CITY OF OAKLAND

AGENDA REPORT

TO: Office of the City Administrator
ATTN: Deborah Edgerly
FROM: Oakland Fire Department
DATE: January 17, 2006

RE: RESOLUTION MAKING URGENCY FINDINGS AND APPROVING THE ASSOCIATION OF BAY AREA GOVERNMENTS (ABAG) MULTI-JURISDICTIONAL REPORT "TAMING NATURAL DISASTERS" AS THE CITY OF OAKLAND'S LOCAL HAZARD MITIGATION PLAN

SUMMARY

The federal Disaster Mitigation Act of 2000 requires all cities, counties, and special districts to have adopted a Local Hazard Mitigation Plan (LHMP) in order to receive disaster mitigation funding from the Federal Emergency Management Agency (FEMA).

The City of Oakland is in the process of applying for a federal hazard mitigation grant which totals approximately $3 million. FEMA recently clarified grant requirements, noting that City Council adoption of an LHMP was mandatory prior to FEMA's final approval of any local LHMP. This explanation, which reversed an earlier interpretation of this eligibility requirement, was communicated after the agenda for the January 17, 2006 City Council meeting was posted. FEMA further noted that the deadline for LHMP approval is now February 3, 2006, instead of April 14, 2006. As a result, an urgency finding exists.

This report recommends that the City of Oakland adopt the Association of Bay Area Governments (ABAG) multi-jurisdictional report, "Taming Natural Disasters," as the City of Oakland's Local Hazard Mitigation Plan. FEMA has already approved ABAG's report as a Local Hazard Mitigation Plan for the San Francisco Bay Area.

To ensure that the City's specific hazards are addressed, the Safety Element of the General Plan, adopted by Council Resolution No. 78915 C.M.S. on November 16, 2004, will serve as the foundation for a City of Oakland Annex in the ABAG Plan. FEMA has given preliminary approval to Oakland's Annex.

FISCAL IMPACT

Without an approved Local Hazard Mitigation Plan, the City of Oakland is not eligible to apply for hazard mitigation grants from FEMA.

Staff is currently working on an application for the 2006 Pre-Disaster Mitigation Grant. The grant potentially provides $3 million in funding for a proposed fuel mitigation project that partners the City of Oakland with University of California at Berkeley and the East Bay Regional Parks District.

BACKGROUND

Public Law 106-390, known as the Disaster Mitigation Act of 2000 (DMA 2000), amended the Robert T. Stafford Disaster Relief and Emergency Services Act. This Act requires local governments to have a Local Hazard Mitigation Plan (LHMP). An LHMP has to be approved by FEMA in order for a local government to be eligible to receive federal hazard mitigation project funding.

The Disaster Mitigation Act of 2000 reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. As such, this Act establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). DMA 2000 is intended to facilitate cooperation between state and local authorities, prompting them to work together. It encourages and rewards local and state pre-disaster planning and promotes sustainability as a strategy for disaster resistance. This enhanced planning network will better enable local and state governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

KEY ISSUES AND IMPACTS

The San Francisco Bay Area is subject to various earthquake-related hazards such as ground shaking, liquefaction, landslides, fault surface rupture, and tsunamis. Further, the Bay Area is subject to wildfires which affect open space and development in the urban fringe. The Bay Area is also subject to weather-related hazards, including floods and landslides. The City of Oakland acknowledges that disasters do not recognize city, county, or special district boundaries and as such, seeks to maintain and enhance a disaster-resistant City by reducing the potential loss of life, property damage, and environmental degradation from disasters, while accelerating economic recovery after a disaster.

Therefore, compliance with the federal Disaster Mitigation Act of 2000 is a desirable goal. To this end, the City of Oakland joined with other cities, counties, and special districts in the region to collaborate in preparing ABAG's multi-jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area. To date, approximately forty local jurisdictions have decided to participate in ABAG's Plan. Each participating jurisdiction submits documents to form an annex to the regional plan. In order to address Oakland's specific hazards, the Safety Element of Oakland's General Plan, known as "Protect Oakland," serves as the foundation for the City of Oakland Annex and is incorporated by reference into the Annex.

The City of Oakland has received preliminary approval of its Annex from FEMA. City Council adoption of ABAG's Local Hazard Mitigation Plan is the only regulatory step still required prior to final approval by FEMA.

The City of Oakland will lose its eligibility to apply for this grant unless the City has an approved Local Hazard Mitigation Plan in place prior to February 3, 2006. Loss of eligibility will have a substantial adverse impact on the City's vegetation management program, a cornerstone of the City's public safety efforts. High fuel load in wildland areas throughout the City was a key condition which contributed to the 1991 Oakland Hills Firestorm.

SUSTAINABLE OPPORTUNITIES

- Environmental: The City's efforts to mitigate the future impacts of fires, floods, accidental releases of hazardous materials, and other natural and human-caused disasters can be expected to result in improvements in environmental quality and public health.

- Social Equity: Oakland's Safety Element, and Oakland's Local Annex to the ABAG Multi-jurisdictional Hazard Mitigation Plan considers impacts to disadvantaged populations and areas of the City, including the interaction of industrial and residential land uses in West Oakland and the Fruitvale/San Antonio waterfront.

- Economic: By reducing the amount of property damage, and economic and social dislocation resulting from natural and human-caused hazards, the City's Safety Element and Oakland's Local Annex to the ABAG Multi-jurisdictional Hazard Mitigation Plan can be expected to reduce the time and money needed to recover from a disaster.

DISABILITY AND SENIOR CITIZEN ACCESS

Because emergency management plans serve all citizens, adoption of ABAG's multi-jurisdictional Local Hazard Mitigation Plan will have no obvious impact on equal opportunity or access to City programs, services, or activities for senior citizens or people with disabilities.

RECOMMENDATION

Staff recommends the Council accept the urgency finding and approve this report and resolution.

Respectfully submitted,

Daniel D. Farrell
Fire Chief

Prepared by: Coleen A. Bell
Emergency Planning Coordinator
Oakland Fire Department Office of
Emergency Services and

Kimberly Shunk
Administrative Services Manager
Oakland Fire Department Office of
Emergency Services

APPROVED FOR FORWARDING
TO THE CITY COUNCIL

Office of the City Administrator

Item: _____
Oakland City Council
January 17, 2006

Approved as to Form and Legality

City Attorney

OAKLAND CITY COUNCIL

OFFICE OF THE CITY CLERK OAKLAND

RESOLUTION No. _____ C.M.S.

2006 JAN 12 PM 1:25

RESOLUTION MAKING URGENCY FINDINGS AND APPROVING THE ASSOCIATION OF BAY AREA GOVERNMENTS (ABAG) MULTI-JURISDICTIONAL REPORT "TAMING NATURAL DISASTERS"AS THE CITY OF OAKLAND'S LOCAL HAZARD MITIGATION PLAN

WHEREAS, this matter is urgent any may be considered by the City Council for action on 72 hours notice pursuant to Oakland Municipal Code Title 2, Chapter 2.20, Article II, Section 2.20.080.E.2.a because the need to take action came to the attention of the local body after the 10-day agenda was posted, and immediate action is required to avoid a substantial adverse impact on the City as described in City Administrator's report accompanying this item; and

WHEREAS, the Bay Area is subject to various earthquake-related hazards such as ground shaking, liquefaction, landslides, fault surface rupture, and tsunamis; and

WHEREAS, the Bay Area is subject to wildfires which affect open space and development on the urban fringe; and

WHEREAS, the Bay Area is subject to various weather-related hazards including floods, and landslides; and

WHEREAS, the City of Oakland acknowledges that disasters do not recognize city, county, or special district boundaries; and

WHEREAS, the City of Oakland seeks to maintain and enhance a disaster-resistant City by reducing the potential loss of life, property damage, and environmental degradation from natural disasters, while accelerating economic recovery from those disasters; and

WHEREAS, the City of Oakland is committed to increasing the disaster resistance of the infrastructure, health, housing, economy, government services, education, environment, and land use systems in the City, as well as in the Bay Area as a whole; and

WHEREAS, the federal Disaster Mitigation Act of 2000 requires all cities, counties, and special districts to have adopted a Local Hazard Mitigation Plan to receive disaster mitigation funding from the Federal Emergency Management Agency (FEMA); and

WHEREAS, the Association of Bay Area Governments (ABAG) and FEMA have approved and adopted the ABAG report, **"Taming Natural Disasters,"** as the multi-jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area; and

WHEREAS, the Safety Element of the City of Oakland's General Plan, known as "Protect Oakland," was adopted by Council Resolution No. 78915 C.M.S. on November 16, 2004, and was intended to serve as the foundation for Oakland's Local Hazard Mitigation Plan; and

WHEREAS, "Protect Oakland," augmented with ABAG's regionally developed strategies and introductory material, has been incorporated as a City of Oakland Annex into ABAG's multi-jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area; now therefore be it

RESOLVED: That the City Council hereby finds and determines that this matter is urgent and may be considered for action on 72 hours notice pursuant to Oakland Municipal Code Title 2, Chapter 2.20, Article II, Section 2.20.080.E.2.a, because the need to take action came to the attention of the local body after the 10-day agenda was posted, and immediate action is required to avoid a substantial adverse impact on the City as described in City Administrator's report accompanying this item; and, be it

FURTHER RESOLVED: That the City of Oakland adopts, and adapts with its Local Hazard Mitigation Plan Annex, ABAG's multi-jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area as Oakland's Local Hazard Mitigation Plan; and, be it

FURTHER RESOLVED: That the City of Oakland commits to continuing to take those actions and initiating further actions, as appropriate, as identified in the City of Oakland Local Hazard Mitigation Plan Annex to the ABAG multi-jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area.

IN COUNCIL, OAKLAND, CALIFORNIA, _____, 20_____

PASSED BY THE FOLLOWING VOTE:

AYES- BROOKS, BRUNNER, CHANG, NADEL, QUAN, REID, KERNIGHAN and PRESIDENT DE LA FUENTE

NOES-

ABSENT-

ABSTENTION-

ATTEST:_____
LaTonda Simmons
City Clerk and Clerk of the Council
of the City of Oakland, California

Taming Natural Disasters

Multi-Jurisdictional Local Government Hazard Mitigation Plan for the San Francisco Bay Area

Adopted by ABAG Executive Board - March 17, 2005

ASSOCIATION OF BAY AREA GOVERNMENTS

BACKGROUND

The purpose of this Local Hazard Mitigation Plan document is to serve as a catalyst for a dialog on public policies needed to mitigate the natural hazards that affect the San Francisco Bay Area.

The overall strategy is to use this multi-jurisdictional effort to not only maintain and enhance the disaster resistance of our region, but also to fulfill the requirements of the Disaster Mitigation Act of 2000 for all local governments to develop and adopt this type of plan.

For purposes of this plan, local governments include not only the cities and counties of our region, but also special districts with elected boards.

For information complete information on ABAG's Local Hazard Mitigation Planning Effort, including interactive hazard mapping and risk assessment, see our Internet site at: *http://quake.abag.ca.gov/mitigation*

ABAG Publication Number: P05001EQK

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Credits

Principal Project Manager:

Jeanne B. Perkins – Earthquake Program Manager, Association of Bay Area Governments

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Brian Kirking – Senior Planner and Data Analyst
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The writing and production of this report was funded by Grant No. PDM-03 PL04 from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) through the California Governor's Office of Emergency Services, as well as by the Association of Bay Area Governments and, through in-kind services, the local governments of the Bay Area.

Goals

Our Challenge

The San Francisco Bay Area is in a spectacular region with valleys and ridges, views and access to rivers, the ocean, and the Bay, and a mild climate. It is also home to 7 million people and has a $400 billion economy[1].

But many of those ridges and valleys have been formed by active earthquake faults that can generate devastating shaking and ground failures. The typically mild climate is subject to occasional winter storms leading to landslides in the hills and flooding of the valleys. During the fire season, typically from May through November, the region is subject to periods of Diablo Winds bringing high temperatures, gusting winds, and low humidity. Tinder-dry trees, brush, and grasslands are subject to fires that can become catastrophic on the edges of urban development. Given an increasingly mobile population, our citizens and crops are subject to disease epidemics. Natural disasters can lead to secondary events that are disasters in themselves, including hazmat releases and dam failures. During the period from 1950 – 2000, all or part of the Bay Area was subjected to 56 disasters, or about a third of the 181 occurring in the entire State of California during that time[2].

These hazards are not new, and neither are the risks to lives, property, the environment, and our economy. Bay Area local governments, together with private utilities and the state, have created programs and regulations that are as creative and comprehensive as any region in the world.

Overall Goal

To maintain and enhance a disaster-resistant region by reducing the potential loss of life, property damage, and environmental degradation from natural disasters, while accelerating economic recovery from those disasters.

We need to continue to work to reduce and avoid risks from natural hazards to protect lives, property, the environment, and our economy.

This natural hazard mitigation plan is a joint effort by the cities, counties, and special districts in the Bay Area to build a more disaster-resistant region. We recognize that disasters do not respect the boundaries between our individual jurisdictions and have worked together to identify our hazards, assess our risks, and develop this goal, eight commitments, and a comprehensive list of strategies (or actions) to mitigate the identified risks.

We view this plan as a shared mental model of our overall goal, commitments, and mitigation actions. ***We can no longer afford random acts of preparedness and mitigation.***

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[1] Fassinger and others, 2003 – ***ABAG's Projections 2003***. Economy is based on annual Gross Regional Product (GRP).

[2] California Governor's Office of Emergency Services database of disasters and major states of emergencies.

Commitments

The overall goal is being addressed by asking all local governments in the Bay Area to adopt formal resolutions in support of the following eight ***commitments areas***. These commitments are not organized by hazard, but by the types of services supplied either directly, or indirectly, by local governments. With this organization, ***each*** of the Bay Area's cities and counties should find ways to address these major commitments by reducing identified risks. In addition, the Bay Area's special districts can address many of these commitments, depending on the role and responsibilities of that district. ***Together, we are committed to increasing the disaster resistance of the infrastructure, health, housing, economy, government services, education, environment, and land use systems in the Bay Area.***

1. Infrastructure
Bay Area transportation and utility facilities and networks are vital lifelines during and following disasters, as well as in the functioning of our region and its economy.

2. Health
Bay Area facilities, networks, and systems providing care of sick and those with special needs need to be resilient after disasters for these systems will need to care for additional injured at the same time as those currently cared for are stressed.

3. Housing
Bay Area residents need to have safe and disaster-resistant housing that is architecturally diverse and serves a variety of household sizes and incomes.

4. Economy
Safe, disaster-resilient, and architecturally diverse downtown commercial areas, business and industrial complexes, and office buildings are essential to the overall economy of the Bay Area.

5. Government Services
Bay Area city and county governments, as well as community services agencies, provide essential services during and immediately following disasters, as well as critical functions during recovery, that need to be resistant to disasters.

6. Education
Safe and disaster-resistant school, education, and childcare-related facilities are critical to the safety of our children, as well as to the quality of life of Bay Area families.

7. Environment
Disaster resistance needs to further environmental sustainability, reduce pollution, strengthen agriculture resiliency, and avoid hazardous material releases in the Bay Area.

8. Land Use
Land use change needs to be accompanied by a respect for hazardous areas and facilities, as well as recognize the interconnected nature of the Bay Area.

Implementation Strategies

Background on Implementation Strategy Organization

The implementation strategies, or action items, are listed under the eight major commitments identified on the previous page, rather than by hazard. As stated in the previous section, with this organization, ***each*** of the Bay Area's cities and counties should find ways to address these major commitments by reducing identified risks. In addition, the Bay Area's special districts can address many of these commitments, depending on the role and responsibilities of that district.

Any scheme to identify a comprehensive list of potential strategies is bound to have some overlaps. This list is no exception. Because those ideas listed under housing and economy have at their core the relationship between government and the people who live and work in their jurisdictions, there is overlap. City and counties, as well as special districts handling lifelines and schools, have buildings that are critical to their functioning, so there is duplication in the discussion of these issues.

Most of the strategies listed are clearly within the definition of "hazard mitigation," that is, "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards."[3] The strategies address all of the hazards identified when performing the risk assessment work described in Appendix C. In addition, there are four notable areas where we have "pushed" this definition.

- The first is in the area of public education. Author Stephen Flynn notes in his 2004 book[4] in a plea for greater public education following 9/11 that federal "security officials often act as though members of the American public are either potential recruits for an easily panicked mob or a passive part of a haystack that must constantly be sifted through to find terrorist needles." The Bay Area learned this lesson twelve years earlier in 1989 as a result of the Loma Prieta earthquake. People who live and work in our region also need to understand our hazards so that they can take appropriate mitigation measures in their homes, schools, and work places.

- Second, we have included under ***Government Services*** several ideas to "*Maintain and Enhance Local Government's Emergency Response and Recovery Capacity.*" These ideas have been included because we believe that many go well beyond the traditional response activities of city and county police and fire services.

- Several strategies are drafted so that they apply to natural – and security – hazards, such as the mitigation of disasters resulting from weapons of mass destruction. Hazmat releases and dam failures due to flooding, earthquakes, or terrorism have some similar impacts and therefore some similar mitigation strategies. Some methods of combating "common" crime and violence may deter major terrorist actions.

- Finally, the strategies dealing with health, both under the ***Health*** commitment, as well as sprinkled elsewhere in this document, have traditionally been funded by the Centers for Disease Control and Prevention (CDC), rather than FEMA. They also may involve the use of the National Disaster Medical System under U.S. Health and Human Services (including both uniformed and non-uniformed medical personnel under the U.S. Surgeon General). We view this Local Hazard Mitigation Plan, while a requirement of the Disaster Mitigation Act of 2000 being administered by FEMA, as an opportunity to build administrative bridges in the public health field. For example, local government actions to deal with managing "natural" deadly pathogens such as SARS, AIDS, West Nile, and mad cow disease in an increasingly mobile world can also assist in the response to bioterrorism.

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[3] Stafford Act (44 CFR 206:401)

[4] Flynn, Stephen. 2004. ***America the Vulnerable: How Our Government Is Failing to Protect Us from Terrorism***. HarperCollins Publishers, New York, page 160.

Status and Priorities

For each of the following potential mitigation strategies, local governments have been asked to choose their own priority for this strategy. The priorities in each of these local government Annexes were selected based on:

- the level of hazards identified in Appendix C,
- the Bay Area preliminary risk assessment conducted and described in Appendix C,
- supplementary hazard and risk assessment information developed by ABAG for each local government on the interactive internet site http://quake.abag.ca.gov/mitigation, and
- any specific studies conducted by the local government and included in that local government's Annex to this plan.

The priorities for each local government participating in this multi-jurisdictional plan are in that local government's ***Annex*** to this plan.

[ ] Existing program
Responsible agency or department _____
Provide ordinance or resolution number, if applicable _____

[ ] Very High priority – to be adopted by local government immediately
Responsible agency or department _____

[ ] High priority – to be adopted by local government as soon as funding and resources allow
Agency responsible for seeking and administering funding _____
Sources of potential funding _____
Estimated amount of funding needed _____

[ ] Moderate priority – will be adopted by local government as funding and resources allow

[ ] Under study
Responsible agency or department _____
Provide estimated date of completion _____

[ ] Not applicable, not appropriate, or not cost effective

[ ] Not yet considered

This list is a "work in progress." It will expand and change over time, hopefully becoming as dynamic as the restless earth whose hazards demand our attention. It is not meant to discourage local experimentation with alternative strategies. Rather, it is meant to be a list of both common and innovative practices. In addition, local governments choosing to reword specific strategies to meet their local needs, or to be more specific in their strategies, are encouraged to do so.

Some of the strategies will not be appropriate for some jurisdictions, but all jurisdictions should be able to address the general commitments with identifiable actions. Valid risk management requires a careful weighing of the advantages and disadvantages of action. ***Thus, while some strategies may be appropriate for some jurisdictions, those same strategies may not be appropriate or may not be cost effective for others.*** Over time, we are committed to developing better hazard and risk information to use in making those trade-offs. We are not trying to create

a disaster-proof region, but a disaster-resistant one. Finally, the cost of strategies varies greatly. Some of the most cost-effective relate to building and maintaining partnerships, not buildings.

Following approval of this plan by FEMA, ABAG will include the comprehensive strategies identified by all of these local governments Annexes as an interactive searchable database on that same internet site at http://quake.abag.ca.gov/mitigation. This interactive capability should begin to assist the California Office of Emergency Services in its efforts to monitor the effectiveness of this Local Hazard Mitigation Plan. For example, since this list of strategies has been conceived as a comprehensive list of "best practices," strategies given relatively lower priorities by most local governments might be viewed as a multi-jurisdictional weakness, while those utilized and given a relatively high priority by most local governments might be viewed as a multi-jurisdictional strength.

Decisions on those strategies utilized and given a relatively high priority have been based on a variety of criteria, not simply on an economic cost-benefit analysis. These criteria include being technically and administratively feasible, politically acceptable, socially appropriate, legal, economically sound, and not harmful to the environment or our heritage.

Scope of Mitigation Strategies -New and Existing Development

Not only are the mitigation strategies have been designed to cover all of the hazards identified during the development of the natural hazard risk assessment for the plan as described in Appendix C, but the strategies also are designed to apply to existing development, new development, and even land use planning. For example, many of the strategies in infrastructure, housing, and economy focus on existing buildings, while many of those in land use focus on new development and general land use planning.

1. Infrastructure (INFR)

Bay Area transportation and utility facilities and networks are vital lifelines during and following disasters, as well as in the functioning of our region and its economy.

INFR-a. ***Multi-hazard***

1) Assess the vulnerability of critical facilities designated by lifeline operators[5] to damage in natural disasters or security threats, including facilities owned outside of the Bay Area that can impact service delivery within the region.
2) Comply with State of California and federal requirements to assess the vulnerability of dams to damage from earthquakes, seiches, landslides, liquefaction, or security threats.
3) Encourage the cooperation of utility system providers and cities, counties, and other special districts to develop strong and effective mitigation strategies for infrastructure systems and facilities.
4) Retrofit or replace critical lifeline facilities and/or their backup facilities that are shown to be vulnerable to damage in natural disasters.

[5] Lifeline agencies, departments, and districts are those that operate transportation and utility facilities and networks.

5) Support and encourage efforts of ***other*** (lifeline) agencies as they plan for and arrange financing for seismic retrofits and other disaster mitigation strategies. (For example, a city might pass a resolution in support of a transit agency's retrofit program.)
6) Plan for speeding the repair and functional restoration of lifeline systems through stockpiling of shoring materials, temporary pumps, surface pipelines, portable hydrants, and other supplies, such as those available through the Water Agency Response Network (WARN).
7) Engage in, support, and/or encourage research by others on measures to further strengthen transportation, water, sewer, and power systems so that they are less vulnerable to damage in disasters.
8) Pre-position emergency power generation capacity (or have rental/lease agreements for these generators) in critical buildings of cities, counties, and special districts to maintain continuity of government and services.
9) Have back-up emergency power available for critical intersection traffic lights.
10) Develop unused or new pedestrian rights-of-way as walkways to serve as additional evacuation routes (such as fire roads in park lands).
11) Coordinate with PG&E and others to investigate ways of minimizing the likelihood that power interruptions will adversely impact vulnerable communities, such as the disabled and the elderly.
12) Encourage replacing aboveground electric and phone wires and other structures with underground facilities, and use the planning-approval process to ensure that all new phone and electrical utility lines are installed underground.
13) Coordinate with the State Division of Safety of Dams to ensure an adequate timeline for the maintenance and inspection of dams, as required of dam owners by State law.
14) Encourage communication between State OES, FEMA, and utilities related to emergencies occurring outside of the Bay Area that can affect service delivery in the region.
15) Ensure that transit operators, private ambulance companies, cities, and/or counties have mechanisms in place for medical transport during and after disasters that take into consideration the potential for reduced capabilities of roads following these same disasters.
16) Effectively utilize the Transportation Management Center (TMC), the staffing of which is provided by Caltrans, the CHP and MTC. The TMC is designed to maximize safety and efficiency throughout the highway system. It includes the Emergency Resource Center (ERC) which was created specifically for primary planning and procedural disaster management.

INFR-b. ***Earthquakes***

1) Expedite the funding and retrofit of seismically-deficient city- and county-owned bridges and road structures by working with Caltrans and other appropriate governmental agencies.
2) Establish a higher priority for funding seismic retrofit of existing transportation and infrastructure systems (such as BART) than for expansion of those systems.

3) Include "areas subject to high ground shaking, earthquake-induced ground failure, and surface fault rupture" in the list of criteria used for determining a replacement schedule for pipelines (along with importance, age, type of construction material, size, condition, and maintenance or repair history).
4) Install specially-engineered pipelines in areas subject to faulting, liquefaction, earthquake-induced landsliding, or other earthquake hazard.
5) Replace or retrofit water-retention structures that are determined to be structurally deficient.
6) Install portable facilities (such as hoses, pumps, emergency generators, or other equipment) to allow pipelines to bypass failure zones such as fault rupture areas, areas of liquefaction, and other ground failure areas (using a priority scheme if funds are not available for installation at all needed locations).
7) Install earthquake-resistant connections when pipes enter and exit bridges.
8) Comply with all applicable building and fire codes, as well as other regulations (such as state requirements for fault, landslide, and liquefaction investigations in particular mapped areas) when constructing or significantly remodeling infrastructure facilities.
9) Clarify to workers in critical facilities and emergency personnel, as well as to elected officials and the public, the extent to which the facilities are expected to perform only at a life safety level (allowing for the safe evacuation of personnel) or are expected to remain functional following an earthquake.
10) Examine the feasibility of developing a water-borne transportation "system" – comprised mainly of relatively inexpensive barges – across the Bay for use in the event of major earthquakes. Implementation of such a system could prove extremely useful in the event of structural failure of either the road-bridge systems or BART and might serve as an adjunct to existing transportation system elements in the movement of large numbers of people and/or goods.

INFR-c. ***Wildfire***

1) Ensure a reliable source of water for fire suppression (meeting acceptable standards for minimum volume and duration of flow) for existing and new development.
2) Develop a coordinated approach between fire jurisdictions and water supply agencies to identify needed improvements to the water distribution system, initially focusing on areas of highest wildfire hazard.
3) Develop a defensible space vegetation program that includes the clearing or thinning of (a) non-fire resistive vegetation within 30 feet of access and evacuation roads and routes to critical facilities, or (b) all non-native species (such as eucalyptus and pine, but not necessarily oaks) within 30 feet of access and evacuation roads and routes to critical facilities.
4) Ensure all dead-end segments of public roads in high hazard areas have at least a "T" intersection turn-around sufficient for typical wildland fire equipment.
5) Enforce minimum road width of 20 feet with an additional 10-foot clearance on each shoulder on ***all*** driveways and road segments greater than 50 feet in length in wildfire hazard areas.

6) Require that development in high fire hazard areas provide adequate access roads (with width and vertical clearance that meet the minimum standards of the *Fire Code* or relevant local ordinance), onsite fire protection systems, evacuation signage, and fire breaks.
7) Ensure adequate fire equipment road or fire road access to developed and open space areas.
8) Maintain fire roads and/or public right-of-way roads and keep them passable at all times.

INFR-d. ***Flooding***

1) Conduct a watershed analysis of runoff and drainage systems to predict areas of insufficient capacity in the storm drain and natural creek system.
2) Develop procedures for performing a watershed analysis to look at the impact of development on flooding potential downstream, including communities outside of the jurisdiction of proposed projects.
3) Conduct a watershed analysis at least once every three years.
4) Assist, support, and/or encourage the U.S. Army Corp of Engineers, various Flood Control and Water Conservation Districts, and other responsible agencies to locate and maintain funding for the development of flood control projects that have high cost-benefit ratios (such as through the writing of letters of support and/or passing resolutions in support of these efforts).
5) Pursue funding for the design and construction of storm drainage projects to protect vulnerable properties, including property acquisitions, upstream storage such as detention basins, and channel widening with the associated right-of-way acquisitions, relocations, and environmental mitigations.
6) Continue to repair and make structural improvements to storm drains, pipelines, and/or channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.
7) Continue maintenance efforts to keep storm drains and creeks free of obstructions, while retaining vegetation in the channel (as appropriate), to allow for the free flow of water.
8) Enforce provisions under creek protection, stormwater management, and discharge control ordinances designed to keep watercourses free of obstructions and to protect drainage facilities to confirm with the Regional Water Quality Control Board's Best Management Practices.
9) Develop an approach and locations for various watercourse bank protection strategies, including for example, (1) an assessment of banks to inventory areas that appear prone to failure, (2) bank stabilization, including installation of rip rap, (3) stream bed depth management using dredging, and (4) removal of out-of-date coffer dams in rivers and tributary streams.
10) Use reservoir sediment removal as one way to increase storage for both flood control and water supply.
11) Elevate critical bridges affected by flooding to increase stream flow and maintain critical access and egress routes.

12) Provide a mechanism to expedite the repair or replacement of levees that are vulnerable to collapse from earthquake-induced shaking or liquefaction, rodents, and other concerns, particularly those protecting critical infrastructure.
13) Ensure that utility systems in new developments are constructed in ways that reduce or eliminate flood damage.
14) Determine whether or not wastewater treatment plants are protected from floods, and if not, investigate the use of flood-control berms to not only protect from stream or river flooding, but also increasing plant security.
15) Work cooperatively with water agencies, flood control districts, Caltrans, and local transportation agencies to determine appropriate performance criteria for watershed analysis.
16) Work for better cooperation among the patchwork of agencies managing flood control issues.
17) Work cooperatively with upstream communities to monitor creek and watercourse flows to predict potential for flooding downstream.

INFR-e. ***Landslides***

1) Include "areas subject to ground failure" in the list of criteria used for determining a replacement schedule (along with importance, age, type of construction material, size, condition, and maintenance or repair history) for pipelines.
2) Establish requirements in zoning ordinances to address hillside development constraints in areas of steep slopes that are likely to lead to excessive road maintenance or where roads will be difficult to maintain during winter storms due to landsliding.

INFR-f. ***Building Reoccupancy***

1) Ensure that critical buildings owned or leased by special districts or private utility companies participate in a program similar to San Francisco's Building Occupancy Resumption Program (BORP). The BORP program permits owners of buildings to hire qualified structural engineers[6] to create facility-specific post-disaster inspection plans and allows these engineers to become automatically deputized as City/County inspectors for these buildings in the event of an earthquake or other disaster. This program allows rapid reoccupancy of the buildings.

INFR-g. ***Public Education***

1) Provide materials to the public related to planning for power outages.
2) Provide materials to the public related to family and personal planning for delays due to traffic or road closures.
3) Provide materials to the public related to coping with reductions in water supply or contamination of that supply.
4) Provide materials to the public related to coping with disrupted storm drains, sewage lines, and wastewater treatment.

[6] A qualified structural engineer is a California licensed structural engineer with relevant experience.

5) Facilitate and/or coordinate the distribution of materials that are prepared by others, such as by placing materials in city or utility newsletters, or on community access channels, as appropriate.

2. Health (HEAL)

Bay Area facilities, networks, and systems providing care of sick and those with special needs need to be resilient after disasters for these systems will need to care for additional injured at the same time as those currently cared for are stressed.

HEAL-a. ***Hospitals and Other Critical Health Care Facilities***[7]

1) Work with critical health care facilities operators to ensure that critical facilities are structurally sound and have nonstructural systems designed to remain functional following disasters (as required for acute-care hospitals for earthquakes by State law).
2) Encourage hospitals to work with the California Office of Statewide Health Planning and Development (OSHPD) to formalize arrangements with structural engineers to report to the hospital, assess damage, and determine if the buildings can be reoccupied. The program should be similar to San Francisco's Building Occupancy Resumption Program (BORP) that permits owners of buildings to hire qualified structural engineers to create building-specific post-disaster inspection plans and allows these engineers to become automatically deputized as inspectors for these buildings in the event of an earthquake or other disaster. OSHPD, rather than city/county building departments, has the authority and responsibility for the structural integrity of hospital structures.
3) Ensure health care facilities are adequately prepared to care for victims with respiratory problems related to smoke and/or particulate matter inhalation.
4) Ensure these health care facilities have the capacity to shut off outside air and be self-contained.
5) Ensure that hospitals and other major health care facilities have auxiliary water and power sources.
6) Work with health care facilities to institute isolation capacity should a need for them arise following a communicable disease epidemic.
7) Develop printed materials, utilize existing materials (such as developed by FEMA and the American Red Cross), conduct workshops, and/or provide outreach encouraging employees of these critical health care facilities to have family disaster plans and conduct mitigation activities in their own homes.

[7] Critical care facilities include hospitals, long-term care, primary care, or specialty clinics (such as dialysis clinics), home health agencies, or hospices.

HEAL-b. ***Ancillary Health-Related Facilities***[8]

1) Work with State of California licensing agencies to identify these ancillary facilities in your community.
2) Encourage ancillary facility operators to develop disaster mitigation plans.
3) Encourage ancillary facility operators to create, maintain, and/or continue partnerships with local governments to develop response and recovery plans.

HEAL-c. ***Environmental Health***

1) Create and/or participate in discussion forums for food and health personnel, including, for example, medical professionals, veterinarians, plant pathologists, and city/county environmental health officers to develop safety, security, and response strategies for food supply contamination.

HEAL-d. ***Interface with National and State Health Care Initiatives***

1) Designate locations for the distribution of antibiotics to large numbers of people should the need arise, as required to be included in each county's Strategic National Stockpile Plan.
2) Train appropriate personnel to understand that the Metropolitan Medical Response System (MMRS) cities in your area. For example, Oakland and Fremont are the MMRS cities in Alameda County. MMRS cities are those cities that are provided with additional federal funds for organizing, equipping, and training groups of local fire, rescue, medical, and other emergency management personnel.
3) Train appropriate personnel to know if any National Disaster Medical System (NDMS) uniformed or non-uniformed personnel are within one-to-four hours of your community. These federal resources include veterinary, mortuary, and medical personnel.
4) Train appropriate personnel to know to utilize the State of California Department of Health Services laboratory in Richmond for confirmation of biological agents and Department of Defense laboratories in Berkeley (Lawrence Berkeley National Laboratory) or Livermore (Lawrence Livermore National Laboratory and Sandia) for confirmation of radiological agents.

3. Housing (HSNG)

Bay Area residents need to have safe and disaster-resistant housing that is architecturally diverse and serves a variety of household sizes and incomes.

HSNG-a. ***Multi-Hazard***

1) Be aware of past problems of inadequate hazard disclosure and work with real estate agents to improve enforcement of real estate disclosure requirements for those hazards covered by this plan, for example, by making those agents and the

[8] Ancillary health care facilities include pharmacies, private offices of health care providers (such as doctors, dentists, ophthalmologists, psychologists, and alternative medical care givers), retail sales offices for health care devices (such as optometric, auditory, or prosthetic devices), laboratories, and offices of the private non-profit agencies services clients.

disclosure firms aware of the hazard maps incorporated in this plan and available on the ABAG web site at http://quake.abag.ca.gov/mitigation, as well as locally developed maps.

2) Create incentives for owners of historic or architecturally significant buildings to undertake mitigation to levels that will minimize the likelihood that these buildings will need to be demolished after a disaster, particularly if those alterations conform to the federal Secretary of the Interior's *Guidelines for Rehabilitation*.

HSNG-b. ***Single-Family Homes Vulnerable to Earthquakes***

1) Utilize or recommend adoption of a retrofit standard that includes standard plan sets and construction details for voluntary bolting of homes to their foundations and bracing of outside walls of crawl spaces ("cripple" walls), such as that being developed by a committee representing the East Bay-Peninsula-Monterey Chapters of the International Code Council (ICC), California Building Officials (CALBO), the Structural Engineers Association of Northern California (SEAONC), the Northern California Chapter of the Earthquake Engineering Research Institute (EERI-NC), and ABAG's Earthquake Program.
2) Require engineered plan sets for retrofitting of heavy two-story homes with living areas over garages, as well as for split level homes, until standard plan sets and construction details become available.
3) Require engineered plan sets for retrofitting of homes on steep hillsides.
4) Encourage local government building inspectors to take classes on a periodic basis (such as the FEMA-developed training classes offered by ABAG) on retrofitting of single-family homes.
5) Encourage private retrofit contractors and home inspectors doing work in your area to take retrofit classes on a periodic basis (such as the FEMA-developed training classes offered by ABAG) on retrofitting of single-family homes.
6) Conduct demonstration projects on common existing housing types demonstrating structural and nonstructural mitigation techniques as community models for earthquake mitigation.
7) Provide retrofit classes or workshops for homeowners.
8) Establish tool-lending libraries with common tools needed for retrofitting for use by homeowners with appropriate training.
9) Provide financial incentives to owners of applicable homes to retrofit.

HSNG-c. ***Soft-Story[9] Multifamily Residential Structures Vulnerable to Earthquakes***

1) Require engineered plan sets for voluntary or mandatory soft-story retrofits until a standard plan set and construction details become available.

[9] A condition in which the building has far less stiffness in its lowest story than in upper stories, often due to multiple garage openings at the ground floor or large open windows for commercial space, increasing the likelihood of excessive sidesway or even collapse. Many of these buildings collapsed in the 1971 San Fernando, 1989 Loma Prieta, and 1994 Northridge earthquakes. An engineering definition is "a condition in which the stiffness of the seismic-force-resisting system in any story is less than 70 percent of the stiffness in the story above" (modified from the American Society of Civil Engineers (ASCE 31).

2) Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory soft-story building retrofits.
3) Work to educate condominium and apartment owners, local government staff, engineers, and contractors on soft-story retrofit procedures and incentives using materials such as those developed by ABAG (see http://quake.abag.ca.gov/fixit) and the City of San Jose.
4) Conduct an inventory of existing or suspected soft-story residential structures.
5) Use the soft-story inventory to require owners to inform all existing tenants that they live in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will live in this type of building prior to signing a lease.
6) Use the soft-story inventory to require owners to inform all existing tenants that they should be prepared to live elsewhere following an earthquake if the building has not been retrofitted.
7) Investigate and adopt appropriate financial, procedural, and land use incentives for owners of soft-story buildings to facilitate retrofit such as those developed by ABAG (see http://quake.abag.ca.gov/fixit).
8) Explore development of local ordinances or State regulations to require or encourage owners of soft-story structures to strengthen them.
9) Provide technical assistance in seismically strengthening soft-story structures.

HSNG-d. ***Unreinforced Masonry Housing Stock***

1) Continue to actively implement existing State law that requires cities and counties to maintain lists of the addresses of unreinforced masonry buildings and inform property owners that they own this type of hazardous structure.
2) Accelerate retrofitting of unreinforced masonry structures that have not been retrofitted, for example, by (a) actively working with owners to obtain structural analyses of their buildings, (b) helping owners obtain retrofit funding, (c) adopting a mandatory versus voluntary, retrofit program, and/or (d) applying penalties to owners who show inadequate efforts to upgrade these buildings.
3) Require owners to inform all existing tenants that they live in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will live in this type of building prior to signing a lease.
4) Require owners to inform all existing tenants that they should be prepared to live elsewhere following an earthquake even if the building has been retrofitted, for it has probably been retrofitted to a life-safety standard, not to a standard that will allow occupancy following major earthquakes.

HSNG-e. ***Other Privately Owned Structural-Suspicious Residential Buildings and Earthquakes***

1) Identify and work toward tying down mobile homes used as year-round permanent residences using an appropriate cost-sharing basis (for example, 75% grant, 25% owner).

2) Inventory non-ductile concrete, tilt-up concrete, and other privately-owned structurally suspicious residential buildings.
3) Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory retrofit of seismically vulnerable buildings.
4) Adopt one or more of the following strategies as incentives to encourage retrofitting of privately-owned structurally deficient residential buildings: (a) waivers or reductions of permit fees, (b) below-market loans, (c) local tax breaks, (d) grants to cover the cost of retrofitting or of a structural analysis, (e) land use and procedural incentives, or (f) technical assistance.

HSNG-f. ***New Construction and Earthquakes***

1) Continue to require that all new housing be constructed in compliance with structural requirements of the most recently adopted version of the *California Building Code*.
2) Conduct appropriate employee training and support continued education to ensure enforcement of building codes and construction standards, as well as identification of typical design inadequacies of housing and recommended improvements.

HSNG-g. ***Wildfire and Structural Fires***

1) Increase efforts to reduce hazards in existing development in high wildfire hazard areas (identified as wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat) through improving engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on defensible space mitigation strategies.
2) Tie public education on defensible space and a comprehensive defensible space ordinance to a field program of enforcement.
3) Require that new homes in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat be constructed of fire-resistant building materials (including roofing and exterior walls) and incorporate fire-resistant design features (such as minimal use of eaves, internal corners, and open first floors) to increase structural survivability and reduce ignitability[10].
4) Develop financial incentives for homeowners to be "model" defensible space homes in neighborhoods that are wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.
5) Consider fire safety, evacuation, and emergency vehicle access when reviewing proposals to add secondary units or additional residential units in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.
6) Adopt and/or amend, as needed, updated versions of the *California Building and Fire Codes* so that optimal fire-protection standards are used in construction and renovation projects.

[10] See *Structural Fire Prevention Field Guide for Mitigation of Wildfires* at **http://osfm.fire.ca.gov/structural.html**.

7) Create a mechanism to enforce provisions of the *California Building and Fire Codes* and local housing codes that require the installation of smoke detectors and/or fire-extinguishing systems by making installation a condition of (a) finalizing a permit for any work on existing properties valued at over a fixed amount, such as $500 or $1000, and/or (b) a condition for the transfer of property if these changes are determined cost-effective strategies.
8) Work to ensure a reliable source of water for fire suppression in rural-residential areas through the cooperative efforts of water districts, fire districts, and residents.
9) Expand vegetation management programs in wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat to more effectively manage the fuel load through roadside collection and chipping, mechanical fuel reduction equipment, selected harvesting, use of goats or other organic methods of fuel reduction, and selected use of controlled burning.
10) Promote the installation of early warning fire alarm systems in homes wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat connected to fire department communication systems.
11) Establish a Fire Hazard Abatement District to fund reduction in fire risk of existing properties through vegetation management that includes reduction of fuel loads, use of defensible space, and fuel breaks.
12) Work with residents in rural-residential areas to ensure adequate access and evacuation in wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.
13) Require fire sprinklers in new homes located more than 1.5 miles or a 5-minute response time from a fire station or in an identified high hazard wildland-urban-interface wildfire area.
14) Require fire sprinklers in all new or substantially remodeled multifamily housing, regardless of distance from a fire station.
15) Require sprinklers in all mixed use development to protect residential uses from fires started in non-residential areas.
16) Compile a list of high-rise and high-occupancy buildings which are deemed, due to their age or construction materials, to be particularly susceptible to fire hazards, and determine an expeditious timeline for the fire-safety inspection of all such structures.
17) Conduct periodic fire-safety inspections of all multi-family buildings, as required by State law.
18) Ensure that fire-preventive vegetation-management techniques and practices for creek sides and high-slope areas do not contribute to the landslide and erosion hazard.
19) Create a mechanism to require the bracing of water heaters and flexible couplings on gas appliances, and/or (as specified under "a. Single-family homes vulnerable to earthquakes" above) the bolting of homes to their foundations and strengthening of cripple walls to reduce fire ignitions due to earthquakes.
20) Work with the State Fire Marshall, the California Seismic Safety, PEER, and other experts to identify and manage gas-related fire risks of soft-story residential or mixed use buildings that are prone to collapse and occupant entrapment

consistent with the natural gas safety recommendations of Seismic Safety Commission Report SSC-02-03.[11]

HSNG-h. ***Flooding***

1) To reduce flood risk, and thereby reduce the cost of flood insurance to property owners, work to qualify for the highest-feasible rating under the Community Rating System of the National Flood Insurance Program.
2) Balance the housing needs of residents against the risk from potential flood-related hazards.
3) Ensure that new development pays its fair share of improvements to the storm drainage system necessary to accommodate increased flows from the development.
4) Provide sandbags and plastic sheeting to residents in anticipation of rainstorms, and deliver those materials to the disabled and elderly upon request.
5) Provide public information on locations for obtaining sandbags and/or deliver those sandbags to those various locations throughout a city and/or county prior to and/or during the rainy season.
6) Apply floodplain management regulations for development in the floodplain and floodway.
7) Ensure that new subdivisions are designed to reduce or eliminate flood damage by requiring lots and rights-of-way are laid out for the provision of approved sewer and drainage facilities, providing on-site detention facilities whenever practicable.
8) Encourage home and apartment owners to participate in home elevation programs.
9) As funding opportunities become available, encourage home and apartment owners to participate in acquisition and relocation programs for areas within floodways.
10) Encourage owners of properties in a floodplain to consider purchasing flood insurance. For example, point out that most homeowners' insurance policies do not cover a property for flood damage.

HSNG-i. ***Landslides and Erosion***

1) Increase efforts to reduce landslides and erosion in existing and future development by improving appropriate code enforcement and use of applicable standards, such as those appearing in the *California Building Code*, California Geological Survey *Special Report 117 – Guidelines for Evaluating and Mitigating Seismic Hazards in California*[12], American Society of Civil Engineers (ASCE) report *Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Landslide Hazards in California*[13], and the California Board for Geologists and Geophysicists *Guidelines for Engineering Geologic Reports*[14]. Such standards should cover excavation, fill

[11] See http://www.seismic.ca.gov/pub/CSSC_2002-03_Natural%20Gas%20Safety.pdf. Note: any values that are installed may need to have both excess flow and seismic triggers ("hybrid" valves).
[12] See http://gmw.consrv.ca.gov/shmp/SHMPsp117.asp.
[13] See http://www.scec.org/resources/catalog/LandslideProceduresJune02.pdf.
[14] See http://www.geology.ca.gov/publications/engineering.pdf.

placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.

2) Increase efforts to reduce landslides and erosion in existing and future development through continuing education of design professionals on mitigation strategies.

HSNG-j. ***Building Reoccupancy***

1) Develop and enforce an ordinance for disaster-damaged structures to ensure that residential buildings are repaired in an appropriate and timely manner and retrofitted concurrently to avoid a recurrence.

HSNG-k. ***Public Education***

1) Provide information to residents of your community on the availability of interactive hazard maps showing your community on ABAG's web site.
2) Develop printed materials, utilize existing materials (such as developed by FEMA and the American Red Cross), conduct workshops, and/or provide outreach encouraging residents to have family disaster plans that include drop-cover-hold earthquake drills, fire and storm evacuation procedures, and shelter-in-place emergency guidelines.
3) Better inform residents of comprehensive mitigation activities, including elevation of appliances above expected flood levels, use of fire-resistant roofing and defensible space in high wildfire threat and wildfire-urban-interface areas, structural retrofitting techniques for older homes, and use of intelligent grading practices through workshops, publications, and media announcements and events.
4) Develop a public education campaign on the cost, risk, and benefits of earthquake, flood, and other hazard insurance.
5) Use disaster anniversaries, such as April (Earthquake Month and the 1906 earthquake), September (9/11), and October (Loma Prieta earthquake and Oakland Hills fire), to remind the public on safety and security mitigation activities.
6) Sponsor the formation and training of Community Emergency Response Teams (CERT) training. [Note – these programs go by a variety of names in various cities and areas.]
7) Include flood fighting technique session based on California Department of Water Resources training to the list of available public training classes offered by CERT.
8) Institute the neighborhood watch block captain and team programs outlined in the Citizen Corps program guide.
9) Assist residents in the development of defensible space through the use of, for example, "tool libraries" for weed abatement tools, roadside collection and/or chipping services (for brush, weeds, and tree branches) in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.
10) Train homeowners to locate and shut off gas valves if they smell or hear gas leaking.

11) Distribute NOAA weather radios to high-risk, limited-income families living in flood hazard areas.
12) Develop a program to provide at-cost NOAA weather radios to residents of flood hazard areas.
13) Make use of the materials on the ABAG web site at http://quake.abag.ca.gov/fixit and other web sites to increase residential mitigation activities related to earthquakes. (ABAG plans to continue to improve the quality of those materials over time.)
14) Develop a "Maintain-a-Drain" campaign, similar to that of the City of Oakland, encouraging businesses and residents to keep storm drains in their neighborhood free of debris.
15) Encourage the formation of a community- and neighborhood-based approach to wildfire education and action through local Fire Safe Councils and the *Fire Wise Program.*
16) Inform shoreline-property owners of the possible long-term economic threat posed by rising sea levels.
17) Develop and distribute culturally appropriate materials related to disaster mitigation and preparedness, such as those on the http://www.preparenow.org website.

4. Economy (ECON)

Safe, disaster-resilient, and architecturally diverse downtown commercial areas, business and industrial complexes, and office buildings are essential to the overall economy of the Bay Area.

ECON-a. ***Multi-Hazard***

1) Be aware of past problems of inadequate hazard disclosure and work with real estate agents to improve enforcement of real estate disclosure requirements for those hazards covered by this plan, for example, by making those agents and the disclosure firms aware of the hazard maps incorporated in this plan and available on the ABAG web site at http://quake.abag.ca.gov/mitigation, as well as locally developed maps.
2) Create incentives for owners of historic or architecturally significant buildings to undertake mitigation to levels that will minimize the likelihood that these buildings will need to be demolished after a disaster, particularly if those alterations conform to the federal Secretary of the Interior's *Guidelines for Rehabilitation.*

ECON-b. ***Soft-Story[15] Commercial Buildings Vulnerable to Earthquakes***

1) Require engineered plan sets for voluntary or mandatory soft-story retrofits until a standard plan set and construction details become available.
2) Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory soft-story building retrofits.
3) Work to educate building owners, local government staff, engineers, and contractors on soft-story retrofit procedures and incentives using materials such as those developed by ABAG (see http://quake.abag.ca.gov/fixit) and the City of San Jose.
4) Conduct an inventory of existing or suspected soft-story commercial and industrial structures.
5) Use the soft-story inventory to require owners to inform all existing tenants that they work in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will work in this type of building prior to signing a lease.
6) Use the soft-story inventory to require owners to inform all existing tenants that they should be prepared to work elsewhere following an earthquake if the building has not been retrofitted.
7) Investigate and adopt appropriate financial, procedural, and land use incentives for owners of soft-story buildings to facilitate retrofit.
8) Explore development of local ordinances or State regulations to require or encourage owners of soft-story structures to strengthen them.
9) Provide technical assistance in seismically strengthening soft-story structures.

ECON-c. ***Unreinforced Masonry Buildings in Older Downtown Areas***

1) Continue to actively implement existing State law that requires cities and counties to maintain lists of the addresses of unreinforced masonry buildings and inform property owners that they own this type of hazardous structure.
2) Accelerate retrofitting of unreinforced masonry structures that have not been retrofitted, for example, by (a) actively working with owners to obtain structural analyses of their buildings, (b) helping owners obtain retrofit funding, (c) adopting a mandatory versus voluntary, retrofit program, and/or (d) applying penalties to owners who show inadequate efforts to upgrade these buildings.
3) Require owners to inform all existing tenants that they work in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will work in this type of building prior to signing a lease.
4) Require owners to inform all existing tenants that they should be prepared to work elsewhere following an earthquake even if the building has been retrofitted, for it

[15] A condition in which the building has far less stiffness in its lowest story than in upper stories, often due to multiple garage openings at the ground floor or large open windows for commercial space, increasing the likelihood of excessive sidesway or even collapse. Many of these buildings collapsed in the 1971 San Fernando, 1989 Loma Prieta, and 1994 Northridge earthquakes. An engineering definition is "a condition in which the stiffness of the seismic-force-resisting system in any story is less than 70 percent of the stiffness in the story above" (modified from the American Society of Civil Engineers (ASCE 31).

has probably been retrofitted to a life-safety standard, not to a standard that will allow occupancy following major earthquakes.

ECON-d. ***Other Privately-Owned Structurally Suspicious Buildings***

1) Inventory non-ductile concrete, tilt-up concrete, and other privately-owned structurally suspicious buildings.
2) Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory retrofit of seismically vulnerable buildings.
3) Adopt one or more of the following strategies as incentives to encourage retrofitting of privately-owned structurally suspicious commercial and industrial buildings: (a) waivers or reductions of permit fees, (b) below-market loans, (c) local tax breaks, (d) grants to cover the cost of retrofitting or of a structural analysis, (e) land use and procedural incentives, or (f) technical assistance.

ECON-e. ***Wildfire and Structural Fires***

1) Increase efforts to reduce fire in existing development through improving engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on mitigation strategies.
2) Require that new business and office buildings in high fire hazard areas be constructed of fire-resistant building materials and incorporate fire-resistant design features (such as minimal use of eaves, internal corners, and open first floors) to increase structural survivability and reduce ignitability.
3) Adopt and amend as needed updated versions of the *California Building and Fire Codes* so that optimal fire-protection standards are used in construction and renovation projects.
4) Create a mechanism to enforce provisions of the *California Building and Fire Codes* and other local codes that require the installation of smoke detectors and fire-extinguishing systems by making installation a condition of (a) finalizing a permit for any work on existing properties valued at over a fixed amount, such as $500 or $1000, and/or (b) on any building over 75 feet in height, and/or (b) as a condition for the transfer of property.
5) Expand existing vegetation management programs in commercial and/or industrial areas.
6) Establish a Fire Hazard Abatement District to fund reduction in fire risk of existing properties through vegetation management that includes reduction of fuel loads, use of defensible space, and fuel breaks.
7) Establish a Fire Hazard Abatement District to fund fire-safety inspections of private properties, roving firefighter patrols on high fire-hazard days, and public education efforts.
8) Compile a list of high-rise and high-occupancy buildings that are deemed, due to their age or construction materials, to be particularly susceptible to fire hazards, and determine an expeditious timeline for the fire-safety inspection of all such structures.
9) Conduct periodic fire-safety inspections of all commercial and institutional buildings.

10) Work with the State Fire Marshall, the California Seismic Safety, PEER, and other experts to identify and manage gas-related fire risks of soft-story mixed use buildings that are prone to collapse and occupant entrapment consistent with the natural gas safety recommendations of Seismic Safety Commission Report SSC-02-03.[16]
11) Ensure that fire-preventive vegetation-management techniques and practices for creek sides and high-slope areas do not contribute to the landslide and erosion hazard.
12) Work with insurance companies to create a public/private partnership to give a discount on fire insurance premiums to "Forester Certified" *Fire Wise* landscaping and fire-resistant building materials.

ECON-f. ***Flooding***

1) To reduce flood risk, thereby reducing the cost of flood insurance to property owners, work to qualify for the highest-feasible rating under the Community Rating System of the National Flood Insurance Program.
2) Balance the needs for commercial and industrial development against the risk from potential flood-related hazards.
3) Ensure that new development pays its fair share of improvements to the storm drainage system necessary to accommodate increased flows from the development, ***or*** does not increase runoff by draining water to pervious areas or detention facilities.
4) Provide sandbags and plastic sheeting to businesses in anticipation of rainstorms, and deliver those materials to the disabled and elderly upon request.
5) Provide public information on locations for obtaining sandbags and deliver those sandbags to those various locations throughout a city and/or county.
6) Apply floodplain management regulations for development in the floodplain and floodway.
7) Encourage business owners to participate in building elevation programs.
8) Encourage business owners to participate in acquisition and relocation programs for areas within floodways.
9) Require an annual inspection of approved flood-proofed buildings to ensure that (a) all flood-proofing components will operate properly under flood conditions and (b) all responsible personnel are aware of their duties and responsibilities as described in their building's *Flood Emergency Operation Plan* and *Inspection & Maintenance Plan.*

ECON-g. ***Landslides and Erosion***

1) Increase efforts to reduce landslides and erosion in existing and future development by improving appropriate code enforcement and use of applicable standards, such as those appearing in the *California Building Code*, California Geological Survey *Special Report 117 – Guidelines for Evaluating and Mitigating Seismic Hazards in California*[17], American Society of Civil Engineers (ASCE)

[16] See http://www.seismic.ca.gov/pub/CSSC_2002-03_Natural%20Gas%20Safety.pdf. Note: any values that are installed may need to have both excess flow and seismic triggers ("hybrid" valves).
[17] See http://gmw.consrv.ca.gov/shmp/SHMPsp117.asp.

report *Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Landslide Hazards in California*[18], and the California Board for Geologists and Geophysicists *Guidelines for Engineering Geologic Reports*[19]. Such standards should cover excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.

2) Increase efforts to reduce landslides and erosion in existing and future development through continuing education of design professionals on mitigation strategies.

ECON-h. ***Construction***

1) Continue to require that all new commercial and industrial buildings be constructed in compliance with structural requirements of the most recently adopted version of the *California Building Code*.
2) Conduct appropriate employee training and support continued education to ensure enforcement of construction standards.
3) Recognize that many strategies that increase earthquake resistance also decrease damage in an explosion. In addition, recognize that ventilation systems can be designed to contain airborne biological agents.

ECON-i. ***Building Reoccupancy***

1) Institute an aggressive program similar to San Francisco's Building Occupancy Resumption Program (BORP). This program permits owners of private buildings to hire qualified structural engineers to create building-specific post-disaster inspection plans and allows these engineers to become automatically deputized as City/County inspectors for these buildings in the event of an earthquake or other disaster.
2) Actively notify owners of historic or architecturally significant buildings of the availability of the local BORP-type program and encourage them to participate to ensure that appropriately qualified structural engineers are inspecting their buildings, thus reducing the likelihood that the buildings will be inappropriately evaluated following a disaster.
3) Actively notify owners of educational facility buildings of the availability of the local BORP-type program and encourage them to participate to ensure that appropriately qualified structural engineers are inspecting their buildings, thus reducing the likelihood that the buildings will be inappropriately evaluated following a disaster.
4) Allow owners to participate in a BORP-type program as described above, but not actively encourage them to do so.
5) Develop and enforce an ordinance for disaster-damaged structures to ensure that damaged buildings are repaired in an appropriate and timely manner.

[18] See http://www.scec.org/resources/catalog/LandslideProceduresJune02.pdf.
[19] See http://www.geology.ca.gov/publications/engineering.pdf.

6) Establish preservation-sensitive measures for the repair and reoccupancy of historically significant structures, including requirements for temporary shoring or stabilization where needed, arrangements for consulting with preservationists, and expedited permit procedures for suitable repair or rebuilding of historically or architecturally valuable structures.

ECON-j. ***Public Education***

1) Provide information to business owners and employees on the availability of interactive hazard maps on ABAG's web site.
2) Develop printed materials, utilize existing materials (such as developed by FEMA and the American Red Cross), conduct workshops, and/or provide outreach encouraging businesses' employees to have family disaster plans that include drop-cover-hold earthquake drills, fire and storm evacuation procedures, and shelter-in-place emergency guidelines.
3) Develop printed materials, conduct workshops, and provide outreach to Bay Area businesses focusing on business continuity planning.
4) Better inform Bay Area business owners of mitigation activities, including elevation of appliances above expected flood levels, use of fire-resistant roofing and defensible space in wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat, structural retrofitting techniques for older buildings, and use of intelligent grading practices through workshops, publications, and media announcements and events.
5) Sponsor the formation and training of Community Emergency Response Teams (CERT) training through partnerships with local businesses. [Note – these programs go by a variety of names in various cities and areas.]
6) Assist businesses in the development of defensible space through the use of, for example, "tool libraries" for weed abatement tools, roadside collection and/or chipping services (for brush, weeds, and tree branches) in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.
7) Make use of the materials developed by others (such as found on ABAG's web site at http://quake.abag.ca.gov/business) to increase mitigation activities related to earthquakes. ABAG plans to continue to improve the quality of those materials over time.
8) Develop a "Maintain-a-Drain" campaign, similar to that of the City of Oakland, encouraging businesses and residents to keep storm drains in their neighborhood free of debris.
9) Encourage the formation of a community-based approach to wildfire education and action through local Fire Safe Councils and the *Fire Wise Program.*
10) Encourage businesses and laboratories handling hazardous materials or pathogens increase security to a level high enough to create a deterrent to crime and terrorism, including active implementation of "cradle-to-grave" tracking systems.
11) Encourage joint meetings of security and operations personnel at major employers to develop innovative ways for these personnel to work together to increase safety and security.

12) Inform shoreline-property owners of the possible long-term economic threat posed by rising sea levels.
13) Develop and distribute culturally appropriate materials related to disaster mitigation and preparedness, such as those on the http://www.preparenow.org website.

5. Government Services (GOVT)

Bay Area city and county governments, as well as community services agencies, provide essential services during and immediately following disasters, as well as critical functions during recovery, that need to be resistant to disasters.

GOVT-a. ***Focus on Critical Facilities***

1) Assess the vulnerability of critical facilities (such as city halls, fire stations, community service centers, seaports, and airports) to damage in natural disasters and make recommendations for appropriate mitigation.
2) Retrofit or replace critical facilities that are shown to be vulnerable to damage in natural disasters.
3) Clarify to workers in critical facilities and emergency personnel, as well as to elected officials and the public, the extent to which the facilities are expected to perform only at a life safety level (allowing for the safe evacuation of personnel) or are expected to remain functional following an earthquake.
4) Conduct comprehensive programs to identify and mitigate problems with facility contents, architectural components, and equipment that will prevent critical buildings from being functional after major natural disasters.
5) Encourage joint meetings of security and operations personnel at critical facilities to develop innovative ways for these personnel to work together to increase safety and security.
6) Install micro and/or surveillance cameras around critical public assets tied to web-based software, and develop a surveillance protocol to monitor these cameras.
7) Identify and undertake cost-effective retrofit measures on critical facilities (such as moving and redesigning air intake vents and installing blast-resistant features) when these buildings undergo major renovations.
8) Coordinate with the State Division of Safety of Dams to ensure that cities and counties are aware of the timeline for the maintenance and inspection of dams whose failure would impact their jurisdiction.
9) As a secondary focus, assess the vulnerability of ***non***-critical facilities to damage in natural disasters based on occupancy and structural type, make recommendations on priorities for structural improvements or occupancy reductions, and identify potential funding mechanisms.
10) Ensure that government-owned facilities are subject to the same or more stringent regulations as imposed on privately-owned development.
11) Comply with all applicable building and fire codes, as well as other regulations (such as state requirements for fault, landslide, and liquefaction investigations in particular mapped areas) when constructing or significantly remodeling government-owned facilities.

12) Prior to acquisition of property to be used as a critical facility, conduct a study to ensure the absence of significant hazards.

GOVT-b. ***Maintain and Enhance Local Government's Emergency Response and Recovery Capacity***

1) Establish a framework and process for pre-event planning for post-event recovery that specifies roles, priorities, and responsibilities of various departments within the local government organization, and that outlines a structure and process for policy-making involving elected officials and appointed advisory committees.
2) Prepare a basic Recovery Plan that outlines the major issues and tasks that are likely to be the key elements of community recovery, as well as integrate this planning into response planning.
3) Establish a goal for the resumption of local government services that may vary from function to function.
4) Develop a plan for short-term and intermediate-term sheltering of impacted residents.
5) Periodically assess the need for new or relocated fire or police stations and other emergency facilities, changes in staffing levels, and additional or updated supplies, equipment, technologies, and in-service training classes.
6) Ensure that fire and police department personnel have adequate radios, breathing apparatuses, protective gear, and other equipment to respond to a major disaster.
7) Develop and maintain a system of interoperable communications for first responders from cities, counties, special districts, state, and federal agencies.
8) Harden emergency response communications, including, for example, building redundant capacity into public safety alerting and/or answering points, replacing or hardening microwave and simulcast systems, adding digital encryption for programmable radios, and ensuring a plug-and-play capability for amateur radio.
9) Purchase command vehicles for use as mobile command/EOC vehicles if current vehicles are unsuitable or inadequate.
10) Maintain the local government's emergency operations center in a fully functional state of readiness.
11) Expand or participate in expanding traditional disaster exercises involving city and county emergency personnel to include airport and port personnel, transit and infrastructure providers, hospitals, schools, park districts, and major employers.
12) Maintain and update as necessary the local government's Standardized Emergency Management System Plan.
13) Continue to participate not only in general mutual-aid agreements, but also in agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters.
14) Install an alert and warning system with outdoor sirens, coordinating them, to the extent possible, with those of neighboring jurisdictions.
15) Conduct periodic tests of the alerting and warning system's outdoor sirens no less frequently than once per month.
16) Regulate and enforce the location and design of street-address numbers on buildings and minimize the naming of short streets (that are actually driveways) to single homes.

17) Monitor weather during times of high fire risk using, for example, weather stations tied into police and fire dispatch centers.
18) Establish regional protocols on how to respond to the NOAA Monterey weather forecasts, such as the identifying types of closures, limits on work that could cause ignitions, and prepositioning of suppression forces. A multi-agency coordination of response also helps provide unified messages to the public about how they should respond to these periods of increased fire danger.
19) Increase local patrolling during periods of high fire weather.
20) Create and maintain an automated system of rain and flood gauges that is web enabled and publicly accessible.
21) Place remote sensors in strategic locations for early warning of hazmat releases or use of weapons of mass destruction.
22) Investigate the use of phone-based warning systems for selected geographic areas.
23) Review and update, as necessary, procedures pursuant to the *State Dam Safety Act* for the emergency evacuation of areas located below major water-storage facilities.
24) Develop procedures for the emergency evacuation of areas identified on tsunami evacuation maps as these maps become available.
25) Develop a business continuity plan that includes back-up storage of vital records, such as essential medical records and financial information.

GOVT-c. ***Participate in National, State, Multi-Jurisdictional and Professional Society Efforts to Identify and Mitigate Hazards***

1) Promote information sharing among overlapping and neighboring local governments, including cities, counties, and special districts, as well as utilities.
2) Recognize that emergency services is more than the coordination of police and fire response, for it also includes planning activities with providers of water, food, energy, transportation, financial, information, and public health services.
3) Recognize that a multi-agency approach is needed to mitigate flooding by having flood control districts, cities, counties, and utilities meet at least annually to jointly discuss their a capital improvement programs for most effectively reducing the threat of storm-induced flooding.
4) As new flood-control projects are completed, request that FEMA revise its flood-insurance rate maps and digital geographic information system data to reflect flood risks as accurately as possible.
5) Participate in FEMA's National Flood Insurance Program.
6) Participate in multi-agency efforts to mitigate fire threat, such as the Hills Emergency Forum (in the east Bay), various *FireSafe* Council programs, and city-utility task forces.
7) Work with major employers and agencies that handle hazardous materials to coordinate mitigation efforts for the possible release of these materials due to a natural disaster such as an earthquake, flood, fire, or landslide.
8) Encourage staff to participate in efforts by professional organizations to mitigate earthquake and landslide disaster losses, such as the efforts of the Northern California Chapter of the Earthquake Engineering Research Institute, the East Bay-Peninsula Chapter of the International Code Council, the Structural

Engineers Association of Northern California, and the American Society of Grading Officials.

9) Conduct and/or promote attendance at local or regional hazard conferences and workshops for elected officials to educate the officials on the critical need for programs in mitigating earthquake, wildfire, flood, and landslide hazards.
10) Cooperate with researchers working on government-funded projects to refine information on hazards, for example, by expediting the permit and approval process for installation of seismic arrays, gravity survey instruments, borehole drilling, fault trenching, landslide mapping, flood modeling, and/or damage data collection.

6. Education (EDUC)

Safe and disaster-resistant school, education, and childcare-related facilities are critical to the safety of our children, as well as to the quality of life of Bay Area families.

EDUC-a. ***Focus on Critical Facilities***

1) Assess the vulnerability of critical education facilities to damage in natural disasters and make recommendations for appropriate mitigation.
2) Retrofit or replace critical education facilities that are shown to be vulnerable to damage in natural disasters.
3) Conduct comprehensive programs to identify and mitigate problems with facility contents, architectural components, and equipment that will prevent critical buildings from being functional after major disasters.
4) As a secondary focus, assess the vulnerability of ***non***-critical educational facilities to damage in natural disasters based on occupancy and structural type, make recommendations on priorities for structural improvements or occupancy reductions, and identify potential funding mechanisms.
5) Participate in or facilitate adoption of a program to formalize arrangements with structural engineers to report to the district, assess damage, and determine if the buildings can be reoccupied. The program should be similar to San Francisco's Building Occupancy Resumption Program (BORP) that permits owners of buildings to hire qualified structural engineers to create building-specific post-disaster inspection plans and allows these engineers to become automatically deputized as inspectors for these buildings in the event of an earthquake or other disaster. Unlike the buildings of most special districts, however, these plans should be developed with the review and guidance of the Division of the State Architect because this agency has the authority and responsibility for the structural integrity of these structures.

EDUC-b. ***Use of Educational Facilities as Emergency Shelters***

1) Work cooperatively with the American Red Cross and others to set up memoranda of understanding for use of education facilities as emergency shelters following disasters.
2) Work cooperatively to ensure that school district personnel and relevant staff understand and are trained that being designated by the American Red Cross or others as a potential emergency shelter does not mean that the school has had a

hazard or structural evaluation to ensure that it can be used as a shelter following any specific disaster.

3) Work cooperatively to ensure that school district personnel understand and are trained that they are designated as disaster service workers and must remain at the school until released.

EDUC-c. ***Use of Schools as Conduits for Information to Families About Emergencies***

1) Work on and/or support efforts by schools, local governments, and other agencies to utilize their unique ability to reach families through educational materials on hazards, mitigation, and preparedness, particularly after disasters and at the beginning of the school year. These efforts will not only make the entire community more disaster-resistant, but speed the return of schools from use as shelters to use as teaching facilities.
2) Work on and/or support joint efforts of schools and fire jurisdictions to develop plans for evacuation or sheltering in place of school children during periods of high fire danger, thereby recognizing that overloading of streets near schools by parents attempting to pick up their children during these periods can restrict access by fire personnel and equipment.
3) Offer the 20-hour basic CERT training to teachers and after-school personnel.
4) Offer the 20-hour basic CERT training to middle school and/or high school students as a part of the basic science or civics curriculum, as an after school club, or as a way to earn public service hours.
5) Offer the 20-hour basic CERT training course through the Adult School system and/or through the Community College system.
6) Develop and maintain the capacity for schools to take care of the students for the first 48 hours after a disaster, and notify parents that this capacity exists.
7) Develop and distribute culturally appropriate materials related to disaster mitigation and preparedness, such as those on the http://www.preparenow.org website.

7. Environment (ENVI)

Disaster resistance need to further environmental sustainability, reduce pollution, strengthen agriculture resiliency, and avoid hazardous material releases in the Bay Area.

ENVI-a. ***Environmental Sustainability and Pollution Reduction***

1) Continue to enforce State-mandated requirements, such as the *California Environmental Quality Act*, to ensure that mitigation activities for hazards, such as vegetation clearance programs for fire threat and seismic retrofits, are conducted in a way that reduces environmental degradation such as air quality impacts, noise during construction, and loss of sensitive habitats and species, while respecting the community value of historic preservation.
2) Encourage regulatory agencies to work collaboratively with safety professionals to develop creative mitigation strategies that effectively balance environmental and safety needs, particularly to meet critical wildfire, flood, and earthquake safety levels.

3) Continue to enforce and/or comply with State-mandated requirements, such as the *California Environmental Quality Act* and environmental regulations to ensure that urban development is conducted in a way to minimize air pollution. For example, air pollution levels can lead to global warming, and then to drought, increased vegetation susceptibility to disease (such as pine bark beetle infestations), and associated increased fire hazard.
4) Develop and implement a comprehensive program for watershed maintenance, optimizing forest health with water yield to balance water supply, flooding, fire, and erosion concerns.
5) Balance the need for the smooth flow of storm waters versus the need to maintain wildlife habitat by developing and implementing a comprehensive Streambed Vegetation Management Plan that ensures the efficacy of flood control efforts and maintains the viability of living rivers.
6) Stay informed of emerging scientific information on the subject of rising sea levels, especially on additional actions that local governments can take to mitigate this hazard.
7) Monitor the science associated with global warming to be able to act promptly when data become available to warrant special design and engineering of government-owned facilities located in low-lying areas, such as wastewater treatment plants, ports, and airports.
8) Comply with applicable performance standards of any *National Pollutant Discharge Elimination System* municipal stormwater permit that seeks to manage increases in stormwater run-off flows from new development and redevelopment construction projects.
9) Enforce and/or comply with the grading, erosion, and sedimentation requirements by prohibiting the discharge of concentrated stormwater flows by other than approved methods that seek to minimize associated pollution.
10) Explore ways to require that hazardous materials stored in the flood zone be elevated or otherwise protected from flood waters.
11) Enforce and/or comply with the hazardous materials requirements of the State of California Certified Unified Program Agency (CUPA).
12) Provide information on hazardous waste disposal and/or drop off locations.
13) Develop and implement a program to control invasive and exotic species that contribute to fire and flooding hazards (such as eucalyptus, cattails, and cordgrass).
14) Enforce provisions under creek protection, stormwater management, and discharge control ordinances designed to keep watercourses free of obstructions and to protect drainage facilities to conform with the Regional Water Quality Control Board's Best Management Practices.

ENVI-b. ***Agricultural and Aquaculture Resilience***

1) Maintain a variety of crops in rural areas of the region to increase agricultural diversity and crop resiliency.
2) Promote and maintain the public-private partnerships dedicated to preventing the introduction of agricultural pests into regionally-significant crops, such as the glassy-winged sharpshooter into vineyards.

3) Remove septic tanks and other sources of contamination adjacent to economically-significant aquacultural and agricultural resources.
4) Encourage livestock operators to develop an early-warning system to detect animals with communicable diseases (due to natural causes or bioterrorism).

8. Land Use (LAND)

Land use change needs to be accompanied by a respect for hazardous areas and facilities, as well as recognize the interconnected nature of the Bay Area.

LAND-a. ***Earthquake Hazard Studies for New Developments***

1) Enforce and/or comply with the State-mandated requirement that site-specific geologic reports be prepared for development proposals within Alquist-Priolo Earthquake Fault Zones, and restrict the placement of structures for human occupancy. (This Act is intended to deal with the ***specific*** hazard of active faults that extend to the earth's surface, creating a surface rupture hazard.)
2) Require preparation of site-specific geologic or geotechnical reports for development and redevelopment proposals in areas subject to earthquake-induced landslides or liquefaction as mandated by the State Seismic Hazard Mapping Act in selected portions of the Bay Area where these maps have been completed, and condition project approval on the incorporation of necessary mitigation measures related to site remediation, structure and foundation design, and/or avoidance.
3) Recognizing that some faults may be a hazard for surface rupture, even though they do not meet the strict criteria imposed by the Alquist-Priolo Earthquake Fault Zoning Act, identify and require geologic reports in areas adjacent to locally-significant faults.
4) Recognizing that the California Geological Survey has not completed earthquake-induced landslide and liquefaction mapping for much of the Bay Area, identify and require geologic reports in areas mapped by others as having significant liquefaction or landslide hazards.
5) Support and/or facilitate efforts by the California Geological Survey to complete the earthquake-induced landslide and liquefaction mapping for the Bay Area.
6) Require that local government reviews of geologic and engineering studies are conducted by appropriately trained and credentialed personnel.

LAND-b. ***Wildfire and Structural Fires***

1) Review development proposals to ensure that they incorporate required and appropriate fire-mitigation measures, including adequate provisions for occupant evacuation and access by emergency response personnel and equipment.
2) Develop a clear legislative and regulatory framework at both the state and local levels to manage the wildland-urban-interface consistent with *Fire Wise* and sustainable community principles.

LAND-c. ***Flooding***

1) Establish and enforce requirements for new development so that site-specific designs and source-control techniques are used to manage peak stormwater runoff flows and impacts from increased runoff volumes.

2) Incorporate FEMA guidelines and suggested activities into local government plans and procedures for managing flood hazards.
3) Provide an institutional mechanism to ensure that development proposals adjacent to floodways and in floodplains are referred to flood control districts and wastewater agencies for review and comment (consistent with the NPDES program).
4) Establish and enforce regulations concerning new construction (and major improvements to existing structures) within flood zones in order to be in compliance with federal requirements and, thus, be a participant in the Community Rating System of the *National Flood Insurance Program.*

LAND-d. ***Landslides and Erosion***

1) Establish and enforce provisions (under subdivision ordinances or other means) that geotechnical and soil-hazard investigations be conducted and filed to prevent grading from creating unstable slopes, and that any necessary corrective actions be taken prior to development approval.
2) Require that local government reviews of these investigations are conducted by appropriately trained and credentialed personnel.
3) Establish and enforce grading, erosion, and sedimentation ordinances by requiring, under certain conditions, grading permits and plans to control erosion and sedimentation prior to development approval.
4) Establish and enforce provisions under the creek protection, storm water management, and discharge control ordinances designed to control erosion and sedimentation.
5) Establish requirements in zoning ordinances to address hillside development constraints, especially in areas of existing landslides.

LAND-e. ***Hillside – Multi-Hazard***

1) Establish a buffer zone between residential properties and landslide or wildfire hazard areas.
2) Discourage, add additional mitigation strategies, or prevent construction on slopes greater than a set percentage, such as 15%, due to landslide or wildfire hazard concerns.

LAND-f. ***Smart Growth to Revitalize Urban Areas and Promote Sustainability***

1) Prioritize retrofit of infrastructure that serves urban areas over constructing new infrastructure to serve outlying areas.
2) Work to retrofit homes in older areas to provide safe housing close to job centers.
3) Work to retrofit older downtown areas to protect architectural diversity and promote disaster-resistance.
4) Protect as open space areas susceptible to extreme hazards.
5) Provide new buffers and preserve existing buffers between development and existing users of large amounts of hazardous materials, such as major industry, due to the potential for catastrophic releases due to an earthquake or terrorism. (Flooding might also result in release or spread of these materials, however it is unlikely.)

APPENDIX A
The Planning Process

Introduction

Development of this multi-jurisdictional plan addressing the diverse concerns and challenges of a region of seven million people has required a planning process that employs a variety of forums and techniques. These are described in the sections that follow. Development of the plan began with a discussion of the overall scope of work and selection of the key hazards to be addressed and our vulnerabilities. The process then proceeded to a framing of policy goals and finally to a selection of specific mitigation strategies to address the hazards and risks.

This process was familiar to the local governments of the Bay Area. All of the local governments involved in the development of this plan have plans, policies, and/or programs that predate this plan because of:

- the vulnerability of the Bay Area to natural hazards;
- our experiences with past disasters;
- the requirements of the State of California for Safety (and, earlier, Seismic Safety) Elements in city and county General Plans since the early 1970s;
- California Environmental Quality Act (CEQA) requirements (particularly since 1988);
- the need to develop sophisticated risk and mitigation information on infrastructure as transportation providers and utilities have worked to gain public acceptance for major programs to strengthen the disaster resistance of these facilities; and
- ABAG's long history of developing hazard maps and risk assessment information.

Our effort has focused on building on these pre-existing efforts and identifying gaps that may lead to disaster vulnerabilities in order to work on ways to address risks through mitigation.

Initial Workshops with Local Government Staff to Identify Hazards, Concerns, and Needs

From June 1 through August 5, 2004, ABAG staff held a series of nine 3-hour forums, one in each of the nine counties in the San Francisco Bay Area. Email invitations were sent to city and town managers, county administrators, planning directors, public works directors, building officials, fire chiefs, and emergency managers of cities and counties. Separate invitations were emailed and faxed to all of the city and county elected officials on ABAG standing committees and the ABAG Executive Board. County emergency managers forwarded the information to their contacts in special districts. ABAG worked with staff of the Metropolitan Transportation Commission (MTC) so that transit districts would be notified. A total of 260 staff (and two elected officials) from counties, cities, and special districts attended these workshops.

At these meetings, ABAG staff spent approximately two hours discussing the scope of work in developing this plan, demonstrating proposed Internet-based hazard mapping capabilities, discussing the types of risk assessments to be performed, and talking about the general format of the plan.

An hour during each of these three-hour workshops was spent discussing hazards to be addressed, hazard mapping, risk assessment, and hazard mitigation strategies. Each person was individually queried regarding their views on the process, their concerns, and what they viewed as the most important outcomes of this process. This hour-long discussion became more focused and interactive in the later workshops than in the earlier ones. However, the issues identified in later workshops were brought to the attention of the attendees of the earlier workshops through email to ensure adequate feedback.

The immediate result of these workshops and follow-up emails was the "finalization" of the key hazards to be addressed, as well as the draft list of 53 hazard maps to be put into ABAG's on-line geographic information system (GIS). In addition to the more general issues, some specific concerns were also addressed. For example, several attendees stressed the need to provide adequate explanatory materials on the hazard maps being developed for non-technical local government staff members, elected officials, and the general public. They had discovered this problem while showing hazard maps at past city council meetings. This discussion resulted in a redesign of the map layouts.

ABAG outlined the existing technical reports and studies that have been used as a basis for the hazard assessment, exposure, and vulnerability portion of this plan and encouraged feedback to ensure that they are the most comprehensive and technically accurate reports and studies available. These specific reports are discussed and referenced in the applicable plan sections.

ABAG staff also outlined the pros and cons of organizing the mitigation section of the plan based on the traditional categories of hazards versus organizing this section along functional areas. The consensus of these groups was to organize the plan by functional area (health, housing, education, etc. – not fire, earthquake, flood, etc.). The advantages of this organization scheme were viewed as:

- stressing opportunities for multi-hazard mitigation;
- focusing on the positive aspects of what we want to have (housing and a functional transportation system, for example), rather than what we do not want (a fire or earthquake disaster, for example);
- providing stronger opportunities to integrate hazard mitigation into other areas of planning, such as transportation, housing, and land use, rather than isolating it as an offshoot of emergency response; and
- creating ways to have a large and diverse region containing numerous cities, counties, and special districts identify what we can do together.

Review and Incorporation of Existing Information

ABAG directed local governments to review the plans and studies described in the *Introduction* to this appendix and provide ABAG with relevant information. In addition, ABAG itself examined the existing technical information available on the various hazards affecting the Bay Area and their impacts. ABAG is very familiar with this information because of the extensive amount of research it has conducted with funding from the U. S. Geological Survey, the National Science Foundation, and others. However, many of the relevant flooding, landsliding, and wildfire data and reports were provided to ABAG following extensive outreach to state and federal agencies, as well as to relevant professional organizations. The result was an extensive

library of publications, including plans, studies, reports, and technical data. The most relevant are referenced as footnotes or are summarized briefly in Appendix C. Additional reports are more relevant to specific local government issues and are cited in specific local annexes to this overall plan.

Mitigation Policy Outline and Review

Having reviewed the discussions at eight of the nine county forums, as well as the draft plans of Berkeley, Napa, and the State of California, ABAG staff developed a draft overall goal and eight basic commitments for the plan. These general policies were presented for comment at the July 15, 2004 meeting of ABAG's Executive Board. This Board is the principal policy Board for ABAG. It meets once every two months and is composed of County Supervisors and City Council members representing all of the counties in the Bay Area and the cities in those counties. Meeting agendas are publicly announced as required by California's Brown Act and are mailed to hundreds of individuals who have requested to receive the agendas. The meetings of this Board are open to the public. While there was considerable discussion on the need to address hazard issues, no substantive changes in the goal or commitments were made.

Next, the goal and policies were presented to ABAG's Regional Planning Committee (RPC) at the September 1, 2004 meeting. RPC is the planning policy committee for ABAG. It meets once every two months and is composed of County Supervisors and City Council members representing all of the counties in the Bay Area and the cities in those counties, as well as environmental, economic, and equity groups. Meeting agendas are publicly announced as required by California's Brown Act and are mailed to hundreds of individuals who have requested to receive the agendas. The meeting was also open to the public and the public had the opportunity to comment. The group discussed the general commitments, recommended a change in the way the commitments were ordered (to their current order), and supported the commitments in concept.

Use of Two ABAG Special-Issue Review Committees

Two committees were used to develop the sections of the plan that address housing safety, business risk, and lifeline issues.

The ABAG Earthquake and Hazards Outreach Committee was tasked to help with development and review of the mitigation strategies related to housing and business. The committee is chaired by an elected official and has members consisting of city staffs, private construction contractors, California Geological Survey and U.S. Geological Survey scientists, and structural engineers (including both private-sector engineers and an engineer from the State Seismic Safety Commission staff).

At the meetings of this Outreach Committee on June 30, 2004 and September 15, 2004, continued integration with the International Code Council (ICC) Joint East Bay-Peninsula Chapter effort to develop housing retrofit standards was discussed, and supported. ABAG's proposed new effort to coordinate with the American Association of Grading Officials on landslide mitigation was also presented and discussed. Concerns for soft-story apartments were

discussed and the need for a full-day charrette and policy forum was expressed. ABAG has been working with, and was encouraged to continue to work with, Lakeshore Ave. businesses in Oakland in an effort to identify ways to improve the resiliency of downtown retail businesses.

The second committee, the ABAG Hazards Transportation and Lifelines Review Committee, is also chaired by an elected official and has members from city and county staffs, local transit districts, the California Highway Patrol (CHP), Caltrans District 4, local water districts, PG&E, SBC Communications, the American Red Cross-Bay Area, the U.S. Geological Survey, and the Coastal Region office of the California Office of Emergency Services. This group met on July 26, 2004 to discuss the development of this plan and to brainstorm potential mitigation strategies, particularly those related to transportation, water supply, sewage, power, and communications systems. The ways these issues interrelate to health, education, and the environment were also discussed. A particular effort was made to develop additional, and improve existing, mitigation strategies related to flooding hazards. Additional comments and ideas were obtained from this committee at its meeting of September 16, 2004.

Creation of First Draft of Mitigation Strategies

ABAG staff drafted an outline of mitigation strategies and circulated the strategies to all participating local government agencies and various professional organizations during September 2004. The strategies were created based on comments and discussions of the groups listed above, as well as from a review of the State Hazard Mitigation Plan and draft (at the time) Local Hazard Mitigation Plans of Berkeley, Napa (City), Napa County, and Oakland.

Interaction with Professional Groups

From late July 2004 through November 2004, ABAG staff actively approached various professional organizations and advocacy groups to obtain feedback on the preliminary commitment policy statements and mitigation strategies in the plan. These meetings and workshops were invaluable, in part because they generated active involvement of staff members of consulting firms, construction contractors, universities, and non-governmental agencies.

Formal and informal presentations were given to meetings or workshops of:

- the Earthquake Engineering Research Institute Northern California Chapter (EERI-NC) Government Committee (July 26, 2004),
- the ICC East Bay/Peninsula Chapter (July 21, 2004),
- the American Society of Grading Officials (July 21, 2004), and
- the FireSafe Councils (August 25, 2004).

At these meetings, ABAG staff stressed the need for feedback and assistance in drafting mitigation strategies that could be incorporated into the general outline of the eight key commitments of this multi-jurisdictional plan. The EERI-NC meeting resulted in a revised draft of the mitigation strategies related to various types of privately-owned and local government buildings vulnerable to earthquake damage. The ICC meeting resulted in an outline of the mitigation strategies related to vulnerability of single-family homes. The ASGO meeting resulted in strategies related to mitigation of landslides. Finally, the FireSafe Councils meeting resulted the development of the range of strategies related to fire.

Additional outreach to professional organizations occurred in October and November after the first formal plan release on October 6, 2004. (More information on the October 6th event is included in the following section.) These efforts focused on obtaining comments and peer review for the draft strategies and were more outreach than plan development. Presentations were made to the following groups:

- the Geotechnical Engineering Earthquake Reconnaissance (GEER) group (October 7, 2004) related to landslide mitigation strategies,
- the Earthquake Engineering Research Institute Northern California Chapter (EERI-NC) Lifeline Committee (October 28, 2004) related to the ***Infrastructure*** area,
- San Francisco Community Agencies Responding to Disasters (SF-CARD) (November 4, 2004) related to the ***Health*** area,
- the Structural Engineers Association of Northern California (SEAONC) (November 9, 2004), and
- the California Preservation Foundation (November 18, 2004) related to historic issues under ***Housing***, ***Economy***, and ***Government***.

Initial General Public Outreach

The DRAFT Local Hazard Mitigation Plan was distributed at the ABAG General Assembly conference on "Taming Natural Disasters" on October 6, 2004. This conference was widely advertised with printed and email fliers sent to 60,000 people representing local governments, business, social services, engineering, and environmental groups. Comments on additional strategies were solicited at the conference. Conference attendees were encouraged to submit comments.

ABAG used the October 6th conference to encourage the media to help publicize the plan and posted a request for comments on our web site to collect comments from the public. Additional press outreach occurred before October 17, 2004, the 15th anniversary of the Loma Prieta earthquake, including an article in the San Jose Mercury News, the largest circulation newspaper in the region. We encouraged the public to mail in or email suggestions.

Based on the comments received, the DRAFT Local Hazard Mitigation Plan was revised. All of the comments were addressed. Most were incorporated directly in the plan. People who suggested changes that were not incorporated into the plan were sent replies explaining why the changes were not made. Largely the changes that were not made would have added duplication or would have put the plan's focus on emergency response, rather than on mitigation. The revised Local Hazard Mitigation Plan was forwarded to FEMA Region IX and the California Office of Emergency Services on October 27, 2004.

Focused Issue Workshops and Additional Outreach and Review

Based on the comments received on the Draft Local Hazard Mitigation Plan distributed at the October General Assembly on "Taming Natural Disasters," four issues were identified that would benefit from immediate further work – health and disasters, education and schools,

historic structures, and soft-story multi-family residential buildings. ABAG held focused workshops were held on each of these issues:

- Health and Disasters on December 14, 2004 – attended by 8 people (including local government public health experts and non-profits),
- Education and schools on December 16, 2004 – attended by 22 people (largely school district employees), and
- Soft-Story Residential January 27, 2005 – attended by 45 people (including private contractors, architects, and engineers as well as local government building officials, planners, and elected officials).

ABAG staff used an existing forum organized by the City and County of San Francisco on historic buildings attended by approximately 20 people on January 12, 2005 to gain insight on how to modify the plan rather than holding the meeting at ABAG.

Comments received from OES, FEMA, professional organization outreach in late October and November, and the first two of these focused workshops were incorporated into another version of this Local Hazard Mitigation Plan. These revisions were provided to cities, counties, and special districts for a final round of comment in early January 2005.

Again, ***all*** of the comments received were reviewed. Again, most suggestions were incorporated directly in the plan. Again, people who suggested that changes be made that were not incorporated into the plan were sent replies explaining why the changes were not made. Again, almost all suggested changes that were not incorporated were not made because they would have added duplication or made the plan's focus on emergency response, rather than on mitigation. All changes to the mitigation portion of this plan were finalized on January 28, 2005.

A Note on General Public Participation and Outreach

While every effort has been made to make this entire process open and accessible for public participation, the general low level of interest and knowledge of hazards and mitigation by a many members of the public makes outreach more difficult than for other issues, such as traffic, education, or crime. Thus, an extensive effort was made to supplement typical outreach efforts with extensive interaction with "publics" that, by definition, are more interested in this process – existing ABAG committees, local governments, and professional organizations. This conclusion does not mean that the public did not examine the plan. For example, the "home page" for the "web site" set up for this effort, http://quake.abag.ca.gov/mitigation, received 2,870 "hits" from October-December 2004. In addition, the plan was developed by focusing outreach both on each ***hazard***, and on each commitment (or ***functional area***).

While outreach to neighboring local governments might normally be appropriate in the development of a plan such as this, because the area covered by this plan is so large, the logical neighboring entity is the State of California. Staff members of the State Seismic Safety Commission, California Geological Survey, California Department of Forestry, and Coastal Regional Office of Emergency Services were all involved in the development of this plan. Some additional outreach with reclamation districts that own levees in the delta areas will be brought into future workshops held by the ABAG Hazards Transportation and Lifelines Review Committee.

Additional Information on the Local Planning Process, Public Participation, and Outreach

In addition to the information provided in this section, many cities, counties, and special districts held additional meetings and workshops as part of the process needed to identify their specific hazards, risks, and appropriate mitigation strategies. At a minimum, the mitigation strategies were reviewed at an open meeting of the organization's Council or Board. For more information on each jurisdiction's planning process, see the specific annexes prepared by that local government.

Finally, the contributions of each local government to the development of this overall plan are detailed in Appendix E. The tables in this appendix specify which local governments attended which ABAG forum or workshop, those that provided written or oral comments on various aspects of the overall plan (including providing information on critical government facilities), and the name and contact information for those individuals who worked directly on this effort. While Appendix E is not on ABAG's web site, it has been forwarded to State OES and FEMA.

This Local Hazard Mitigation Plan, as well as the ABAG Annex to the Plan, were adopted at the public meeting of ABAG's Executive Board on March 17, 2005.

APPENDIX B
The Plan Maintenance and Update Process

Background

ABAG received funding for the preparation of this multi-jurisdictional plan from the California Governor's Office of Emergency Services (OES) through the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation Grant Competitive (PDM-C) program in mid-April 2004. While cities and counties must complete the initial plan by May 1, 2005 to be eligible for the 05 PDM-C program, the ABAG funding is for a two-year project. Thus, this initial Local Hazard Mitigation Plan for the San Francisco Bay Area must be viewed in this unique context.

Preparation Schedule for the "Interim" and "Comprehensive" Plan

Our goal is to have an "interim" plan developed, adopted by many local governments, and approved by OES and FEMA by March 17, 2005. This "interim" plan will meet all of the minimum requirements of a Local Hazard Mitigation Plan. However, it will be missing several plan pieces that are in the regulations defining the plan contents with the language that the plan "should" contain versus the plan "shall" contain these items. These pieces are typically related to loss estimation and the clear tie between risk and mitigation impacts.

Our goal is to have a "comprehensive" plan by April 1, 2006 near the end of the 24-month grant. ***This complete plan will include much more extensive loss estimation data, clear ties between risk assessment data and mitigation strategies, and additional information on the mitigation strategies, including criteria for measuring progress toward the goal of disaster resistance.***

Integration into Existing Planning Mechanisms

Typically, cities and counties have three major mechanisms for integrating the programs and policies identified in this plan: the Safety Element of their local General Plan, the requirements for project review of the California Environmental Quality Act (CEQA), and on-going capital improvement programs. The components of some of these other programs are identified as "Existing Programs" in the Annex of each participating local government. In addition, the recommendation of this overall plan is for local governments to adopt the specific mitigation strategies identified as an "Implementation Appendix" of their Safety Element.

The situation for special districts and other governmental agencies is slightly different. However, the recommendation of this overall plan is to identify a variety of funding sources and implementation mechanisms for the higher priority mitigation strategies identified in each local government's annex.

Future Updates of This Plan

ABAG will continue to update this plan over time. The plan will be updated at least every five years, as required by DMA 2000. However, it will be updated more frequently as time and money allow. ABAG's Planning Department will take the lead in updating hazard mapping and

risk information, while participating local governments will take the lead in developing and updating mitigation goals and strategies.

For example, ABAG will continue to update its geographic information system based on new information from state and federal agencies, as well as from research projects conducted by ABAG and others. The lead in this effort at ABAG will be the Planning Department, specifically the Earthquake and Hazards Program.

When an update occurs, participating local governments will be notified of the planned update and encouraged to provide comments. If changes are significant (that is, involve more than minor changes to, for example, the hazard mapping), all participating local governments will be involved in any needed updates in mitigation strategies and all will be asked to submit another resolution approving the plan.

In addition, public participation will be encouraged at specific issue-oriented workshops and forums as time and funding allow. As at the numerous workshops and forums held during the development of this initial plan, a wide variety of participation will be encouraged, including:

- local and state government staff and elected officials,
- private engineers, construction contractors, financial experts, and business owners,
- professional organizations,
- university professors, and
- nonprofits.

If ABAG is unwilling or unable to act as the lead agency in the multi-jurisdictional effort, participating local governments will contact each County's Office of Emergency Services. Counties should then work together to identify another regional forum for developing a multi-jurisdictional plan. Unlike in other metropolitan areas of the country, the Bay Area has no single dominant city or county. Many special districts, including BART, MTC, AC Transit, and the East Bay Regional Park District also have multi-county service areas. Thus, although counties could be used as lead agencies in updating the plan, this option is not as appropriate as in other areas of the country.

APPENDIX C
Natural Hazard Risk Assessment

What Makes a Disaster?

A disaster is a natural or man-made emergency whose response needs exceed available resources. Thus, disasters are not just emergencies that make the national news!

There were 4,215 traffic-related fatalities in California in 2003, yet this was not called a "disaster.[20]"

Traffic-Related Fatalities in 2003
Alameda – 114
Contra Costa – 70
Marin – 13
Napa – 20
San Francisco – 52
San Mateo – 36
Santa Clara – 91
Solano – 56
Sonoma – 57
TOTAL = 509 in the Bay Area

The number of homicides in California in 2003 was roughly half as large, with 2,402 deaths.[21]

Again, homicides aren't disasters – unless committed in mass as an act of terrorism.

Homicides in 2003
Alameda – 139
Contra Costa – 74
Marin – 0
Napa – 2
San Francisco – 69
San Mateo – 20
Santa Clara – 48
Solano – 20
Sonoma – 12
TOTAL = 384 in the Bay Area.

For comparison, all of the deaths associated with the September 11, 2001 attacks totaled 2,992[22]. In addition, the attacks caused billions of direct and indirect economic losses.

Deaths Associated with 9/11
2,749 deaths associated with the World Trade Center
184 deaths in the Pentagon tragedy
40 deaths when a hijacked jet crashed in Pennsylvania.
19 suicides by hijackers
TOTAL = 2,992

A single homicide is a crime, and an attack with political intent is terrorism. But both may not be a disaster.

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[20] Source – August 2004. National Highway Traffic Safety Administration. ***2003 Annual Assessment of Motor Vehicle Crashes*** (based on Fatality Analysis Reporting System – FARS): National Highway Traffic Safety Administration. Published at http://www-fars.nhtsa.dot.gov/finalreport.cfm?year=2003&stateid =6&title =States&title2=Fatalities_and_Fatality_Rates&SpecialRpt=query1_county&SpecialRpt_lvl=2

[21] Source – July 2004. California Department of Justice Criminal Justice Statistics Center. ***Crime in California, 2003 Advance Release***: Attorney General's Office. Published at http://ag.ca.gov/cjsc/publications/advrelease/ad/ad03/ad03.pdf

[22] Source – 2004. National Commission on Terrorist Attacks Upon the United States (9-11 Commission). ***Final Report of the National Commission on Terrorist Attacks Upon the United States, Official Government Edition.*** (Ch. 9, Footnote 188.) Published at http://www.gpoaccess.gov/911/

On the other hand, the San Simeon earthquake of December 2003 that resulted in only 2 fatalities, but caused hundreds of millions in property losses, was a disaster[23].

As stated above, disaster professionals define a disaster as a natural or man-made emergency whose response needs exceed available resources. When local government resources are exceeded, the California Governor's Office of Emergency Services (State OES) is contacted and the Governor is requested to declare a State Disaster. When State resources are exceeded, State OES contacts the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) and the President is requested to declare a National Disaster. This Presidential Declaration triggers funding resources for the public, the state, and local governments to use for clean-up, repair, recovery, and mitigation.

What Are Our Natural Hazards?

The focus of this effort is on ***natural*** hazards, that is, natural occurrences that can pose a risk of injury, loss of life, or damage to property. The nine most significant of these affecting the Bay Area, based on our past history, as well as on the State Hazard Mitigation Plan, are related to:

- earthquakes (***surface faulting***, ***ground shaking***, ***liquefaction***, ***landslides***, and ***tsunamis***), or
- weather (***flooding***, ***landslides***, ***wildfires***, and ***drought***).

Other hazards relate to man-made conditions, including releases of hazardous materials, dam failures, energy shortages, and weapons of mass destruction. These other hazards are only addressed as they relate to earthquake and weather-related hazards. The only one of these additional hazards that is readily mapped and analyzed is ***dam failure***.

Finally, people and the food they eat are subject to disease. These concerns are also not addressed in great detail, except as they relate to earthquake and weather-related hazards.

As part of this hazard identification process, ABAG has created a web site with access to 53 hazard maps. These maps are referenced to the "hard copy" maps in this document. However, these maps can be interactively zoomed by address, zip code, city, county, school district, fire jurisdiction, and water district for use in the preparation of local Annexes to this plan. They also are all publicly accessible on the web at http://quake.abag.ca.gov/mitigation/.

Why Are We Concerned with Exposure and Probability, Not Just Hazards?

If a river overflows its bank in an uninhabited area with no roads and no buildings, it is a flood, but not a flood disaster. If a major earthquake occurs in the desert of southeastern California where no one lives, it is still an earthquake, but not an earthquake disaster. Thus, this hazard mitigation plan is concerned about the location of people, buildings, and infrastructure relative to the hazards of floods, earthquakes, wildfires, and landslides – our hazard exposure.

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[23] Source – 2004. FEMA. "President Orders Aid for California Earthquake Recovery." FEMA News Press Release HQ04-003. Published at http://www.fema.gov/news/newsrelease.fema?id=10390

Hazards also need to be expressed with some sort of probability. Typically, hazards that cause disasters are not common, or these disasters would have long ago triggered an increase in response capability and hazard mitigation. For example, Bay Area cities and counties have adopted mitigation strategies and building codes that allow moderate earthquakes to occur with minimal damage. Because these hazards cause rare disasters, the probability information on their future occurrence is incomplete or subject to large errors.

A complete risk assessment should identify:

- the existing land uses, buildings, infrastructure, and critical facilities located in each of these hazard areas (exposure);
- a general description of land use and development trends along with associated anticipated changes in exposure;
- an estimate of the potential deaths and injuries, property damages (dollar losses), and functional losses (disruption) based on exposure and vulnerability of various types of structures; and
- estimates of the probabilities of these losses over time.

The risk assessment ABAG is creating for the Bay Area is incomplete at this time. However, we anticipate that it will become more complete as we work with cities, counties, and special districts to incorporate additional information on critical and vulnerable facilities. ABAG plans to develop additional vulnerability information, as well as additional information on the potential impacts of mitigation strategies on vulnerability, from the fall of 2004 through the spring of 2006.

The following sections focus on describing the most significant natural hazards affecting the San Francisco Bay Area so that options for mitigation of those hazards can be developed.

What Is Hazard Mitigation?

There are two ways to deal with disasters.

1. We can increase emergency ***response*** capability. Thus, more damage needs to occur for those capabilities to be exceeded. Large incidents become manageable emergencies.
2. Projects can be undertaken to prevent or lessen the impacts of future incidents, and thus reduce the need for larger and larger response capability. Homes can be moved from areas suffering repeated floods. Buildings and infrastructure can be built to reduce expected damage in earthquakes. Wood shakes on homes in woodland areas can be replaced with asphalt shingles or tile. These actions are called "***mitigation***."

More specifically, the Stafford Act defines "mitigation" as "*any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.*"[24] Thus, as mitigation activities are undertaken, the risks associated with disasters decrease.

[24] Source – 44 CFR Section 201.2 pertaining to Section 322 of the Stafford Act, 42 U.S.C. 5165.

Earthquakes

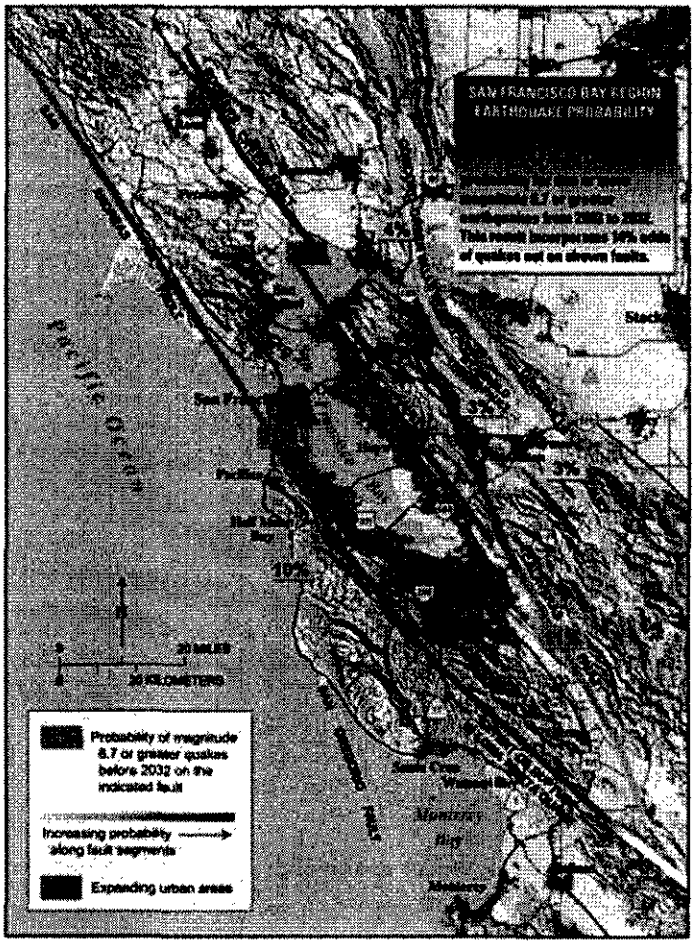
Probability of earthquake-related hazards

The Bay Area is in the heart of Earthquake Country. The Bay Area is crossed by many active faults. This ma figure shows that major active faults ru through or adjacent to all nine Bay Are counties.

While recent research by the U.S. Geological Survey (USGS) has provide more reliable probability information fc future Bay Area earthquakes than for any other area of the country (62% of a magnitude 6.7 or larger earthquake), it has a wide error range – from a low of 37% to a high of 87%, or plus or minus 25%[25]!

Probability information for the rupture of individual faults has also been prepared by USGS, as shown on the following table.[26]

Note that there are major faults in the Bay Area, such as the West Napa fault and the Maacama fault, for which there is insufficient information to produce probability estimates.



Map Source – USGS, 2003

Location and extent of earthquake-related hazards

Earthquakes result in five different hazards that have been mapped in the Bay Area. The following sections describe those hazards, as well as reference the map plates showing the location and extent of the hazard in the Bay Area.

Surface Rupture

Earthquakes occur in the Bay Area when forces underground cause the faults beneath us to rupture and suddenly slip. If the rupture extends to the surface, we see movement on a fault (***surface rupture***). Because faults are weaknesses in the rock, earthquakes tend to occur over and over on these same faults.

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[25] Source – 2003. USGS Working Group on Earthquake Probabilities. ***Is a Powerful Earthquake Likely to Strike in the Next 30 Years?*** – USGS Fact Sheet 039-03 at http://geopubs.wr.usgs.gov/fact-sheet/fs039-03/fs039-03.pdf and ***Earthquake Probabilities in the San Francisco Bay Region*** - USGS Open-File Report 03-214 at http://geopubs.wr.usgs.gov/open-file/of03-214/.

[26] The probability information provided by the USGS for earthquakes on each fault also applies to the associated earthquake-related hazards (ground shaking, liquefaction, landslides, and, except for faults that do not extend to the surface, fault surface rupture). Tsunamis probabilities are more complicated, however, as noted on page 48 and 49.

TABLE 1 – Probabilities of Selected Earthquake Scenarios Occurring in the Next 30 Years and Slip Rates on Associated Fault Segments [*based on USGS Working Group on California Earthquake Probabilities, 2003, except slip rates for last three faults from Petersen and others, 2002 update*] [***Scenario maps on ABAG web site are shaded.***]

Fault	Segment (s)	Average Long-Term Slip Rate (mm / year)	% Probability of Characteristic Quake 2002-2031	% Probability of Quake ≥ 6.7 2002-2031
San Andreas	Santa Cruz Mountains (SAS)	17	2.6	2.5
	Peninsula (SAP)	17	4.4	4.3
	North Bay (SAN)	24	0.9	0.9
	Ocean (north of Bay Area – SAO)	24	0.9	0.9
	South Bay Segments (SAS + SAP)	17	3.5	3.5
	Central Bay Segments (SAP + SAN)	17 – 24	0.0	0.0
	Northern Segments (SAN + SAO)	24	3.4	3.4
	Bay Area Segments (SAS+SAP+SAN)	17 – 24	0.1	0.1
	Central + North (SAP + SAN + SAO)	17 – 24	0.2	0.2
	Entire – Repeat of 1906 (SAS + SAP + SAN + SAO)	17 – 24	4.7	4.7
	Floating M6.9	17 – 24	7.1	6.8
Hayward/Rogers Creek	Southern (HS)	9	11.3	4.3
	Northern (HN)	9	12.3	1.5
	Entire (HS + HN)	9	8.5	7.2
	Rogers Creek (RC)	9	15.2	14.4
	HN + RC	9	1.8	1.8
	HS + HN + RC	9	1.0	1.0
	Floating M6.9	9	0.7	0.7
Calaveras	Southern (Outside Bay Area - CS)	15	21.3	0.0
	Central (CC)	15	13.8	0.5
	CS + CC	15	5.0	0.5
	Northern (CN)	6	12.4	8.0
	CC + CN	6 – 15	0.3	0.2
	CS + CC + CN	6 – 15	2.0	1.8
	Floating M6.2	6 – 15	7.4	0.0
	Floating M6.2 on CS + CC	15	7.4	0.0
Concord/Green Valley	Concord (CON)	4	5.0	0.1
	Southern Green Valley (GVS)	5	2.3	0.0
	CON + GVS	4 – 5	1.6	0.3
	Northern Green Valley (GVN)	5	6.1	0.0
	Entire Green Valley (GVS + GVN)	5	3.2	0.4
	Entire (CON + GVS + GVN)	4 – 5	6.0	2.7
	Floating M6.2	4 – 5	6.2	0.0
San Gregorio	Southern (Outside Bay Area - SGS)	3	2.3	2.1
	Northern (SGN)	7	3.9	3.9
	SGS + SGN	3 – 7	2.6	2.6
	Floating M6.9	3 – 7	2.1	2.0
Greenville	Southern (GS)	2	3.1	0.7
	Northern (GN)	2	2.9	1.0
	Entire (GS + GN)	2	1.5	1.4
	Floating M6.2	2	0.4	0.0
Mt. Diablo Thrust	Mt. Diablo Thrust (MTD)	2	7.5	2.5
Maacama	Southern (part in Bay Area)	9	*Not available*	*Not available*
Monte Vista - Shannon	Monte Vista Segment	0.4	*Not available*	*Not available*
West Napa	Entire Segment	1	*Not available*	*Not available*

The California Geological Survey (CGS) publishes maps of the active faults in the Bay Area that reach the surface as part of its work to implement the requirements of the Alquist-Priolo Earthquake Fault Zone Act. These maps show not only the most comprehensive depiction of fault traces that can rupture the surface, but also the zones in which cities and counties must require special geologic studies to prevent the building of structures intended for human occupancy from being built ***and*** in which the surface rupture hazard must be disclosed in real estate transactions. The regional depiction of the location of this hazard is on ***Plate 1 – Fault Surface Rupture Hazard***.

In some respects, fault rupture is a relatively minor problem in earthquakes. For example, strong earthquakes can occur when the fault rupture does not extend to the surface, and that fault-related damage is rare when compared to shaking-related damage. Neither the Loma Prieta nor the Northridge earthquakes resulted in surface rupture. In addition, the major thrust faults listed in Table 1 have not experienced surface rupture. While the faults shown on Plate 1 only include those faults that have experienced surface rupture, only structures that are directly astride the fault trace that ruptures will be damaged in a future earthquake, not all of the structures in the study zones.

That said, the amount of ground displacement can be quite large, particularly when a major strike-slip fault is involved. For example, in a study conducted by ABAG examining the potential impact of this hazard on road closures[27], the amount of horizontal displacement on the large strike-slip faults was estimated as 2 – 4 meters, and the amount of vertical displacement was estimated as 0 – 0.4 meters, with actual values sometimes reaching double these values.

Maps of fault rupture hazard for individual local governments are on line at http://quake.abag.ca.gov/faults.

Ground Shaking

The fault rupture of the ground generates vibrations or waves in the rock that we feel as ***ground shaking***. Larger magnitude earthquakes generally cause a larger area of ground to shake hard, and to shake longer. Thus, one principal factor in determining shaking hazard is the magnitude of expected earthquakes. However, an earthquake shakes harder in one area versus another based not only on the magnitude, but also on other factors, including the distance of the area to the fault source of the earthquake and the type of geologic materials underlying the site, with stronger shaking occurring on softer soils. Earthquake intensity measures the strength of ground shaking in an individual earthquake at a particular location. ABAG and the U.S. Geological Survey (USGS) have developed several maps to aid in depicting shaking intensity, and thus ground shaking hazard.

- ABAG, in conjunction with scientists at USGS, has developed shaking intensity maps for 18 likely future earthquakes, as shown on ***Plates 2 – 19 – ABAG Earthquake Shaking Scenarios***. These maps are appropriate for use in disaster exercises and in earthquake disaster planning.
- USGS has also developed several earthquake shaking intensity maps for anticipated future earthquakes. These maps are based on the ground motion models that are used to

[27] Source – 1997. Perkins, J., and others. ***Riding Out Future Quakes*** – ABAG, 198 pp. See fault rupture discussion on pages 15-19.

generate ShakeMaps for large and moderate earthquakes immediately after these earthquakes occur. A comparison of the USGS ShakeMap versus ABAG Earthquake Shaking Scenario map for the North and South Hayward fault scenario has been included as ***Plate 20*** for information. As can be seen from this comparison, the ABAG Earthquake Shaking Scenario maps show higher shaking near the fault than the ShakeMaps for the large strike-slip faults that are common in the Bay Area. Estimating ground motions near rupturing faults is an active area of earthquake research. Records of strong ground motions with peak velocities consistent with the ABAG model were obtained from near-fault stations for the recent 2002 Denali and 1999 Chi-Chi earthquakes. Because of our desire to be conservative, ABAG is using the ABAG Earthquake Shaking Scenario maps for this disaster planning effort.

As is obvious when examining the explanation on these maps, higher modified Mercalli intensities translate into higher shaking. The impact of this increased shaking varies. For example, higher shaking translates into higher numbers of landslides, greater areas of liquefaction, and more damaged buildings. More information on this subject is available at http://www.abag.ca.gov/bayarea/eqmaps/doc/mmi.html for the modified Mercalli intensity (MMI) scale itself, and at http://www.abag.ca.gov/bayarea/eqmaps/doc/1998gs.html for what higher ground shaking means in a way that is more quantified than the MMI scale itself. This information was developed by ABAG for the U.S. Geological Survey in 1998[28].

Finally, it is often useful to have a single hazard map containing the shaking hazard information for the Bay Area for long-term risk analysis. USGS cooperated with CGS, the California Seismic Safety Commission (CSSC), and State OES to develop such a "composite" scenario map. There are two principal caveats to use of this map. First, it incorporates probability information that has a wide margin of error. As stated earlier, while recent research by USGS has provided more reliable probability information for future Bay Area earthquakes than for any other area of the country (62% of a magnitude 6.7 or larger earthquake), it has a wide error range (from a low of 37% to a high of 87%, or plus or minus 25%[29])! In addition, the December 2003 San Simeon earthquake occurred in an area shown on this map as having less potential for strong shaking than many other areas of coastal California. The second caveat is that the shaking intensity levels are based on the ShakeMap models, and may underestimate the hazard near the Bay Area's large strike-slip faults, as noted above. See ***Plate 21 – Earthquake Shaking Potential*** for a regional depiction of this hazard map.

See http://quake.abag.ca.gov/mapsba.html for more information and local government-specific depictions of these 20 earthquake shaking hazard maps.

Liquefaction

Ground shaking can lead to ***liquefaction.*** When the ground liquefies in an earthquake, sandy or silty materials saturated with water behave like a liquid, causing pipes to leak, roads and airport runways to buckle, and building foundations to be damaged. As with ground shaking, several types of maps aid in depicting this hazard.

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[28] Source – 1998. Perkins, J. ***The San Francisco Bay Area – On Shaky Ground - Supplement*** – ABAG, 28 pp. See discussion on meaning of MMI on pages 2-11. Note – this information is also on the web at http://www.abag.ca.gov/bayarea/eqmaps/doc/1998gs.html.

[29] Source – 2003. USGS Working Group on Earthquake Probabilities. ***Is a Powerful Earthquake Likely to Strike in the Next 30 Years?*** – USGS Fact Sheet 039-03 at http://geopubs.wr.usgs.gov/fact-sheet/fs039-03/fs039-03.pdf.

- Liquefaction susceptibility maps show areas with water-saturated sandy and silty materials. ***Plate 22*** shows a map of liquefaction susceptibility for the Bay Area published by USGS showing various levels of liquefaction susceptibility. ***Plate 23*** shows the liquefaction susceptible areas as depicted by CGS. Unlike Plate 22, the map groups most of the moderate to very high susceptible areas shown on the USGS map into official seismic hazard map zones where real estate disclosure and hazard analysis are required. Note, however, that this type of map is only available for a portion of the Bay Area.
- Liquefaction hazard maps for specific earthquake scenarios show areas where the ground is both susceptible to liquefaction and that are likely to be shaken hard enough in a particular earthquake to trigger liquefaction. These maps are depicted in ***Plates 24 – 41.***

ABAG has conducted extensive studies looking at the ways that liquefaction could potentially impact the Bay Area summarized in an ABAG report.[30] In general, the potential impacts to infrastructure are more significant than to building structures.

See http://quake.abag.ca.gov/liquefac/liquefac.html for more information and local government-specific depictions of these two liquefaction susceptibility and 18 liquefaction hazard maps.

Earthquake-Induced Landslides

Ground shaking can also lead to ground failure on slopes, or ***earthquake-induced landslides***. While USGS has created several demonstration maps for this type of hazard, the best depiction is shown in ***Plate 42***, the CGS seismic hazard map for earthquake-induced landslides. As with the CGS liquefaction susceptibility map, this map is only available for a portion of the Bay Area. The list of mitigation strategies includes several relating to ways in which local governments can increase the speed of completion of hazard maps, particularly GOVT-c-10, LAND-a-2, LAND-a-4, and LAND-a-5. ABAG is also working to secure funding for additional studies related to earthquake-induced landslide hazards in the Bay Area.

More detailed maps for individual local governments and additional landslide hazard information are available on line at http://quake.abag.ca.gov/landslide.

Tsunamis

Large underwater displacements from major earthquake fault ruptures or underwater landslides can lead to ocean waves called ***tsunamis***.[31] Since tsunamis have high velocities, the damage from a particular level of inundation is far greater than with a normal flood event. Tsunamis can result from off-shore earthquakes within the Bay Area, or from distant events.

A large effort is underway to develop tsunami hazard maps for the western coast of the United States. The State of California Governor's Office of Emergency Services (OES) is leading this effort. As of February 2005, a map of a portion of the Bay Area ocean coastline from San Gregorio in San Mateo County to Lincoln Park in San Francisco has been published. The map shows a "worst case" tsunami event for evacuation planning. The map is based on a maximum run-up to a specific contour, in this case, 12.8 meters (42 feet). While no maps of the area south

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[30] Source – 2001. Perkins, J. ***The San Francisco Bay Area – The Real Dirt on Liquefaction*** – ABAG, 25 pp. See discussion on "What Happens to Our Built Environment" on pages 11-19. Note – this information is also on the web at http://quake.abag.ca.gov/liquefac/liquefac.html.

[31] Waves in enclosed bodies, such as lakes or Bays, are called ***seiches***. There are no published maps or hazard information on seiche hazards in the Bay Area.

of San Gregorio to the southern tip of San Mateo County have been published, the coastal bluffs in the area would tend to confine the inundation area to the beaches. The regional depiction of this hazard is on ***Plate 43 – Tsunami Evacuation Planning Areas***. ABAG has worked with OES and the two affected counties to make the regional map, more detailed maps for individual local governments, and additional tsunami hazard information publicly available at http://quake.abag.ca.gov/tsunami.

Maps of the coastline portions of Sonoma and Marin counties are expected by fall 2005. No maps have been published as part of this OES effort for the area within San Francisco Bay, although an ongoing study[32] indicates that if the run-up height is 10 meters at the Golden Gate, it might be half as high when it reaches the East Bay, and only 10% as high (1 meter) by the time it reaches the northern and southern ends of the Bay. ABAG continues to work with OES and the affected counties and hopes to make additional maps of this type available in the coming months.

It is important to understand that, even when the current OES mapping is complete, no probability information is available for the Bay Area tsunami hazard. ABAG and others are working with State OES to encourage more mapping that has an estimate of probability associated with it. OES and the California Geological Survey will be discussing this issue in a meeting tentatively scheduled for the fall of 2005. The tsunami hazard map is not even officially called a hazard map, but an evacuation planning map, because it is not based on probabilities.

The list of mitigation strategies includes several relating to ways in which local governments can increase the speed of completion of hazard maps, particularly GOVT-b-24 and GOVT-c-10.

Past occurrences of Bay Area earthquake-related disasters

The fact that a devastating earthquake occurred in 1906 – the San Francisco earthquake – is common knowledge. Larger earthquakes generally affect larger areas; the San Francisco earthquake caused extensive damage in Oakland, San Jose and Santa Rosa. More recently, the 1989 Loma Prieta earthquake caused extensive damage in the Santa Cruz Mountains, as well as in Oakland and San Francisco tens of miles away. But many moderate to great earthquakes (over magnitude 6.0) have affected the Bay Area; 22 such events have occurred in the last 160 years – for an average of one every seven years.

There have been only three earthquake-related natural disasters in the Bay Area since 1950 – the September 3, 2000 Napa earthquake (declared a disaster in only Napa County), the 1989 Loma Prieta earthquake (declared a disaster in Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, and Solano counties), and the April 1984 Morgan Hill earthquake (declared a disaster in Santa Clara County). In addition, the April 1964 Good Friday Alaskan earthquake triggered mitigation conducted for the tsunami warning in Marin County. See Appendix D and http://quake.abag.ca.gov/mitigation/disaster-history.html.

Vulnerability of the Bay Area to earthquakes

ABAG has focused its assessment of Bay Area earthquake vulnerability assessment by conducting several major analyses – three exposure analyses as part of its development of this

[32] Dengler, L., Borrero, J., Patton, J., 2004. "The Tsunami Hazard in San Francisco Bay" in ***Eos Trans***. AGU, 85(47), Fall Meet. Suppl., Abstract OS23D-1354.

multi-jurisdictional Local Hazard Mitigation Plan (with plans to conduct additional ones when more complete mapping is available), and three as part of earlier efforts.

Fault surface rupture hazard and exposure of existing land use –
The analysis of the types of land use and facilities focuses on the California Geological Survey's map of surface fault rupture hazard study zones (Plate 1) described earlier under the Alquist-Priolo Earthquake Fault Zoning Act. These zones are not fault zones, but zones in which studies are required to ensure that no structures intended for human occupancy are placed across active faults. Thus, only a small fraction of the land use areas and infrastructure miles in these zones are actually subject to fault rupture.

- Of the 4.36 million acres of land in the Bay Area, 1.8% is in areas designed as subject to the study requirement of the Alquist-Priolo Earthquake Fault Zoning Act.
- 2.2% of the urban land is in one of these areas, versus 1.7% of the non-urban land.
- Types of existing urban land uses with the highest percentages in these areas are urban open (3.1%), mixed residential-commercial (2.9%), and residential use (2.3%).
- The percentage of urban land located in these areas ranged from a high of over 4% in Alameda and San Mateo counties to a low of 0% in San Francisco.

These percentages are based on information in ***Table 2: Surface Rupture Hazard and Existing (2000) Land Use***. See Plate 1 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Fault surface rupture hazard and exposure of existing infrastructure –
Rather than discuss the percentages of road miles in these areas, it is useful to note the number of road closures in these areas in various earthquake scenarios. See http://www.abag.ca.gov/bayarea/eqmaps/eqtrans/result.html and select a specific scenario. For example, of the 1,734 road closures expected in a future North-South Hayward fault earthquake; 520 will be due to surface rupture. (These estimates are an update of the ***Riding Out Future Quakes*** report discussed earlier.)

Pipelines have different issues, particularly the large water importation aqueducts of the East Bay Municipal Utility District (EBMUD), the Hetch-Hetchy system administered by the Public Utility Commission of the City and County of San Francisco (SF-PUC), and the Santa Clara Valley Water District. These local government agencies have unique issues with each major fault crossing. For example, EBMUD is continuing to work on its fault crossing issues, in spite of major construction projects that have already been completed.

Fault surface rupture hazard and exposure of existing critical facilities –

- Of the 812 critical health care facilities in the Bay Area, 1.8% are in areas designed as subject to the study requirement of the Alquist-Priolo Earthquake Fault Zoning Act.
- Only 1.1% of the 2,063 public schools are in these areas.
- Of the 3,991 critical facilities owned by cities, counties, and other special districts, 1.5% are in these areas.
- Of greater concern than a facility actually being astride a fault, however, is that the fault rupture will impede access and the functioning of infrastructure service to those facilities.

These percentages are based on information in ***Table 2: Surface Rupture Hazard and Existing (2000) Land Use***. See Plate 1 and http://quake.abag.ca.gov/mitigation/pickcrit.html for more specific information for individual counties and cities.

Shaking hazard and exposure of existing land use –
Rather than perform this analysis for each of the many earthquake scenarios developed by USGS and ABAG, we have used the shaking potential map (Plate 21) described earlier.

- Of the 4.36 million acres of land in the Bay Area, 8.1% is in the areas with highest shaking potential, while 29.0% is in the next to highest area of shaking potential.
- 55.5% of the urban land is in one of these two areas, versus 31.1% of the non-urban land.
- Types of existing urban land uses with the highest percentages in these two areas are mixed commercial-industrial complexes (93.6%), mixed residential-commercial (80.7%), and commercial use (66.4%).
- Of the 115,986 acres of urban land in the highest shaking potential category, 47.1% is in residential use.
- The percentage of urban land located in the highest two shaking potential areas ranged from a high of over 78% in Alameda, San Francisco, San Mateo, and Santa Clara counties to lows of less than 7% in Napa and Solano counties.

These percentages are based on information in ***Table 3: Shaking Hazard and Existing (2000) Land Use***. See Plate 21 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Shaking hazard and exposure of existing infrastructure –
Rather than perform this analysis for each of the many earthquake scenarios developed by USGS and ABAG, we have used the shaking potential map (Plate 21) described earlier.

- A huge 86.7% of the fixed transit in the Bay Area is in the two highest shaking potential areas, including 84.8% of the BART lines. This finding on exposure is consistent with the BART effort to upgrade and strengthen its facilities.
- In comparison, 55.7% of the miles of roads, 56.8% of the rail lines, and 55% of the pipelines are in these areas.

These percentages are based on information in ***Table 3: Shaking Hazard and Existing (2000) Land Use***. See Plate 21 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Shaking hazard and exposure of existing critical facilities –
Rather than perform this analysis for each of the many earthquake scenarios developed by USGS and ABAG, we have used the shaking potential map (Plate 21) described earlier.

- Of the 812 critical health care facilities in the Bay Area, over three-quarters (77.7%) are in the two highest shaking potential areas.
- In addition, 70.1% of the 2,063 public schools are in the two highest shaking potential areas.
- Of the 3,991 critical facilities owned by owned by cities, counties, and other special districts in the Bay Area, 72.8% are in the two highest shaking potential areas.
- These vulnerabilities show the need for more detailed risk assessment of these critical facilities, as addressed in the mitigation strategies in the areas of "Education" and "Government." Many of these facilities have been seismically retrofitted or will require seismic retrofitting.

These percentages are based on information in ***Table 3: Shaking Hazard and Existing (2000) Land Use***. See Plate 21 and http://quake.abag.ca.gov/mitigation/pickcrit.html for more specific information for individual counties and cities.

Liquefaction susceptibility and exposure of existing land use –
Rather than perform this analysis for each of the earthquake scenarios developed by USGS and ABAG, we used the liquefaction susceptibility map (Plate 22) described earlier. The areas mapped as having moderate, high, and very high liquefaction susceptibility are roughly equivalent to the areas mapped by CGS as areas where studies are required (Plate 23).

- Of the 4.36 million acres of land in the Bay Area, 2.4% is in areas mapped as having very high liquefaction susceptibility, while 22.3% is the areas mapped in the combined moderate-high-very high liquefaction susceptibility category.
- 6.1% of the urban land is in the areas mapped as having very high liquefaction susceptibility, versus only 1.2% of the non-urban land.
- 39.1% of the urban land is in the areas mapped in the combined moderate-high-very high liquefaction susceptibility category, versus only 16.9% of the non-urban land.
- Types of existing urban land uses with the highest percentages in those areas mapped as having very high liquefaction susceptibility are mixed commercial-industrial complexes (18.6%), industrial (13.8%), military use (11.9%), and infrastructure (10.4%).
- The percentage of urban land located in these areas mapped as having very high liquefaction susceptibility ranged from a high of 16.8% in San Francisco to lows of less than 5% in Contra Costa, Napa, Santa Clara, Solano, and Sonoma counties.

These percentages are based on information in ***Table 4: Liquefaction Susceptibility and Existing (2000) Land Use***. See Plate 22 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Liquefaction susceptibility and exposure of existing infrastructure –
Again, we have used the liquefaction susceptibility map (Plate 22) described earlier.

- Of the 33,995 miles of roads in the Bay Area, 4.6% are in areas mapped as having very high liquefaction susceptibility, while 27.9% are the areas mapped in the combined moderate-high-very high liquefaction susceptibility category.
- In comparison, 51.9% of the miles of rail, 34.6% of transit lines, and 27.5% of pipelines are in the combined moderate-high-very high liquefaction susceptibility category. These exposures are of concern because of the potential vulnerability of these lines to damage.

These percentages are based on information in ***Table 4: Liquefaction Susceptibility and Existing (2000) Land Use***. See Plate 22 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Liquefaction susceptibility and exposure of existing critical facilities –
Again, we have used the liquefaction susceptibility map (Plate 22) described earlier.

- Of the 812 critical health care facilities in the Bay Area, 5.4% are in areas mapped as having very high liquefaction susceptibility, while 56.7% are the areas mapped in the combined moderate-high-very high liquefaction susceptibility category.
- Of the 2,063 public schools in the Bay Area, 4.8% are in areas mapped as having very high liquefaction susceptibility, while 50.8% are the areas mapped in the combined moderate-high-very high liquefaction susceptibility category.
- Of the 3,991 critical facilities owned by cities, counties, and other districts, 16.2% are in areas mapped as having very high liquefaction susceptibility, while 58.0% are the areas mapped in the combined moderate-high-very high liquefaction susceptibility category.

These percentages are based on information in ***Table 4: Liquefaction Susceptibility and Existing (2000) Land Use***. See Plate 22 and http://quake.abag.ca.gov/mitigation/pickcrit.html for more specific information for individual counties and cities.

Earthquake-induced landslide susceptibility and exposure of existing land use, infrastructure, and critical facilities –
The best available map for showing earthquake-induced landslide susceptibility is the one prepared by CGS showing the areas where studies are required (Plate 42). The problem with any type of regional assessment using this map is that it does not cover the entire Bay Area. Thus, while the database of exposed land uses exists at http://quake.abag.ca.gov/mitigation/pickdbh2.html, the data for the region does not exist in a format for a regional analysis.

Housing damage due to earthquake ground shaking damage (last updated in 2003) –

- The 1989 Loma Prieta earthquake caused a total of over 16,000 units to be uninhabitable throughout the Monterey and San Francisco Bay Areas (including almost 13,000 in the Bay Area).
- As shown in ***Table 5*: *Predicted Uninhabitable Units for Bay Area Counties and Selected Earthquake Scenarios***, thirteen of 18 potential Bay Area earthquakes analyzed are expected to have a far larger impact than the Loma Prieta earthquake. In fact, ***eight*** of these earthquakes will probably have a greater impact than the 1994 Northridge earthquake in the Los Angeles area, where over 46,000 housing units were made uninhabitable.

See http://www.abag.ca.gov/bayarea/eqmaps/eqhouse.html for additional information.

Transportation system disruption due to earthquakes (last updated in 2003) –

- The 1989 Loma Prieta earthquake caused a total of only 142 road closures throughout the Monterey and San Francisco Bay Areas, whereas the Northridge earthquake resulted in only 140 road closures.
- As shown in ***Table 6*: *Predicted Road Closures for Bay Area Counties and Selected Earthquake Scenarios***, 16 of 18 potential Bay Area earthquakes analyzed are expected to have a far larger impact than either the Loma Prieta or the Northridge earthquake. In fact, ***five*** of these earthquakes are predicted to have over 1,000 road closures.
- One of the major causes of potential road and transit closures is BART.

See http://www.abag.ca.gov/bayarea/eqmaps/eqtrans/eqtrans.html for additional information.

Assessment of HAZUS for earthquake loss estimation (2003) –

- The 1994 Northridge earthquake caused over $40 billion in losses, while the 1989 Loma Prieta earthquake caused about $6 billion in losses.
- ABAG collaborated with USGS, CGS, and OES to write a paper on the results of several HAZUS[33] runs for earthquake-related losses associated with future scenario earthquakes.
- ABAG staff identified several potentially significant problems with using a combination of ShakeMap scenarios (which, as explained earlier, tend to produce shaking levels lower than the ABAG Shaking Scenario maps), the existing vulnerability formulas (which are prone to underestimate housing losses and losses to wood-frame structures such as dominate the building stock in the Bay Area), and incomplete building inventory data.
- ***These HAZUS loss estimates are inadequate for planning purposes at the present time.***
- See http://quake.abag.ca.gov/mitigation/HAZUS_Paper.pdf for the entire paper.

[33] HAZUS is a software package developed by FEMA for loss modeling.

TABLE 5: Predicted Uninhabitable Units for Bay Area Counties and Selected Earthquake Scenarios

Earthquake Scenario	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	TOTAL
Santa Cruz Mts. San Andreas	1,968	159	297	0	11,781	223	1,277	2	3	15,710
Peninsula-Golden Gate San Andreas	3,820	188	1,485	3	65,316	22,525	15,094	11	42	108,484
Northern Golden Gate San Andreas	4,345	560	2,988	19	62,654	1,904	449	127	1,804	74,851
Entire Bay Area San Andreas	16,048	1,173	3,495	20	82,354	24,472	29,593	185	2,530	159,870
No. San Gregorio	3,104	238	1,176	4	38,306	9,040	589	12	45	52,514
So. Hayward	64,451	1,760	1,030	16	13,940	245	11,892	126	37	93,497
No. Hayward	43,132	7,686	1,653	19	11,464	210	303	128	74	64,669
N + S Hayward	88,265	10,102	2,125	36	37,670	1,616	14,273	1,046	559	155,692
Rodgers Creek	3,688	1,418	1,549	53	11,460	151	100	1,148	13,988	33,555
Rodgers Creek-No. Hayward	49,284	9,786	2,691	713	29,758	363	402	1,386	14,115	108,498
So. Maacama	325	17	27	22	1,986	11	11	15	825	3,239
West Napa	1,382	286	27	4,284	2,011	15	29	1,668	126	9,828
Concord-Green Valley	3,511	11,363	29	1,307	3,191	76	325	2,868	37	22,707
No. Calaveras	7,836	3,509	27	18	3,191	78	4,882	181	6	19,728
Central Calaveras	3,037	75	27	3	3,191	182	10,145	13	4	16,677
Mt. Diablo	6,128	4,868	751	3	10,489	23	109	17	4	22,392
Greenville	2,701	2,637	27	19	2,005	16	101	190	6	7,701
Monte Vista	323	5	16	1	2,429	2,392	27,223	2	2	32,393

TABLE NOTES – This table is based on ABAG's modeling of uninhabitable housing units in future earthquake scenarios (***Shaken Awake!***, Perkins and others, 1996) that was last updated in 2003 for consistency with U.S. Geological Survey earthquake scenarios released at that time. This modeling is based on an extensive statistical analysis of the housing damage which occurred as a result of the 1989 Loma Prieta and 1994 Northridge earthquakes. However, the expected percentage of pre-1940 single-family homes rendered uninhabitable used to generate this table is larger than published in 1996. New data on lack of retrofitting and reasons for low damage in the Northridge earthquake caused ABAG to increase the uninhabitable percentages used to create this table for pre-1940 single-family homes to 19% and 25% for MMI IX and X, respectively.

Note that several fault segments listed above have new segment end points or were not included in the 1996 report. They are included in this table to reflect ground shaking information published by USGS in 2003. The Santa Cruz Mts.–San Andreas is similar, but not identical, to the fault causing the Loma Prieta earthquake. The Monte Vista and West Napa faults have been added to the faults analyzed by USGS to illustrate the impact of an earthquake in these areas. The Maacama fault could impact the North Bay, but too little was known about the fault for the USGS to issue probabilities for it in 2003. It, too, has been added to illustrate possible damage. On the other hand, the Southern Calaveras, the Southern San Gregorio, and the northern North Coast–San Andreas faults are outside of the Bay Area. The Bay Area impacts of earthquakes on these fault segments are dwarfed by their Bay Area segments so they are not included. Additional information on earthquakes and housing is available in ***Shaken Awake!*** and on the ABAG Earthquake Program Internet site at http://quake.abag.ca.gov.

TABLE 6: Predicted Road Closures for Bay Area Counties and Selected Earthquake Scenarios

Earthquake Scenario	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	TOTAL
Santa Cruz Mts. San Andreas	24	10	3	0	44	9	64	0	1	154
Peninsula-Golden Gate San Andreas	50	9	22	0	335	300	146	1	4	866
Northern Golden Gate San Andreas	62	20	70	1	321	24	10	4	69	581
Entire Bay Area San Andreas	146	30	77	3	429	315	250	6	75	1,332
No. San Gregorio	43	11	20	0	164	144	13	1	6	401
So. Hayward	901	43	15	1	72	8	90	4	4	1,138
No. Hayward	335	238	20	1	48	5	7	5	8	667
N + S Hayward	1,081	268	28	2	214	16	99	10	16	1,734
Rodgers Creek	54	34	20	4	48	3	3	12	223	4
Rodgers Creek-No. Hayward	363	256	34	9	157	11	10	14	230	1,084
So. Maacama	8	3	1	3	6	0	1	1	53	74
West Napa	22	20	1	89	6	1	1	14	5	159
Concord-Green Valley	56	201	1	19	11	3	7	83	4	386
No. Calaveras	180	107	1	1	11	3	53	6	1	363
Central Calaveras	51	10	1	0	11	4	132	1	1	210
Mt. Diablo	94	78	7	0	41	2	4	2	1	228
Greenville	70	47	1	1	6	1	4	6	1	138
Monte Vista	10	1	0	0	8	23	283	0	1	326

TABLE NOTES – This table is based on ABAG's modeling of road closures in future earthquake scenarios (***Riding Out Future Quakes,*** Perkins and others, 1997) that was last updated in 2003 for consistency with U.S. Geological Survey earthquake scenarios released at that time. This modeling is based on an extensive statistical analysis of the road closures which occurred as a result of the 1989 Loma Prieta and 1994 Northridge earthquakes.

Note that several fault segments listed above have new segment end points or were not included in the 1996 report. They are included in this table to reflect ground shaking information published by USGS in 2003. The Santa Cruz Mts.–San Andreas is similar, but not identical, to the fault causing the Loma Prieta earthquake. The Monte Vista and West Napa faults have been added to the faults analyzed by USGS to illustrate the impact of an earthquake in these areas. The Maacama fault could impact the North Bay, but too little was known about the fault for the USGS to issue probabilities for it in 2003. It, too, has been added to illustrate possible damage. On the other hand, the Southern Calaveras, the Southern San Gregorio, and the northern North Coast–San Andreas faults are outside of the Bay Area. The Bay Area impacts of earthquakes on these fault segments are dwarfed by their Bay Area segments so they are not included. Additional information on earthquakes and housing is available in ***Riding Out Future Quakes*** and on the ABAG Earthquake Program Internet site at http://quake.abag.ca.gov.

Tsunamis and exposure of existing land use and infrastructure –
ABAG has not performed any analysis of the land use and infrastructure exposure within the tsunami evacuation areas as part of this Local Hazard Mitigation Plan. This exposure data is also not available on ABAG's internet site. The maps are too preliminary and only cover a fraction of the coastline. In addition, the California Governor's Office of Emergency Services has stressed that these maps are NOT appropriate for anything but evacuation planning.

Additional earthquake risk assessment plans –
In addition, ABAG is in the process of conducting additional analyses on privately-owned hazardous buildings in earthquakes (initially to focus on unreinforced masonry buildings). These analyses will be completed after ABAG receives data from the cities and counties.

Weather

Weather-related hazards – probabilities, location, and extent

Weather can result in three different hazards that have been mapped in this plan, as well as one that has not been mapped. First, large winter storms can result in flooding, landslides, and coastal erosion.

Flooding

The Federal Emergency Management Agency has mapped ***flooding*** hazards in the Bay Area's low-lying areas. These flood hazard maps have built-in probability information – the 100-year floodplain or the 500-year floodplain. ***Plate 44*** depicts the 100-year flood zone for the Bay Area, as well as the zone for 500-year floods and other concerns. More detailed maps for individual local governments and additional landslide hazard information are available on line at http://www.abag.ca.gov/bayarea/eqmaps/eqfloods/floods.html.

The maps available on the ABAG web site do not include information on depth of flooding, except that the 500-year flood areas also include areas subject to 100-year flood events with flooding depths expected to be less than one foot.

[*Note that flooding associated with tsunami hazards are covered above under earthquake-related hazards, not as part of flooding in this discussion.*]

Landslides

These same storms also impact our hillsides by triggering debris flows and more slow-moving traditional landslides. The U.S. Geological Survey has developed maps depicting both ***debris flow*** source areas (***Plate 45***) and ***existing landslides*** (***Plate 46***). The map of existing landslides covers areas of severe coastal erosion.

No formal estimates of probability are associated with these maps and there is no way to estimate these probabilities within the scope of this initial Local Hazard Mitigation Plan. There is also no way to estimate the scale of individual landslides in terms of size or extent based on these maps. The list of mitigation strategies includes several relating to ways in which local governments can increase the speed of completion of hazard maps, particularly GOVT-c-10, LAND-a-2, LAND-a-4, and LAND-a-5. ABAG is also working to secure funding for additional studies related to rainfall-induced landslide hazards in the Bay Area.

More detailed maps for individual local governments and additional landslide hazard information are available on line at http://quake.abag.ca.gov/landslide.

Wildfire

Just as weather can result in too much water, the Bay Area's weather can result in too little water. One of the resulting hazards is ***wildfire***. The California Department of Forestry has developed state-of-the-art maps depicting wildfire hazard areas. The two most useful maps are those depicting Wildland Urban Interface (WUI) wildfire threat (***Plate 47***) and wildfire threat from wildland fuels in State Responsibility Areas (***Plate 48***). Additional maps include a map of perimeters of past large fires (300 acre minimum for CDF fires since 1950 and 10 acre minimum for USFS fires since 1910 (***Plate 49***), a map of fire-related risks to ecosystem health as measured by condition class (***Plate 50***), a map of the distribution of wildland-urban-interface housing unit density (***Plate 51***), and a map of post-fire risk of increased surface erosion (***Plate 52***). More detailed maps for individual local governments and additional wildfire hazard information are available on line at http://quake.abag.ca.gov/wildfire.

Using a combination of the map of past wildfires (Plate 49) in combination with the fire threat maps (Plates 47 and 48), a table of the probability of an area burning in the next 50 years can be calculated. Based on an analysis of data on wildfires during the past 50 years, 27% of the areas mapped as an extreme wildfire threat have burned, 23% of those mapped as very high, and 14% of those mapped as high. In addition, 4.3% of the areas in wildland-urban-interface fire threat areas have burned.[34] Thus, the probability of the areas mapped as very high hazard on the wildfire threat is much greater than those mapped on the wildland-urban-interface fire threat map. On the other hand, the wildland-urban-interface fire threat map shows more urban areas with a greater potential property value.

More specific results of this analysis are shown in ***Table 7: Estimate of Probability of Fire Affecting a Given Area Based on Data from Past 50 Years.***

[34] Source – Data from analysis of California Department of Forestry maps at http://www.abag.ca.gov/bayarea/eqmaps/wildfire/. (Also see Table 5.)

TABLE 7: Estimate of Probability of Fire Affecting a Given Area Based on Data from Past 50 Years

Threat Category	Acres Burned in Past 50 Years	Total Number of Acres Within Threat Classification	Percent of Acres That Burned in Past 50-Year Period
On Wildfire Threat Map			
Little or no threat	16,109	600,703	2.68%
Moderate	23,333	1,168,996	2.00%
High	159,681	1,152,490	13.86%
Very High	312,034	1,366,544	22.83%
Extreme	23,012	84,661	27.18%
On Wildland Urban Interface Fire Threat Map			
WUI Acres	34,652	810,757	4.27%

Drought and Dam Failure

While the Bay Area's annual six-month dry season is associated with an annual wildfire "season" in the fall, what would be a ***drought*** in other areas of the country is controlled in this region through the importation of water and the storage of water in reservoirs. Occasionally, the impacts of prolonged periods of drought cause additional drought-related problems, including crop losses and shortages of water for landscaping.

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. Thus, drought is not a hazard that can be depicted in map form.

There is also no current data on the probability of drought that would be comparable to the USGS effort on earthquakes in the region, or the way 100-year flood maps are created. Such an effort has been proposed by the Western Governors' Association, most recently in 2003. See http://www.westgov.org/wga/initiatives/drought2.htm for more information.

The list of mitigation strategies includes several relating to ways in which local governments can help efforts to increase the knowledge of this hazard and/or plan for its impacts, particularly GOVT-c-10, ENVI-a-3, ENVI-a-4, ENVI-a-6, ENVI-a-7, and ENVI-b-1.

On the other hand, the dams built to hold the water in reservoirs can be damaged, due to a huge storm and associated runoff, an earthquake, or a terrorism event. Maps depicting the areas that might be inundated were prepared by the dam owners. No probability information is available for the Bay Area dam failure hazard. These maps have been generalized into a single regional map (***Plate 53***). More detailed maps for individual local governments and additional dam failure hazard information are available on line at http://www.abag.ca.gov/bayarea/eqmaps/damfailure/damfail.html.

Other Weather Concerns Not Addressed Directly as Part of This Plan

Similarly, the Bay Area can have days that exceed 100°F. These ***heat*** waves would be more life-threatening if it were not for the common availability of air conditioning. Thus, this hazard is not dealt with as part of this Local Hazard Mitigation Plan.

Finally, the Bay Area, particularly its crops, can be subject to extensive damage due to ***freezes***. Freezing conditions also cause die back of vegetation that can become fuel for the subsequent fire seasons. This issue has been especially problematic for the Bay Area's eucalyptus trees. Again, this hazard is not something that can be easily depicted in map form. The hazard itself can be mitigated, however. Some available strategies are included in Local Hazard Mitigation Plan when dealing with the more general wildfire hazard.

Past occurrences of Bay Area weather-related disasters

Flooding, storms, landslides, droughts, and wildfires have been among the most common disasters in the Bay Area during the period from 1950 to 2000.

- Extensive flooding and/or landslides occurred in 1950, 1955, 1957, 1958, 1959,1962, 1963, 1964, 1965, 1966, 1969, 1970, 1973, 1980, 1982, 1983, 1992, 1995, 1996, 1997, and 1998.
- Large wildfires occurred in 1961, 1962, 1964, 1965, 1970, 1981, 1985, 1988, and 1991.
- Major droughts were in 1973 and 1976.
- Freezing conditions caused emergency conditions in 1970, 1972, 1973, and 1990.
- While dams have failed elsewhere, a dam has never failed in the Bay Area.

See Appendix D and http://quake.abag.ca.gov/mitigation/disaster-history.html for more specific information.

Vulnerability of the Bay Area to weather-related disasters

ABAG has focused its assessment of weather-related vulnerability by examining the existing land uses in mapped hazard areas.

Flooding and exposure of existing land use –

- Of the 4.36 million acres of land in the Bay Area, 9.4% is in the 100-year flood zone, while only 2.1% is in the 500-year flood zone or area of other flooding concern.
- 8.9 % of the urban land is in the 100-year flood zone, versus 9.6% of the non-urban land.
- 4.9% of the urban land is in the 500-year flood zone or area of other concern, versus only 1.2% of the non-urban land. The fact that over four times the percentage of urban versus non-urban land is in these areas is because lands protected from 100-year flooding are in these areas of "other flooding concerns."
- Types of existing urban land uses with the highest percentages in 100-year flood zones are mixed commercial-industrial complexes (22.7%), urban open space (19.7%), and military use (15.4%).
- The percentage of urban land located in the 100-year flood zone ranged from a high of 13.9% in Solano County and 12.2% in Marin County to lows of 0% in San Francisco and 4.6% in San Mateo County.

These percentages are based on information in ***Table 8: Flooding Hazards and Existing (2000) Land Use***. See Plate 44 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Flooding and exposure of existing infrastructure –

- Rail is disproportionately located in zones subject to 100-year floods, with 19.7% of the miles of track located in these areas.
- Pipelines, as underground lines, should not be impacted by flooding even though 4.5% of the miles of pipelines in the region are in these areas.
- While 6.4% of the transit lines are in these areas, this statistic simply points to a need for further assessment on the part of transit operators. For example, underground BART stations are more vulnerable to potential flooding than are elevated track.

These percentages are based on information in ***Table 8: Flooding Hazards and Existing (2000) Land Use***. See Plate 44 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Flooding and exposure of existing critical facilities –

- Of the 812 critical health care facilities in the Bay Area, 6.9% are in zones subject to 100-year floods.
- Of the 2,063 public schools in the Bay Area, 5.9% are in zones subject to 100-year floods.
- Of the 3,991 critical facilities owned by cities, counties, and other districts, 9.3% are in zones subject to 100-year floods.

These percentages are based on information in ***Table 8: Flooding Hazards and Existing (2000) Land Use***. See Plate 44 and http://quake.abag.ca.gov/mitigation/pickcrit.html for more specific information for individual counties and cities.

Repetitive flood losses –

The Federal Emergency Management Agency (FEMA) insures properties against flooding losses in the Bay Area through the National Flood Insurance Program. Those properties that have had more than one insured flood loss are called "repetitive loss properties." There are 1,158 properties that have experienced repetitive losses in the Bay Area, resulting in a total of 3,218 claims totaling $64,032,056. A total of 921 of the properties are located in the 100-year flood plain. An additional 80 are located in the areas mapped as a 500-year flood zone or area of other concern. The remaining 157 properties are located outside of these mapped hazard areas.

Most of these properties (67%) are located in Sonoma County. An even higher percentage of the claims (69.6%) and insured losses (73.6%) are located in this county. Almost all of these losses occurred in the unincorporated portion of that county. See ***Table 9: Repetitive Flood Losses*** for data summarized by county and http://quake.abag.ca.gov/mitigation/pickflood.html for more specific information for individual counties and cities.

TABLE 9: Repetitive Flood Losses

	Total Number of Properties	Within 100-Year Flood Zone	Within 500-Year Flood Zone or Other Area of Concern	Not Within the Mapped Flood Zone	Number of Claims
Total	1,158	921	80	157	3,218
Alameda	10	2	0	8	20
Contra Costa	46	29	9	8	103
Marin	149	124	6	19	398
Napa	95	67	7	21	247
San Francisco	4	0	0	4	11
San Mateo	23	8	4	11	56
Santa Clara	27	19	4	4	67
Solano	28	22	5	1	76
Sonoma	776	650	45	81	2,240

See **http://quake.abag.ca.gov/mitigation/pickflood.html** for more specific information.

Existing landslide areas and existing land use –

- Of the 4.36 million acres of land in the Bay Area, 23.0% are in areas mapped as mostly landslides on the existing landslide map.
- Only 8.3% of the urban land is in these mostly landslide areas, versus 27.9% of the non-urban land.
- Types of existing urban land uses with the highest percentages in these mostly landslide areas are urban open space (14.1%) and residential use (9.3%).
- Of the 89,647 acres of urban land in these areas of extensive landslides, 59.8% is residential use.
- The percentage of urban land located in these mostly landslide areas ranged from a high of 18.2% in Marin County, 13.2% in Contra Costa County, and 12.5% in Sonoma County to a low of 1% in San Francisco.

These percentages are based on information in ***Table 10: Existing Landslide Areas and Existing (2000) Land Use***. See Plate 46 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Existing landslide areas and existing infrastructure –

- While 11% of the miles of pipelines and 10.6% of the miles of roads are in areas mapped as mostly landslides, only 2.3% of the miles of transit miles and 1.3% of the rail miles are in these areas.
- The exposure of pipelines and roads to landslide hazards is greatest in Marin County, where 23.1% of the pipelines and 22.5% of the roads are in these areas of existing landslides.

These percentages are based on information in ***Table 10: Existing Landslide Areas and Existing (2000) Land Use***. See Plate 46 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Existing landslide areas and existing critical facilities –

- Of the 812 critical health care facilities in the Bay Area, only 0.5% are in areas mapped as mostly landslides on the existing landslide map.
- Of the 2,063 public schools in the Bay Area, only 1.0% are in areas mapped as mostly landslides on the existing landslide map.
- Of the 3,991 critical facilities owned by cities, counties, and other special districts in the Bay Area, 2.7% are in areas mapped as mostly landslides on the existing landslide map.

These percentages are based on information in ***Table 10: Existing Landslide Areas and Existing (2000) Land Use***. See Plate 46 and http://quake.abag.ca.gov/mitigation/pickcrit.html, for more specific information for individual counties and cities.

Wildfire and exposure of existing land use –

- Of the 4.36 million acres of land in the Bay Area, 18.4% is in Wildland Urban Interface (WUI) wildfire threat areas, while 59.2% is in the high, very high, or extreme wildfire threat areas in State Responsibility Areas (SRAs).
- 48.5% of the urban land is in the WUI wildfire threat areas.
- 21.3% of the urban land is in the SRA wildfire threat areas, versus 71.6% of the non-urban land. This discrepancy is to be expected because the State focuses on non-urban areas.
- Types of existing urban land uses with the highest percentages in WUI wildfire threat areas are residential (56.3%), mixed residential-commercial (52.0%), urban open (45.8%), and infrastructure use (42.7%).
- Of the 524,913 acres of urban land in these WUI wildfire threat areas, 62% is residential use.
- The percentage of urban land located in WUI wildfire threat areas ranged from a high of 72.8% in Marin County and 63.0% in Contra Costa County to lows of 31.7% in Solano County and 39.6% in Santa Clara County.

These percentages are based on information in ***Table 11: Wildfire Hazards and Existing (2000) Land Use***. See Plates 47 and 48, as well as http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Wildfire and exposure of existing infrastructure –

- While 42.7% of the region's roads and 36.4% of the transit lines are in WUI wildfire threat areas, only 27.8% of the rail is in these areas.
- While 26.6% of the region's roads are in areas mapped as having high, very high, or extreme wildfire threat, only 5.8% of the transit lines and 10% of the rail lines are in these areas.
- Data on pipelines, though provided, is not particularly relevant because underground pipelines are not particularly vulnerable to damage from wildfires.

These percentages are based on information in ***Table 11: Wildfire Hazards and Existing (2000) Land Use***. See Plates 47 and 48, as well as http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Wildfire and exposure of existing critical facilities –

- Of the 812 critical health care facilities in the Bay Area, 38.4% are in WUI wildfire threat areas, while only 0.6% are in areas mapped as having high, very high, or extreme wildfire threat.
- Of the 2,063 public schools in the Bay Area, 48.6% are in WUI wildfire threat areas, while 2.2% are in areas mapped as having high, very high, or extreme wildfire threat.
- Of the 2,063 critical facilities owned by cities, counties, and other special districts in the Bay Area, 44.2% are in WUI wildfire threat areas, while 5.1% are in areas mapped as having high, very high, or extreme wildfire threat.
- These statistics point to the need to ensure that basic fire mitigation measures are undertaken for these exposed facilities.

These percentages are based on information in ***Table 11: Wildfire Hazards and Existing (2000) Land Use***. See Plates 47 and 48, as well as http://quake.abag.ca.gov/mitigation/pickcrit.html, for more specific information for individual counties and cities.

Drought exposure of existing land use –
All of the 4.36 million acres of land in the Bay Area is subject to drought.

Dam failure inundation areas and exposure of existing land use –

- Of the 4.36 million acres of land in the Bay Area, 10.4% are in areas mapped as dam failure inundation areas.
- 18.5% of the urban land is in these dam failure inundation areas, versus only 7.8% of the non-urban land.
- Types of existing urban land uses with the highest percentages in these dam failure inundation areas are mixed commercial-industrial complexes (42.4%) and industrial use (31.9%).
- Of the 200,142 acres of urban land in these dam failure inundation areas, 50% is residential use.
- The percentage of urban land located in these dam failure inundation areas ranged from a high of approximately 32% in Alameda and Santa Clara counties to lows of 4.8% in Marin County and 6.1% in San Francisco.

These percentages are based on information in ***Table 12: Dam Failure Inundation Areas and Existing (2000) Land Use***. See Plate 53 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Dam failure inundation areas and exposure of existing infrastructure –

- 32.5% of the miles of rail and 24.3% of transit lines in the region are in areas mapped as dam failure inundation areas.
- On the other hand, 17.6% of the roads and 17.1% of the pipelines are in these areas.
- The exposure of transit lines is highest in Santa Clara County, where 66.7% of the miles of the Santa Clara VTA are in these areas.
- The exposure of rail lines to dam failure inundation are highest in Santa Clara County, where 59.6% of the miles of rail are in these areas, and in Alameda County, where 46.1% of the miles of rail are in these areas.

These percentages are based on information in ***Table 12: Dam Failure Inundation Areas and Existing (2000) Land Use***. See Plate 53 and http://quake.abag.ca.gov/mitigation/pickdbh2.html for more specific information for individual counties and cities.

Dam failure inundation areas and exposure of existing critical facilities –

- Of the 812 critical health care facilities in the Bay Area, 25.5% are in areas mapped as dam failure inundation areas.
- Of the 2,063 public schools in the Bay Area, 19.9% are in areas mapped as dam failure inundation areas.
- Of the 3,991 critical facilities owned by cities, counties, and other special districts in the Bay Area, 25.8% are in areas mapped as dam failure inundation areas.

These percentages are based on information in ***Table 12: Dam Failure Inundation Areas and Existing (2000) Land Use***. See Plate 53 and http://quake.abag.ca.gov/mitigation/pickcrit.html, for more specific information for individual counties and cities.

These high exposures point to the need to ensure the safety of dams in the region. Existing state and federal laws and requirements should be followed.

Summary Overview of Impacts of Natural Hazards on the Bay Area

Earthquake Impacts –
The natural disasters with the largest potential impacts on the Bay Area are earthquakes. Most of the damage is due to ground shaking, with relatively little due to liquefaction and landsliding. For example, in the Loma Prieta earthquake, only 1.6% of the $6 billion in losses could be attributed to liquefaction[35], and an even smaller percentage to landsliding. Surface fault rupture can do significant damage to infrastructure systems, depending on the earthquake. (The fault that caused the Loma Prieta earthquake, for example, did not rupture the surface, so there were no losses associated with fault rupture in that earthquake.)

The extent of the impact of earthquake disasters can best be explained using various earthquake scenario events. For example, in a magnitude 6.9 earthquake on the entire Hayward fault (extending from San Pablo Bay to the border of Alameda and Santa Clara counties), ABAG has estimated over 150,000 uninhabitable housing units and 1,700 road closures. The FEMA-developed HAZUS software only estimates 24,000 displaced households, a factor of 6 lower than the ABAG estimates. Part of this discrepancy is due to uncertainty on the impact on wood-frame apartments with parking in the ground floor ("soft-story" apartments). HAZUS estimates the total losses for that earthquake as only $23 billion (versus actual losses of over $40 billion in the Northridge earthquake, a smaller magnitude earthquake with a less vulnerable building stock). The Bay Area Economic Forum produced a 2002 report on the impact of this earthquake on ***Hetch-Hetchy Water and the Bay Area Economy***[36], estimating that the losses associated with failure of that system alone would be $17.2 billion. Finally, the HAZUS software predicts from 100-700 fatalities in that earthquake scenario, depending on the time of day. These estimates are difficult to evaluate, particularly because they are so tied to the vulnerability of particular systems. For example, fatalities in the BART tube alone could exceed that value if the tube were to rupture catastrophically. Obviously, the current HAZUS estimates are inadequate. Thus, as specified in the ABAG Annex to this plan, ABAG will be working to develop different ways to either refine those estimates or develop alternative ways to express losses and risk during 2005 and early 2006. See ABAG Annex mitigation strategy GOVT-d-2. Any remaining gaps in knowledge following that effort will be identified as part of that effort. The risk and loss estimates will be city-specific.

Weather-Related Impacts –
Past flooding losses have been significant, but not as large as for earthquakes. For example, the January 1997 floods resulted in $1.8 billion in total damage in California, while the El Nino storms of early 1998 resulted in $550 million in losses in the entire state, including both flooding and landslides impacts. FEMA documents $64 million in total repetitive losses in the Bay Area that have been paid by their insurance program since its inception, most of which ($48 million) has occurred in Sonoma County. The Holland and Webb Tracts levee breaks in 1980 impacted Contra Costa, Sacramento, and San Joaquin counties and resulted in $17.4 million in damage. However, since 8.9% of the urban land in the Bay Area is within the 100-year flood plain, future

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[35] Holzer, T.L., ed., 1998. "Introduction" in ***The Loma Prieta, California, Earthquake of October 17, 1989 – Liquefaction.*** U.S. Geological Survey Prof. Paper 1551-B: Reston, VA, pp. B4.

[36] See http://www.bayeconfor.org/pdf/hetchhetchyfinal2.pdf to view the entire report.

losses could be more significant than in the past. Note that some of the repetitive loss claims have occurred in areas outside of the mapped 100-year flood plain, it is also clear that other areas are susceptible to flooding, but to a lesser extent.

Losses from landslides are typically lower than associated flooding. However, in the El Nino storms of early 1998, USGS documented approximately $150 million in losses due to approximately 300 landslides that occurred in the Bay Area and Santa Cruz County[37]. The landslides ranged in size from a 25 m^3 failure of engineered material to a reactivation of the massive (13 million m^3) Mission Peak earthflow complex in Alameda County.

The largest urban-wildland fire in the Bay Area, the 1991 fire in the East Bay Hills, resulted in $1.7 billion in losses. In that fire, 3,354 family dwellings and 456 apartments were destroyed, while 25 people were killed and 150 people were injured. It is unlikely that any single fire disaster in the Bay Area would exceed that fire in total losses.

The report on ***Hetch-Hetchy Water and the Bay Area Economy*** discussed earlier hints at the importance of water to the region and the potential impacts of drought and population growth. That report notes on page 5 that:

> Based on conditions during the most recent drought period, SFPUC now has determined that the maximum quantity of water it can reliably deliver to its customer base is 239 mgd annually. However, actual demand in 2000-2001 was nearly 260 mgd, and it is generally understood that the SFPUC system is operating in excess of its assured supply capacity and approaching its actual delivery capacity.
>
> Total demand for Hetch Hetchy water is expected to grow to 303 mgd in 2030 and 310 mgd by 2050. Absent a significant expansion of the system, the shortfall relative to assured supply will therefore increase from 21 mgd presently to 64 mgd within 30 years and 71mgd within 50 years.

Most Bay Area water districts develop long-term water supply and management plans, including urban water shortage contingency analyses. ABAG will be working with water districts and others on this issue, as specified in the ABAG Annex, Mitigation Strategy INFR-d-4 and ENVI-a-4 and ENVI-a-5.

Catastrophic failure of a dam in the region would result in huge losses. While damage losses have not been quantified, the areas subject to dam failure inundation include 18.5% of the urban land in the Bay Area.

Lack of understanding of potential impacts of global warming on the region leads to further uncertainties in estimating weather-related losses and impacts.

Again, more work is needed in estimating the impacts of weather-related disasters. Thus, as specified in the ABAG Annex to this plan, ABAG will be working to develop different ways to express losses and risk during 2005 and early 2006. See ABAG Annex mitigation strategy GOVT-d-2. Any remaining gaps in knowledge following that effort will be identified as part of that effort. The risk and loss estimates will be city-specific.

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[37] Godt, J.W. , ed., 1999. "Introduction" in ***Maps Showing Locations of Damaging Landslides Caused by El Nino Rainstorms, Winter Season1997-98, San Francisco Bay Region, California***: U.S. Geological Survey Misc. Field Studies Map MF 2325-A-J: Reston, VA. See http://pubs.usgs.gov/mf/1999/mf-2325/.

APPENDIX D
Disasters Affecting the San Francisco Bay Area
1950 - 2000

The California Office of Emergency Services has compiled two lists of disasters affecting the State, including the San Francisco Bay Area – one for the period from 1950 – 1999, and a second for more recent disasters. The following list of 56 disasters affecting all or part of the nine-county Bay Area during that 51-year period is extracted from those lists (of 181 disasters statewide). All but seven of these disasters are caused by natural hazards, for an average of almost one natural disaster affecting all or part of the San Francisco Bay Area every year.

11/50
Floods
Declared: statewide CA OCD 50-01(11/21/50)
Federal: not declared
9 deaths
Damage: Sacramento River Basin above Delta-$4,983,000; Sacramento-San Joaquin Delta-$4,550,000; San Joaquin River Basin-Consumnes River to Upper San Joaquin River-$11,460,000; Upper San Joaquin River Basin-Kings River to Kern River-$11,190,000; TOTAL-$32,183,000

12/55
Floods
Declared: statewide CD 47-DR-CA (12/22/55)
Federal: 12/23/55
74 deaths
Damage: $200 million

5/57
Unseasonal and Heavy Rainfall
Declared: State of Emergency—cherry producing areas of Northern California (requested by Department of Agriculture) 5/20/57
Federal: not declared
no deaths, 2 injuries
Damage: $6 million in agricultural losses

2/58
Storm And Flood Damage
Declared: Northern California (Southern boundaries of Santa Cruz, Santa Clara, Stanislaus, Tuolumne, Alpine Counties to the Oregon border) CDO 58-03 (2/26/58)
Federal: not declared
Damage: not available

4/58

Storm and Flood Damage

Declared: statewide (4/2/58)
Federal: 82 (4/4/58)
13 deaths, several injuries
Damage: $20 million, plus $4 million agricultural

9/59

Unseasonal and Heavy Rainfall

Declared: Tokay grape producing areas of Northern California (requested by Dept. of Agriculture) (9/19/59)
Federal: not declared
2 deaths
Damage: $100,000

9/61

Widespread Fires

Declared: Amador, Butte, El Dorado, Napa, Nevada, Placer, San Diego, Sonoma, Tehama (9/8/61)
Federal: not declared
Damage: public-$243,000; private-$4,183,098; watershed-$1,270,715; TOTAL-$5,696,813

9/62

Fires and Explosions

Declared: City of San Leandro (Alameda County) (9/14/62)
Federal: not declared
1 death, 12 injuries
Damage: $500,000

Fall '62

Flood and Rainstorms

Declared: Alameda, Butte, Contra Costa, Modoc, Napa, San Mateo, Sierra, Sutter, Yuba (10/17/62), Placer (10/25/62), Trinity (10/30/62), Lassen (11/4/62)
Federal: 138 (10/24/62) amended to include Placer, Trinity, and Lassen Counties
Damage: $4 million+

2/63

Abnormally Heavy and Continuous Rainfall

Declared: Northern California (boundaries of San Luis Obispo, Ventura, Los Angeles, and San Bernardino counties to the Oregon State line) (2/14/64)
Federal: not declared
Damage: not available

2/63

Flood and Rainstorms

Declared: Alpine, Nevada, Placer, Plumas, Sierra (2/7/63), Amador, Colusa, El Dorado, Glenn, Lake, Lassen, Tehama, Santa Clara, Santa Cruz, Siskiyou, Yolo, Tulare (2/26/63), Mono, Trinity (2/29/63), Yuba (4/22/63)
Federal: 145 (2/25/63), amended 1/30/63 to include Orange County and Redondo Beach
Damage: not available

9/64

Major and Widespread Fires and Excessively High Winds

Declared: Napa (9/22/64), Sonoma (9/23/64), Santa Barbara (9/25/64)
Federal: not declared
Damage: private-$3.5 million; watershed-$13 million; TOTAL-$16.5 million
Note: By special appropriation, Congress approved $860,000 for Santa Barbara County. The USDA, through Forest Service programs, spent $1.044 million for seeding and reestablishing dams in these counties.

9/64

Tsunami Caused by March 1964 Earthquake in Alaska

Declared: Marin (9/15/64) (Tax Relief)
Federal: not declared
Damage: not applicable, only costs were for mitigation

Winter '64-'65

1964 Late Winter Storms

Abnormally heavy and continuous rainfall and windstorm Declared: OEP 183-DR-CA Del Norte, Humboldt, Shasta, Mendocino (12/22/64), Colusa, Glenn, Lassen, Plumas, Sierra, Siskiyou, Sonoma, Sutter, Tehama, Trinity (12/23/64), Amador, Butte, El Dorado, Modoc, Nevada, Placer, Yuba (12/28/64), Alpine, Lake, Sacramento, Yolo (1/5/65), Marin (1/14/65)
Federal: 12/29/64
Damage: public-$85.327 million; private-$127.822 million; TOTAL-$213.149 million

9/65

Major and Widespread Fires

Declared: Marin, Napa, Placer, Solano, Sonoma (9/18/65)
Federal: not declared
no deaths
Damage: not available; 113,766 acres and 41 bldgs. Destroyed

9/66

Riots

Declared: San Francisco (9/27/66)
Federal: not declared
no deaths, 42 injuries
Damage: not available

12/66
Earthslides
Declared: Redwood City (San Mateo County) (12/16/66)
Federal: not declared
Damage: private-$100,000

8/68
Riots and Other Conditions
Declared: City of Richmond (Contra Costa) (8/2/68)
Federal: not declared
Damage: not applicable (worker strike)

Winter '69
1969 Storms
Storms, flooding
Declared: OEP 253-DR-CA Los Angeles, San Luis Obispo (1/23/69), Fresno, Inyo, Riverside, San Bernardino, Santa Barbara, Tulare, Ventura (1/25/69), Amador, El Dorado, Kern, Kings, Madera, Modoc, Mono, Monterey, Orange, Placer, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Tuolumne (1/28/69), Mariposa, Merced (1/29/69), Calaveras, San Benito, Sierra (2/8/69), Contra Costa, Humboldt, Mendocino, Sonoma (2/10/69), Plumas, Tehama, Yuba (2/16/69), Butte, Marin, Yolo (3/12/69)
Federal: 1/26/69
47 dead, 161 injured
Damage: public-$185 million; private-$115 million; TOTAL-$300 million

12/69
Riots
Declared: City of Berkeley (Alameda County) (2/5/69)
Federal: not declared
no deaths, 20 injuries
Damage: not available

Winter '70
Northern California Flooding
Heavy Winds, Storms, Flooding
Declared: OEP 283-DR-CA Butte, Colusa, Glenn, Lake, Lassen, Marin, Modoc, Plumas, Shasta, Siskiyou, Tehama, Trinity (1/27/70), Sutter, Yuba (2/3/70), Del Norte (2/10/70), Alameda, El Dorado, Mendocino (3/2/70)
Federal: 2/16/70
Damage: public-$19,659,078; private-$7,998,400; TOTAL-$27,657,478

2/10/70
Slide Damage Caused by Heavy Rains and Storms
Declared: City of Oakland (Alameda County) 2/10/70 (Tax Relief)
Federal: not declared
Damage: $11.5 million

3/70 (beginning)
Freezing Conditions
Declared: Ag. area of Napa (5/1/70), Ag. area of Sonoma (5/19/70), Ag. area of Mendocino (6/8/70), Ag. community of San Joaquin (6/10/70), Ag. community of Lake (7/24/70)
Federal: not declared
Damage: Agricultural loss $19,749,200

4/70
Storms And Floods
Declared: Contra Costa (4/10/70) (Tax Relief)
Federal: not declared
Damage: not available

Fall '70
Statewide Fires
Declared: OEP 295-DR-CA City of Oakland (Alameda County 9/24/70), Los Angeles, Ventura, San Diego (9/28/70), Kern (10/1/70), San Bernardino (10/2/70), Monterey, Riverside (10/20/70), San Bernardino (11/14/70)
Federal: 9/29/70 amended 11/25/70 to include San Bernardino
19 deaths
Damage: public-$52,862,000; watershed-$24,826,000; private-$145,923,000 TOTAL-$223,611,000; 576,508 acres, 722 bldgs. San Bernardino-53,100 acres, 54 bldgs.

Spring '72
Freeze and Severe Weather Conditions
Declared: Fresno, Kings, Tulare, Merced, Kern, Madera, San Benito, Stanislaus, El Dorado, Tehama, Placer, Nevada, San Joaquin (4/17/72), Colusa (5/22/72), Siskiyou, Modoc (5/22/72), Santa Clara (5/31/72)
Federal: not declared
Damage: crop loss-$111,517,2604/10/72

Drought Conditions
Declared: Glenn, San Benito, Santa Clara (7/3/73)
Federal: not declared
Damage: agricultural loss-$8 million

1/73

Coastal Flooding

Heavy rains, winds, floods, and tidal action
Declared: OEP 364-DR-CA Marin, San Luis Obispo (1/23/73), City of South San Francisco (San Mateo County 1/30/73), Santa Barbara, Solano (2/8/73), Ventura (2/28/73)
Federal: 2/3/73
Damage: public-$5,291,350; private-$12,706,900; TOTAL-$17,998,250

2/73

Storms And Floods

Declared: Colusa, Glenn, Napa, Placer, Sutter, Yuba (2/28/73)
Federal: not declared
Damage: public-$1.357 million; private-$507,000; TOTAL-$1.864 million

4/73

Storms and Floods

Declared: City of Pacifica—San Mateo (4/11/73) (Tax Relief)
Federal: not declared
Damage: public-$450,000; private-$250,000; TOTAL-$700,000

5/73

Eucalyptus Tree Freeze

Declared: Alameda, Contra Costa (4/4/73)
Federal: 5/25/73
Damage: removal of approx. 2 million dead trees—$8-10 million

3/74

Gasoline Purchasing Problems

Declared: Alameda, Contra Costa, Los Angeles, Orange, Riverside, San Mateo, Solano (2/28/74), Santa Clara (3/4/74), Ventura (3/10/74)
Federal: not declared
Damage: not applicable

1976

Drought

Declared: Alpine, Calaveras, Colusa, Fresno, Glenn, Madera, Merced, San Diego, San Joaquin, Solano, Stanislaus, Sutter, Tuolumne (2/9/76), Alameda, Butte, Contra Costa, Kings, Los Angeles, Riverside, San Luis Obispo, Tulare, Yolo (2/13/76), Amador, Monterey, Napa, Nevada, San Benito, San Bernardino, Tehama (2/24/76), San Mateo (3/26/76), Marin (7/6/76)
Federal: not declared
Damage: 1976-$888.5 million; 1977-$1.775 billion; TOTAL-$2.664 billion

1979

Gasoline Shortage Emergency

Declared: Alameda, Contra Costa, Los Angeles, Marin, Monterey, Orange, Riverside, San Francisco, San Diego, Santa Clara, Santa Cruz, San Mateo, Ventura, San Bernardino (11/13/79), San Bernardino (amending boundaries 9/29/79), Monterey (7/13/79), San Bernardino (7/13/79), Riverside (6/22/79), San Bernardino (6/7/79), Monterey (6/7/79), Riverside, (amending boundaries 5/18/79), Monterey, Riverside (portion) (5/11/79), San Mateo, Santa Cruz (5/9/79), San Bernardino (portion 5/8/79), Alameda, Contra Costa, Los Angeles, Marin, Sonoma, Orange, Santa Clara, Ventura (5/8/79)
Federal: not declared
Damage: not applicable

1/80

Delta Levee Break

Rain, high tides, strong winds, and flooding (Holland and Webb Levee breaks)
Declared: FEMA 3078-EM-CA Contra Costa, Sacramento, San Joaquin (1/23/80)
Federal: 1/23/80
Damage: public-$11,158,700; private-$1,479,500; agricultural-$3,887,195; TOTAL-$17,388,013

3/80

Storms

Rain, winds, mud slides, and flooding
Declared: Stanislaus, Monterey, Solano, Santa Cruz (3/5/80)
Federal: not declared
Damage: *include figures from 2/82. public-$164,990,642; private-$75,755,500; agricultural-$75,894,675; TOTAL-$316,640,817. These four counties proclaimed in Feb. 1982 but were not included in the Presidential declaration.

Summer '81

Mediterranean Fruit Fly Infestation

Declared: Contra Costa (9/25/81), Los Angeles (8/25/81), San Benito (8/25/81), Stanislaus (8/14/81), Santa Cruz (8/13/81), San Mateo (8/8/81)
Federal: not declared
Damage: $22 million

6/81

Atlas Peak Fire

Declared: Napa (6/24/81)
Federal: not declared
no deaths
Damage: private-$11 million; watershed-$20 million; TOTAL-$31 million; 23,000 acres burned, 69 structures destroyed

1/82

1982 Winter Storms

Heavy winds, rain, flooding, and mud slides
Declared: FEMA 651-DR-CA Alameda, Santa Clara, Solano, San Joaquin (1/9/82), Contra Costa, Humboldt, Marin, San Mateo, Santa Cruz, Sonoma (1/5/82)
Federal: 1/7/82
33 dead, 481 injured
Damage: public-$101.400 million; private-$172.450 million; TOTAL-$273.850 million; 256 homes and 41 businesses destroyed, 6259 homes and 1276 businesses damaged.

10/82

Rains Causing Agricultural Losses

Declared: Fresno, Madera, Merced, Monterey, Kern, Tulare, Sacramento, San Joaquin, Solano, Stanislaus, Yolo (10/26/82)
Federal: not declared
Damage: agricultural $345,195,974

12/82

High Tides, Strong Winds, and Rains

Declared: Contra Costa, Sacramento, San Joaquin (12/8/82)
Federal: not declared
Damage: public-$5,313,198; private-$1,651,800; TOTAL-$6,964,998

Winter '82-'83

Winter Storms

Heavy rains, high winds, flooding, levee breaks
Declared: FEMA 682-DR--CA Contra Costa, San Joaquin, Sacramento (12/8/82), Marin, San Mateo, Los Angeles, San Diego (1/27/83), Alameda, Orange, San Benito, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Sonoma, Ventura, Trinity (1/31/83), Colusa, Lake, Mendocino, Monterey, San Luis Obispo, Solano, Yolo (2/7/83), Butte, Glenn, Kern, Kings, San Bernardino, Sutter Tehama, Merced (3/3/83), Del Norte, Fresno, Madera, Napa, Placer, Riverside, Stanislaus, Tulare (3/15/83), Humboldt, Mariposa, Nevada, Yuba (3/21/83)
Federal 2/9/83
Damage: public-$151,185,870; private-$158,641,170; agricultural-$213,789,992; TOTAL-$523,617,032

12/83

Levee Failure, High Winds, High Tides, Floods, Storms, Wind Driven Water

Declared: Contra Costa (12/9/83), Alameda (1/18/84)
Federal: not declared
Damage: public-$7,240,785; private-$2.669 million; agricultural-$1 million; TOTAL-$10,909,785

4/84

Morgan Hill Earthquake

6.2M
Declared: Santa Clara
Federal: FEMA 4043-EM-CA (4/25//84
no deaths, 27 injuries
Damage: public-$365,000; business-$1.7 million; private-$5.2 million; TOTAL-$7.265 million

6/85

Statewide Fires

Declared: FEMA 739-DR-CA San Diego (7/1/85), City of Los Angeles (7/3/85), San Luis Obispo (7/8/85), Monterey, Santa Clara, Santa Cruz (7/9/85), Ventura (7/11/85)
Federal: 4/25/84
3 deaths, 470 injured (124 civilians, 346 firefighters)
Damage: public-$34,751,400; private-$30,094,464; TOTAL-$64,845,864; 375,000+ acres, 215 homes destroyed; 131 homes and businesses damaged; 71 miscellaneous structures and vehicles destroyed

2/86 (beginning)

Storms

Rains, winds, flooding, and mud slides
13 deaths, 67 injuries
Declared: FEMA 758-DR-CA Humboldt, Napa, Sonoma (2/18/86), Glenn, Lake, Marin, Modoc, Sacramento, Santa Clara, Santa Cruz, Solano, Yuba (2/19/86), Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Lassen, Mendocino, Nevada, Placer, Plumas, San Joaquin, Sierra, Sutter, Tehama, Tuolumne, Yolo (2/20/86), Fresno, Madera, San Mateo (2/26/86), Alameda, Contra Costa, Del Norte, Trinity (3/4/86), Mono, San Benito, Shasta (3/12/86)
Federal: 2/18/86
Damage: public-$157,987,493; private-$249,551,411; TOTAL-$407,538,904; 12,447 homes damaged; 1,382 homes destroyed; 967 businesses damaged; 185 businesses destroyed

9/88

Fires (49er, Miller, and Fern)

Declared: FEMA 815-DR-CA Shasta, Solano (9/20/88, beginning 9/17/88), Yuba, Nevada (9/13/88, beginning 9/11/88)
Federal: 9/13/88
no deaths
Damage: public-$31,247,534; business-$2,533,100; private-$18,033,800; TOTAL-$31,247,534; 238 homes destroyed, 41 homes damaged; 29 businesses destroyed

8/89

Mediterranean Fruit Fly

Declared: Santa Clara (9/6/89)
Federal: not declared
Damage: not applicable—damage was avoided

10/89

Loma Prieta Earthquake

7.1M

Declared: FEMA 845-DR-CA Alameda, Monterey, San Benito, San Mateo, Santa Clara, Santa Cruz, San Francisco (10/18/89), Contra Costa, Marin, City of Isleton (10/23/89), City of Tracy, Solano (10/30/89)

Federal: 10/18/89

63 deaths, 3,757 injuries (10/18/89)

Damage: Alameda $1,479,104,500, Contra Costa $25 million, Monterey $108 million, San Benito $103.55 million, San Francisco $2 billion, San Mateo $292,941,001, Santa Clara $727.7 million, Santa Cruz $1.526 million, $500 million to $1 billion damage in roads and bridges, $20 million in state government buildings. Total: $5.9 billion; 23,408 homes damaged, 3,530 businesses damaged, 1,018 homes destroyed, 366 businesses destroyed.

12/90 (beginning)

Freeze

Declared: FEMA 894-DR-CA Santa Cruz (12/28/90), Fresno, Glenn, Imperial, Kern, Mendocino, Monterey, Riverside, San Benito, San Bernardino, San Diego, San Mateo, Santa Barbara, Santa Clara, Solano, Sonoma, Tulare, Ventura (1/11/91), Alameda, Butte, Colusa, Los Angeles, Madera, Marin, Merced, Napa, San Joaquin, San Luis Obispo, Sutter, Yolo, Yuba (1/18/91), Stanislaus, Tehama (2/14/91, beginning 12/19/90)

Federal: 2/11/91

Damage: public buildings-$2,330,353; utilities-$1,614,040; crop damage-$852,385,282; TOTAL-$856,329,675; 500 broken pipes, affecting 5,400 homes

10/91

East Bay Hills Fire

Declared: Alameda County, 10/20/91)

Federal: 919 (10/22/91)

25 deaths, 150 injuries

Damage: $1.7 billion; 3,354 family dwellings and 456 apartments destroyed

12/92

1992 Late Winter Storms

Snow, rain, and high winds

Declared: FEMA 979-DR-CA Alpine, Los Angels (2/19/93), Humboldt, Napa, Santa Barbara, Culver City and the City of Los Angeles (2/8/93, for event beginning 1/25/93), Contra Costa, Mendocino, Sonoma (1/25/93, for event beginning 1/25/93), Fresno, Imperial, Madera, Monterey, San Bernardino, Sierra, Tehama, Trinity, and Tulare (1/21/93, for event beginning 1/19/93), Modoc, Orange, Riverside (1/19/93, for event beginning 1/15/93), Lassen, Siskiyou (1/15/93, for event beginning 1/13/93), Plumas (1/13/93, for event beginning 1/12/93), San Diego (1/7/93, for event beginning 1/7/93)

Federal 1/15/93

20 deaths, 10 injuries

Damage: public property-$32,215, $600 million

1/95
Severe Winter Storms
Declared: FEMA 1044-DR-CA Los Angeles, Orange (1/6/95), Humboldt, Lake, Sonoma (1/9/95), Butte, Colusa, Contra Costa, Del Norte, Glenn, Kern, Lassen, Mendocino, Modoc, Monterey, Napa, Placer, Plumas, San Luis Obispo, Santa Barbara, Santa Clara, Santa Cruz, Tehama, Ventura, Yolo, Yuba (1/10/95), Alpine, Amador, Nevada, Riverside, Sacramento, San Bernardino, San Mateo, Shasta, Sutter, Trinity (1/11/95), San Diego (1/13/95), Alameda, Marin (1/14/95), Fresno, Kings (1/17/95), El Dorado (2/15/95), Madera, Solano (2/17/95), Siskiyou (3/14/95)
Federal-1044 (1/13/95)
11 deaths
Damage: public-$299.6 million; individual-$128.4 million; businesses $58.4 million; highways-$158 million; ag-$97 million; TOTAL-$741.4 million; damage to homes: major-1,883; minor-4,179; destroyed-370.

2/95
Late Winter Storms
Declared: FEMA 1046-DR-CA 57 counties (all except Del Norte).
Federal: 1/10/95
17 deaths
Damage: public property-$190.6 million; individual-$122.4 million; business-$46.9 million; highways-$79 million; ag-$651.6 million; TOTAL-approximately $1.1 billion; damage to homes: major-1,322; minor-2,299; destroyed-267

12/96 to 1/97
January 1997 Floods
Declared: Alpine, Amador, Butte, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Modoc, Napa, Nevada, Plumas, Sacramento, San Joaquin, Sierra, Siskiyou, Solano, Sonoma, Sutter, Tehama, Trinity, Yuba (1/2/97); Calaveras, Madera, Mono, Monterey, Placer, San Benito, San Luis Obispo, San Mateo, Santa Cruz, Shasta, Stanislaus, Tuolumne, Yolo (1/3/97); Contra Costa, Fresno, Marin, Tulare (1/5/97); Mariposa (1/6/97); Merced, Santa Clara (1/10/97); Alameda, San Francisco (1/19/97); Kings, San Luis Obispo (1/31/97).
Federal: all 48 counties listed above
8 deaths
Damage: $1.8 billion
Add: 300 square miles of land flooded; 23,000 homes, 2,000 busineses damaged or destroyed.

2/2/98

El Nino

Declared: Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, Fresno, Glenn, Humboldt, Kern, Kings, Lake, Los Angeles, Marin, Mendocino, Merced, Monterey, Napa, Orange, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Siskiyou, Solano, Sonoma, Stanislaus, Sutter, Tehama, Trinity, Tulare, Ventura, Yolo, Yuba.
Federal: All above except Kings and Siskiyou counties
17 deaths
Damage: $550 million

9/3/00

Napa Earthquake

Declared: Napa
Federal: not provided by OES
Damage: not provided by OES

APPENDIX E
Record of Plan Participation

The following two tables indicate the local governments participating in the plan development process as of March 2005. Records of the precise meetings attended by individuals, as well as contact information for plan participants, are on file at ABAG.

Projections of Future Land Uses in Hazard Areas

There are strong pressures to build in areas of natural hazards. ABAG's **Projections 2005** forecasts for the region to grow from a population of 7,091,700 in 2005 to 8,747,100 in 2030. At the same time, these people, who live in 2,582,980 households in 2005, are projected to live in 3,182,220 households in 2030. Finally, while the Bay Area employed 3,516,960 in 2005, it is expected to employ 5,120,600 people in 2030.

This growth continues to place increasing pressure on the region to continually expand urban development by both patterns explained in the previous sections.

Yet at the same time there are strong pressures not to build in these areas. Over the past few decades, a desire to build more disaster-resistant communities and create more environmentally-sensitive growth has led to a series of state laws and local regulations. These restrictions on development are intended to promote one of the eight major objectives of the Bay Area's Local Hazard Mitigation Plan –

> ***Land use change needs to be accompanied by a respect for hazardous areas and facilities, as well as recognize the interconnected nature of the Bay Area.***

Two State laws related to land use and disaster mitigation were enacted in the early 1970s and a third one was enacted in 1991. Additional local regulations typically have been instituted more recently. Some have been implemented as a result of adopting annexes to the Bay Area multi-jurisdictional Local Hazard Mitigation Plan. For a comprehensive picture of the priorities being established for the identified strategies, see **http://quake.abag.ca.gov/mitigation/strategies.html.**

The following sections catalog some of the State laws and local regulations controlling development in hazard areas that could potentially affect future land use densities in hazard areas. These laws take varying approaches to mitigating the effects of hazards. At their most efficient, these controls can eliminate a hazard, particularly hazards associated with new construction. On the other hand, most regulations are merely requirements to mitigate a hazard through engineering, not avoidance of the land where the hazard is located. Finally, for two of the hazards (dam failure and tsunamis) the strategy is to expedite evacuations, not mitigation.

Because these conflicting pressures concerning development in hazard area have been in existence for several years, it is probable that the development trends and future land use densities in these areas of the last five years will continue for the foreseeable future. This trend, however, will be affected by more stringent mitigation measures and a continual replacement of older structures and development with new, better engineered, but denser, development.

Add paragraph after Jonathan's section is written …

State Laws Applying to Multiple Hazards

Every city and county is required to prepare a ***General Plan***. Over the years, required elements have been specified, including the Safety and Seismic Safety elements (now consolidated into a single ***Safety Element***), which has been required since 1971. The General Plan and its seven required elements outline the local policies guiding future development in the jurisdiction. Local zoning for future development is required to be consistent with the policies identified in this General Plan (except for in charter cities). All of the cities and counties have a Safety Element, either as a separate document or integrated into their General Plan. As part of that plan, jurisdictions must identify and map natural hazards.

Most of the local governments are implementing the mitigation strategies of their annexes to this multi-jurisdictional plan by adopting them as an implementation appendix to their Safety Elements. This re-examination of the Safety Element will be useful, for many of these elements are several years old and out of date. See http://ceres.ca.gov/planning/genplan/gpg.pdf for the California ***General Plan Guidelines*** published by the California Office of Planning and Research (OPR).

Local Regulations Applying to Multiple Hazards

Smart Growth programs are intended to revitalize urban areas and promote sustainability. ABAG and the other regional agencies in the region, including the Metropolitan Transportation Commission (MTC) and the Bay Area Air Quality Management District have adopted polices to promote Smart Growth. In addition, the boards of supervisors of all nine Bay Area counties and city councils of 66 of the regions cities have taken action in support of the objectives of the Bay Area Alliance for Sustainable Communities, a multi-stakeholder coalition established in 1997 to develop and implement an action plan that will lead to a more sustainable region. Some of the ways to meld Smart Growth and sustainability concepts with hazard mitigation include –

1) Prioritizing retrofit of infrastructure that serves urban areas over constructing new infrastructure to serve outlying areas.
2) Working to retrofit homes in older areas to provide safe housing close to job centers.
3) Working to retrofit older downtown areas to protect architectural diversity and promote disaster-resistance.
4) Protecting areas susceptible to extreme hazards as open space.
5) Providing new buffers and preserve existing buffers between development and existing users of large amounts of hazardous materials, such as major industry, due to the potential for catastrophic releases due to an earthquake or terrorism. (Flooding might also result in release or spread of these materials, however it is unlikely.)

Hillside development can be problematic due to the potential hazards of wildfire and landsliding. The pressure to convert hillside areas to urban uses is great, however, in inner suburban communities that have no remaining non-urban land, as well as in communities actively preserving agricultural land (particularly in the North Bay where vineyards are prevalent). Two ways to mitigate these risks identified by local governments are –

1) Establishing a buffer zone between residential properties and landslide or wildfire hazard areas.

2) Discouraging, adding additional mitigation strategies for, or preventing construction on slopes greater than a set percentage, such as 15%, due to landslide or wildfire hazard concerns.

State Laws Applying to Earthquakes

The ***Alquist-Priolo Earthquake Fault Zoning Act*** of 1972 was passed by the legislature as a result of the San Fernando earthquake in southern California. This Act is intended to deal with the specific hazard of active faults that extend to the earth's surface, creating a ***surface rupture hazard***. The Act requires that the State Geologist (the head of the California Geological Survey – CGS) designate zones approximately ¼-mile wide along known active faults. Within these zones, site-specific geologic reports must be prepared for development proposals (except for housing developments of less than four units or not involving structures intended for human occupancy). Typically, at a minimum, structures intended for human occupancy cannot be placed within 50 feet of an active fault trace. Finally, the Act requires disclosure to potential buyers in these zones. Every city and county with a mapped surface rupture hazard is required to implement this Act. In 2005, this included eight counties (all but San Francisco) and 31 cities in the Bay Area.

The Act's ability to eliminate the surface fault rupture hazards in the region for future development, is limited because it specifically exempts:

- existing development;
- new developments containing less than four single family homes; and
- structures not intended for human occupancy (including pipelines, power substations, and pumping plants).

Local governments need to ensure that these facilities, many of which are actually constructed by local governments, have adequate mitigation to increase safety.

The ***Seismic Hazards Mapping Act*** of 1991 requires the preparation of site-specific geologic or geotechnical reports for development proposals in areas subject to ***earthquake-induced landslides or liquefaction*** as designated by the State Geologist, as well as disclosure to buyers in these areas. Due to limited funds, the maps have only been completed in selected portions of the Bay Area. As maps become available, affected cities and counties are required to enforce the preparation of these reports and condition project approval on the incorporation of necessary mitigation measures related to site remediation, structure and foundation design, and/or avoidance. This Act must be implemented by cities and counties in the region with hazards mapped by CGS. In 2005, this included San Francisco and parts of Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as 43 cities.

Since the Act has only been in place for less than 15 years, and most Bay Area maps are recent, the impact of this legislation has not been as great as the Alquist-Priolo Fault Study Zones Act. In addition, the focus on the Act is on new development, not existing development, and on mitigation, rather than avoidance of the identified seismic (liquefaction or earthquake-induced landslide) hazards.

Local Regulations Applying to Earthquakes

First, Section 2624 of the Fault Zoning Act specifically states that local governments have the authority to recognize that some faults may be a hazard for surface rupture even though they do not meet the strict criteria imposed by the Fault Zoning Act. For example, zones have been identified by Santa Clara County and by the City of Saratoga for the Monte Vista-Shannon fault system.

Second, recognizing that CGS has not completed earthquake-induced landslide and liquefaction mapping for significant portions of the Bay Area, local governments can require geologic reports in areas mapped by others as having significant liquefaction or landslide hazards.

Third, CGS's efforts to complete the earthquake-induced landslide and liquefaction mapping will be easier if cities and counties cooperate by providing access to their records and by expediting permitting for new research conducted in their jurisdiction.

Finally, local governments review the geologic and engineering reports prepared by developers to implement the Fault Zoning Act and the Seismic Hazards Mapping Act. They should require that their reviews be conducted by appropriately trained and credentialed personnel, whether they use their own staff or outside consultants.

Local Regulations Applying to Wildland and Structural Fires

Local government regulations mitigating fire hazards include –

1) Reviewing development proposals to ensure that they incorporate required and appropriate fire-mitigation measures, including adequate provisions for occupant evacuation and access by emergency response personnel and equipment.
2) Developing a clear legislative and regulatory framework at both the state and local levels to manage the wildland-urban-interface consistent with ***Fire Wise*** and sustainable community principles.

Local Regulations Applying to Flooding

Local government regulations mitigating flooding hazards include –

1) Establishing and enforcing requirements for new development so that site-specific designs and source-control techniques are used to manage peak stormwater runoff flows and impacts from increased runoff volumes.
2) Incorporating FEMA guidelines and suggested activities into local government plans and procedures for managing flood hazards.
3) Providing an institutional mechanism to ensure that development proposals adjacent to floodways and in floodplains are referred to flood control districts and wastewater agencies for review and comment (consistent with the NPDES program).
4) Establishing and enforcing regulations concerning new construction (and major improvements to existing structures) within flood zones in order to be in compliance with federal requirements and, thus, be a participant in the Community Rating System of the ***National Flood Insurance Program.***

Local Regulations Applying to Landslides and Erosion

Local government regulations mitigating rainfall-induced landsliding hazards and erosion include –

1) Establishing and enforcing provisions (under subdivision ordinances or other means) that geotechnical and soil-hazard investigations be conducted and filed to prevent grading from creating unstable slopes, and that any necessary corrective actions be taken prior to development approval.
2) Requiring that local government reviews of these investigations are conducted by appropriately trained and credentialed personnel.
3) Establishing and enforcing grading, erosion, and sedimentation ordinances by requiring, under certain conditions, grading permits and plans to control erosion and sedimentation prior to development approval.
4) Establishing and enforcing provisions under the creek protection, storm water management, and discharge control ordinances designed to control erosion and sedimentation.
5) Establishing requirements in zoning ordinances to address hillside development constraints, especially in areas of existing landslides.

Local Hazard Mitigation Plan ANNEX
City of Oakland

Introduction

The City of Oakland is the largest city in Alameda County, California. The City has a population of 399,488 people, based on the 2000 census[1]. It is the eighth most populous city in the State of California. It is also the county seat. It is one of the most ethnically diverse cities in the United States, with each of the four main ethnic/racial groups – blacks, non-Hispanic whites, Hispanics, and Asian/Pacific Islanders – making up more than 15% of the population.

Last year, the City's budget was approximately $387 million. The City employs 2,682 full-time equivalent people. The City provides local police services and local fire services. In addition, the Fire Services Agency receives $1.8 million annually in revenues from the Oakland Wildfire Prevention Assessment District.

The Port of Oakland, which operates the Oakland International Airport, as well as the Port, also owns additional waterfront property that it leases as commercial real estate. The Port Board consists of seven members nominated by the Mayor and appointed by the City Council appointed by the City. The budget for the Port for FY 2004-05 is $259 million.

The Planning Process

This process of preparing this Local Hazard Mitigation Plan is a continuation of a planning process that has been in place since the early 1970s with the adoption of the City's first Seismic and Safety elements to the City's General Plan. The City has a Safety Element to its General Plan last updated in 2004 that includes a discussion of:

- public safety (including violent crime and terrorism);
- geologic hazards (including earthquake fault displacement, ground shaking, liquefaction, subsidence and settlement, slope instability or landslide hazards, erosion, soils, structural hazards, transportation facilities, and utility systems);
- fire hazards (including fire-fighting response, water supply, structural fires, wildland fires, roadway standards and emergency routes);
- hazardous materials (including business plan program, CalARP program, UST program, aboveground storage tank program, hazardous waste tiered permitting program, household hazardous water management, toxic air contaminants, contaminated sites and brownfields, transportation, pipelines, emergency response, and zoning);
- flooding hazards (including storm-induced flooding, tsunamis, seiches, dam failure, and sea-level rise).

In addition, the City routinely enforces the requirements of the California Environmental Quality Act (CEQA) requirements (which, since 1988, have required mitigation for identified natural

[1] For complete Census information on this city, see **http://www.bayareacensus.ca.gov/**.

hazards). The City has been a model of disaster mitigation and was designated as one of the first Disaster Resistant Communities in the United States. Most recently, the Safety Element "Protect Oakland" of the Oakland General Plan won the prestigious 2005 award in "Focused Issue Planning" from the Northern California Section of the American Planning Association (APA).

The City's effort in preparing this annex has focused on reviewing these pre-existing programs and identifying any gaps that may lead to disaster vulnerabilities in order to work on ways to address these risks through mitigation. This effort has been minimal because of Oakland's close collaboration with ABAG in its preparation of the multi-jurisdictional Local Hazard Mitigation Plan for the region. In addition, the Safety Element was completed during the same period when ABAG was working on its initial outline of the multi-jurisdictional LHMP.

The City participated in various ABAG workshops and meetings, including the general "kick-off" meeting and the soft-story charrette. Nancy Nadel, a councilmember, served as chair of the ABAG Earthquake and Hazards Outreach Committee. The Port of Oakland also actively participated in the ABAG Hazards Transportation and Lifelines Review Committee In addition, both the City and the Port provided written and oral comments on the multi-jurisdictional plan. Finally, the City provided information on facilities that are viewed as "critical" to ABAG.

Key City staff and members of related external agencies have met as Oakland's Emergency Management Board (Disaster Council) each quarter for several years. This Board has been meeting since prior to the Loma Prieta earthquake in 1989 and is a model of continued awareness and coordination of disaster activities. Members include representatives of PG&E, the East Bay Municipal Utility District, the East Bay Regional Park District, SBC, and BART. Additionally, all five hospitals in the City participate on this Board. Several of these meetings have related to the development of the most recent version of the Safety Element, as well as coordination with ABAG's activities on the multi-jurisdictional LHMP.

The City has also had additional public outreach meetings that have included public comment. These include the January 22, 2003 and October 20, 2004, Oakland City Planning Commission meetings, as well as the May 13, 2003 and November 16, 2004 City Council meetings. Finally, the Safety Element was available for public comment online for weeks prior to these meetings.

Following meetings of key staff to identify and prioritize DRAFT mitigation strategies appropriate for the City, the strategies were reviewed and approved by the Planning Commission and the City Council. Key staff involved in this meetings included not only department and agency directors, but integrated review by committees within each city agency.

The resolution adopting this annex to ABAG's multi-jurisdictional LHMP will be on the City Council agenda January 17, 2006. The mitigation strategies identified in this annex have already been integrated into those contained in the City's Safety Element "Protect Oakland". This has been possible because of the close collaboration between the City of Oakland and ABAG.

Hazard and Risk Assessment

The ABAG multi-jurisdictional Local Hazard Mitigation Plan, to which this is an Annex, lists nine hazards that impact the Bay Area, five related to earthquakes (faulting, shaking, earthquake-induced landslides, liquefaction, and tsunamis) and four related to weather (flooding, landslides, wildfires, and drought). These hazards also impact this community.

The City has undertaken a number of hazard mapping activities since the first Seismic and Safety Elements were prepared by the City. Several of these maps are the same as those on ABAG's website at **http://quake.abag.ca.gov/mitigation/**. In addition, the City has developed unique maps of safety hazards by neighborhood area that overlay the various hazard maps.

Information on disasters declared in Alameda County is at
http://quake.abag.ca.gov/mitigation/disaster-history.html.

Oakland's two most significant and costly disasters were the Loma Prieta earthquake in October 1989 and the Oakland-Berkeley Tunnel fire in October 1991. Oakland experienced its worst ever flooding conditions during the storm of October 1962. The El Niño storms of January and February 1995 cause extensive flooding and landsliding in the City. Specific information on past disasters and emergencies is contained in the 2004 Safety Element on Oakland's website at **http://www.oaklandnet.com/government/ceda/revised/planningzoning/StrategicPlanningSection/default.html**.

The City examined the hazard exposure of City urban land based on the information on ABAG's website at **http://quake.abag.ca.gov/mitigation/pickdbh2.html**. Of the 33,811 urban acres in the City,

- Earthquake faulting – 1,858 acres are in the Alquist-Priolo Earthquake Fault Study Zone.
- Earthquake shaking – most of the urban acres (33,081) are in the highest two categories of shaking potential, in large part because the Hayward fault runs through to the eastern portion of the City.
- Earthquake-induced landslides – the California Geological Survey has identified 4,586 acres in the Seismic Hazard Mapping Zones for this hazard.
- Earthquake liquefaction – 16,247 acres are in areas of moderate, high, or very high liquefaction susceptibility mapped by the U.S. Geological Survey, while 13,761 are in the California Geological Survey's Seismic Hazard Mapping Zones for this hazard.
- Tsunamis – While tsunamis may be a hazard in the City of Oakland, the mapping of the inundation area has not been completed at this time. Some recent research indicates that the run-up elevation may be as high as 50% of the wave height at the Golden Gate Bridge. Since that height is currently estimated at 42 feet, this would indicate that the height in Oakland would be as great as 21 feet. However, other researchers estimate that the maximum event would be far less. The most vulnerable facilities are in the waterfront area, particularly the lands owned by the Port of Oakland, a Special District of the City of Oakland.
- Flooding – only 663 acres are in the 100-year flood plain, while an additional 1,756 acres are in other flood-prone areas.
- Landslides – 2,335 acres are in areas of existing landslides.

- Wildfires – 2,495 acres are subject to high, very high, or extreme wildfire threat (because of the urban nature of the City), but 19,251 acres are in wildland-urban interface threat areas.
- Dam Inundation – 5,354 acres are subject to dam inundation.
- Drought – all 33,811 acres are subject to drought.

The City also examined the hazard exposure of infrastructure based on the information on ABAG's website at **http://quake.abag.ca.gov/mitigation/pickdbh2.html**. Of the 1,086 miles of roadway in the City,

- Earthquake faulting – 66 miles of roadway are in the Alquist-Priolo Earthquake Fault Study Zone.
- Earthquake shaking – almost all of the miles of roadway (1,078) are in the highest two categories of shaking potential.
- Earthquake-induced landslides – the California Geological Survey has identified 69 miles of roadway in the Seismic Hazard Mapping Zones for this hazard.
- Earthquake liquefaction – 516 miles of roadway are in areas of moderate, high, or very high liquefaction susceptibility mapped by the U.S. Geological Survey, while 422 are in the California Geological Survey's Seismic Hazard Mapping Zones for this hazard.
- Tsunamis – As noted above, while tsunamis may be a hazard in the City of Oakland, the mapping of the inundation area has not been completed at this time. Roads in low-lying areas near the waterfront will be most vulnerable.
- Flooding – 12 miles of roadway are in the 100-year flood plain, while an additional 58 miles are in other flood-prone areas.
- Landslides – 46 miles of roadway are in areas of existing landslides.
- Wildfires – while only 54 miles of roadway are subject to high, very high, or extreme wildfire threat, 560 miles of roads are in wildland-urban interface threat areas.
- Dam Inundation – 179 miles of roadway are in an area subject to dam inundation.
- Drought – is not a hazard for roadways.

Finally, the City examined the hazard exposure of critical health care facilities, schools, and city-owned buildings based on the information on ABAG's website at **http://quake.abag.ca.gov/mitigation/pickcrit.html**. Of the critical facilities in the City,

- Earthquake faulting – no hospitals or other health care facilities, 5 of 133 schools, and only one of 65 critical facility owned by the City are in Alquist-Priolo Study Zone.
- Earthquake shaking – all health care facilities, schools, and critical facilities owned by the City are in the highest two categories of shaking potential.
- Earthquake-induced landslides – no hospitals or other health care facilities, but 124 of 133 schools, and 63 of 65 critical facility owned by the City are in the Seismic Hazard Mapping Zones for this hazard.
- Earthquake liquefaction – 44 critical health care facilities, 61 of 133 schools, and 51 of 65 critical facilities owned by the city are in areas of moderate, high, or very high liquefaction susceptibility. In addition, 27 critical health care facilities, 47 of these

schools, and 42 critical facilities owned by the city are in the Seismic Hazard Mapping Zones for this hazard.

- Tsunamis – While tsunamis may be a hazard in the City of Oakland, including to critical facilities in the Port area, the mapping of the inundation area has not been completed at this time.
- Flooding – Only two critical health care facilities, one school, and no city-owned facilities are in the 100-year flood plain. In addition, five critical health care facilities, seven schools, and four city-owned facilities are in other flood-prone areas.
- Landslides – No critical health care facilities, no schools, and only two city-owned facilities are in areas of existing landslides.
- Wildfires – No critical health care facilities, two schools, and no city-owned facilities are in areas of wildfire threat. However, 34 critical health care facilities, 65 schools, and 28 city-owned facilities are in areas of wildland-urban interface threat.
- Dam Inundation – A total of 22 critical health care facilities, 20 schools, and nine city-owned facilities are in an area subject to dam inundation.
- Drought – Drought will not affect City buildings directly. However, the City does not operate a water-supply distribution system. City water is supplied by the East Bay Municipal Utility District.

There are five repetitive loss properties in the City based on the information at http://quake.abag.ca.gov/mitigation/pickflood.html. Only one of these properties is in the mapped 100-year floodplain, while four are outside of the floodplain. This is because of the susceptibility of the City to mudslides.

The City plans to work with ABAG during 2005 to improve the risk assessment information being compiled by ABAG by providing any existing City information on unreinforced masonry buildings and soft-story apartments located in the City.

Drought, though a potential problem in the City, is not fully assessed. The City will work with ABAG and various water supply agencies, particularly the East Bay Municipal Utility District, on this issue.

The City plans to work with ABAG to develop specific information about the kind and level of damage to buildings, infrastructure, and critical facilities which might result from any of the hazards previously noted. The ABAG Annex states that ABAG will be doing this work in 2005 through early 2006.

As these impacts are not fully developed, the City has reviewed the hazards identified and ranked the hazards based on past disasters and expected future impacts based on hazard exposure. The conclusion is that earthquakes (particularly shaking), wildfire, and landslides (including unstable earth) pose a significant risk for potential loss. As noted in the City's Safety Element, in addition to the Hayward fault, Oakland is in close proximity to Calaveras and San Andreas faults. Of these three faults, the Hayward fault poses the most serious threat by far to Oakland due to its location through the city, the intensity of land uses near the fault zone, and the long interval since the land major quake along the fault.

Mitigation Activities and Priorities

As a participant in the ABAG multi-jurisdictional planning process, City of Oakland staff was one of the principal partners in the development and review of the comprehensive list of mitigation strategies in the overall multi-jurisdictional plan. The mitigation strategies were the subject of numerous meetings, as identified in the Planning Process section above.

The tentative decision on priority was made based on a variety of criteria, not simply on an economic cost-benefit analysis. These criteria include being technically and administratively feasible, politically acceptable, socially appropriate, legal, economically sound, and not harmful to the environment or our heritage.

Over time, we are committed to developing better hazard and risk information to use in making those trade-offs. We are not trying to create a disaster-proof region, but a disaster-resistant one. In addition, several of the strategies are existing City programs.

The public was provided with an opportunity to comment on the DRAFT priorities on numerous occasions, as listed in the section on the Planning Process. The final strategies (as shown in the attached Table) have already been incorporated into the City's Safety Element adopted in 2004. Many of the strategies have already been implemented.

The City has retrofitted several critical facilities, including City Hall and seventeen of the twenty-five fire stations for earthquake shaking. If retrofit was not cost effective, the fire station was demolished and replaced. Seven fire stations have been rebuilt during the years 1994, 1995, 1997 (2), 1998, 1999, and 2002. The status of the one remaining station is currently under review.

The Plan Maintenance and Update Process

The City's Emergency Management Board, in conjunction with the Fire Services Agency's Homeland Security Director, will ensure that ***monitoring*** of this Annex will occur. The plan will be monitored on an on-going basis. However, the major disasters affecting our community, legal changes, notices from ABAG as the lead agency in this process, and other triggers will be used.

Finally, the Annex and Safety Element will be a discussion item on the agenda of the meeting of City's Emergency Management Board at least once a year. At that meeting, the Board members heads will focus on ***evaluating*** the Annex and Safety Element in light of technological and political changes during the past year or other significant events. This group will be responsible for determining if the plan should be updated.

The City of Oakland is committed to reviewing and updating this plan annex at least once every five years, as required by the Disaster Mitigation Act of 2000. The City Homeland Security Director will contact ABAG four years after this plan is approved to ensure that ABAG plans to undertake the plan update process. If so, the City again plans to participate in the multi-jurisdictional plan. If ABAG is unwilling or unable to act as the lead agency in the multi-jurisdictional effort, other agencies will be contacted, including the County's Office of

Emergency Services. Counties should then work together to identify another regional forum for developing a multi-jurisdictional plan.

The ***public*** will continue to be involved whenever the plan is updated, and as appropriate during the monitoring and evaluation process. Prior to adoption of updates, the City will provide the opportunity for the public to comment on the updates. A public notice will be posted prior to the meeting to announce the comment period and meeting logistics.

Housing Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
HSNG - a - Multi-Hazard										
1)	Be aware of past problems of inadequate hazard disclosure and work with real estate agents to improve enforcement of real estate disclosure requirements for those hazards covered by this plan, for example, by making those agents and the disclosure firms aware of the hazard maps incorporated in this plan and available on the ABAG web site at ***http://quake.abag.ca.gov/mitigation***, as well as locally developed maps.							√	CEDA/Board of Realtors	
2)	Create incentives for owners of historic or architecturally significant residential buildings to undertake mitigation to levels that will minimize the likelihood that these buildings will need to be demolished after a disaster, particularly if those alterations conform to the federal Secretary of the Interior's *Guidelines for Rehabilitation.*							√	CEDA	
HSNG - b - Single-Family Homes Vulnerable to Earthquakes										
1)	Utilize or recommend adoption of a retrofit standard that includes standard plan sets and construction details for voluntary bolting of homes to their foundations and bracing of outside walls of crawl spaces ("cripple" walls), such as that being developed by a committee representing the East Bay-Peninsula-Monterey Chapters of the International Code Council (ICC), California Building Officials (CALBO), the Structural Engineers Association of Northern California (SEAONC), the Northern California Chapter of the Earthquake Engineering Research Institute (EERI-NC), and ABAG's Earthquake Program.			√					OES/CEDA	

Housing Mitigation Strategies

2)	Require engineered plan sets for retrofitting of heavy two-story homes with living areas over garages, as well as for split level homes, until standard plan sets and *construction details become available.*							√	CEDA	
3)	Require engineered plan sets for retrofitting of homes on steep hillsides.							√	CEDA	
4)	Encourage local government building inspectors to take classes on a periodic basis (such as the FEMA-developed training classes offered by ABAG) on retrofitting of single-family homes.							√	CEDA	
5)	*Encourage private retrofit contractors and home inspectors doing work in your area to take retrofit classes on a periodic basis(such as the FEMA-developed training classes offered by ABAG) on retrofitting of single-family homes.*	√							CEDA	
6)	Conduct demonstration projects on common existing housing types demonstrating structural and nonstructural mitigation techniques as community models for earthquake mitigation.							√	CEDA	
7)	Provide retrofit classes or workshops for homeowners.							√	CEDA	
8)	Establish tool-lending libraries with common tools needed for retrofitting for use by homeowners with *appropriate training.*	√							OES/CEDA/Library	
9)	Provide financial incentives to owners of applicable homes to retrofit.				√				CEDA Building Services Division	Oakland Safety Element, Policy GE-3.4
HSNG - c - Soft-Story Multifamily Residential Structures Vulnerable to Earthquakes										
1)	Require engineered plan sets for voluntary or mandatory soft-story retrofits until a standard plan set and construction details become available.							√	CEDA	
2)	Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory soft-story building retrofits.							√	CEDA	

Housing Mitigation Strategies

3)	Work to educate condominium and apartment owners, local government staff, engineers, and contractors on soft-story retrofit procedures and incentives using materials such as those developed by ABAG (see ***http://quake.abag.ca.gov/fixit***) and the City of San Jose.							√	CEDA	
4)	Conduct an inventory of existing or suspected soft-story residential structures.							√	ABAG/CEDA	
5)	Use the soft-story inventory to require owners to inform all existing tenants that they live in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will live in this type of building prior to signing a lease.							√	ABAG/CEDA	
6)	Use the soft-story inventory to require owners to inform all existing tenants that they should be prepared to live elsewhere following an earthquake if the building has not been retrofitted.							√	ABAG/CEDA	
7)	Investigate and adopt appropriate financial, procedural, and land use incentives for owners of soft-story buildings to facilitate retrofit such as those developed by ABAG (see ***http://quake.abag.ca.gov/fixit***) .				√				CEDA Building Services Division	Oakland Safety Element, Policy GE-3.4
8)	Explore development of local ordinances or State regulations to require or encourage owners of soft-story structures to strengthen them.							√		
9)	Provide technical assistance in seismically strengthening soft-story structures.							√	CEDA Building Services Division	
HSNG - d - Unreinforced Masonry Housing Stock										
1)	Continue to actively implement existing State law that requires cities and counties to maintain lists of the addresses of unreinforced masonry buildings and *inform property owners that they own this type of* hazardous structure.	√							CEDA Building Services Division	
2)	Accelerate retrofitting of unreinforced masonry structures that have not been retrofitted, for example, by (a) actively working with owners to obtain structural analyses of their buildings, (b) helping owners obtain retrofit funding, (c) adopting a mandatory versus voluntary, retrofit program, and/or (d) applying penalties to owners who show inadequate efforts to upgrade these buildings.		√						CEDA	

Housing Mitigation Strategies

3)	Require owners to inform all existing tenants that they live in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will live in this type of building prior to signing a lease.		√				√	CEDA (Completed)	Ordinance
4)	Require owners to inform all existing tenants that they should be prepared to live elsewhere following an earthquake even if the building has been retrofitted, for it has probably been retrofitted to a life-safety standard, not to a standard that will allow occupancy following major earthquakes.						√	CEDA (Completed)	
HSNG - e - Other Privately-Owned Structurally Suspicious Residential Buildings and Earthquakes									
1)	Identify and work toward tying down mobile homes used as year-round permanent residences using an appropriate cost-sharing basis (for example, 75% grant, 25% owner).						√	OES	
2)	Inventory non-ductile concrete, tilt-up concrete, and other privately-owned structurally suspicious residential buildings.						√	CEDA	
3)	Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory retrofit of seismically vulnerable buildings.						√	CEDA	
4)	Adopt one or more of the following strategies as incentives to encourage retrofitting of privately-owned structurally deficient residential buildings: (a) waivers or reductions of permit fees, (b) below-market loans, (c) local tax breaks, (d) grants to cover the cost of retrofitting or of a structural analysis, (e) land use and procedural incentives, or (f) technical assistance.				√			CEDA Building Services Division	Oakland Safety Element, Policy GE-3.4
HSNG - f - New Construction and Earthquakes									
1)	Continue to require that all new housing be constructed in compliance with structural requirements of the most recently adopted version of the *California Building Code*.	√						CEDA Building Services Division	Oakland Safety Element, Policy GE-3.1
2)	Conduct appropriate employee training and support continued education to ensure enforcement of building codes and construction standards, as well as identification of typical design inadequacies of housing and recommended improvements.						√	CEDA	

Housing Mitigation Strategies

HSNG - g - Wildfire and Structural Fires										
1)	Increase efforts to reduce hazards in existing development in high wildfire hazard areas (identified as wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat) through improving engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on defensible space mitigation strategies.		√					FPB/CEDA		
2)	Tie public education on defensible space and a comprehensive defensible space ordinance to a field program of enforcement.		√					FPB		
3)	Require that new homes in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat be constructed of fire-resistant building materials (including roofing and exterior walls) and incorporate fire-resistant design features (such as minimal use of eaves, internal corners, and open first floors) to increase structural survivability and reduce ignitability. **Note** - See Structural Fire Prevention Field Guide for Mitigation of Wildfires at http://osfm.fire.ca.gov/structural.html.	√						CEDA Building Services Division, OFD Support Services Division	*Oakland Safety Element*, Policy FI-2.2	
4)	Develop financial incentives for homeowners to be "model" defensible space homes in neighborhoods that are wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.						√	FPB/CEDA		
5)	Consider fire safety, evacuation, and emergency vehicle access when reviewing proposals to add secondary units or additional residential units in wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.		√					FPB/CEDA		
6)	Adopt and/or amend, as needed, updated versions of the *California Building and Fire Codes* so that optimal fire-protection standards are used in construction and renovation projects.	√						CEDA Building Services Division, OFD Support Services Division	Oakland Safety Element, Policy FI-2.1	

Housing Mitigation Strategies

7)	Create a mechanism to enforce provisions of the *California Building and Fire Codes* and local housing codes that require the installation of smoke detectors and/or fire-extinguishing systems by making installation a condition of (a) finalizing a permit for any work on existing properties valued at over a fixed amount, such as $500 or $1000, and/or (b) a condition for the transfer of property if these changes are determined cost-effective strategies.							√	FPB/CEDA	
8)	Work to ensure a reliable source of water for fire suppression in rural-residential areas through the cooperative efforts of water districts, fire districts, and residents.	√							Fire Dept.	
9)	Expand vegetation management programs in wildland-urban- interface fire-threatened communities or in areas exposed to high-to-extreme fire threat to more effectively manage the fuel load through roadside collection and chipping, mechanical fuel reduction equipment, selected harvesting, use of goats or other organic methods of fuel reduction, and selected use of controlled burning.	√							FPB	
10)	Promote the installation of early warning fire alarm systems in homes wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat connected to fire department communication systems.							√	FPB	
11)	Establish a Fire Hazard Abatement District to fund reduction in fire risk of existing properties through vegetation management that includes reduction of fuel loads, use of defensible space, and fuel breaks.	√							FPB	
12)	Work with residents in rural-residential areas to ensure adequate access and evacuation in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.		√						FPB	
13)	Require fire sprinklers in new homes located more than 1.5 miles or a 5-minute response time from a fire station or in an identified high hazard wildland-urban-interface wildfire area.							√	FPB	
14)	Require fire sprinklers in all new or substantially remodeled multifamily housing, regardless of distance from a fire station.							√	FPB	

Housing Mitigation Strategies

15)	Require sprinklers in all mixed use development to protect residential uses from fires started in non-residential areas.							√	FPB	
16)	*Compile a list of high-rise and high-occupancy buildings* which are deemed, due to their age or construction materials, to be particularly susceptible to fire hazards, and determine an expeditious timeline for the fire-safety inspection of all such structures.	√							OFD Support Services Division	Oakland Safety Element, Policy FI-2.4
17)	Conduct periodic fire-safety inspections of all multi-family buildings, as required by State law.	√							OFD Support Services Division	Oakland Safety Element, Policy FI-2.5
18)	*Ensure that fire-preventive vegetation-management techniques and practices for creek sides and high-slope areas do not contribute to the landslide and erosion hazard.*	√							*OFD Support Services Division*	*Oakland Safety Element, Policy GE-2.6*
19)	Create a mechanism to require the bracing of water heaters and flexible couplings on gas appliances, and/or (as specified under "a. Single-family homes vulnerable to earthquakes" above) the bolting of homes to their foundations and strengthening of cripple walls to reduce fire ignitions due to earthquakes.		√						CEDA/Board of Realtors/FPB	
20)	Work with the State Fire Marshall, the California Seismic Safety, PEER, and other experts to identify and manage gas-related fire risks of soft-story residential or mixed use buildings that are prone to collapse and occupant entrapment consistent with the natural gas safety recommendations of Seismic Safety Commission Report SSC-02-03. **Note** - See http://www.seismic.ca.gov/pub/CSSC_2002-03_Natural%20Gas%20Safety.pdf. **Also note** - any values that are installed may need to have both excess flow and seismic triggers ("hybrid" valves).							√	FPB/CEDA	
HSNG - h - Flooding										
1)	To reduce flood risk, and thereby reduce the cost of flood insurance to property owners, work to qualify for the highest-feasible rating under the Community Rating System of the National Flood Insurance Program.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-3.2
2)	Balance the housing needs of residents against the risk from potential flood-related hazards.							√	CEDA/Redevelopment	

Housing Mitigation Strategies

3)	Ensure that new development pays its fair share of improvements to the storm drainage system necessary to accommodate increased flows from the development.	√							CEDA/ORB	
4)	Provide sandbags and plastic sheeting to residents in anticipation of rainstorms, and deliver those materials to the disabled and elderly upon request.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.4
5)	Provide public information on locations for obtaining sandbags and/or deliver those sandbags to those various locations throughout a city and/or county prior to and/or during the rainy season.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.4
6)	Apply floodplain management regulations for development in the floodplain and floodway.							√	N/A	
7)	Ensure that new subdivisions are designed to reduce or eliminate flood damage by requiring lots and rights-of-way are laid out for the provision of approved sewer and drainage facilities, providing on-site detention facilities whenever practicable.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-1.2
8)	Encourage home and apartment owners to participate in home elevation programs.							√	N/A	
9)	As funding opportunities become available, encourage home and apartment owners to participate in acquisition and relocation programs for areas within floodways.							√	N/A	
10)	Encourage owners of properties in a floodplain to consider purchasing flood insurance. For example, point out that most homeowners' insurance policies do not cover a property for flood damage.							√	N/A	

Housing Mitigation Strategies

1)	Increase efforts to reduce landslides and erosion in existing and future development by improving appropriate code enforcement and use of applicable standards, such as those appearing in the *California Building Code*, California Geological Survey *Special Report 117 – Guidelines for Evaluating and Mitigating Seismic Hazards in California, American Society of Civil Engineers (ASCE) report Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Landslide Hazards in California, and the California Board for Geologists and Geophysicists Guidelines for Engineering Geologic Reports.* Such standards should cover excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.								√	CEDA		
2)	Increase efforts to reduce landslides and erosion in existing and future development through continuing education of design professionals on mitigation strategies.									CEDA		
HSNG - j - Building Reoccupancy												
1)	Develop and enforce an ordinance for disaster-damaged structures to ensure that residential buildings are repaired in an appropriate and timely manner and retrofitted concurrently to avoid a recurrence.								√	CEDA/ORB		
HSNG - k - Public Education												
1)	Provide information to residents of your community on the availability of interactive hazard maps showing your community on ABAG's web site.								√	CEDA/OES		

Housing Mitigation Strategies

2)	Develop printed materials, utilize existing materials (such as developed by FEMA and the American Red Cross), conduct workshops, and/or provide outreach encouraging residents to have family disaster plans that include drop-cover-hold earthquake drills, fire and storm evacuation procedures, and shelter-in-place emergency guidelines.	√							OES	
3)	Better inform residents of comprehensive mitigation activities, including elevation of appliances above expected flood levels, use of fire-resistant roofing and defensible space in high wildfire threat and wildfire-urban-interface areas, structural retrofitting techniques for older homes, and use of intelligent grading practices through workshops, publications, and media announcements and events.							√	N/A	
4)	Develop a public education campaign on the cost, risk, and benefits of earthquake, flood, and other hazard insurance.	√							OES	
5)	Use disaster anniversaries, such as April (Earthquake Month and the 1906 earthquake), September (9/11), and October (Loma Prieta earthquake and Oakland Hills fire), to remind the public on safety and security mitigation activities.	√							OES	
6)	Sponsor the formation and training of Community Emergency Response Teams (CERT) training. [Note – these programs go by a variety of names in various cities and areas.]	√							OFD Office of Emergency Services	Oakland Safety Element, Policy FI-1.4
7)	Include flood fighting technique session based on California Department of Water Resources training to the list of available public training classes offered by CERT.							√	N/A	
8)	Institute the neighborhood watch block captain and team programs outlined in the Citizen Corps program guide.							√	City Administration/OPD/OES	

Housing Mitigation Strategies

9)	Assist residents in the development of defensible space through the use of, for example, "tool libraries" for weed abatement tools, roadside collection and/or chipping services (for brush, weeds, and tree branches) in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.							√	FPB	
10)	Train homeowners to locate and shut off gas valves if they smell or hear gas leaking.	√							OES	
11)	Distribute NOAA weather radios to high-risk, limited-income families living in flood hazard areas.							√	N/A	
12)	Develop a program to provide at-cost NOAA weather radios to residents of flood hazard areas.							√	N/A	
13)	Make use of the materials on the ABAG web site at http://quake.abag.ca.gov/fixit and other web sites to increase residential mitigation activities related to earthquakes. (ABAG plans to continue to improve the quality of those materials over time.)	√							OES	
14)	Develop a "Maintain-a-Drain" campaign, similar to that of the City of Oakland, encouraging businesses and residents to keep storm drains in their neighborhood free of debris.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.3
15)	Encourage the formation of a community- and neighborhood-based approach to wildfire education and action through local Fire Safe Councils and the *Fire Wise Program*.	√							FPB	
16)	Inform shoreline-property owners of the possible long-term economic threat posed by rising sea levels.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-4.3
17)	Develop and distribute culturally appropriate materials related to disaster mitigation and preparedness, such as those on the http://www.preparenow.org website.	√							OES	

Infrastructure Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
INFR - a - Multihazard										
1)	Assess the vulnerability of critical facilities designated by lifeline operators to damage in natural disasters or security threats, including facilities owned outside of the Bay Area that can impact service delivery within the region. **Note** - Lifeline agencies, departments, and districts are those that operate transportation and utility facilities and networks.						√			
2)	Comply with State of California and federal requirements to assess the vulnerability of dams to damage from earthquakes, seiches, landslides, liquefaction, or security threats.						√			
3)	Encourage the cooperation of utility system providers and cities, counties, and other special districts to develop strong and effective mitigation strategies for infrastructure systems and facilities.	√							PWA Electrical Services Division	Oakland Safety Element, Policy GE-4.2
4)	Retrofit or replace critical lifeline facilities and/or their backup facilities that are shown to be vulnerable to damage in natural disasters.						√			
5)	Support and encourage efforts of ***other*** (lifeline) agencies as they plan for and arrange financing for seismic retrofits and other disaster mitigation strategies. (For example, a city might pass a resolution in support of a transit agency's retrofit program.)	√							PWA Transportation Services Division	Oakland Safety Element, Policy GE-4.1
6)	Plan for speeding the repair and functional restoration of lifeline systems through stockpiling of shoring materials, temporary pumps, surface pipelines, portable hydrants, and other supplies, such as those available through the Water Agency Response Network (WARN).						√			

Infrastructure Mitigation Strategies

7)	Engage in, support, and/or encourage research by others on measures to further strengthen transportation, water, sewer, and power systems so that they are less vulnerable to damage in disasters.							√			
8)	Pre-position emergency power generation capacity (or have rental/lease agreements for these generators) in critical buildings of cities, counties, and special districts to maintain continuity of government and services.							√			
9)	Have back-up emergency power available for critical intersection traffic lights.							√			
10)	Develop unused or new pedestrian rights-of-way as walkways to serve as additional evacuation routes (such as fire roads in park lands).	√							PWA Transportation Services Division	Oakland Safety Element, Policy FI-3.2
11)	Coordinate with PG&E and others to investigate ways of minimizing the likelihood that power interruptions will adversely impact vulnerable communities, such as the disabled and the elderly.							√			
12)	Encourage replacing aboveground electric and phone wires and other structures with underground facilities, and use the planning-approval process to ensure that all new phone and electrical utility lines are installed underground.	√							PWA Electrical Services Division, CEDA Planning & Zoning Division	Oakland Safety Element, Policy GE-4.4
13)	Coordinate with the State Division of Safety of Dams to ensure an adequate timeline for the maintenance and inspection of dams, as required of dam owners by State law.	√							OFD Office of Emergency Services	Oakland Safety Element, Policy FL-4.1
14)	Encourage communication between State OES, FEMA, and utilities related to emergencies occurring outside of the Bay Area that can affect service delivery in the region.							√			
15)	Ensure that transit operators, private ambulance companies, cities, and/or counties have mechanisms in place for medical transport during and after disasters that take into consideration the potential for reduced capabilities of roads following these same disasters.							√			

Infrastructure Mitigation Strategies

16)	Effectively utilize the Transportation Management Center (TMC), the staffing of which is provided by Caltrans, the CHP and MTC. The TMC is designed to maximize safety and efficiency throughout the highway system. It includes the Emergency Resource Center (ERC) which was created specifically for primary planning and procedural disaster management.						√			
INFR - b - Earthquakes										
1)	Expedite the funding and retrofit of seismically-deficient city- and county-owned bridges and road structures by working with Caltrans and other appropriate governmental agencies.	√							PWA Transportation Services Division	Oakland Safety Element, Policy GE-4.1
2)	Establish a higher priority for funding seismic retrofit of existing transportation and infrastructure systems (such as BART) than for expansion of those systems.					√				
3)	Include "areas subject to high ground shaking, earthquake-induced ground failure, and surface fault rupture" in the list of criteria used for determining a replacement schedule for pipelines (along with importance, age, type of construction material, size, condition, and maintenance or repair history).						√			
4)	Install specially-engineered pipelines in areas subject to faulting, liquefaction, earthquake-induced landsliding, or other earthquake hazard.						√			
5)	Replace or retrofit water-retention structures that are determined to be structurally deficient.						√			
6)	Install portable facilities (such as hoses, pumps, emergency generators, or other equipment) to allow pipelines to bypass failure zones such as fault rupture areas, areas of liquefaction, and other ground failure areas (using a priority scheme if funds are not available for installation at all needed locations).						√			
7)	Install earthquake-resistant connections when pipes enter and exit bridges.						√			
8)	Comply with all applicable building and fire codes, as well as other regulations (such as state requirements for fault, landslide, and liquefaction investigations in particular mapped areas) when constructing or significantly remodeling infrastructure facilities.						√			

Infrastructure Mitigation Strategies

9)	Clarify to workers in critical facilities and emergency personnel, as well as to elected officials and the public, the extent to which the facilities are expected to perform only at a life safety level (allowing for the safe evacuation of personnel) or are expected to remain functional following an earthquake.							√		
10)	Examine the feasibility of developing a water-borne transportation "system" – comprised mainly of relatively inexpensive barges – across the Bay for use in the event of major earthquakes. Implementation of such a system could prove extremely useful in the event of structural failure of either the road-bridge systems or BART and might serve as an adjunct to existing transportation system elements in the movement of large numbers of people and/or goods.							√		
INFR - c - Wildfire										
1)	Ensure a reliable source of water for fire suppression (meeting acceptable standards for minimum volume and duration of flow) for existing and new development.							√		
2)	Develop a coordinated approach between fire jurisdictions and water supply agencies to identify needed improvements to the water distribution system, initially focusing on areas of highest wildfire hazard.	√							OFD Field Operations Division	Oakland Safety Element, Policy FI-1.7
3)	Develop a defensible space vegetation program that includes the clearing or thinning of (a) non-fire resistive vegetation within 30 feet of access and evacuation roads and routes to critical facilities, or (b) all non-native species (such as eucalyptus and pine, but not necessarily oaks) within 30 feet of access and evacuation roads and routes to critical facilities.							√		
4)	Ensure all dead-end segments of public roads in high hazard areas have at least a "T" intersection turn-around sufficient for typical wildland fire equipment.							√		
5)	Enforce minimum road width of 20 feet with an additional 10-foot clearance on each shoulder on ***all*** driveways and road segments greater than 50 feet in length in wildfire hazard areas.							√		

Infrastructure Mitigation Strategies

6)	Require that development in high fire hazard areas provide adequate access roads (with width and vertical clearance that meet the minimum standards of the *Fire Code* or relevant local ordinance), onsite fire protection systems, evacuation signage, and fire breaks.							√						
7)	Ensure adequate fire equipment road or fire road access to developed and open space areas.							√						
8)	Maintain fire roads and/or public right-of-way roads and keep them passable at all times.							√						
INFR - d - Flooding														
1)	*Conduct a watershed analysis of runoff and drainage* systems to predict areas of insufficient capacity in the storm drain and natural creek system.							√						
2)	Develop procedures for performing a watershed analysis to look at the impact of development on flooding potential downstream, including communities outside of the jurisdiction of proposed projects.							√						
3)	Conduct a watershed analysis at least once every three years.							√						
4)	Assist, support, and/or encourage the U.S. Army Corp of Engineers, various Flood Control and Water Conservation Districts, and other responsible agencies to locate and maintain funding for the development of flood control projects that have high cost-benefit ratios (such as through the writing of letters of support and/or passing resolutions in support of these efforts).							√						
5)	Pursue funding for the design and construction of storm drainage projects to protect vulnerable properties, including property acquisitions, upstream storage such as detention basins, and channel widening with the associated right-of-way acquisitions, relocations, and environmental mitigations.							√						
6)	Continue to repair and make structural improvements to storm drains, pipelines, and/or channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	√							PWA Engineering Design Division					Oakland Safety Element, Policy FL-2.1

Infrastructure Mitigation Strategies

7)	Continue maintenance efforts to keep storm drains and creeks free of obstructions, while retaining vegetation in the channel (as appropriate), to allow for the free flow of water.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.2
8)	Enforce provisions under creek protection, stormwater management, and discharge control ordinances designed to keep watercourses free of obstructions and to protect drainage facilities to confirm with the Regional Water Quality Control Board's Best Management Practices.	√							PWA Environmental Services Division	Oakland Safety Element, Policy FL-1.5
9)	Develop an approach and locations for various watercourse bank protection strategies, including for example, (1) an assessment of banks to inventory areas that appear prone to failure, (2) bank stabilization, including installation of rip rap, (3) stream bed depth management using dredging, and (4) removal of out-of-date coffer dams in rivers and tributary streams.							√		
10)	Use reservoir sediment removal as one way to increase storage for both flood control and water supply.							√		
11)	Elevate critical bridges affected by flooding to increase stream flow and maintain critical access and egress routes.							√		
12)	Provide a mechanism to expedite the repair or replacement of levees that are vulnerable to collapse from earthquake-induced shaking or liquefaction, rodents, and other concerns, particularly those protecting critical infrastructure.							√		
13)	Ensure that utility systems in new developments are constructed in ways that reduce or eliminate flood damage.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-1.2
14)	Determine whether or not wastewater treatment plants are protected from floods, and if not, investigate the use of flood-control berms to not only protect from stream or river flooding, but also increasing plant security.							√		

Infrastructure Mitigation Strategies

15)	Work cooperatively with water agencies, flood control districts, Caltrans, and local transportation agencies to determine appropriate performance criteria for watershed analysis.							√					
16)	Work for better cooperation among the patchwork of agencies managing flood control issues.							√					
17)	*Work cooperatively with upstream communities to* monitor creek and watercourse flows to predict potential for flooding downstream.							√					
INFR - e - Landslides													
1)	Include "areas subject to ground failure" in the list of criteria used for determining a replacement schedule (along with importance, age, type of construction material, size, condition, and maintenance or repair history) for pipelines.							√					
2)	Establish requirements in zoning ordinances to address hillside development constraints in areas of steep slopes that are likely to lead to excessive road maintenance or where roads will be difficult to maintain during winter storms due to landsliding.							√					
INFR - *f - Building Reoccupancy*													
1)	Ensure that critical buildings owned or leased by special districts or private utility companies participate in a program similar to San Francisco's Building Occupancy Resumption Program (BORP). The BORP program permits owners of buildings to hire qualified structural engineers[1] to create facility-specific post-*disaster inspection plans and allows these engineers* to become automatically deputized as City/County inspectors for these buildings in the event of an earthquake or other disaster. This program allows rapid reoccupancy of the buildings. **Note** - A qualified structural engineer is a California licensed structural engineer with relevant experience.							√					
INFR - g - Public Education													
1)	Provide materials to the public related to planning for power outages.							√					

Infrastructure Mitigation Strategies

2)	Provide materials to the public related to family and personal planning for delays due to traffic or road closures.							√		
3)	Provide materials to the public related to coping with reductions in water supply or contamination of that supply.							√		
4)	Provide materials to the public related to coping with disrupted storm drains, sewage lines, and wastewater treatment.							√		
5)	Facilitate and/or coordinate the distribution of materials that are prepared by others, such as by placing materials in city or utility newsletters, or on community access channels, as appropriate.							√		

Health Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
HEAL - a - Hospitals and Other Critical Health Care Facilities										
1)	Work with critical health care facilities operators to ensure that critical facilities are structurally sound and have nonstructural systems designed to remain functional following disasters (as required for acute-care hospitals for earthquakes by State law).							√	Alameda County Health Services	
2)	Encourage hospitals to work with the California Office of Statewide Health Planning and Development (OSHPD) to formalize arrangements with structural engineers to report to the hospital, assess damage, and determine if the buildings can be reoccupied. The program should be similar to San Francisco's Building Occupancy Resumption Program (BORP) that permits owners of buildings to hire qualified structural engineers to create building-specific post-disaster inspection plans and allows these engineers to become automatically deputized as inspectors for these buildings in the event of an earthquake or other disaster. OSHPD, rather than city/county building departments, has the authority and responsibility for the structural integrity of hospital structures.							√	Alameda County Health Services	
3)	Ensure health care facilities are adequately prepared to care for victims with respiratory problems related to smoke and/or particulate matter inhalation.							√	Alameda County Health Services	
4)	Ensure these health care facilities have the capacity to shut off outside air and be self-contained.							√	Alameda County Health Services	
5)	Ensure that hospitals and other major health care facilities have auxiliary water and power sources.							√	Alameda County Health Services	
6)	Work with health care facilities to institute isolation capacity should a need for them arise following a communicable disease epidemic.							√	Alameda County Health Services	

Health Mitigation Strategies

7)	Develop printed materials, utilize existing materials (such as developed by FEMA and the American Red Cross), conduct workshops, and/or provide outreach encouraging employees of these critical health care facilities to have family disaster plans and conduct mitigation activities in their own homes.						√	Alameda County Health Services	
HEAL - b - Ancillary Health-Related Facilities									
1)	Work with State of California licensing agencies to identify these ancillary facilities in your community.						√	Alameda County Health Services	
2)	Encourage these facility operators to develop disaster mitigation plans.						√	Alameda County Health Services	
3)	Encourage these facility operators to create, maintain, and/or continue partnerships with local governments to develop response and recovery plans.						√	Alameda County Health Services	
HEAL - c - Interface with National and State Health Care Initiatives									
1)	Designate locations for the distribution of antibiotics to large numbers of people should the need arise, as required to be included in each county's Strategic National Stockpile Plan.		√					OES,PWA,CEDA, DHS	
2)	Ensure that you know the Metropolitan Medical Response System (MMRS) cities in your area. For example, Oakland and Fremont are the MMRS cities in Alameda County. MMRS cities are those cities that are provided with additional federal funds for organizing, equipping, and training groups of local fire, rescue, medical, and other emergency management personnel.	√						OFD Emergency Medical Services Division	Oakland Safety Element, Policy PS-3.2
3)	Know if any National Disaster Medical System (NDMS) uniformed or non-uniformed personnel are within one-to-four hours of your community. These federal resources include veterinary, mortuary, and medical personnel.						√	Alameda County OES	
4)	Plan to utilize the State of California Department of Health Services laboratory in Richmond for confirmation of biological agencies and Department of Defense laboratories in Berkeley (Lawrence Berkeley National Laboratory) or Livermore (Lawrence Livermore National Laboratory and Sandia) for confirmation of radiological agents.						√	Alameda County OES	
HEAL - d - Environmental Health									

Health Mitigation Strategies

1)	Create discussion forums for food and health personnel, including, for example, medical professionals, veterinarians, and plant pathologists, to develop safety, security, and response strategies for food supply contamination.							√	Alameda County OES	
2)	Train appropriate personnel to understand that the Metropolitan Medical Response System (MMRS) cities in your area. For example, Oakland and Fremont are the MMRS cities in Alameda County. MMRS cities are those cities that are provided with additional federal funds for organizing, equipping, and training groups of local fire, rescue, medical, and other emergency management personnel.	√							OFD-EMS	
3)	Train appropriate personnel to know if any National Disaster Medical System (NDMS) uniformed or non-uniformed personnel are within one-to-four hours of your community. These federal resources include *veterinary, mortuary, and medical personnel.*							√	*Alameda County OES & Health Services*	
4)	Train appropriate personnel to know to utilize the State of California Department of Health Services laboratory in Richmond for confirmation of biological agents and Department of Defense laboratories in Berkeley (Lawrence Berkeley National Laboratory) or Livermore (Lawrence Livermore National Laboratory and Sandia) for confirmation of radiological agents.							√	Alameda County OES & Health Services	

Economy Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
ECON - a - Multi-Hazard										
1)	Be aware of past problems of inadequate hazard disclosure and work with real estate agents to improve enforcement of real estate disclosure requirements for those hazards covered by this plan, for example, by making those agents and the disclosure firms aware of the hazard maps incorporated in this plan and available on the ABAG web site at ***http://quake.abag.ca.gov/mitigation***, as well as locally developed maps.							√	RC Board of Directors	
2)	Create incentives for owners of historic or architecturally significant buildings to undertake *mitigation to levels that will minimize the likelihood that* these buildings will need to be demolished after a disaster, particularly if those alterations conform to the federal Secretary of the Interior's *Guidelines for Rehabilitation.*							√	CEDA Historical Preservation Building	
ECON - b - Soft-Story Commercial Buildings Vulnerable to Earthquakes										
1)	Require engineered plan sets for voluntary or mandatory soft-story retrofits until a standard plan set and construction details become available.							√		
2)	Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory soft-story building retrofits.							√	CEDA/FPB	
3)	Work to educate building owners, local government *staff, engineers, and contractors on soft-story retrofit* procedures and incentives using materials such as those developed by ABAG (see ***http://quake.abag.ca.gov/fixit***) and the City of San Jose.					√			CEDA	

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4)	Conduct an inventory of existing or suspected soft-story commercial and industrial structures.							√	CEDA	
5)	*Use the soft-story inventory to require owners to inform* all existing tenants that they work in this type of building and the standard to which it may have been retrofitted, as well as require owners to inform tenants that they will work in this type of building prior to signing a lease.							√		
6)	Use the soft-story inventory to require owners to inform all existing tenants that they should be prepared to work elsewhere following an earthquake if the building has not been retrofitted.							√		
7)	Investigate and adopt appropriate financial, procedural, and land use incentives for owners of soft-story *buildings to facilitate retrofit.*				√				CEDA Building Services Division	Oakland Safety Element, Policy GE-3.4
8)	Explore development of local ordinances or State *regulations* to require or encourage owners of soft-story structures to strengthen them.							√		
9)	Provide technical assistance in seismically *strengthening soft-story structures.*							√		
ECON - c - Unreinforced Masonry Buildings in Older Downtown Areas										
1)	Continue to actively implement existing State law that requires cities and counties to maintain lists of the addresses of unreinforced masonry buildings and inform property owners that they own this type of hazardous structure.	√							CEDA (Completed)	
2)	Accelerate retrofitting of unreinforced masonry structures that have not been retrofitted, for example, by (a) actively working with owners to obtain structural analyses of their buildings, (b) helping owners obtain *retrofit funding, (c) adopting a mandatory versus voluntary, retrofit program, and/or* (d) applying penalties to owners who show inadequate efforts to upgrade these buildings.	√							CEDA (Completed)	
3)	Require owners to inform all existing tenants that they work in this type of building and the standard to which it *may have been retrofitted, as well as require owners to* inform tenants that they will work in this type of building prior to signing a lease.	√							CEDA (Completed)	

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4)	Require owners to inform all existing tenants that they should be prepared to work elsewhere following an earthquake even if the building has been retrofitted, for it has probably been retrofitted to a life-safety standard, not to a standard that will allow occupancy following major earthquakes.	√							CEDA	
ECON - d - Privately-Owned Structurally Suspicious Buildings										
1)	Inventory non-ductile concrete, tilt-up concrete, and other privately-owned structurally suspicious buildings.							√	CEDA	
2)	Adopt the 2003 International Existing Building Code, the 1997 UBC, or the latest applicable code standard for the design of voluntary or mandatory retrofit of seismically vulnerable buildings.	√							CEDA (Completed)	
3)	Adopt one or more of the following strategies as incentives to encourage retrofitting of privately-owned structurally suspicious commercial and industrial buildings: (a) waivers or reductions of permit fees, (b) below-market loans, (c) local tax breaks, (d) grants to cover the cost of retrofitting or of a structural analysis, (e) land use and procedural incentives, or (f) technical assistance.	√							CEDA Building Services Division	Oakland Safety Element, Policy GE-3.4
ECON - e - Wildfire and Structural Fires										
1)	Increase efforts to reduce fire in existing development through improving engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on mitigation strategies.	√							Fire Prevention Bureau (FPB)	
2)	Require that new business and office buildings in high fire hazard areas be constructed of fire-resistant building materials and incorporate fire-resistant design features (such as minimal use of eaves, internal corners, and open first floors) to increase structural survivability and reduce ignitability.	√							CEDA Building Services Division, OFD Fire Prevention	Oakland Safety Element, Policy FI-2.2
3)	Adopt and amend as needed updated versions of the *California Building and Fire Codes* so that optimal fire-protection standards are used in construction and renovation projects.	√							CEDA Building Services Division, OFD Fire Prevention	Oakland Safety Element, Policy FI-2.1

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4)	Create a mechanism to enforce provisions of the *California Building and Fire Codes* and other local codes that require the installation of smoke detectors and fire-extinguishing systems by making installation a condition of (a) finalizing a permit for any work on existing properties valued at over a fixed amount, such as $500 or $1000, and/or (b) on any building over 75 feet in height, and/or (b) as a condition for the transfer of property.							√	FPB/Board of Realtors	
5)	Expand existing vegetation management programs in commercial and/or industrial areas.							√	FPB	
6)	Establish a Fire Hazard Abatement District to fund reduction in fire risk of existing properties through vegetation management that includes reduction of fuel loads, use of defensible space, and fuel breaks.	√							FPB	
7)	Establish a Fire Hazard Abatement District to fund fire-safety inspections of private properties, roving firefighter patrols on high fire-hazard days, and public education efforts.	√							FPB *(Completed)*	
8)	Compile a list of high-rise and high-occupancy buildings that are deemed, due to their age or construction materials, to be particularly susceptible to fire hazards, and determine an expeditious timeline for the fire-safety inspection of all such structures.	√							OFD Support Services Division	Oakland Safety Element, Policy FI-2.4
9)	Conduct periodic fire-safety inspections of all commercial and institutional buildings.	√							OFD Support Services Division	Oakland Safety Element, Policy FI-2.5
10)	Work with the State Fire Marshall, the California Seismic Safety, PEER, and other experts to identify and manage gas-related fire risks of soft-story mixed use buildings that are prone to collapse and occupant entrapment consistent with the natural gas safety recommendations of Seismic Safety Commission Report SSC-02-03. **Note** - See http://www.seismic.ca.gov/pub/CSSC_2002-03_Natural%20Gas%20Safety.pdf. **Also note** - any values that are installed may need to have both excess flow and seismic triggers ("hybrid" valves).							√	FPB	

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11)	Ensure that fire-preventive vegetation-management techniques and practices for creek sides and high-slope areas do not contribute to the landslide and erosion hazard.	√							OFD Fire Prevention	Oakland Safety Element, Policy GE-2.6
12)	Work with insurance companies to create a public/private partnership to give a discount on fire insurance premiums to "Forester Certified" *Fire Wise* landscaping and fire-resistant building materials.							√	City Council/ City Administrator/ Fire Prevention	
ECON - f - Flooding										
1)	To reduce flood risk, thereby reducing the cost of flood insurance to property owners, work to qualify for the highest-feasible rating under the Community Rating System of the National Flood Insurance Program.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-3.2
2)	Balance the needs for commercial and industrial development against the risk from potential flood-related hazards.							√	CEDA	
3)	Ensure that new development pays its fair share of improvements to the storm drainage system necessary to accommodate increased flows from the development, ***or*** does not increase runoff by draining water to pervious areas or detention facilities.							√	PWA	
4)	Provide sandbags and plastic sheeting to businesses in anticipation of rainstorms, and deliver those materials to the disabled and elderly upon request.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.4
5)	Provide public information on locations for obtaining sandbags and deliver those sandbags to those various locations throughout a city and/or county.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.4
6)	Apply floodplain management regulations for development in the floodplain and floodway.							√	CEDA/PWA	
7)	Encourage business owners to participate in building elevation programs.							√	N/A	
8)	Encourage business owners to participate in acquisition and relocation programs for areas within floodways.							√	N/A	

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9)	Require an annual inspection of approved flood-proofed buildings to ensure that (a) all flood-proofing components will operate properly under flood conditions and (b) all responsible personnel are aware of their duties and responsibilities as described in their building's *Flood Emergency Operation Plan* and *Inspection & Maintenance Plan*.								√	CEDA	
ECON - g - Landslides and Erosion											
1)	Increase efforts to reduce landslides and erosion in existing and future development by improving appropriate code enforcement and use of applicable standards, such as those appearing in the *California Building Code*, California Geological Survey *Special Report 117 – Guidelines for Evaluating and Mitigating Seismic Hazards in California, American Society of Civil Engineers (ASCE) report Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Landslide Hazards in California, and the California Board for Geologists and Geophysicists Guidelines for Engineering Geologic Reports.* Such standards should cover excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.								√	CEDA	
2)	Increase efforts to reduce landslides and erosion in existing and future development through continuing education of design professionals on mitigation strategies.								√	CEDA	
ECON - h - Construction											
1)	Continue to require that all new commercial and industrial buildings be constructed in compliance with structural requirements of the most recently adopted version of the *California Building Code*.		√							CEDA Building Services Division	Oakland Safety Element, Policy GE-3.1

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2)	Conduct appropriate employee training and support continued education to ensure enforcement of construction standards.							√	CEDA				
3)	Recognize that many strategies that increase earthquake resistance also decrease damage in an explosion. In addition, recognize that ventilation systems can be designed to contain airborne biological agents.							√	LEA/FPB				
ECON - i - Building Reoccupancy													
1)	Institute an aggressive program similar to San Francisco's Building Occupancy Resumption Program (BORP). This program permits owners of private buildings to hire qualified structural engineers to create building-specific post-disaster inspection plans and allows these engineers to become automatically deputized as City/County inspectors for these buildings in the event of an earthquake or other disaster.							√	CEDA/OPB				
2)	Actively notify owners of historic or architecturally significant buildings of the availability of the local BORP-type program and encourage them to participate to ensure that appropriately qualified structural engineers are inspecting their buildings, thus reducing the likelihood that the buildings will be inappropriately evaluated following a disaster.							√	CEDA/OPB				
3)	Actively notify owners of educational facility buildings of the availability of the local BORP-type program and encourage them to participate to ensure that appropriately qualified structural engineers are inspecting their buildings, thus reducing the likelihood that the buildings will be inappropriately evaluated following a disaster.							√	CEDA				
4)	Allow owners to participate in a BORP-type program as described above, but not actively encourage them to do so.							√	CEDA				
5)	Develop and enforce an ordinance for disaster-damaged structures to ensure that damaged buildings are repaired in an appropriate and timely manner.							√	CEDA (Completed)				

Economy Mitigation Strategies

6)	Establish preservation-sensitive measures for the repair and reoccupancy of historically significant structures, including requirements for temporary shoring or stabilization where needed, arrangements for consulting with preservationists, and expedited permit procedures for suitable repair or rebuilding of historically or architecturally valuable structures.							√	CEDA / Historical Bldgs. Preservation	
ECON - j - Public Education										
1)	Provide information to business owners and employees on the availability of interactive hazard maps on ABAG's web site.							√	CEDA	
2)	Develop printed materials, utilize existing materials (such as developed by FEMA and the American Red Cross), conduct workshops, and/or provide outreach encouraging businesses' employees to have family disaster plans that include drop-cover-hold earthquake drills, fire and storm evacuation procedures, and shelter-in-place emergency guidelines.	√							CEDA/OES	
3)	Develop printed materials, conduct workshops, and provide outreach to Bay Area businesses focusing on business continuity planning.	√							CEDA/OES	
4)	Better inform Bay Area business owners of mitigation activities, including elevation of appliances above expected flood levels, use of fire-resistant roofing and defensible space in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat, structural retrofitting techniques for older buildings, and use of intelligent grading practices through workshops, publications, and media announcements and events.	√							CEDA/OES/FPB	
5)	Sponsor the formation and training of Community Emergency Response Teams (CERT) training through partnerships with local businesses. [Note – these programs go by a variety of names in various cities and areas.]	√							OFD Support Services Division	Oakland Safety Element, Policy FI-1.4

Economy Mitigation Strategies

6)	Assist businesses in the development of defensible space through the use of, for example, "tool libraries" for weed abatement tools, roadside collection and/or chipping services (for brush, weeds, and tree branches) in wildland-urban-interface fire-threatened communities or in areas exposed to high-to-extreme fire threat.							√	CEDA/Library/OES	
7)	Make use of the materials developed by others (such as found on ABAG's web site at ***http://quake.abag.ca.gov/business***) to increase mitigation activities related to earthquakes. ABAG plans to continue to improve the quality of those materials over time.							√	CEDA/City Administrator/OES	
8)	Develop a "Maintain-a-Drain" campaign, similar to that of the City of Oakland, encouraging businesses and residents to keep storm drains in their neighborhood free of debris.	√							PWA Sewer & Storm Drain Maintenance Division	Oakland Safety Element, Policy FL-2.3
9)	Encourage the formation of a community-based approach to wildfire education and action through local Fire Safe Councils and the *Fire Wise Program* .	√							FPB/OES	
10)	Encourage businesses and laboratories handling hazardous materials or pathogens increase security to a level high enough to create a deterrent to crime and terrorism, including active implementation of "cradle-to-grave" tracking systems.							√	FPB	
11)	Encourage joint meetings of security and operations personnel at major employers to develop innovative ways for these personnel to work together to increase safety and security.							√	FPB/OES	
12)	Inform shoreline-property owners of the possible long-term economic threat posed by rising sea levels.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-4.3
13)	Develop and distribute culturally appropriate materials related to disaster mitigation and preparedness, such as those on the http://www.preparenow.org website.	√							FPB/OES/Equal Access/ Library, etc.	

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
GOVT - a - Focus on Critical Facilities										
1)	Assess the vulnerability of critical facilities (such as city halls, fire stations, community service centers, seaports, and airports) to damage in natural disasters and make recommendations for appropriate mitigation.		√						CEDA/PWA	
2)	Retrofit or replace critical facilities that are shown to be vulnerable to damage in natural disasters.		√						CEDA/PWA	
3)	Clarify to workers in critical facilities and emergency personnel, as well as to elected officials and the public, the extent to which the facilities are expected to perform only at a life safety level (allowing for the safe evacuation of personnel) or are expected to remain functional following an earthquake.		√						OES/CEDA/FPB	
4)	Conduct comprehensive programs to identify and mitigate problems with facility contents, architectural components, and equipment that will prevent critical buildings from being functional after major natural disasters.		√						PWA/OES	
5)	Encourage joint meetings of security and operations personnel at critical facilities to develop innovative ways for these personnel to work together to increase safety and security.		√						PWA	
6)	Install micro and/or surveillance cameras around critical public assets tied to web-based software, and develop a surveillance protocol to monitor these cameras.							√	PWA	
7)	Identify and undertake cost-effective retrofit measures on critical facilities (such as moving and redesigning air intake vents and installing blast-resistant features) when these buildings undergo major renovations.							√	PWA	

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
8)	Coordinate with the State Division of Safety of Dams to ensure that cities and counties are aware of the timeline for the maintenance and inspection of dams whose failure would impact their jurisdiction.	√							OFD Office of Emergency Services	Oakland Safety Element, Policy FL-4.1
9)	As a secondary focus, assess the vulnerability of non-critical facilities to damage in natural disasters based on occupancy and structural type, make recommendations on priorities for structural improvements or occupancy reductions, and identify potential funding mechanisms.							√	CEDA	
10)	Ensure that government-owned facilities are subject to the same or more stringent regulations as imposed on privately-owned development.							√	CEDA,PWA	
11)	Comply with all applicable building and fire codes, as well as other regulations (such as state requirements for fault, landslide, and liquefaction investigations in particular mapped areas) when constructing or *significantly remodeling government-owned facilities.*	√							CEDA,PWA	
12)	Prior to acquisition of property to be used as a critical facility, conduct a study to ensure the absence of significant hazards.	√							CEDA,PWA	
GOVT - b - Maintain and Enhance Local Government's Emergency Response and Recovery Capacity										
1)	Establish a framework and process for pre-event planning for post-event recovery that specifies roles, priorities, and responsibilities of various departments within the local government organization, and that outlines a structure and process for policy-making involving elected officials and appointed advisory committees.		√						OES	

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
2)	Prepare a basic Recovery Plan that outlines the major issues and tasks that are likely to be the key elements of community recovery, as well as integrate this planning into response planning.	√							OES	
3)	Establish a goal for the resumption of local government services that may vary from function to function.	√							OES	
4)	Develop a plan for short-term and intermediate-term sheltering of impacted residents.	√							OES/Red Cross/DHS	
5)	Periodically assess the need for new or relocated fire or police stations and other emergency facilities, changes in staffing levels, and additional or updated supplies, equipment, technologies, and in-service training classes.	√							OFD Technical Services Division/OPD	Oakland Safety Element, Policy FI-1.1
6)	Ensure that fire and police department personnel have adequate radios, breathing apparatuses, protective gear, and other equipment to respond to a major disaster.	√							ITD/OPD/OFD Communications/OES	
7)	Develop and maintain a system of interoperable communications for first responders from cities, counties, special districts, state, and federal agencies.	√							UASI/OES/ITD/City Administration	
8)	Harden emergency response communications, including, for example, building redundant capacity into public safety alerting and/or answering points, replacing or hardening microwave and simulcast systems, adding digital encryption for programmable radios, and ensuring a plug-and-play capability for amateur radio.	√							ITD/OPD/OFD Communications/OES	
9)	Purchase command vehicles for use as mobile command/EOC vehicles if current vehicles are unsuitable or inadequate.	√							OFD/OES	

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
10)	Maintain the local government's emergency operations center in a fully functional state of readiness.	√							OFD Office of Emergency Services	Oakland Safety Element, Policy PS-1.1
11)	Expand or participate in expanding traditional disaster exercises involving city and county emergency personnel to include airport and port personnel, transit and infrastructure providers, hospitals, schools, park districts, and major employers.	√							OFD/OES	
12)	Maintain and update as necessary the local government's Standardized Emergency Management System Plan.	√							OFD Office of Emergency Services	Oakland Safety Element, Policy PS-1.2
13)	Continue to participate not only in general mutual-aid agreements, but also in agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters.	√							OFD Field Operations Division	Oakland Safety Element, Policy FI-1.5
14)	Install an alert and warning system with outdoor sirens, coordinating them, to the extent possible, with those of neighboring jurisdictions.	√							OFD Emergency Medical Services	Oakland Safety Element, Policy PS-1.4
15)	Conduct periodic tests of the alerting and warning system's outdoor sirens no less frequently than once per month.	√							OFD Emergency Medical Services	Oakland Safety Element, Policy PS-1.4
16)	Regulate and enforce the location and design of street-address numbers on buildings and minimize the naming of short streets (that are actually driveways) to single homes.	√							CEDA Building Services Division	Oakland Safety Element, Policy FI-2.6
17)	Monitor weather during times of high fire risk using, for example, weather stations tied into police and fire dispatch centers.	√							OPD/OFD/OES	

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
18)	Establish regional protocols on how to respond to the NOAA Monterey weather forecasts, such as the identifying types of closures, limits on work that could cause ignitions, and prepositioning of suppression forces. A multi-agency coordination of response also helps provide unified messages to the public about how they should respond to these periods of increased fire danger.							√	OFD Communications	
19)	Increase local patrolling during periods of high fire weather.	√							OFD Support Services Division, OFD Field Operations Division, PWA Transportation Services Division	Oakland Safety Element, Policy FI-3.1
20)	Create and maintain an automated system of rain and flood gauges that is web enabled and publicly accessible.							√	PWA	
21)	Place remote sensors in strategic locations for early warning of hazmat releases or use of weapons of mass destruction.							√	OFD-Haz Mat	
22)	Investigate the use of phone-based warning systems for selected geographic areas.		√						OES,OPF,OFD Communications	
23)	Review and update, as necessary, procedures pursuant to the *State Dam Safety Act* for the emergency evacuation of areas located below major water-storage facilities.	√							OFD Office of Emergency Services	Oakland Safety Element, Policy FL-4.2
24)	Develop procedures for the emergency evacuation of areas identified on tsunami evacuation maps as these maps become available.							√	OES	
25)	Develop a business continuity plan that includes back-up storage of vital records, such as essential medical records and financial information.							√	OES/Finance/Risk Management	

GOVT - c - Participate in National, State, Multi-Jurisdictional and Professional Society Efforts to Identify and Mitigate Hazards

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
1)	Promote information sharing among overlapping and neighboring local governments, including cities, counties, and special districts, as well as utilities.		√						OES	
2)	Recognize that emergency services is more than the coordination of police and fire response, for it also includes planning activities with providers of water, food, energy, transportation, financial, information, and public health services.		√						OES	
3)	Recognize that a multi-agency approach is needed to mitigate flooding by having flood control districts, cities, counties, and utilities meet at least annually to jointly discuss their a capital improvement programs for most effectively reducing the threat of storm-induced							√	PWA Engineering Design Division	Oakland Safety Element, Policy FL-3.3
4)	As new flood-control projects are completed, request that FEMA revise its flood-insurance rate maps and digital geographic information system data to reflect flood risks as accurately as possible.							√	CEDA Building Services Division	Oakland Safety Element, Policy FL-3.1
5)	Participate in FEMA's National Flood Insurance Program.							√	N/A	
6)	Participate in multi-agency efforts to mitigate fire threat, such as the Hills Emergency Forum (in the east Bay), various *FireSafe* Council programs, and city-utility task forces.							√	OFD Support Services Division	Oakland Safety Element, Policy FI-3.3
7)	Work with major employers and agencies that handle hazardous materials to coordinate mitigation efforts for the possible release of these materials due to a natural disaster such as an earthquake, flood, fire, or landslide.							√	FPB	

Government Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
8)	Encourage staff to participate in efforts by professional organizations to mitigate earthquake and landslide disaster losses, such as the efforts of the Northern California Chapter of the Earthquake Engineering Research Institute, the East Bay-Peninsula Chapter of the International Code Council, the Structural Engineers Association of Northern California, and the American Society of Grading Officials.							√	CEDA-OPB	
9)	Conduct and/or promote attendance at local or regional hazard conferences and workshops for elected officials to educate the officials on the critical need for programs in mitigating earthquake, wildfire, flood, and landslide hazards.		√						OES	
10)	Cooperate with researchers working on government-funded projects to refine information on hazards, for example, by expediting the permit and approval process for installation of seismic arrays, gravity survey instruments, borehole drilling, fault trenching, landslide mapping, flood modeling, and/or damage data collection.		√						OES	

Education Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
EDUC - a - Focus on Critical Facilities										
1)	Assess the vulnerability of critical education facilities to damage in natural disasters and make recommendations for appropriate mitigation.						√		State Architect	
2)	Retrofit or replace critical education facilities that are shown to be vulnerable to damage in natural disasters.						√		State Architect	
3)	Conduct comprehensive programs to identify and mitigate problems with facility contents, architectural components, and equipment that will prevent critical buildings from being functional after major disasters.						√		State Architect	
4)	As a secondary focus, assess the vulnerability of non-critical educational facilities to damage in natural disasters based on occupancy and structural type, make recommendations on priorities for structural improvements or occupancy reductions, and identify potential funding mechanisms.						√		State Architect	

Education Mitigation Strategies

5)	Participate in or facilitate adoption of a program to formalize arrangements with structural engineers to report to the district, assess damage, and determine if the buildings can be reoccupied. The program should be similar to San Francisco's Building Occupancy Resumption Program (BORP) that permits owners of buildings to hire qualified structural engineers to create building-specific post-disaster inspection plans and allows these engineers to become automatically deputized as inspectors for these buildings in the event of an earthquake or other disaster. Unlike the buildings of most special districts, however, these plans should be developed with the review and guidance of the Division of the State Architect because this agency has the authority and responsibility for the structural integrity of these structures.						√		State Architect	
EDUC - b - Use of Educational Facilities as Emergency Shelters										
1)	Work cooperatively with the American Red Cross and others to set up memoranda of understanding for use of education facilities as emergency shelters following disasters.						√		(OUSD) Oakland Unified School District	
2)	Work cooperatively to ensure that school district personnel and relevant staff understand and are trained that being designated by the American Red Cross or others as a potential emergency shelter does not mean that the school has had a hazard or structural evaluation to ensure that it can be used as a shelter following any specific disaster.						√		OUSD	
3)	Work cooperatively to ensure that school district personnel understand and are trained that they are designated as disaster service workers and must remain at the school until released.						√		OUSD	
EDUC - c - Use of Schools as Conduits for Information to Families About Emergencies										

Education Mitigation Strategies

1)	Work on and/or support efforts by schools, local governments, and other agencies to utilize their unique ability to reach families through educational materials on hazards, mitigation, and preparedness, particularly after disasters and at the beginning of the school year. These efforts will not only make the entire community more disaster-resistant, but speed the return of schools *from use as shelters to use as teaching facilities.*						√		OUSD	
2)	Work on and/or support joint efforts of schools and fire jurisdictions to develop plans for evacuation or sheltering in place of school children during periods of high fire danger, thereby recognizing that overloading of streets near schools by parents attempting to pick up their children during these periods can restrict access by fire personnel and equipment.						√		OUSD	
3)	Offer the 20-hour basic CERT training to teachers and after-school personnel.						√		OUSD/OES	
4)	Offer the 20-hour basic CERT training to middle school and/or high school students as a part of the basic science or civics curriculum, as an after school club, or as a way to earn public service hours.						√		OUSD/OES	
5)	Offer the 20-hour basic CERT training course through the Adult School system and/or through the Community College system.						√		OUSD/OES	
6)	Develop and maintain the capacity for schools to take care of the students for the first 48 hours after a disaster, and notify parents that this capacity exists.						√		OUSD	
7)	Develop and distribute culturally appropriate materials related to disaster mitigation and preparedness, such as those on the http://www.preparenow.org website.						√		OUSD	

Environment Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
ENVI - a - Environmental Sustainability and Pollution Reduction										
1)	Continue to enforce State-mandated requirements, such as the *California Environmental Quality Act*, to ensure that mitigation activities for hazards, such as vegetation clearance programs for fire threat and seismic retrofits, are conducted in a way that reduces environmental degradation such as air quality impacts, noise during construction, and loss of sensitive habitats and species, while respecting the community value of historic preservation.	√							FPB,CEDA, PWA	
2)	Encourage regulatory agencies to work collaboratively with safety professionals to develop creative mitigation strategies that effectively balance environmental and safety needs, particularly to meet critical wildfire, flood, and earthquake safety levels.							√	State of California EPA	
3)	Continue to enforce and/or comply with State-mandated requirements, such as the *California Environmental Quality Act* and environmental regulations to ensure that urban development is conducted in a way to minimize air pollution. For example, air pollution levels can lead to global warming, and then to drought, increased vegetation susceptibility to disease (such as pine bark beetle infestations), and associated increased fire hazard.							√	State of California EPA	
4)	Develop and implement a comprehensive program for watershed maintenance, optimizing forest health with water yield to balance water supply, flooding, fire, and erosion concerns.							√	CDF	

Environment Mitigation Strategies

5)	*Balance the need for the smooth flow of storm waters* versus the need to maintain wildlife habitat by developing and implementing a comprehensive Streambed Vegetation Management Plan that ensures the efficacy of flood control efforts and maintains the viability of living rivers.						√		*California EPA*	
6)	Stay informed of emerging scientific information on the subject of rising sea levels, especially on additional actions that local governments can take to mitigate this hazard.	√							CEDA Building Services Division	Oakland Safety Element, Policy FL-4.4
7)	*Monitor the science associated with global warming to* be able to act promptly when data become available to warrant special design and engineering of government-owned facilities located in low-lying areas, such as wastewater treatment plants, ports, and airports.						√		*California EPA*	
8)	Comply with applicable performance standards of any *National Pollutant Discharge Elimination System* municipal stormwater permit that seeks to manage increases in stormwater run-off flows from new development and redevelopment construction projects.	√							PWA Environmental Services Division	Oakland Safety Element, Policy FL-1.3
9)	Enforce and/or comply with the grading, erosion, and sedimentation requirements by prohibiting the discharge of concentrated stormwater flows by other than approved methods that seek to minimize associated pollution.	√							CEDA Building Services Division, PWA Engineering Design Division	Oakland Safety Element, Policy FL-1.4
10)	Explore ways to require that hazardous materials stored in the flood zone be elevated or otherwise protected from flood waters.							√	FPB	
11)	Enforce and/or comply with the hazardous materials requirements of the State of California Certified Unified Program Agency (CUPA).	√							OFD Office of Emergency Services	Oakland Safety Element, Policy HM-1.1
12)	Provide information on hazardous waste disposal and/or drop off locations.	√							PWA Environmental Services Division	Oakland Safety Element, Policy HM-1.5
13)	Develop and implement a program to control invasive and exotic species that contribute to fire and flooding hazards (such as eucalyptus, cattails, and cordgrass).							√	*CDF,FPB, OPR*	

Environment Mitigation Strategies

14)	Enforce provisions under creek protection, stormwater management, and discharge control ordinances designed to keep watercourses free of obstructions and to protect drainage facilities to conform with the Regional Water Quality Control Board's Best Management Practices.	√							PWA Environmental Services Division	Oakland Safety Element, Policy FL-1.5
ENVI - b - Agricultural and Aquaculture Resilience										
1)	Maintain a variety of crops in rural areas of the region to increase agricultural diversity and crop resiliency.						√		N/A	
2)	Promote and maintain the public-private partnerships dedicated to preventing the introduction of agricultural pests into regionally-significant crops, such as the glassy-winged sharpshooter into vineyards.						√		N/A	
3)	Remove septic tanks and other sources of contamination adjacent to economically-significant aquacultural and agricultural resources.						√		N/A	
4)	Encourage livestock operators to develop an early-warning system to detect animals with communicable diseases (due to natural causes or bioterrorism).						√		N/A	

Land Use Mitigation Strategies

	Specific Mitigation Strategy	Priority (CHECK ONLY ONE)							Responsible Agency or Department (Required if Existing Program, Very High, High, or Under Study)	Ordinance or Resolution # (if existing program), Estimated Cost and Possible Funding Agency (if high priority), Estimated Date of Completion (if study) OR Other Comments
		Existing Program	Very High	High	Moderate	Under Study	Not Applicable, Not Appropriate, or Not Cost Effective	Not Yet Considered		
LAND - a - Earthquake Hazard Studies for New Developments										
1)	Enforce and/or comply with the State-mandated requirement that site-specific geologic reports be prepared for development proposals within Alquist-Priolo Earthquake Fault Zones, and restrict the placement of structures for human occupancy. (This Act is intended to deal with the ***specific*** hazard of active faults that extend to the earth's surface, creating a surface rupture hazard.)	√							CEDA Building Services Division	Oakland Safety Element, Policy GE-1.1
2)	Require preparation of site-specific geologic or geotechnical reports for development and redevelopment proposals in areas subject to earthquake-induced landslides or liquefaction as mandated by the State Seismic Hazard Mapping Act in selected portions of the Bay Area where these maps have been completed, and condition project approval on the incorporation of necessary mitigation measures related to site remediation, structure and foundation design, and/or avoidance.			√					CEDA Building Services Division	Oakland Safety Element, Policy GE-1.2
3)	Recognizing that some faults may be a hazard for surface rupture, even though they do not meet the strict criteria imposed by the Alquist-Priolo Earthquake Fault Zoning Act, identify and require geologic reports in areas adjacent to locally-significant faults.							√	Not within Oakland's jurisdiction. N/A	
4)	Recognizing that the California Geological Survey has not completed earthquake-induced landslide and liquefaction mapping for much of the Bay Area, identify *and require geologic reports in areas mapped by others* as having significant liquefaction or landslide hazards.							√	USGU has produced landslide mapping form Oakland as part of *Project Impact. Not* within our jurisdiction or area of responsibility.	

Land Use Mitigation Strategies

5)	Support and/or facilitate efforts by the California Geological Survey to complete the earthquake-induced landslide and liquefaction mapping for the Bay Area.								√	N/A	
6)	Require that local government reviews of geologic and engineering studies are conducted by appropriately trained and credentialed personnel.								√	CEDA	
LAND - b - Wildland and Structural Fires											
1)	Review development proposals to ensure that they incorporate required and appropriate fire-mitigation measures, including adequate provisions for occupant evacuation and access by emergency response	√								OFD Support Services Division	Oakland Safety Element, Policy FI-2.3
2)	Develop a clear legislative and regulatory framework at both the state and local levels to manage the wildland-urban-interface consistent with *Fire Wise* and sustainable community principles.								√		
LAND - c - Flooding											
1)	Establish and enforce requirements for new development so that site-specific designs and source-control techniques are used to manage peak stormwater runoff flows and impacts from increased runoff volumes.				√					CEDA Building Services Division	Oakland Safety Element, Policy GE-2.5
2)	Incorporate FEMA guidelines and suggested activities into local government plans and procedures for managing flood hazards.								√		
3)	Provide an institutional mechanism to ensure that development proposals adjacent to floodways and in floodplains are referred to flood control districts and wastewater agencies for review and comment (consistent with the NPDES program).	√								CEDA Building Services Division	Oakland Safety Element, Policy FL-3.5
4)	Establish and enforce regulations concerning new construction (and major improvements to existing structures) within flood zones in order to be in compliance with federal requirements and, thus, be a participant in the Community Rating System of the *National Flood Insurance Program*.	√								CEDA Building Services Division	Oakland Safety Element, Policy FL-1.1
LAND - d - Landslides and Erosion											

Land Use Mitigation Strategies

1)	Establish and enforce provisions (under subdivision ordinances or other means) that geotechnical and soil-hazard investigations be conducted and filed to prevent grading from creating unstable slopes, and that any necessary corrective actions be taken prior to development approval.	√							CEDA Building Services Division	Oakland Safety Element, Policy GE-2.1
2)	Require that local government reviews of these investigations are conducted by appropriately trained and credentialed personnel.							√		
3)	Establish and enforce grading, erosion, and sedimentation ordinances by requiring, under certain *conditions, grading permits and plans to control erosion* and sedimentation prior to development approval.	√							CEDA Building Services Division	Oakland Safety Element, Policy GE-2.2
4)	Establish and enforce provisions under the creek protection, storm water management, and discharge control ordinances designed to control erosion and sedimentation.	√							PWA Environmental Services Division, CEDA Building Services Division	Oakland Safety Element, Policy GE-2.3
5)	*Establish requirements in zoning ordinances to address* hillside development constraints, especially in areas of existing landslides.				√				*CEDA Planning &* Zoning Division, PWA Environmental Services Division	*Oakland Safety Element,* Policy GE-2.4
LAND - e - Hillside - Multi-Hazard										
1)	Establish a buffer zone between residential properties and landslide or wildfire hazard areas.							√	FPB	
2)	Discourage, add additional mitigation strategies, or prevent construction on slopes greater than a set percentage, such as 15%, due to landslide or wildfire hazard concerns.							√	CEDA	
LAND - f - Smart Growth to Revitalize Urban Areas and Promote Sustainability										
1)	Prioritize retrofit of infrastructure that serves urban areas over constructing new infrastructure to serve outlying areas.							√	CEDA/PWA	
2)	Work to retrofit homes in older areas to provide safe housing close to job centers.							√	OES/CEDA/Project Impact	
3)	Work to retrofit older downtown areas to protect architectural diversity and promote disaster-resistance.							√	CEDA/Redevelopment	

Land Use Mitigation Strategies

4)	Protect as open space areas susceptible to extreme hazards.							√	OFD/OPR/PWA/CEDA	
5)	Provide new buffers and preserve existing buffers between development and existing users of large amounts of hazardous materials, such as major							√		