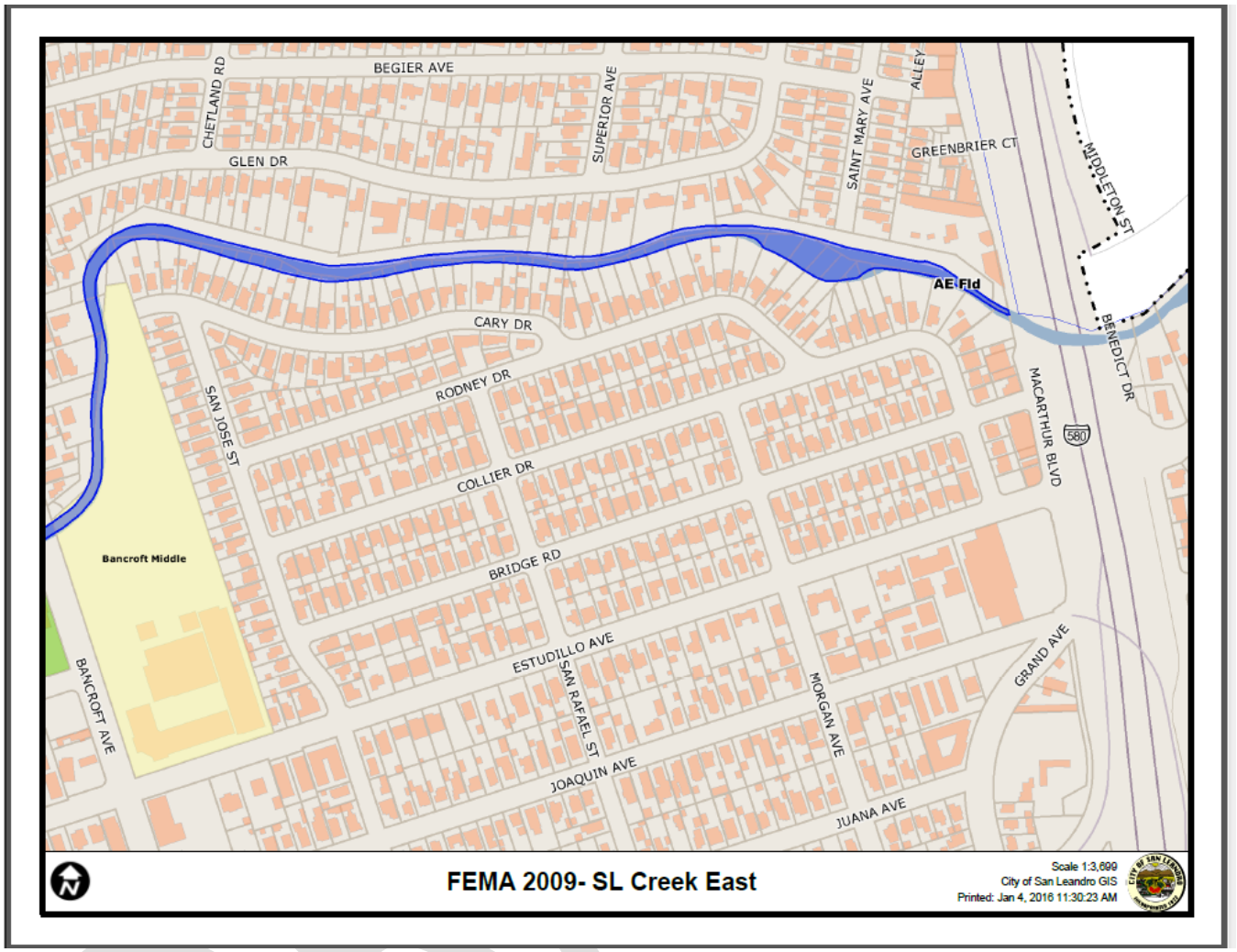
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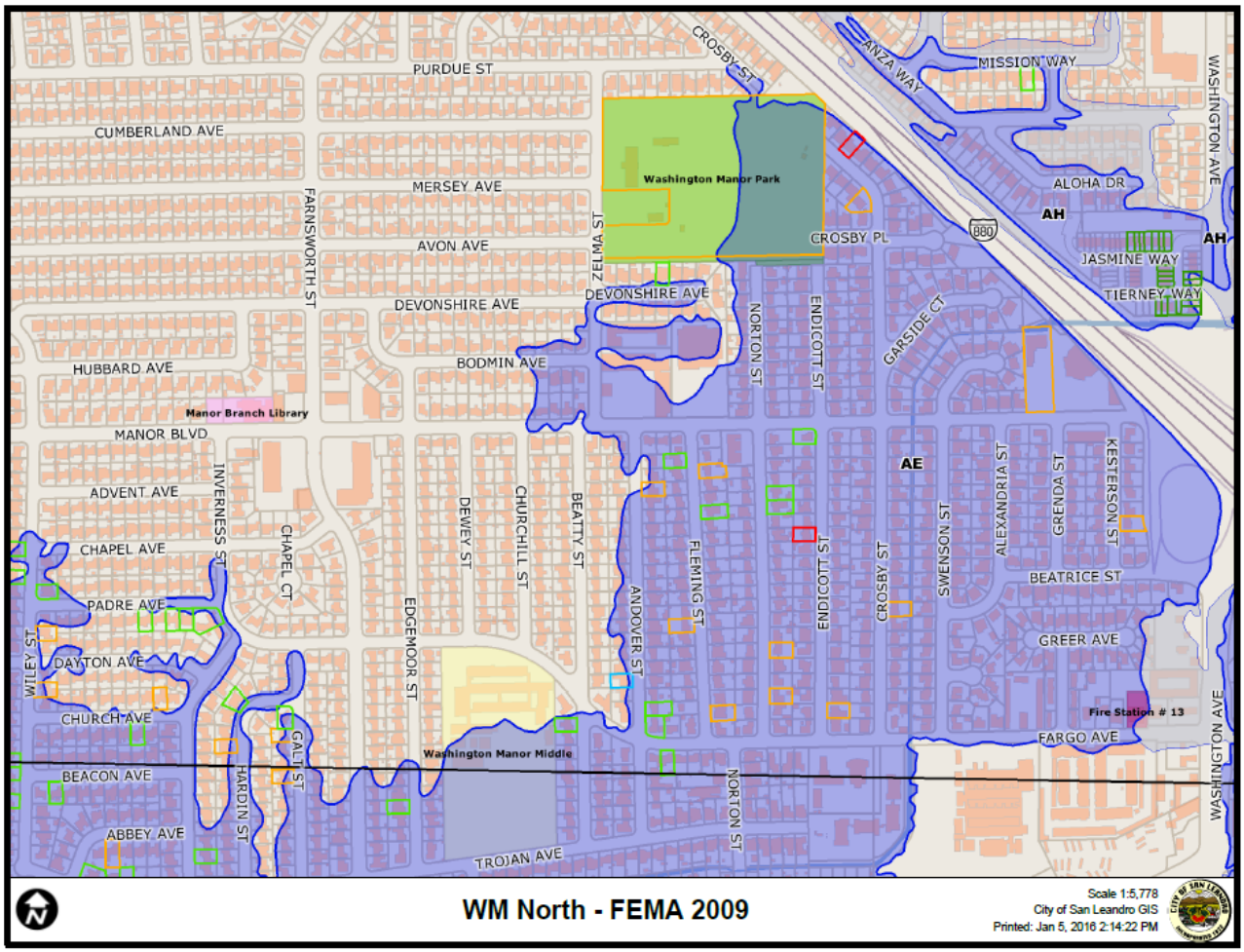
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BEACON AVE
ABBEY AVE
TROJAN AVE
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ZELMA ST
INVERNESS ST
CHAPEL CT
DEWEY ST
CHURCHILL ST
BEATTY ST
EDGEMOOR ST
WILEY ST
HARDIN ST
GALT ST
ANDOVER ST
FLEMING ST
NORTON ST
ENDICOTT ST
CROSBY ST
SWENSON ST
ALEXANDRIA ST
GRENDA ST
KESTERSON ST
GARSIDE CT
CROSBY PL
CROSBY ST
ANZA WAY
MISSION WAY
WASHINGTON AVE
ALOHA DR
JASMINE WAY
TIERNEY WAY
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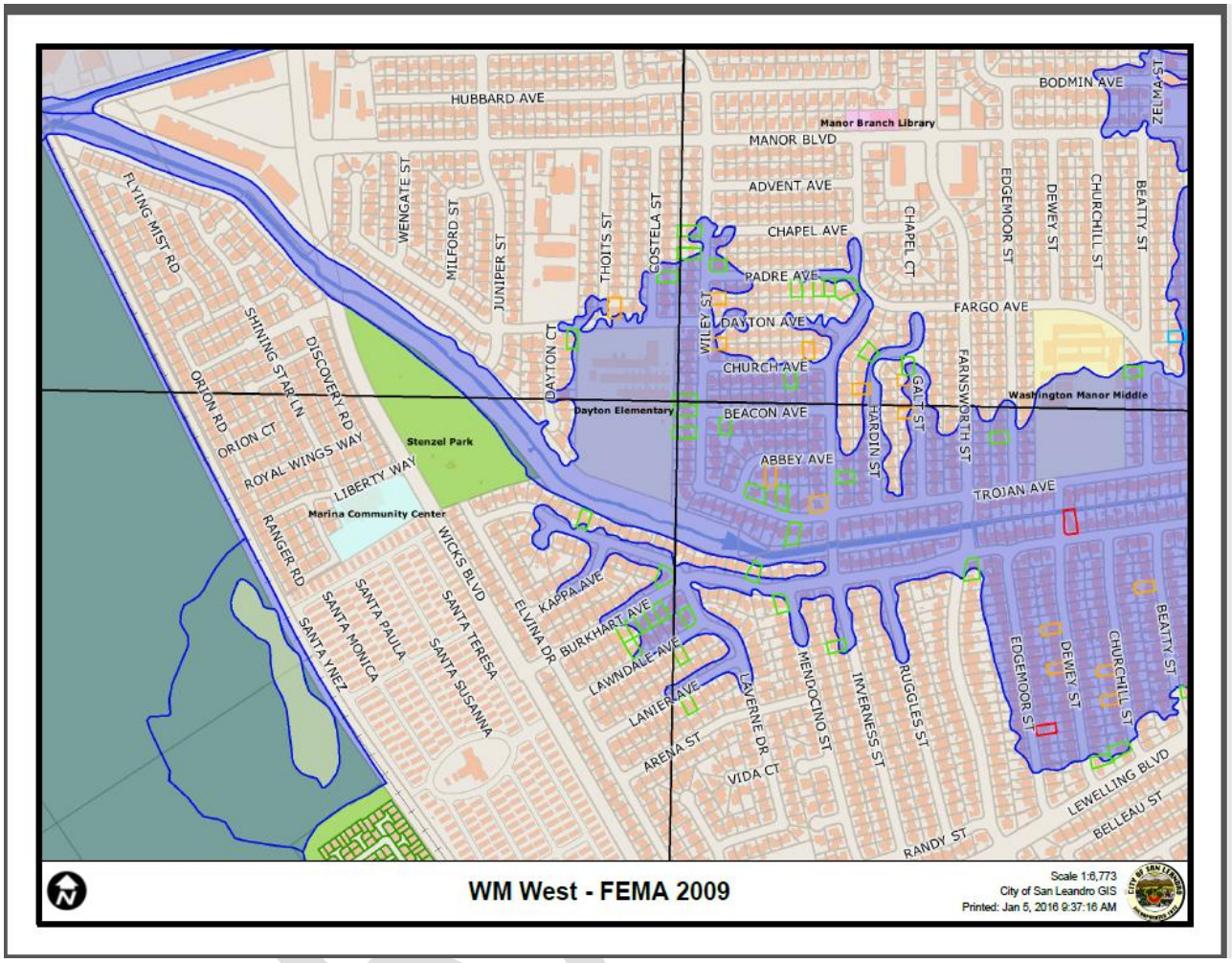
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ABBEY AVE
TROJAN AVE
FARGO AVE
Washington Manor Middle
Dayton Elementary
Stenzel Park
Marina Community Center
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SHINING STAR LN
DISCOVERY RD
ORION RD
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LIBERTY WAY
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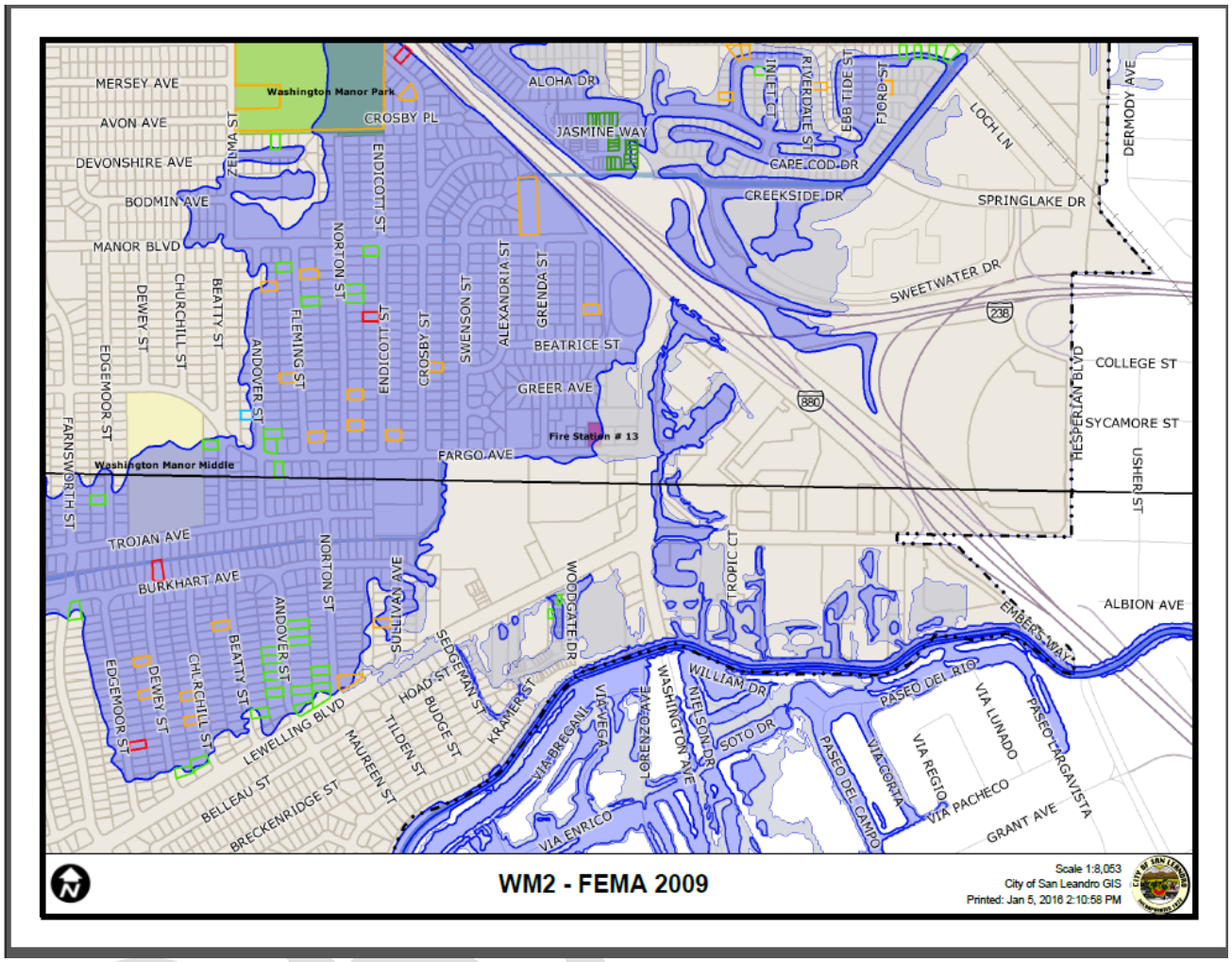
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