

Bay Area Housing and Community Multiple Hazards Risk Assessment

Advisory Committee Meeting
December 5, 2013

*Association of Bay Area Governments
Bay Conservation and Development Commission*



Project Context

Improving the region's understanding of vulnerability to natural hazards is a key first step in developing resilience and recovery strategies that can be incorporated into long-range community plans

This project will:

- Build off of existing projects
- Leverage resources to increase efficiency
- Activate regional experts



The San Francisco Bay Area is vulnerable to a number of hazards, including ground shaking, liquefaction and landslides from earthquakes, flooding, extreme storm events, wildland fires, high heat and drought. Climate change will make many of these hazards more acute, and will result in rising sea levels that will affect the entire Bay Area.

The consequences of these hazards are particularly significant for residential land uses. The vulnerability of the region's existing housing and limitations on the capacity to recover are weak links in our regional resilience.

To increase regional resilience, long-range community plans must not only consider and plan for the hazards faced by existing housing, but future housing as well.

Improving our understanding of the region's resilience to natural hazards is a key first step in developing strategies to decrease vulnerability and increase recovery that can be incorporated in Bay Area long-range community plans.

Existing Projects and Resources

- Regional Resilience Initiative (ABAG)
- Shaken Awake! Estimates of Uninhabitable Dwelling Units (ABAG)
- Adapting to Rising Tides (BCDC)



Project Goals

- Help the region Identify areas where housing and communities are at risk from natural hazards such as earthquakes and future flooding due to sea level rise
- Develop strategies to help the region plan future housing in a manner that meets smart growth, resilience, sustainability, prosperity, and equity goals
- Create partnerships with diverse stakeholders



The goal of this project is to help the region meet smart growth, resilience, sustainability, prosperity, and equity goals by developing strategies to strengthen existing housing and communities and plan smartly for future housing.

Identify areas in the region both within and outside of PDAs where housing and at-risk communities, separately or in combination, may be vulnerable to natural hazards, particularly sea level rise and earthquakes

Based on the understanding of risks, identify a suite of planning, mitigation, and adaptation strategies that could be used to improve the resilience of existing and future housing

Create partnerships with diverse stakeholders and actively engage them in planning for multiple hazards with a focus on improving regional housing resilience

Expected Outcomes

- Analysis and mapping of housing and community risk indicators at a regional scale that will flag priority areas for further evaluation
- Improved understanding of synergies and conflicts between earthquake risk mitigation, sea level rise adaptation, and smart growth strategies
- Recommendations for policy, planning, risk mitigation and adaptation strategy implementation
- Tools and resources for assessing vulnerability that can be used at multiple scales
- Active and engaged experts that can advise the region in how to improve housing and community resilience



Visually accessible maps and graphics to communicate the vulnerability of existing housing and communities and potential risks faced by high growth development areas.

Recommendations for implementing policy, planning, risk mitigation and adaptation strategies through integration with community and regional plans (local land use plans, general and specific plans, local hazard mitigation plans, the SCS and other regional plans)

A summary report with the data, methods, outcomes, and best practices for building regional resilience through joint resilience, adaptation, smart growth actions and accessible guidance documents for jurisdictions.

Want outcomes that are relatable and usable for local jurisdictions and can be turned into plans and policies

Project Components

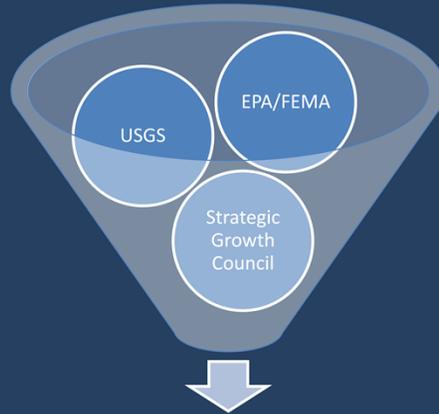
Scope and Organize	Assess	Strategies	Document and Disseminate
<p>Develop project goals and objectives</p> <p>Identify project parameters</p> <p>Convene advisory committee</p> <p>Identify broad stakeholders</p>	<p>Select and assess:</p> <ul style="list-style-type: none">✓ Hazards✓ Existing housing✓ Community characteristics✓ Representative future high growth areas <p>Summarize and organize findings</p>	<p>Identify policy, planning, risk mitigation, and adaptation strategies</p> <p>Develop implementation recommendations</p> <p>Evaluate funding sources</p>	<p>Resilience Strategy Guidance</p> <p>Policy Report</p> <p>Action Plan</p>



Project Timeline



Funding Sources



Housing and Community Risk Project



Advisory Committee Roles & Responsibilities

- Provide expert input and guidance
- Participate in one of two working groups
- Recommend priority housing and community indicators
- Consider how best to apply indicators in the project
- Attend two additional Advisory Committee Meetings
- Participate in three stakeholder charrettes (as available)



Advisory Committee Schedule

Advisors Meeting 1 – December 2013

- Input on assessment approach
- Form indicators working groups

Advisors Meeting 2 – February 2014

- Review and confirm recommended indicators
- Discuss comprehensive approach for applying indicators

Advisors Meeting 3 – May 2014

- Review draft regional vulnerability analysis
- Provide input on draft strategies, implementation options, and funding sources

Stakeholder Charrettes

RISK
April 2014

DRAFT STRATEGIES
June 2014

FINAL STRATEGIES
August 2014



Advisory Committee Meeting #1 (December 2013)

Convene Advisory Committee to confirm, refine, and obtain input on:

Project goals and objectives

Project approach, indicator analysis and mapping methodology

Hazard scenarios and issue statement

Form Working Groups to develop Housing Vulnerability Indicators and Community Vulnerability Indicators

Advisory Committee Meeting #2 (February 2014)

Review draft **Housing Vulnerability Indicators**

Review draft **Community Vulnerability Indicators**

Discuss strategy for comprehensive analysis using indicators

Advisory Committee Meeting #3 (May 2014)

Present final revised **Housing and Community Vulnerability Analysis** and **Community Vulnerability Profiles**

Review methodology, resilience strategies, implementation options, and funding sources

Stakeholder Charrette #1 (April 2014)

Present draft **Housing and Community Vulnerability Analysis** and draft **Community Vulnerability Profiles**

Present methodology for developing strategies, understand what strategies and policies local governments are already using, and develop initial ideas for strategies

Solicit feedback on draft **Housing and Community Vulnerability Analysis** and **Community Vulnerability Profiles**

Stakeholder Charrette #2 (June 2014)

Present draft strategies and solicit feedback

Identify potential implementation issues and barriers

Stakeholder Charrette #3 (August 2014)

Share and confirm findings and ideas about furthering hazard reduction actions in future planning efforts

Assessment Approach

1. Select and assess:

- ✓ Hazards
- ✓ Existing housing characteristics
- ✓ Community characteristics
- ✓ Representative future high growth areas (within PDAs)

2. Summarize and organize findings



The factors we are assessing are those that will help us build a regional vulnerability assessment for housing and neighborhoods. This includes vulnerabilities as well as anything else seen as a limitation on the capacity to recover.

Hazards

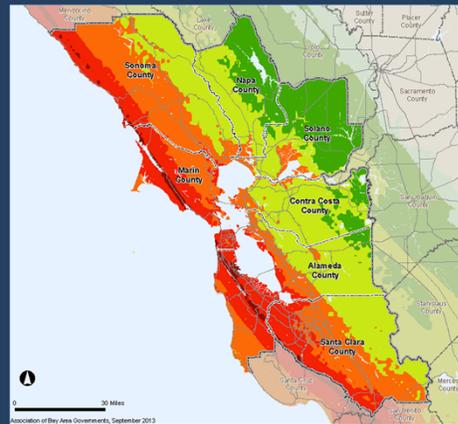
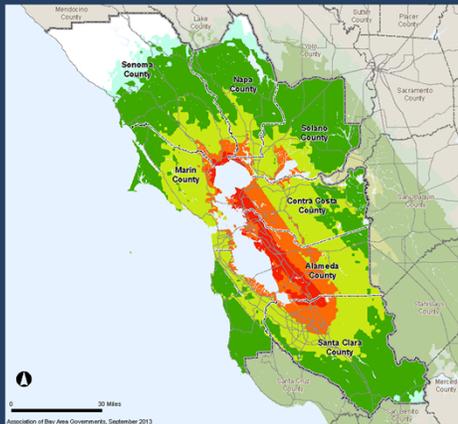
- Ground shaking due to Earthquake
- Liquefaction Susceptibility
- Flooding due to Sea Level Rise and Storm Events



Two Earthquake Scenarios

M6.9 Hayward Scenario

M7.8 San Andreas Scenario



We decided to go with scenario maps instead of probabilistic shaking hazard maps because we determined that these two scenarios covered the majority of the highest probability and greatest impacts of earthquake risks in the Bay Area. We also find that scenario maps are much more relatable to stakeholders and residents, and we want to develop analysis and tools that are accessible to local stakeholders and can help inform policy.

Sea Level Rise and Storm Events

- More frequent flooding
- Floods that last longer
- Elevated groundwater and salinity



Three Inundation Maps = 15 Future Flood Scenarios

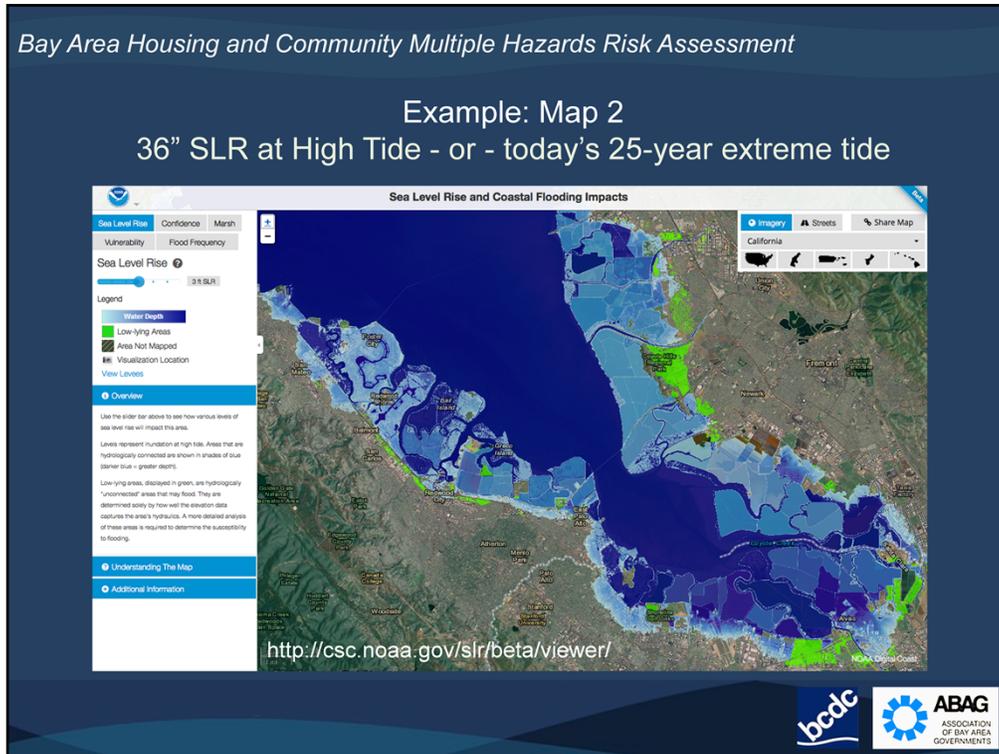
Tide Level	Map 1	Map 2	Map 3
Daily High	24" SLR	36" SLR	48" SLR
1-year	12" SLR	24" SLR	36" SLR
5-year	0" SLR	12" SLR	24" SLR
10-year		6" SLR	18" SLR
25-year		0" SLR	12" SLR
50-year			6" SLR
100-year			0" SLR



Using 3 inundation maps to analyze 15 different combinations of sea level rise and storm events (extreme water levels)

Bay Area Housing and Community Multiple Hazards Risk Assessment

Example: Map 2
36" SLR at High Tide - or - today's 25-year extreme tide



Example – 36" sea level rise is equivalent to four possible futures of SLR and tide levels

Identify and evaluate characteristics that describe existing **housing** vulnerability

Example characteristics (indicators):

- Age
- Construction type
- Configuration (height)
- Value
- Retrofit status



List of potential characteristics that increase risk to EQ and flooding + picture

Identify and evaluate characteristics that describe existing **community** vulnerability

Example characteristics (indicators):

- The elderly
- Young children
- Linguistically isolated households
- Low income households
- People with mobility or medical needs
- People without automobiles
- People without insurance
- Renter-occupied households
- Pet owners and other caretakers of animals



These are community characteristics that make you more or less resilient to hazards and that most of us will have one or more of these characteristics throughout our lives. An example of how these characteristics can affect people during response to a hazard can be found in a Bay Area community that issued a tsunami warning and then called off the warning only in English. Those who did not speak English continued to evacuate, missing a day of work, because the message was not translated. Due to the high consequences associated with these vulnerabilities, it is also important to address this finding early.

Assess Future High Growth Areas

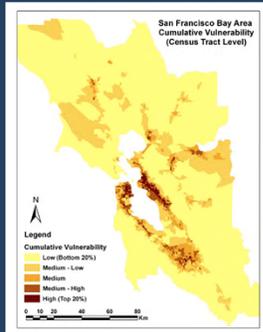
- Identify representative high growth areas within the region's Planned Development Areas (PDAs)
- Use existing hazard, housing and community characteristics to understand current risks within these areas
- Summarize assessment findings into Community Resilience Profiles



In the San Francisco Bay Area our primary long-range regional plan is Plan Bay Area, a Sustainable Communities Strategy, which focuses 80 percent of new housing and 66 percent of new jobs in locally designated Priority Development Areas (PDAs) over the next 30 years. This plan results in reduced greenhouse gas emissions, limited growth outside of the core of the region, and preservation of natural resources and open space. PDAs are areas of focused growth and are therefore of regional importance, however some are located in areas that could be at risk from natural hazards, and in particular along the Bay shoreline to earthquake induced liquefaction and sea level rise.

Summarizing and Organize Findings

- Maps
- Narratives
- Community Resilience Profiles



Adapting to Rising Tides

Community Lead the Vulnerability and Risk Profile

Communities that are most vulnerable to hazards are those that have the highest exposure to hazards, the highest vulnerability, and the lowest resilience. This profile is a key tool for understanding the relative vulnerability and risk of different communities in the Bay Area. It is based on a combination of factors, including population density, income level, and the presence of vulnerable populations (such as the elderly, young children, and people with disabilities). The profile is used to identify communities that are most at risk and to develop targeted resilience strategies.

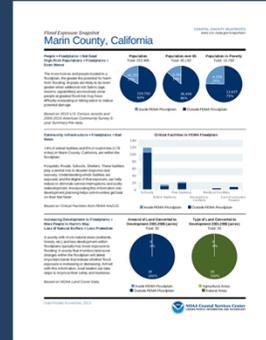
Key Findings

- The most vulnerable communities are those with the highest exposure to hazards, the highest vulnerability, and the lowest resilience.
- These communities are often located in coastal areas, near major transportation corridors, and in areas with high population density.
- These communities often have a high percentage of vulnerable populations.
- These communities often have a low level of income and a high level of unemployment.
- These communities often have a high level of poverty and a high level of homelessness.

Vulnerability

Exposure

Resilience



Strategy Development

- Consider synergistic mitigation, adaptation, and smart growth strategies that will help the region plan future housing in a manner that meets resilience, sustainability, prosperity, and equity goals
- Develop a suite of draft strategies for Advisory Committee review and consideration
- Share draft strategies with a broad group of stakeholders through a series of charrettes
- Revise and finalize strategies based on Advisory Committee and stakeholder input



Based on the **Housing and Community Vulnerability Analysis**, develop policy, planning, risk mitigation and adaptation strategies that can be used in community and regional planning to increase housing resilience (housing resilience strategies)

Develop implementation recommendations for integrating strategies with community and regional plans (local land use plans, general and specific plans, local hazard mitigation plans, the SCS and other regional plans)

Evaluate funding sources for policy, planning, risk mitigation and adaptation strategy selection, refinement and implementation

Develop guidance documents, based on EPA consultant-developed **Policy Report and Action Plan**, for local jurisdictions that explains planning, adaptation, and mitigation strategies for future housing, explains options for implementation, and discusses potential sources of funding

Questions on project goals,
outcomes or approach?



What are Housing and Community Risk Indicators?

- Key characteristics that make existing housing or community members vulnerable to the impacts of earthquakes or sea level rise
- Reflects a component of vulnerability, e.g., sensitivity or adaptive capacity
- Understandable at a scale of interest, e.g., individual, neighborhood, community, organization/institution, regional



To guide the regional assessment the project would like to develop a suite of indicators – that is the conditions and characteristics – that make housing or communities more vulnerable. These indicators should reflect one of the components of vulnerability - either sensitivity or adaptive capacity, and should be able to be applied at various scales of interest.

Vulnerability: the susceptibility of people, property, and resources to negative impacts from climate change. Vulnerability is a function of the level of exposure to climate change impacts, and the sensitivity and adaptive capacity of the communities and resources that are affected.

Project Guidelines for Priority Indicators

- Numerically measurable
- Regional, publicly available, georeferenced, high quality
- Transparently explain the vulnerability or resilience to the impacts of the hazards being evaluated
- Minimizes overlaps, similarities and correlations
- Guides strategy development and leads to effective policy
- Can be based on a single characteristic or multiple characteristics

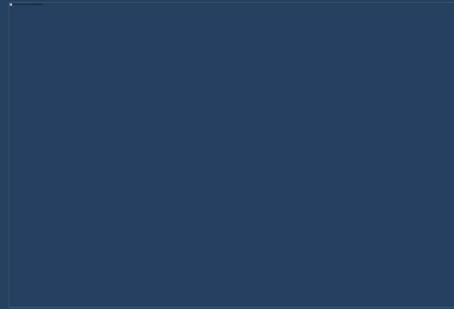


The project team has developed draft guidelines for the types of priority indicators of vulnerability that the regional assessment could use. These are not hard and fast rules, rather they are general principles to keep in mind when considering what conditions and characteristics will best inform housing and community vulnerability to sea level rise and earthquakes.

Earthquake Impact: Ground Shaking

Ground shaking from either a Hayward or San Andreas event would result in:

- Wood-framed buildings shift off foundations
- Soft-story collapse
- Non-ductile concrete collapse
- Ground cracks damaging roads or buried utilities



One way to ensure that the indicators reflect vulnerability is to think about the potential impacts that the hazards may cause. For example, ground shaking due to earthquakes could cause wood frame buildings to shift off of their foundation.

Earthquake Impact: Liquefaction

Loose or sandy soils may liquefy if shaken long and hard enough, causing sinking, displacement, sand boils, or lateral spreading that would:

- Underground pipelines and road surfaces threaten due to the ground shifting
- Foundation movement or cracking due to soils shifting or loss of bearing capacity



Liquefaction of soils during an earthquake could threaten long linear and underground infrastructure, such as pipes and roads, and can cause foundations to crack or move.

Sea Level Rise Impact: More Frequent Floods

Today's extreme high water levels will occur more frequently, causing more flooding in flood-prone areas and new flooding in areas currently not at risk that will:

- Overwhelmed flood protection and storm drainage systems
- Disrupted day-to-day activities and emergency services
- Lost wages and lower productivity
- Increased repeat-loss claims and increase insurance rates



Sea level rise may cause more frequent floods in areas that currently flood, and even cause flooding in new areas that are not currently at risk. This flooding can overwhelm the storm drainage systems causing local roads, basements, and buildings to flood, and putting people and their lives and livelihoods at risk.

Sea Level Rise Impact: Floods Last Longer

Higher water levels, especially during storm events, will flood larger areas for longer periods of time causing:

- Long term displacement and job loss
- Loss of social networks and neighborhood connections
- Release of household hazardous wastes



Sea level rise can also cause floods to last longer as higher Bay water levels during storm events cause areas to be under water longer, affecting neighborhoods and communities.

Sea Level Rise Impact: Elevated Groundwater

Higher water level will result in higher groundwater levels and intrusion of salinity into freshwater coastal aquifers that may:



- Increase risk of liquefaction
- Reduce capacity for gravity drainage and increase the need for pumping
- Mobilize pollutants currently contained within closed landfills



Sea level rise is also expected to cause groundwater levels to become elevated which could increase the risk of liquefaction and cause flooding of below ground spaces, drainage systems, and sites currently that have contained pollutants.

Example Indicators – Single Characteristics

Existing Housing

- Age
- Configuration/size
- Material
- Location
- Condition

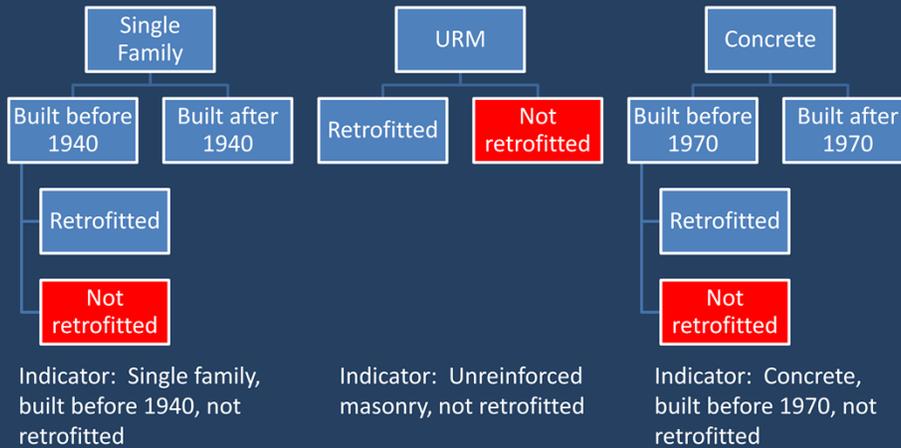
Communities

- Age
- Level of education
- Occupation
- Access to services
- Housing tenure



Some of the indicators of vulnerability that the project team has researched reflect a single characteristic, such as the age or location of housing, or the tenure of residents (renter versus owner).

Example Indicators – Multiple Characteristics



Other indicators could be based on multiple characteristics, such as type (single family) plus age (built before 1940) plus retrofit status (not retrofit). These types of multiple characteristic indicators may provide a more meaningful way to characterize housing and community vulnerabilities in a manner that can lead to planning of policy changes (strategies). For example, if it is found that a community has a large number of concrete construction housing built before 1970 that have not been retrofit then either through codes and standards, or potentially financial incentives, the community would want to target the retrofit of these housing units.

URM – Unreinforced Masonry (brick or stone)

Questions on Indicators?



Wrap Up and Next Steps

- Questions on Advisor Roles & Responsibilities?
- Process for each Working Group decided?
- Next Advisory Committee Meeting: February 27, 2014
- Project website

Housing Indicators

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