Resiliency Planning

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Planning Horizons

March 26, 2014

earthquake and hazards program

Association of Bay Area Governments

EQ Program Background

Vision

- Working in concert with the Planning Department of the Association of Bay Area Governments, the Earthquake and Hazards Program seeks to promote a more sustainable, resilient and prosperous region where our communities are prepared to withstand and quickly recover from the effects of earthquakes and natural hazards of regional importance.

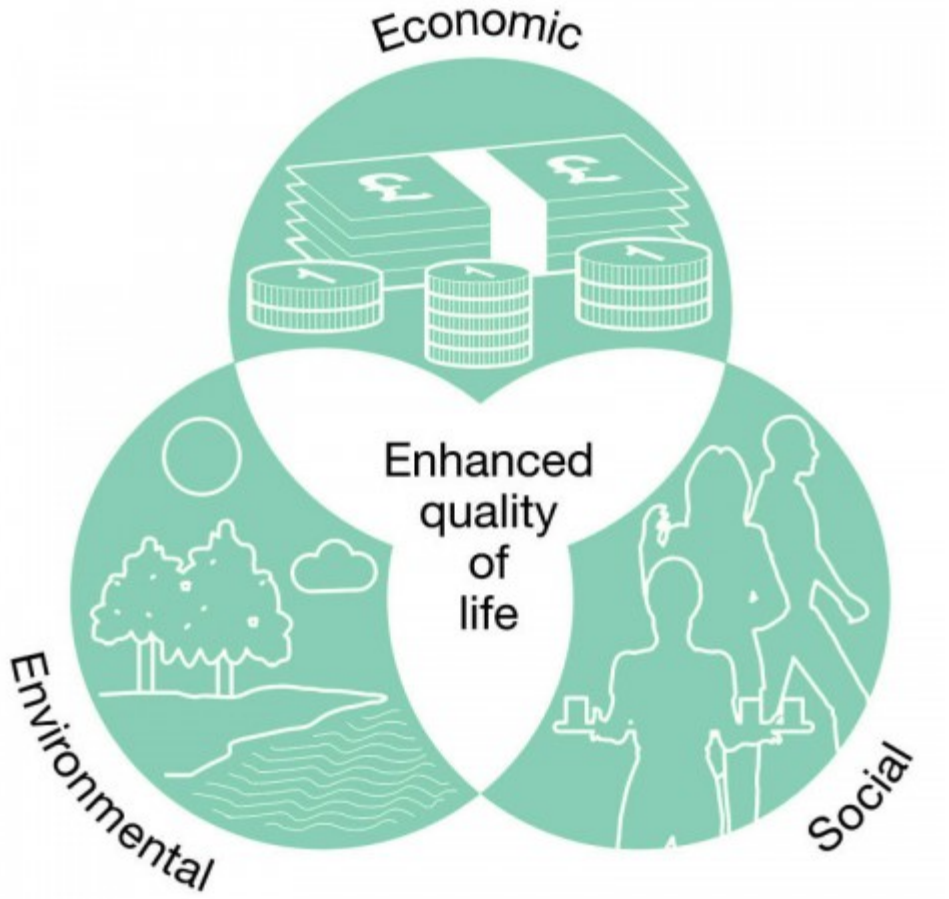
Mission

- ABAG's Earthquake and Hazards Program supports recovery and mitigation planning and implementation at the regional, community, and individual scales.

What are we talking about here?

- Earthquakes
- Flooding and permanent inundation
- Heat and drought
- Social unrest
- Economic disruptions
- Wildfires
- Anything that crosses jurisdictional boundaries and disrupts regional systems

Resilience and Sustainability



Resilience and Sustainability

- Achieving a more sustainable, equitable and prosperous region cannot be achieved without addressing those natural hazards which threaten our way of life and future.

Definitions of Resilience

- “The ability to prepare and plan for, absorb, and recover from or more successfully adapt to actual or potential adverse events” – National Academies Committee on Increasing National Resilience to Hazards and Disasters
- “The ability of a system to absorb shock and maintain its structure with a minimum of loss and resume pre-event functionality in a relatively short time” – CA State Hazard Mitigation Plan

How do we define Resilience?

- Encompassing framework that encompasses multiple hazards, their relationship to the broader region, and all aspects of the planning, response, and recovery life cycle of disaster.

Definitions of Resilience

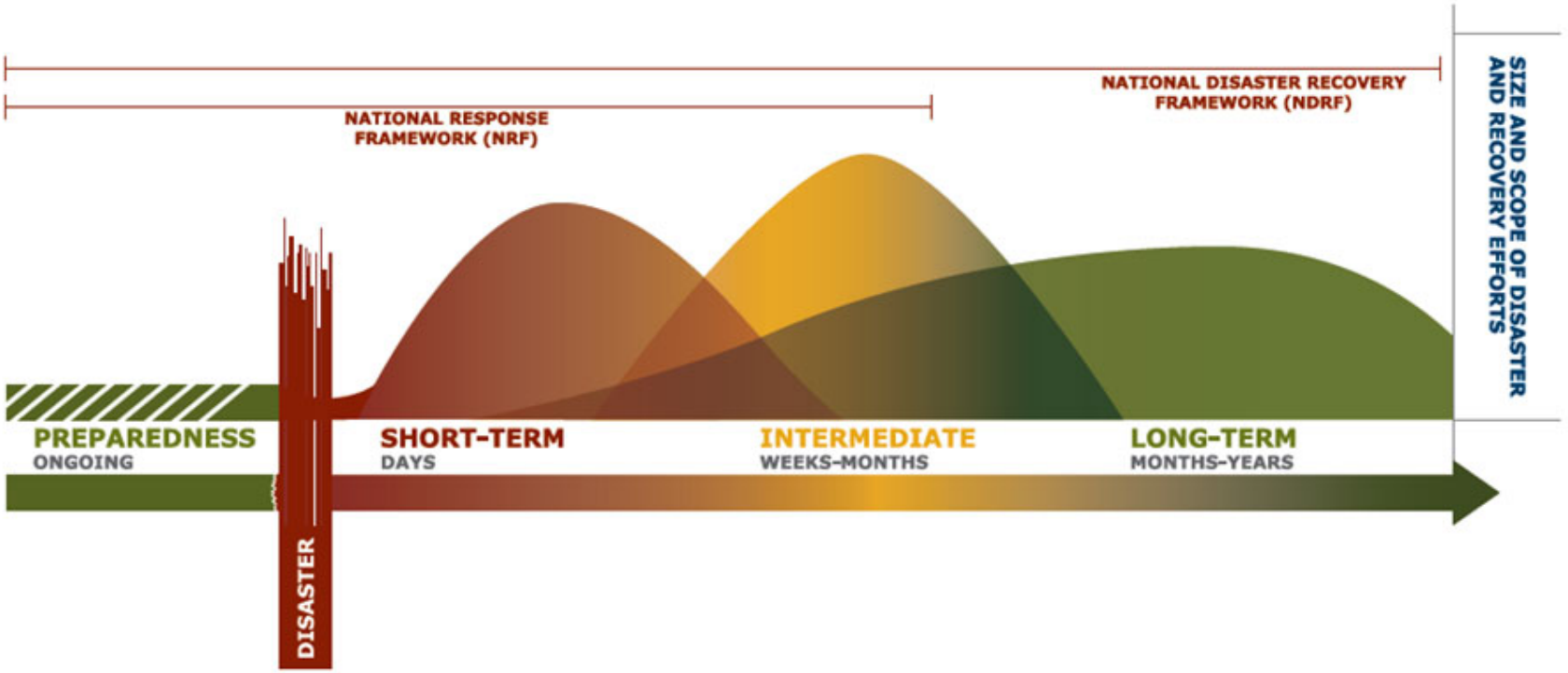
- It is an **attribute**
- It is **continuing**, inherent and dynamic
- It involves elements of **adaptation**
- Puts systems on a **positive trajectory**
- **Comparable and relative**

Characteristics of a Resilient Region

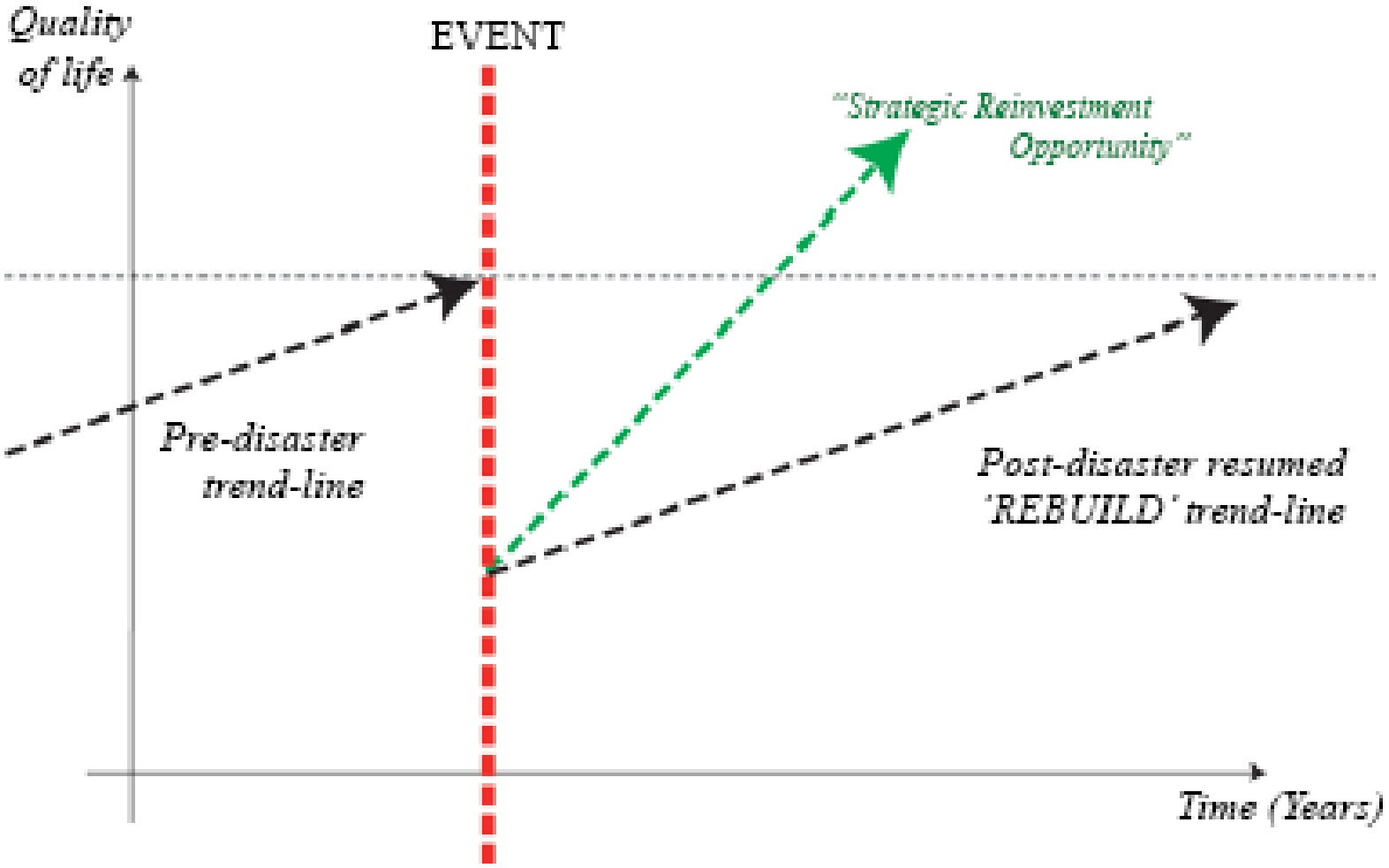
- Minimize disruption on everyday life and the economy
- Minimize loss or damage to life, property, and the environment
- Quickly restore economic functionality
- Survive, adapt, evolve, and reimagine
- Not just prepared for disasters, also economically, environmentally, and socially resilient
- A resilient region is made up of resilient cities, organizations, neighborhoods, and individuals

How do we define Resilience?

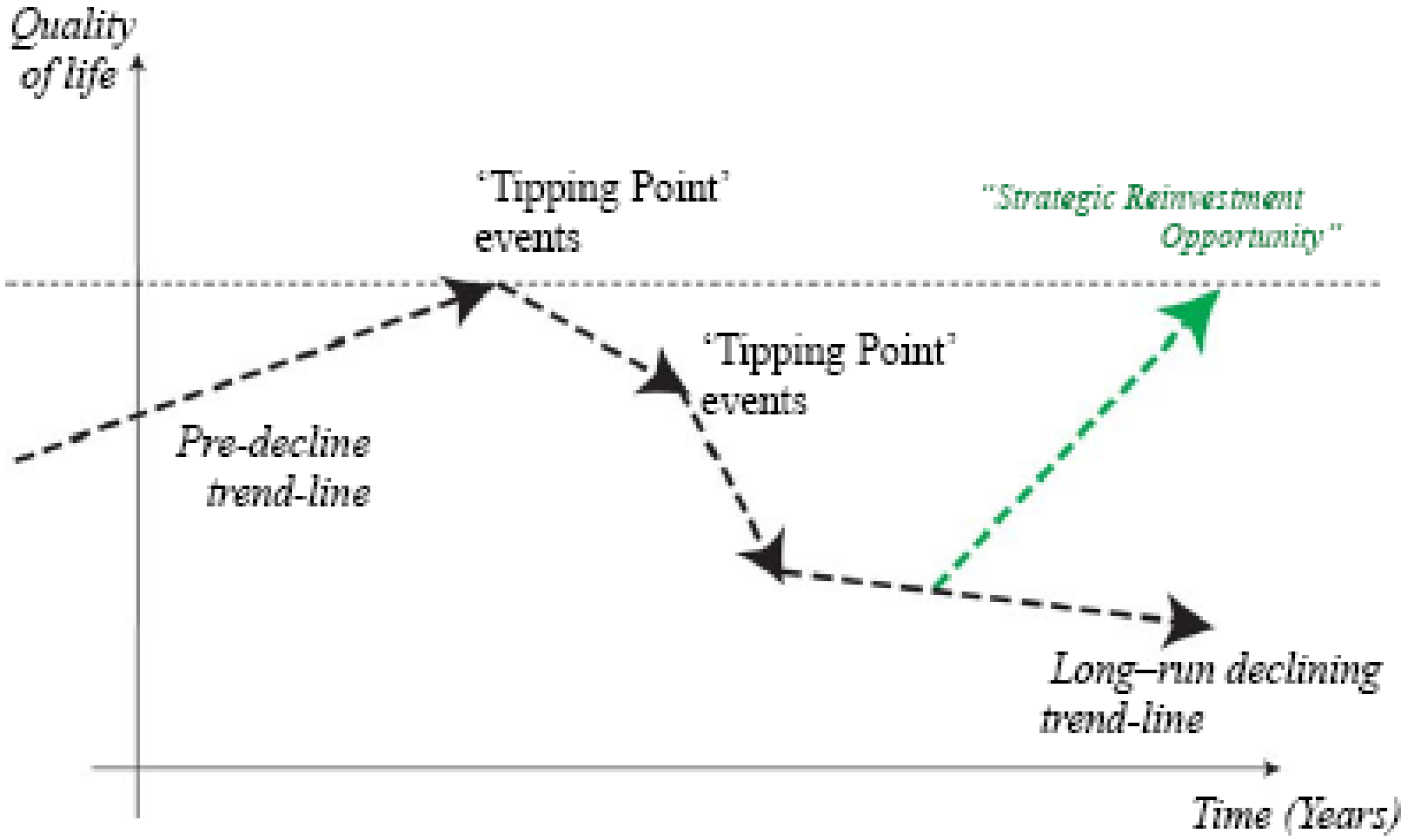
FIGURE 1. RECOVERY CONTINUUM – DESCRIPTION OF ACTIVITIES BY PHASE



Source: FEMA National Disaster Recovery Framework, 2013



Source: Envirenew Resilience Part 1 Report: Creating Resilient Communities, 2012



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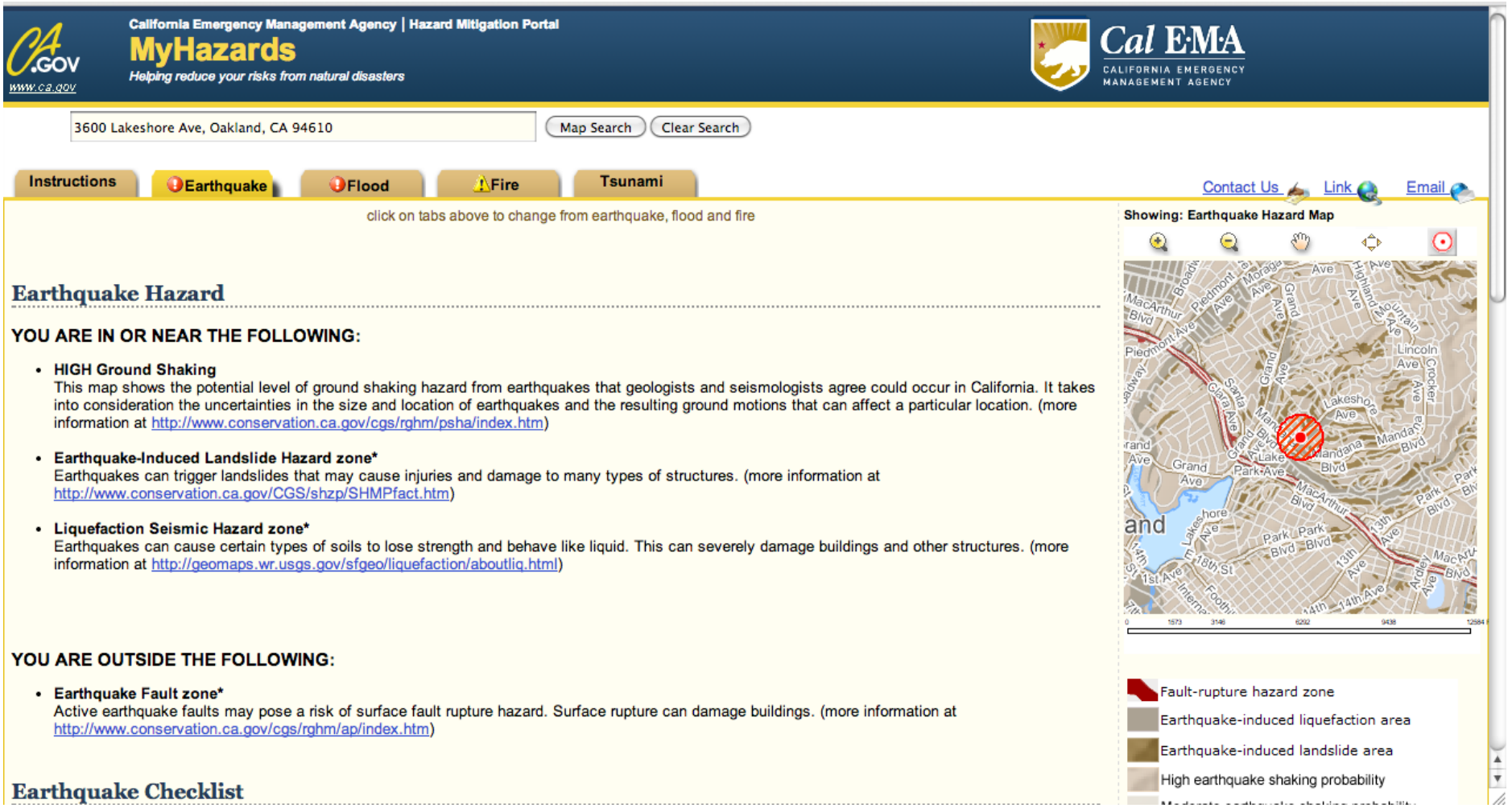
Assessing Hazard



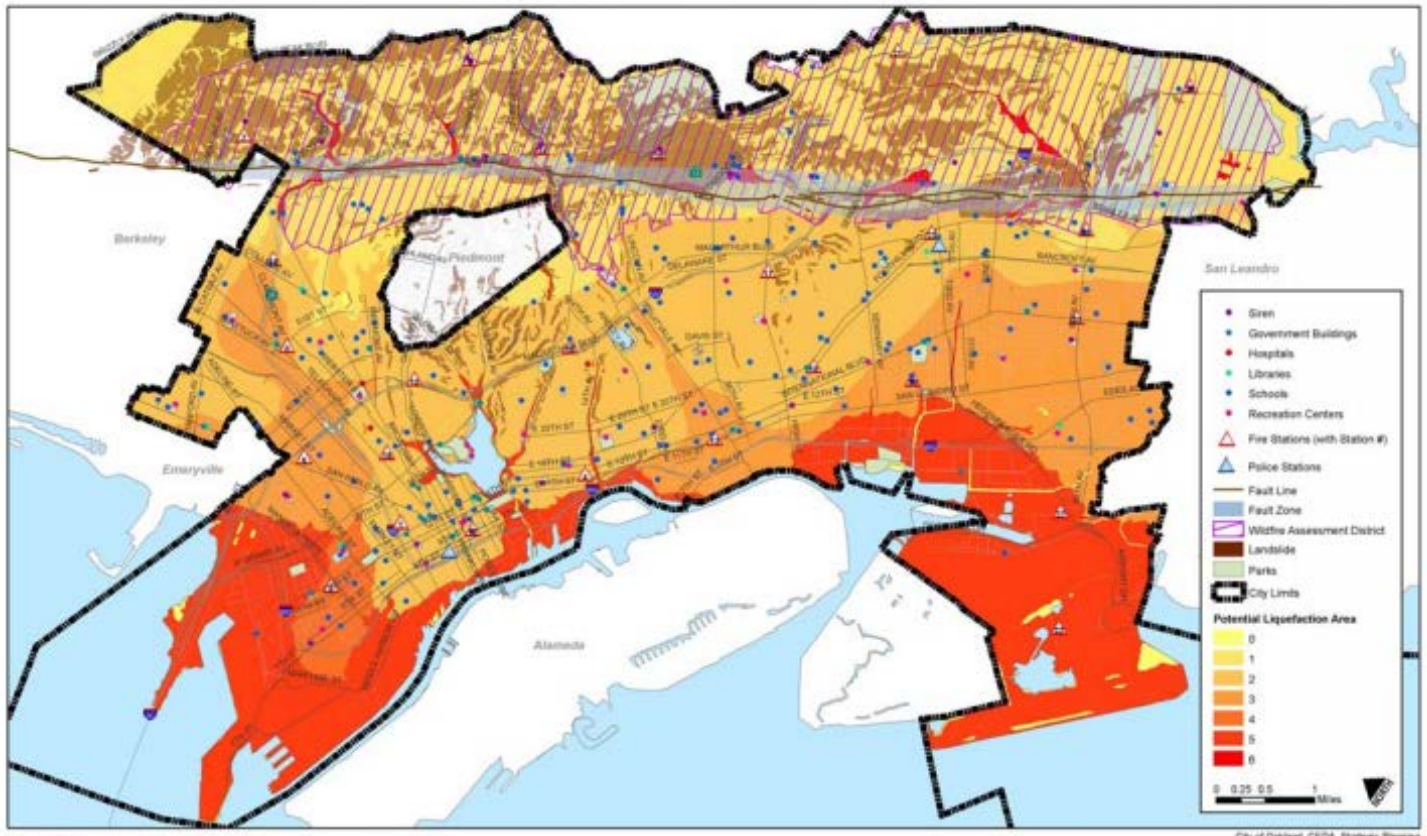
Assessing Exposure

Table 1. Exposure (acres of urban land)			
Hazard	**Plan Year 2005**	**Plan Year 2010**	**Change**
Total Acres of Urban Land	*33,811*	*34,682*	*871*
Earthquake Faulting (within CGS zone)	1,858	1,835	(23)
Earthquake Shaking (within highest two shaking categories)[16]	33,081	33,925	844
Earthquake-Induced Landslides (within CGS study zone)[17]	4,586	4,742	156
Liquefaction (within moderate, high, or very high liquefaction susceptibility	16,247	17,261	1,014
Flooding[18] (within 100 year floodplain)	663	578	(85)
Flooding (within 500 year floodplain)	1,756	1,865	109
Landslides (within areas of existing landslides)	2,335	2,034	301
Wildfire (subject to high, very high, or extreme wildfire threat)[19]	2,495	2,393	(102)
Wildland-Urban Interface Fire Threat	19,251	18,676	(575)
Dam Inundation (within inundation zone)	5,354	5,427	73
Sea Level Rise[20]	Further research needed		
Tsunamis[21] (within inundation area)	Further research needed		
Drought[22]	33,811	34,682	871

Regulatory Maps

- Alquist-Priolo Fault Zones

Assessing Vulnerability



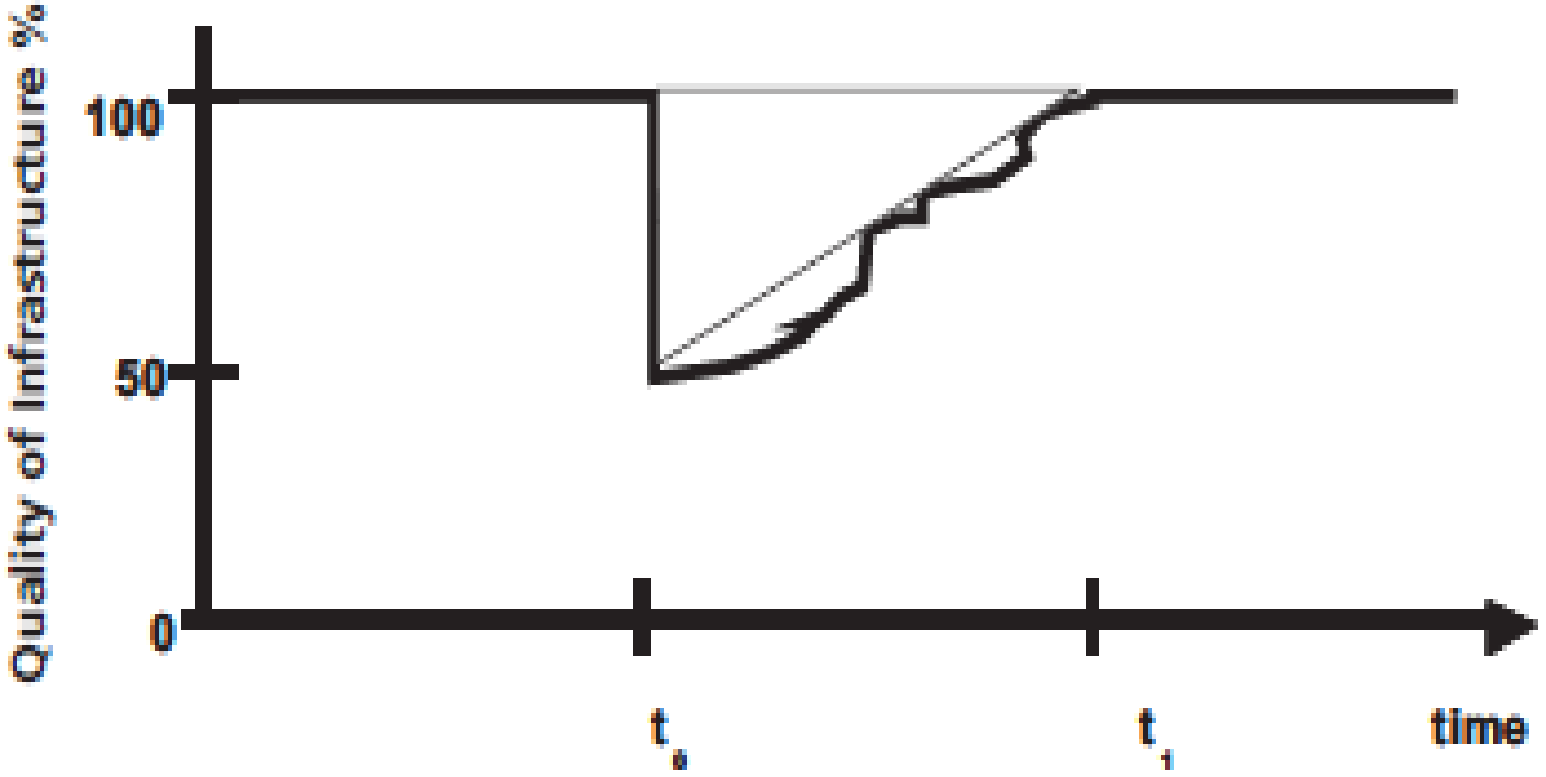
CITY OF OAKLAND

Local Hazard Mitigation Plan 2011

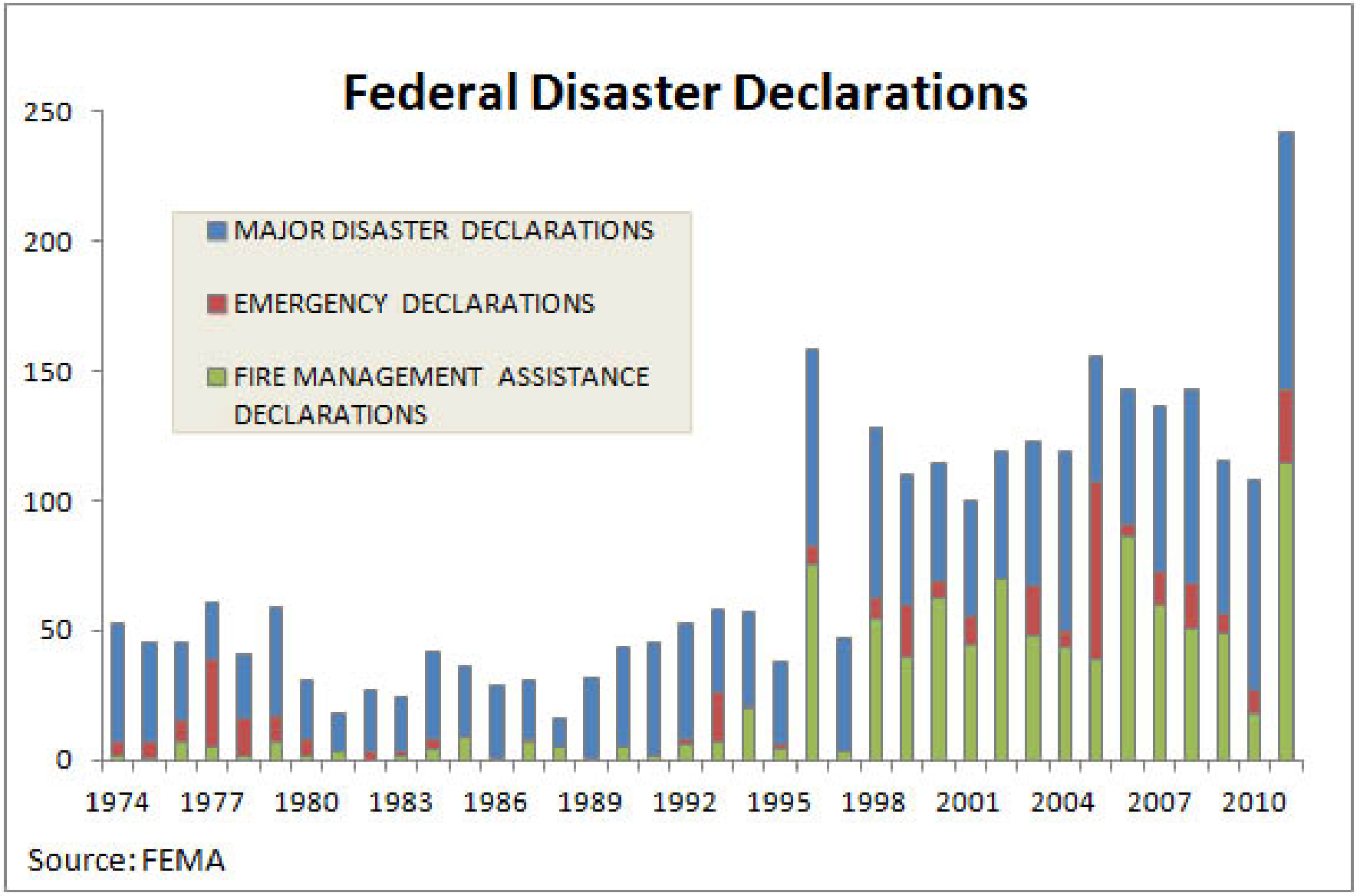
Local Geological Hazard Information - Geological

Resilience Framework

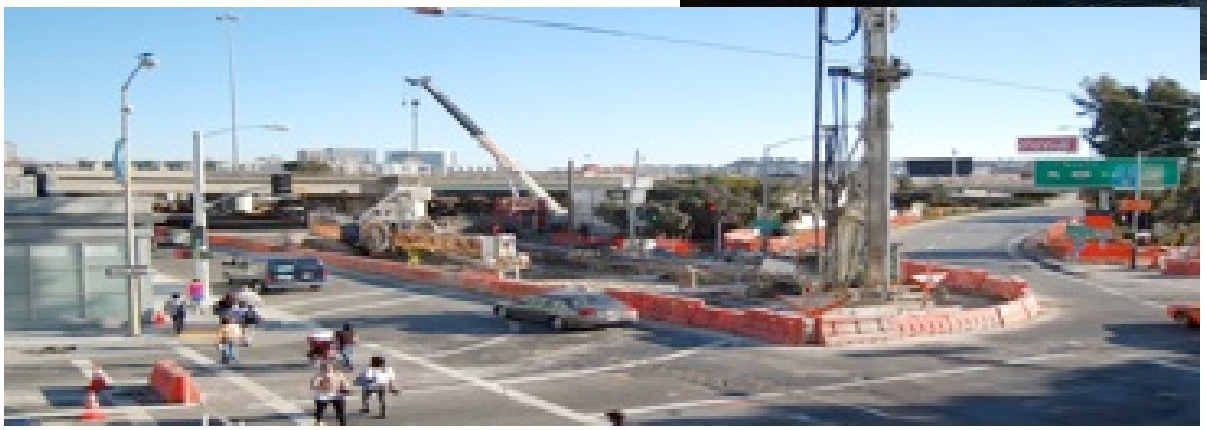
FIGURE 1 The Resilience Triangle



Source: Conceptualizing and Measuring Resilience, Tierney & Bruneau, 2007


Federal Disaster Declarations
250
200
150
100
50
0
MAJOR DISASTER DECLARATIONS
EMERGENCY DECLARATIONS
FIRE MANAGEMENT ASSISTANCE DECLARATIONS
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
Source: FEMA

Mitigation



Characteristics for Successful Recovery

- Social sector – build community capacity and social capital
  - Community capacity: leverage internal resources
  - Social capital: attract external resources
  - Manage expectations for the long-term recovery timeline
  - Create clear accountability for specific tasks

Characteristics for Successful Recovery

- Economic sector – Leverage recovery funds and attract new capital
  - Match pre-disaster preparation and insurance coverage to post-disaster needs for capital
  - Maintain business and market continuity
  - Invest in human capital as well as industries

Characteristics for Successful Recovery

- Physical sector – adapt the physical environment with standards, maps, data and plans
  - Maintain actionable and enforceable physical plans
  - Examine policies and standards for effects on real estate markets
  - Keep land and buildings in commerce post-disaster by creating streamlined, place-focused processes
  - Monitor the physical environment using open data sets and informative maps of recovery

Plan Bay Area: Sustainable Communities Strategy (SCS)

- Enhance regional collaboration
- Reduce greenhouse gas emissions by 15%
- House the region's population at all income levels
- Align transportation investments, housing growth, and land use planning

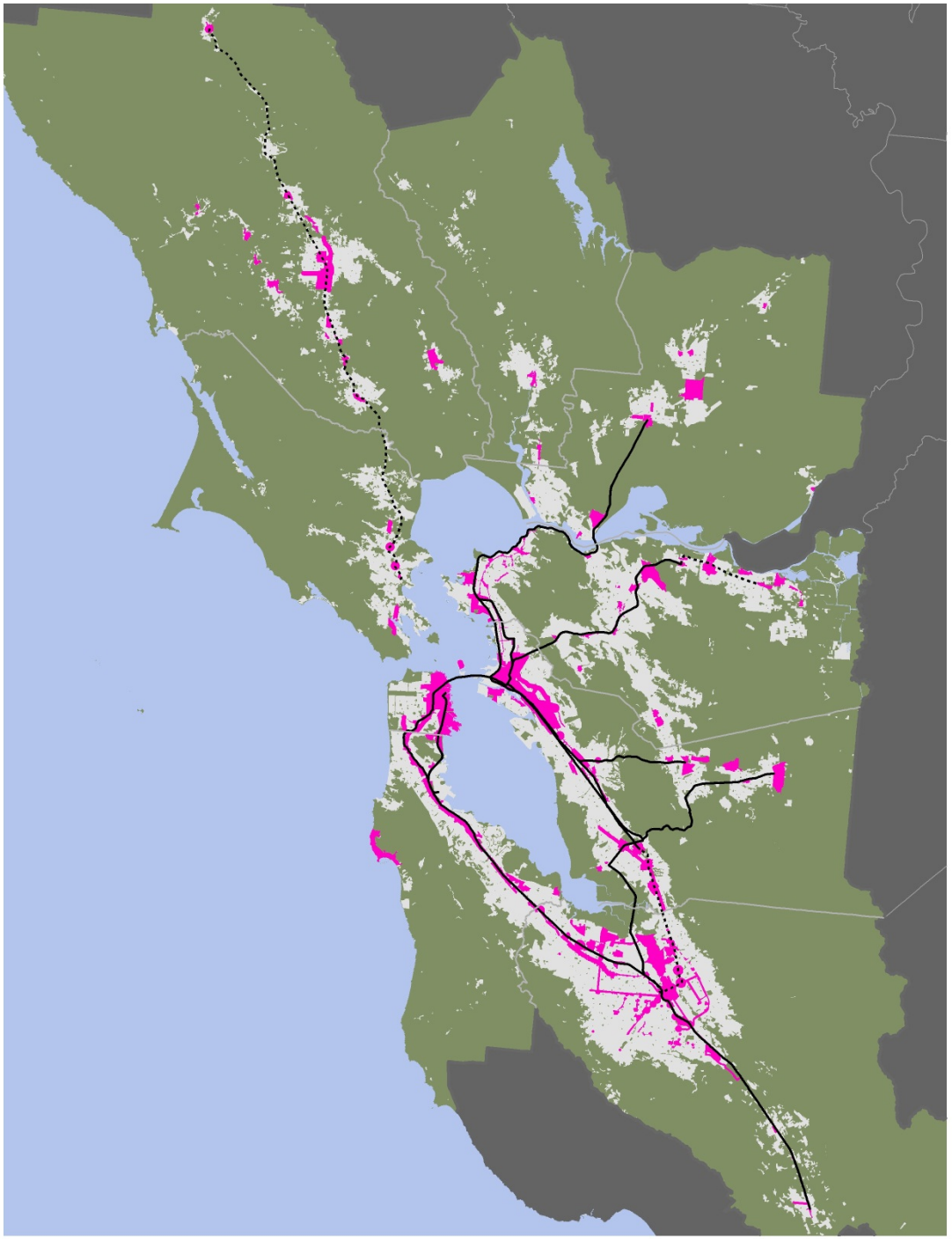
Jobs-Housing Connection Growth Strategy

Non-urbanized land

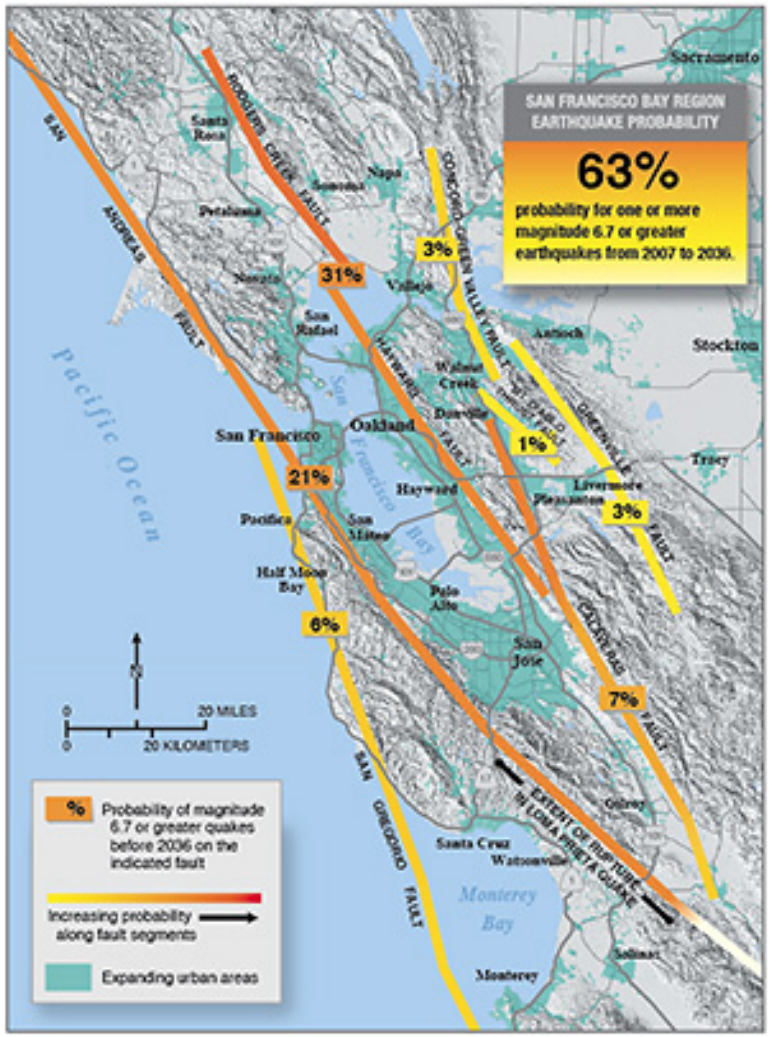
Urbanized land

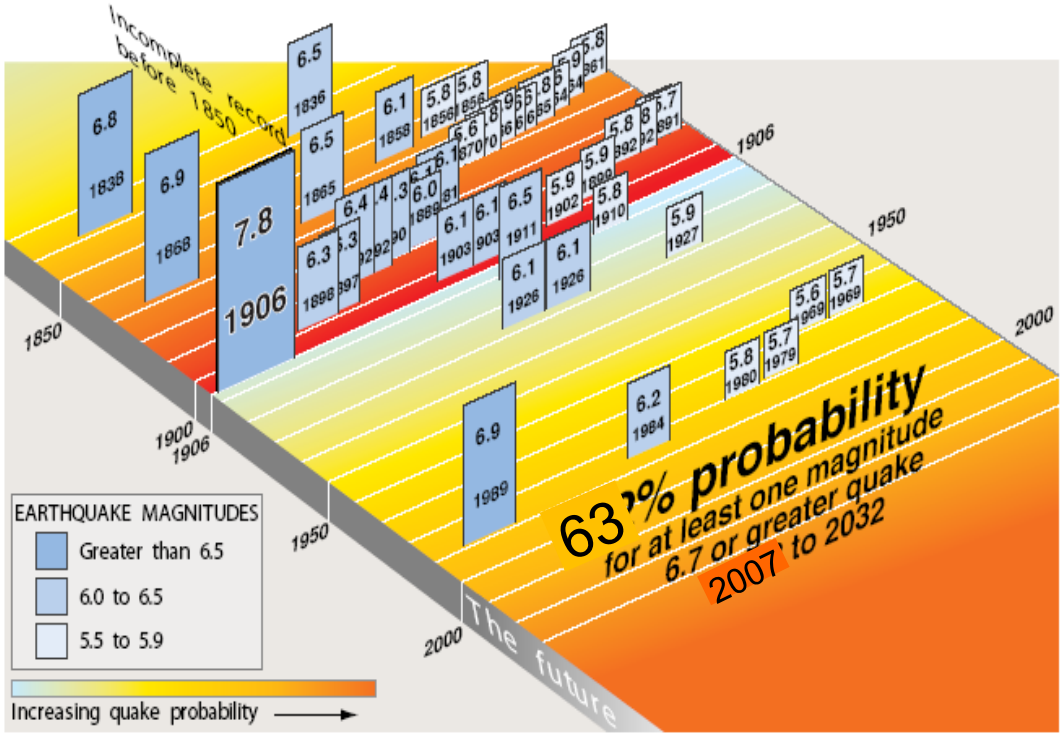
PDAs
- 4% of region's land
- 80% of new homes
- 66% of new jobs

17% per capita GHG emissions reduction



SCS and Resilience Planning





SCS and Resilience Planning

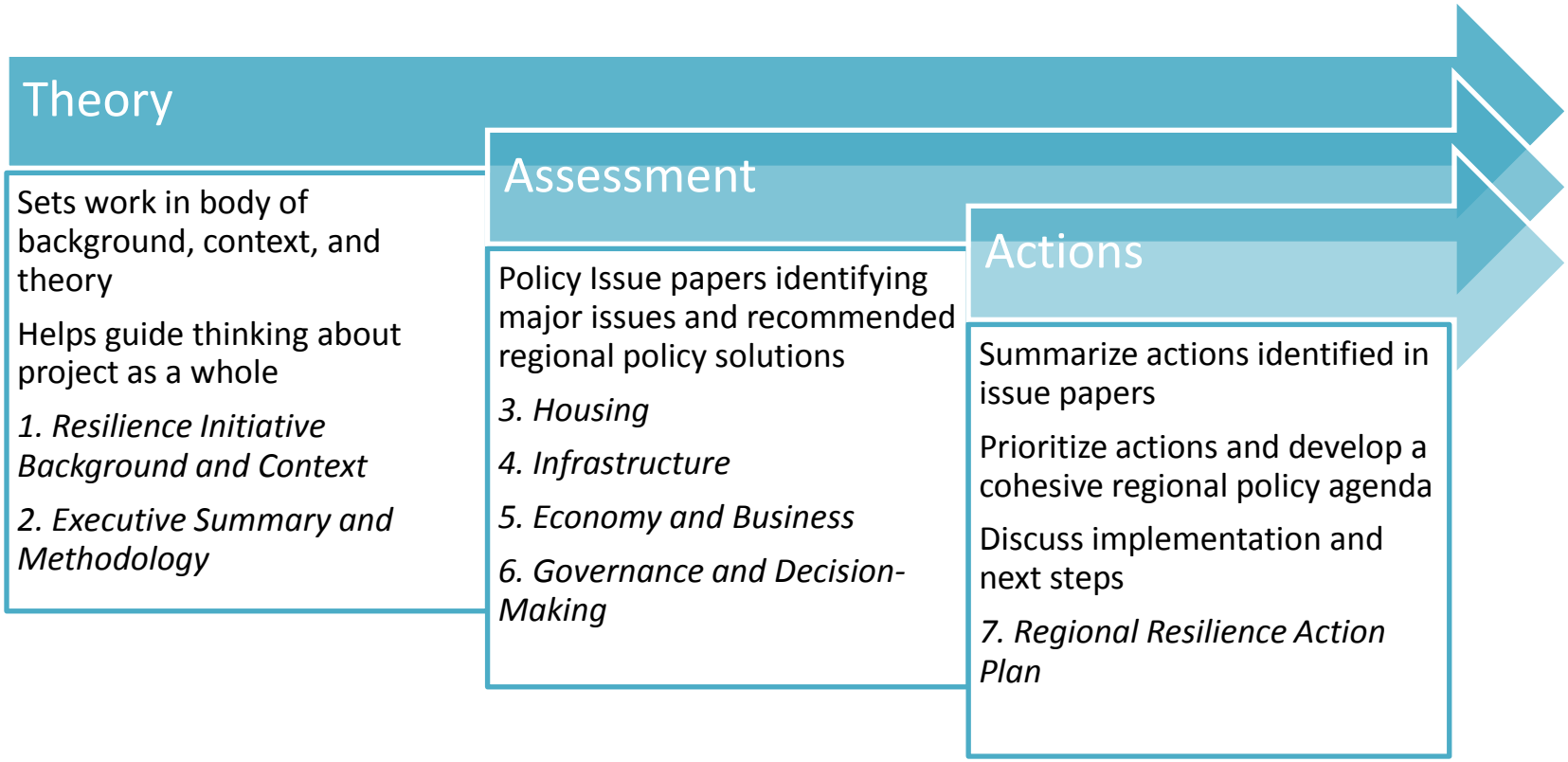
	SCS assumptions	Losses in future Hayward fault earthquake
Households	770,000	(155,000)
People	2 million	(360,000) displaced

Regional Resilience Initiative

http://quake.abag.ca.gov/projects/resilience_initiative/

Resilience Initiative - Overview

- Outcomes
  - Four Workshops
  - Suite of Papers



Integration with National Priorities

- FEMA *National Disaster Recovery Framework*
- Presidential Policy Directive 8
- National Academy of Science *Disaster Resilience: A National Imperative*

Governance and Decision-Making

- Overarching Goal: Regional Communication and Collaboration
  - Goal #1: Create a Regional Resilience Policy Forum
  - Goal #2: Develop Regional Resilience Leaders
  - Goal #3: Use Information and Data Analytics for Disaster Resilience

Housing

- Goal #1: Address regional goals, including economic prosperity, environmental enhancement, and improved governance in housing recovery

- Goal #2: Facilitate housing recovery through good policy, financing, and insurance
- Goal #3: Remove barriers to housing retrofit and replacement

Infrastructure

- Goal #1: Increase technical understanding of region-wide infrastructure system vulnerabilities
- Goal #2: Increase ways to share risk information to collectively improve regional infrastructure system resilience

Economy and Business

- Goal #1: Retain Big Business
- Goal #2: Keep Small and Neighborhood Serving Businesses Open
- Goal #3: Minimize Supply Chain Disruption and Keep Goods Moving

Preliminary Action Plan

Regional Decision-Making

Recommended Action	Level of Implementation	Initial Implementation Tasks
DM-1: Use existing structures to convene jurisdictions and facilitate communication around disaster recovery collaboration	Regional	• Convene JPC and/or RPC to discuss potential formation of disaster recovery forum • Identify potential roles and organizing structure for forum • Identify goals and objectives for forum • Recruit "champion" within RPC or JPC to help gather stakeholders • Coordinate with other similar initiatives, such as the Joint Policy Committee's Climate Action and Energy Resilience Project
DM-2: Examine the feasibility of a regional disaster recovery framework	Regional	• Look at existing recovery plans and frameworks to establish best practices and ensure integration • Work with regional recovery forum to establish a working group tasked with development of a recovery framework • Establish stakeholder input process to solicit feedback from local jurisdictions
DM-3: Integrate resilience policy into current plans and practices	Regional, local	• Incorporate resilience discussions into the second iteration of the SCS • Identify best practices for jurisdictions and develop a guide to assist in implementation
DM-4: Lead reconnaissance missions for local leaders, staff, and community leaders to areas undergoing disaster recovery	Regional, local	• Identify potential funding sources • Identify leaders to attend, such as ABAG's RPC members or other groups • Establish a MOU with EERI to expand their program to include local stakeholders
DM-5: Establish and maintain a recovery clearinghouse to house resources for pre-disaster recovery planning and post-disaster recovery guidance	Regional, local	• Identify a staff lead, with funding, to begin research and resource collection • Examine platforms for sharing, including websites, Base Camp, and file-sharing systems

Airport and Infrastructure Resilience Project

http://quake.abag.ca.gov/airport_resilience/

Project Overview

Four Interrelated Projects

- Airport Liquefaction Susceptibility Analysis
- Role of Airports in Regional Disaster Response and Recovery
- *Regional Infrastructure Vulnerabilities and Interdependencies*
- *Oakland Airport Focus Area Shoreline Resilience Planning (in partnership with BCDC)*

Project Timeline

Airport Liquefaction Susceptibility Analysis

June 2012 – May 2013

Role of Airports in Regional Disaster Response and Recovery

June 2012 – May 2013

Regional Infrastructure Vulnerabilities and Interdependencies *and* Oakland Airport Focus Area Shoreline Resilience Planning (in partnership with BCDC)

January 2013 – June 2014

Overview of Our Study

- Questions to Address
  - What is the state of the vulnerabilities and interdependencies of our regional and sub-regional infrastructure systems?
- Goals
  - Provide a general understanding of infrastructure hazard vulnerability and impacts of system interdependencies on restoration
  - Develop a regional infrastructure vulnerability assessment at transmission scale
  - Recognize the interdependencies in regional infrastructure systems and determine the organization capacity to restore services
- Outcome
  - Sub-Regional Infrastructure Interdependencies Findings and Recommendations Report

Scope of Our Study

- Asset Categories
  - Energy (electricity, natural gas, and fuel)
  - Water and Wastewater
  - Communications
  - Ground Transportation
  - Ports and Airports
- Asset Components
  - Nodes: Key built assets such as pump stations, treatment plants, or substations
  - Links: Distribution and transmission lines such as pipes, wires, or cables
  - Interdependencies: Resources necessary for basic operation of the system, such as electricity, gas, or fuel
  - People: Personnel who run, make decisions about, and oversee the built systems
  - Information: data on systems and their performance

Vulnerability Analysis

- GIS Mapping
  - Geographic interaction between infrastructure and hazard
- Earthquake case studies & technical documents
  - Identify past vulnerabilities.
  - Determine general consequence and interdependencies of outages
- Local failures (not just earthquakes)
  - Determine regional consequences and interdependencies of outages.

Interdependencies Analysis

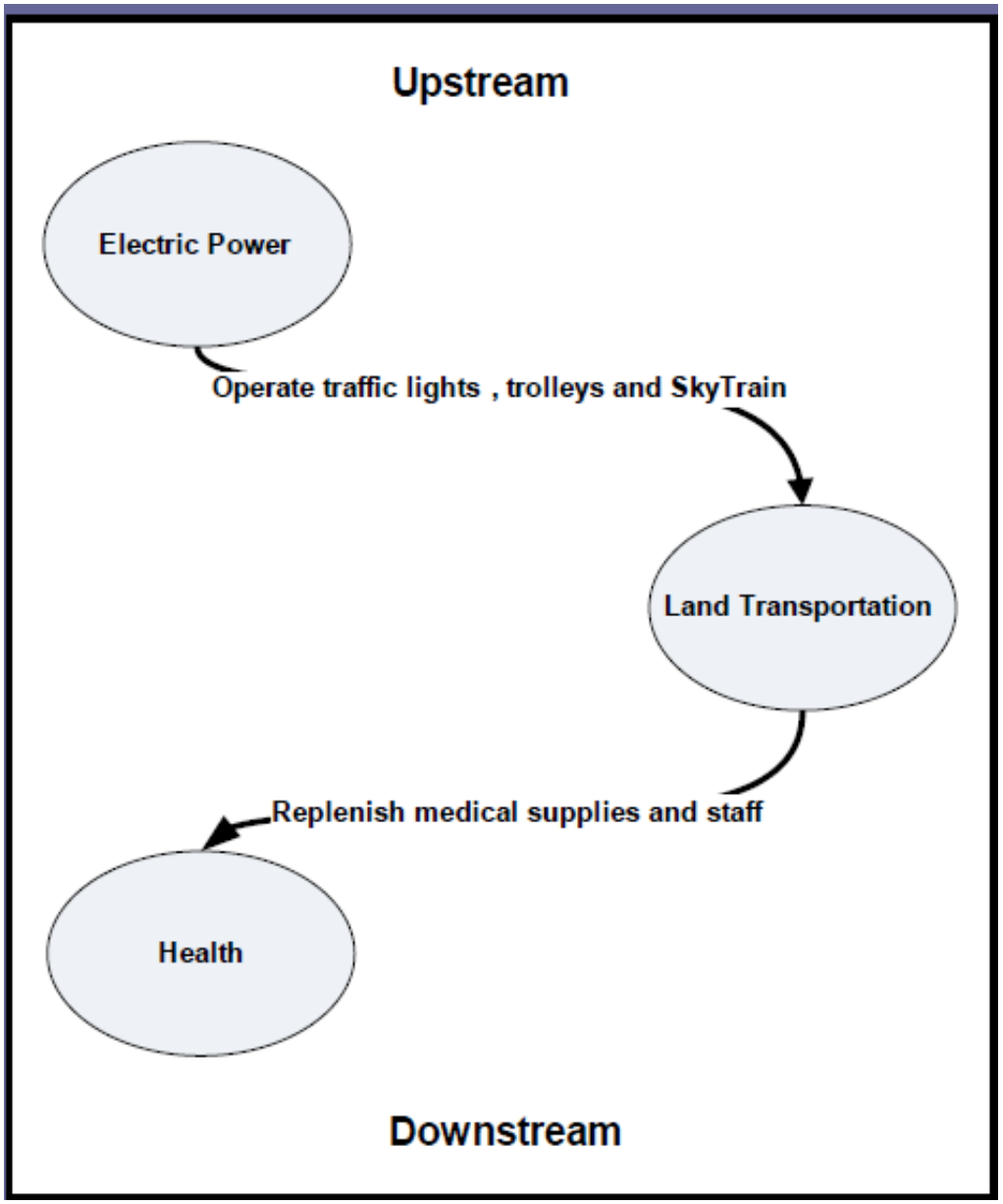
(Chang et al 2006)

- Physical – one system depends on another for operation (ex, wastewater depends on power)
- Geographic – co-located systems
- Cyber – linked electronically or through information-sharing
- Logical – other, such as shared financial market

Types of Interdependent Failures

(Chang et al 2006)

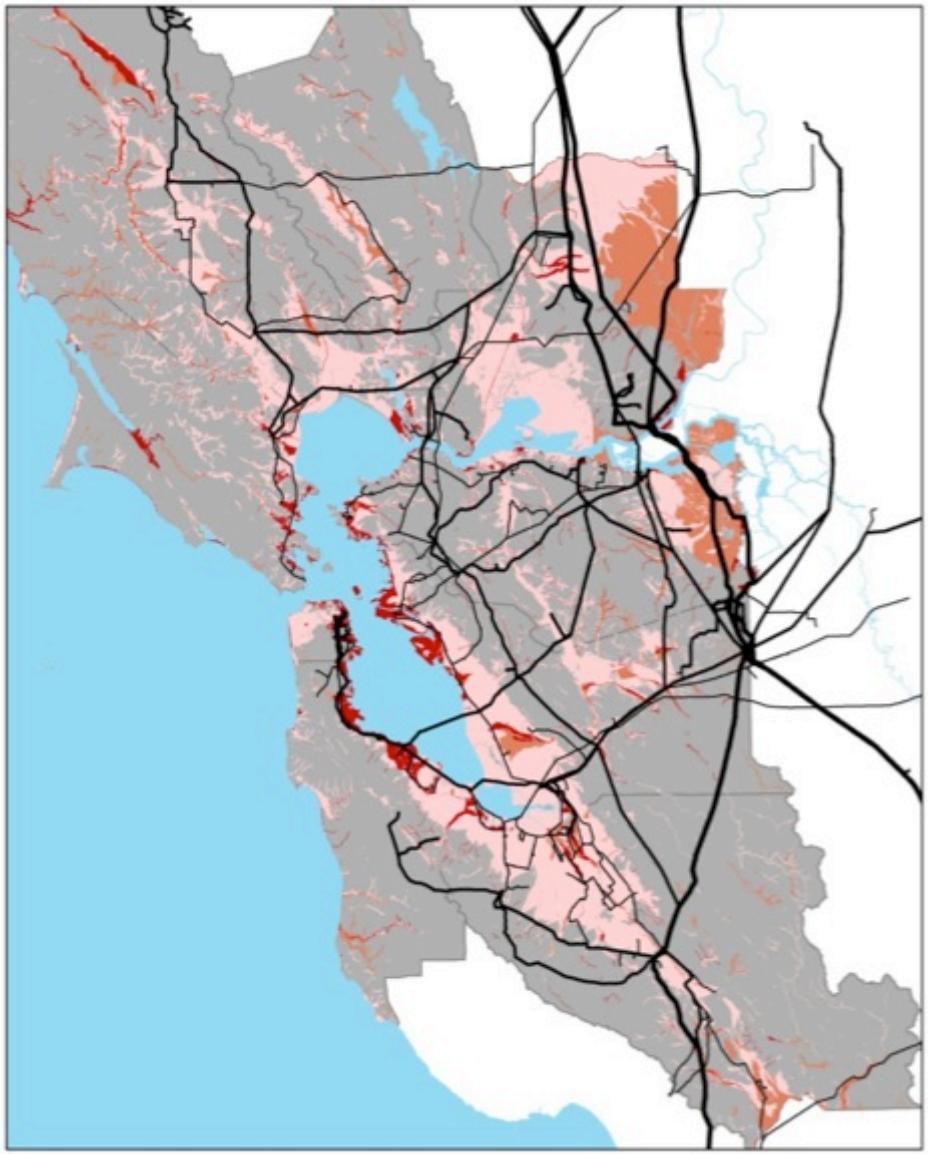
- Cascading – direct disruption
- Escalating – exacerbates already-existing disruption, increasing severity or prolonging
- Restoration – impacts the restoration of another system
- Compound damage propagation – leads to disruption that causes serious damage
- Substitutive – disruption due to excessive demands placed on a system to substitute for failed system

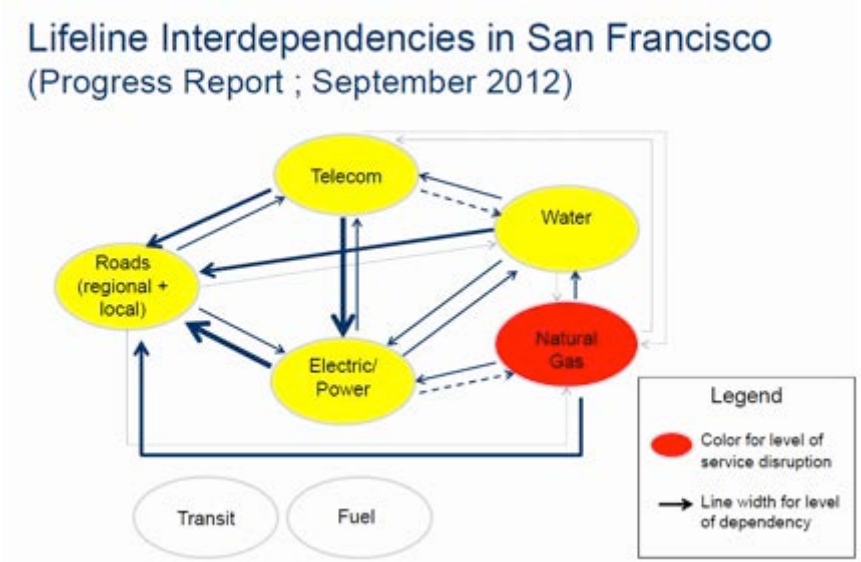


Example:

Upstream and Downstream Interdependencies

Airport and Infrastructure Resilience



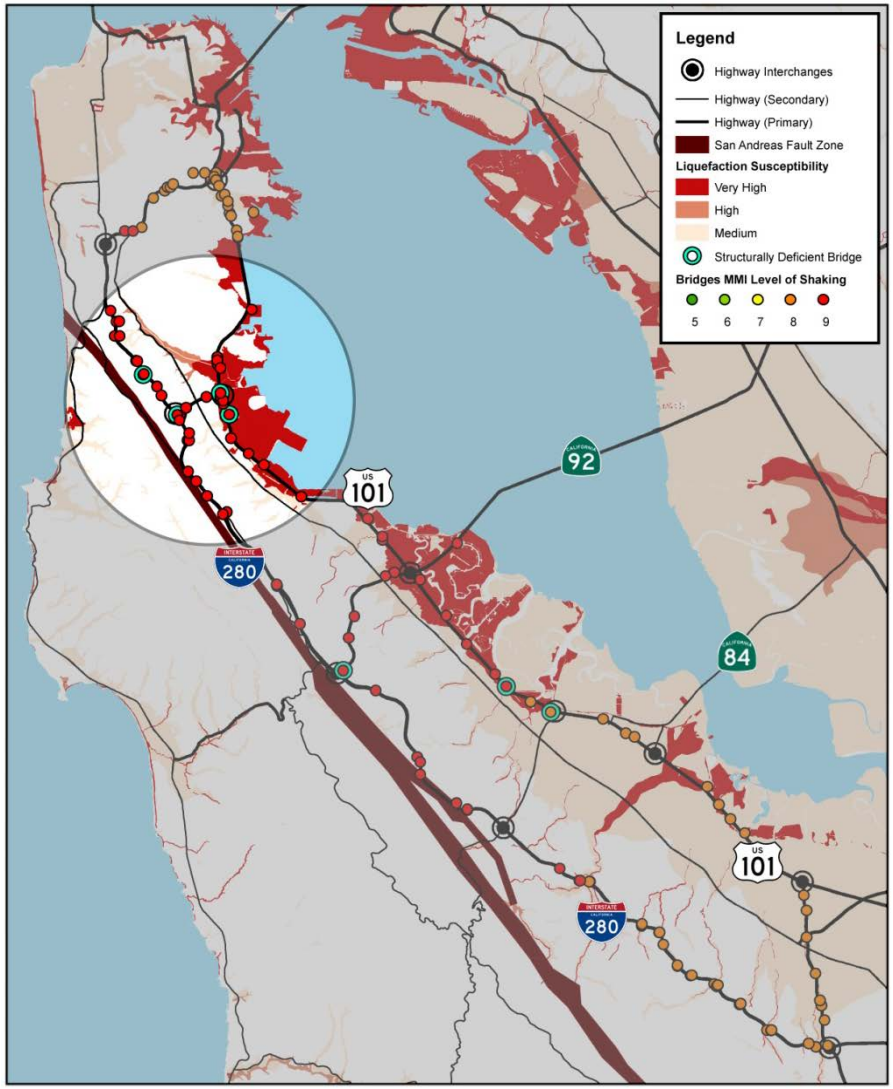


Service Disruption Level
No loss
Slight Disruption
Moderate Disruption
Severe Disruption
Uncertain

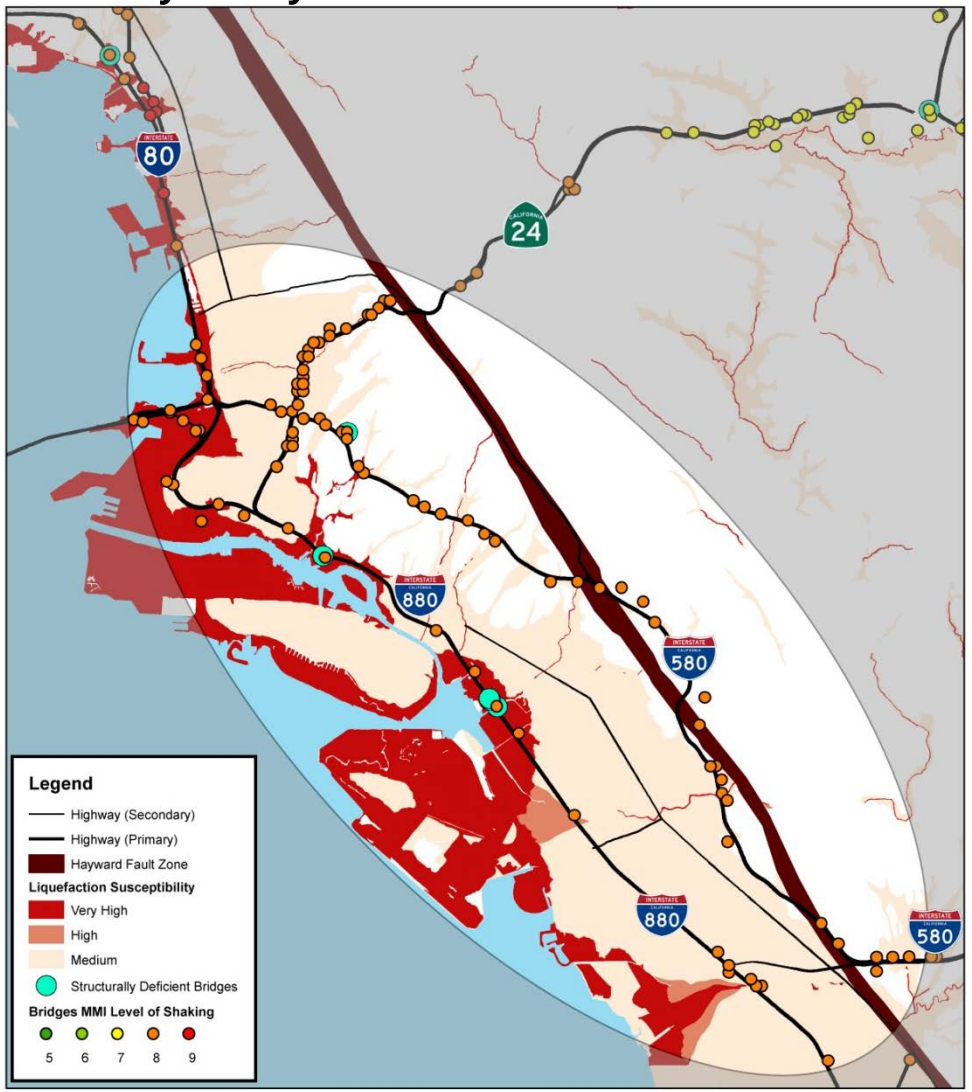
Sector	Time After Event		
	0 hours	72 hours	2 weeks
Power			
Transportation			
Water			
Wastewater			
Natural Gas			
Healthcare			
Solid Waste			

Airport and Infrastructure Resilience

Peninsula – San Andreas Event

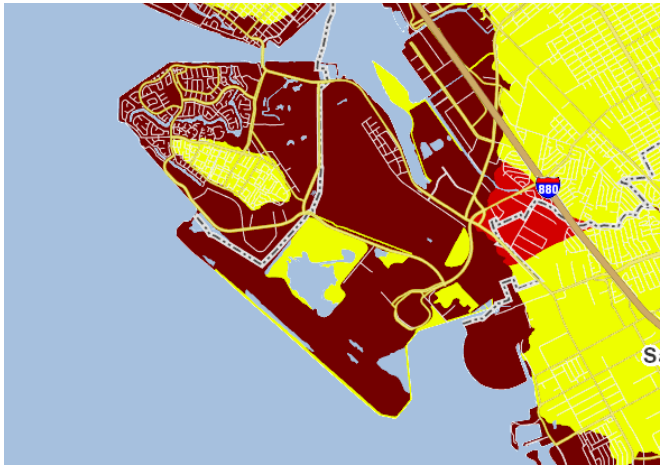


East Bay – Hayward Event



Oakland Airport Focus Area

- Partnership with Adapting to Rising Tides project (BCDC)
- Looking at multiple vulnerabilities to airport and surrounding infrastructure



Resilient Shorelines

- Partnership with BCDC to look at multiple hazards along the Bay shoreline
- Identify risks and develop local and regional approaches to build resilience
- Develop shared regional data, functions, and capabilities
- Inform future updates to regional plans like Plan Bay Area
- Develop regional funding strategies

Local Government Tools

- Collection of Bay Area resilience ordinances, policies, best practices
  - http://quake.abag.ca.gov/resilience/ordinances/
  - Will be developing guidance and case studies in the next year
- Best practices and literature
  - http://quake.abag.ca.gov/resilience/toolkit/

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National Coordination

- Rockefeller Foundation's 100 city program to launch global resilience
- National Association of Counties 2014 resilience effort – May 1 Bay Area meeting
- National Academy of Science Resilience Roundtable— national pilot projects
- ecoAmerica program in partnership with the MacArthur Foundation