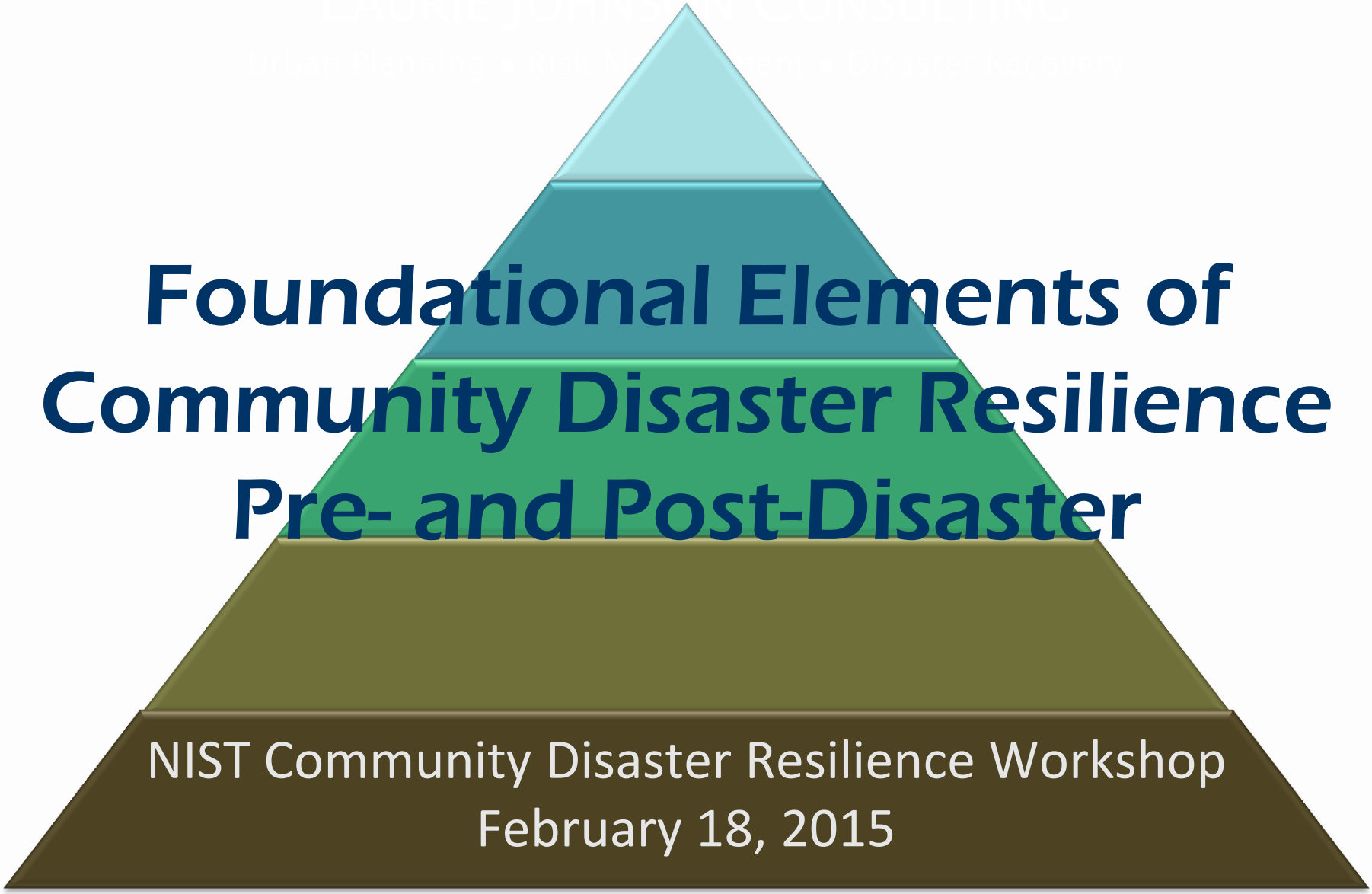


Foundational Elements of Community Disaster Resilience Pre- and Post-Disaster

NIST Community Disaster Resilience Workshop
February 18, 2015

Grand Forks, North Dakota

- 3rd largest city in state (~55,000 pop. / 20,000 households)
- Area: 20 square miles
- University of North Dakota
- Grand Forks Air Force Base

- Red River of the North travels 550 miles northward
- Extremely flat terrain, 830-832 ft. above sea level

Prior to 1997:

- History of flooding; flood stage reached at 28 feet
- Mostly earthen levees could sustain flood heights of 49 feet plus 3 feet of "free board"
- USACE design study underway

1997 Record Snowfal
54.11′


(J.W. Green, March 1997)


(Staff Sgt. Charles Morris, US Air Force, April 17, 1997)


(FEMA, 1997)


(Steven Norbeck, USGS, 1997)

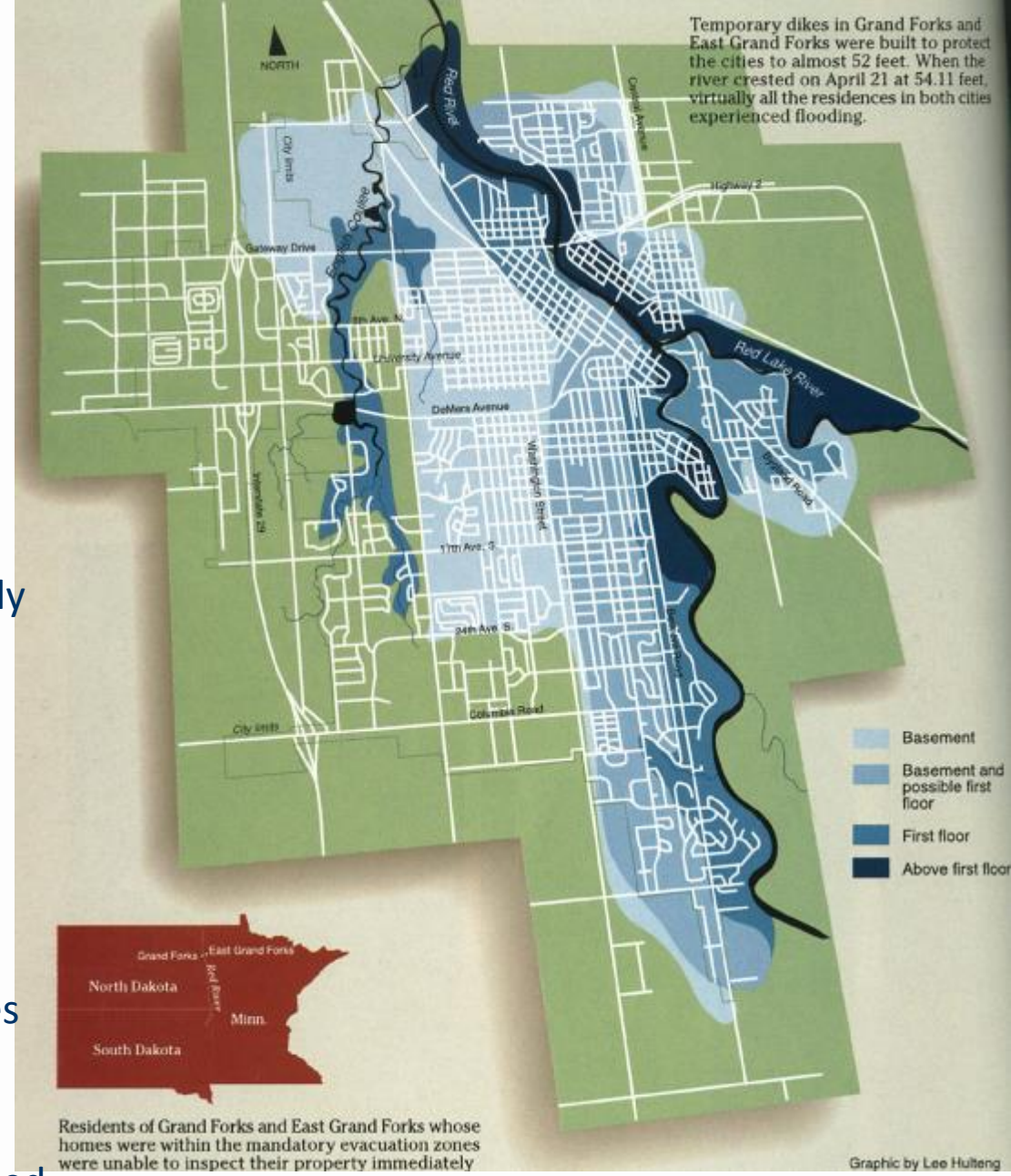
Grand Forks Flood and Fire


(Minnesota Public Radio, 1997)

(U.S. Army Corps of Engineers, 1997)

The Aftermath

- Nearly 80% of city inundated
- 90% residents displaced for weeks
- Water began receding after 3 days but took nearly 5 weeks
- 9,000 homes damaged; 700 severely damaged or destroyed
- 11 downtown buildings and 60 apartments burned
- 750 commercial units damaged; all 385 businesses in downtown were impacted
- Electricity, water and sewer services shut down citywide
- City Hall, County Courthouse and other government buildings damaged



Key Ingredients of Grand Forks' Recovery

- Local leadership with political will and buy-in for hazard mitigation
- Strong State and Federal partnerships– both before and after flood
- Swift and adequate post-disaster funding, cooperatively managed
- Resilience in both interim and long-term recovery goals and specific programs:
  - Voluntary acquisition and relocation
  - Enhanced flood protection (levee and floodwall) system
  - Permanent river greenway construction
  - Downtown revitalization

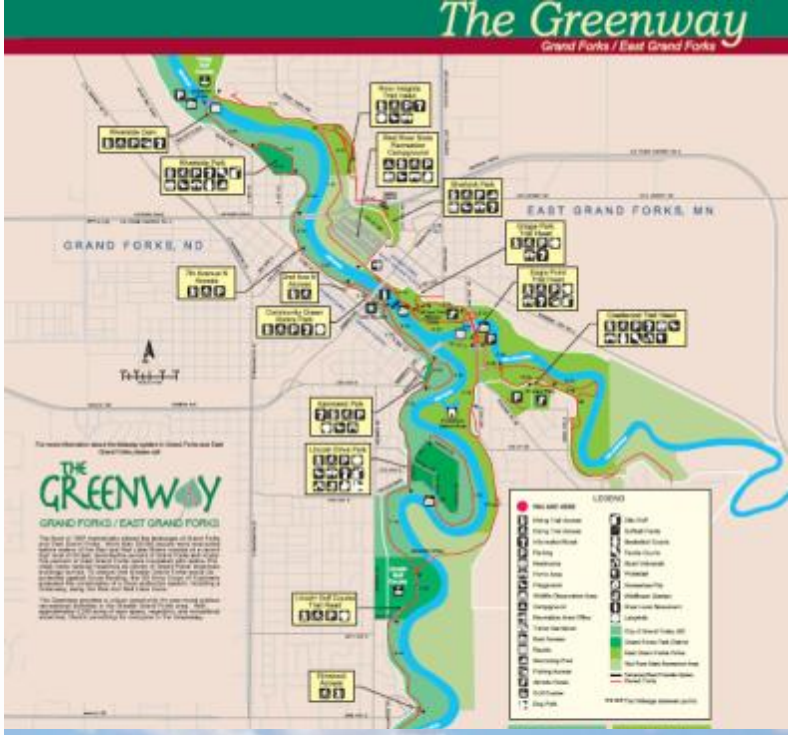
(Geosynthetics, 2009)

River crested at 49.5 feet on April 1, 2009

(Greg Abner, City of Grand Forks, March 29, 2009)

Grand Forks' Resilience "Costs"

- Losses of $1 to $2 billion, and comparable recovery costs much of which funded by federal, state, and local government
- Social and business displacement, some long-term; cultural and historical losses as well
- Mitigation strategies took nearly a decade to achieve, even with swift, well-funded, and well-coordinated start to recovery
- Negative effects on elected officials, staff and population, especially in recovery years 2 and 3



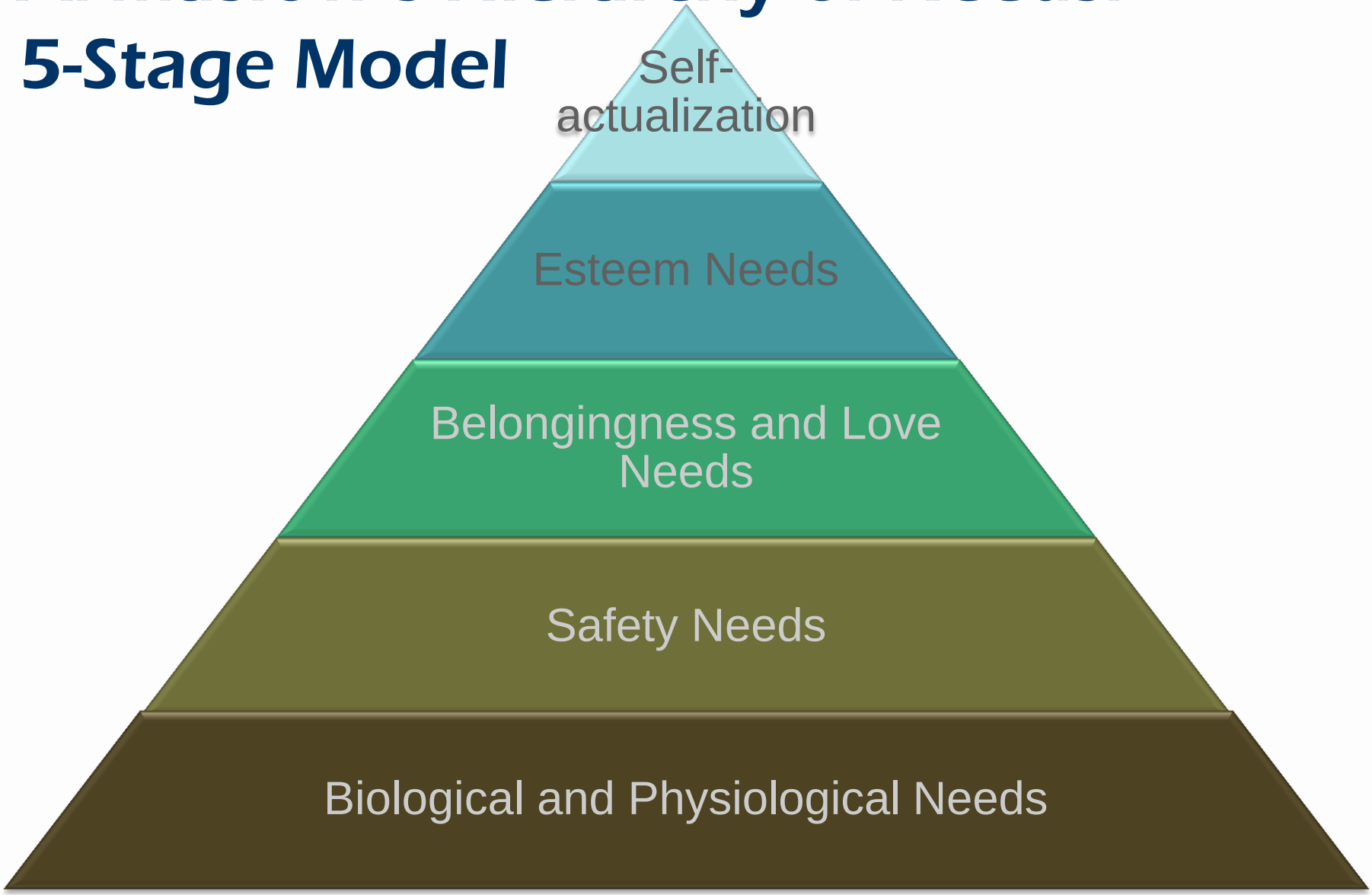
(Geosynthetics, 2009)

"Resilience means the ability to prepare and adapt to changing conditions and withstand and recovery rapidly from disruptions"

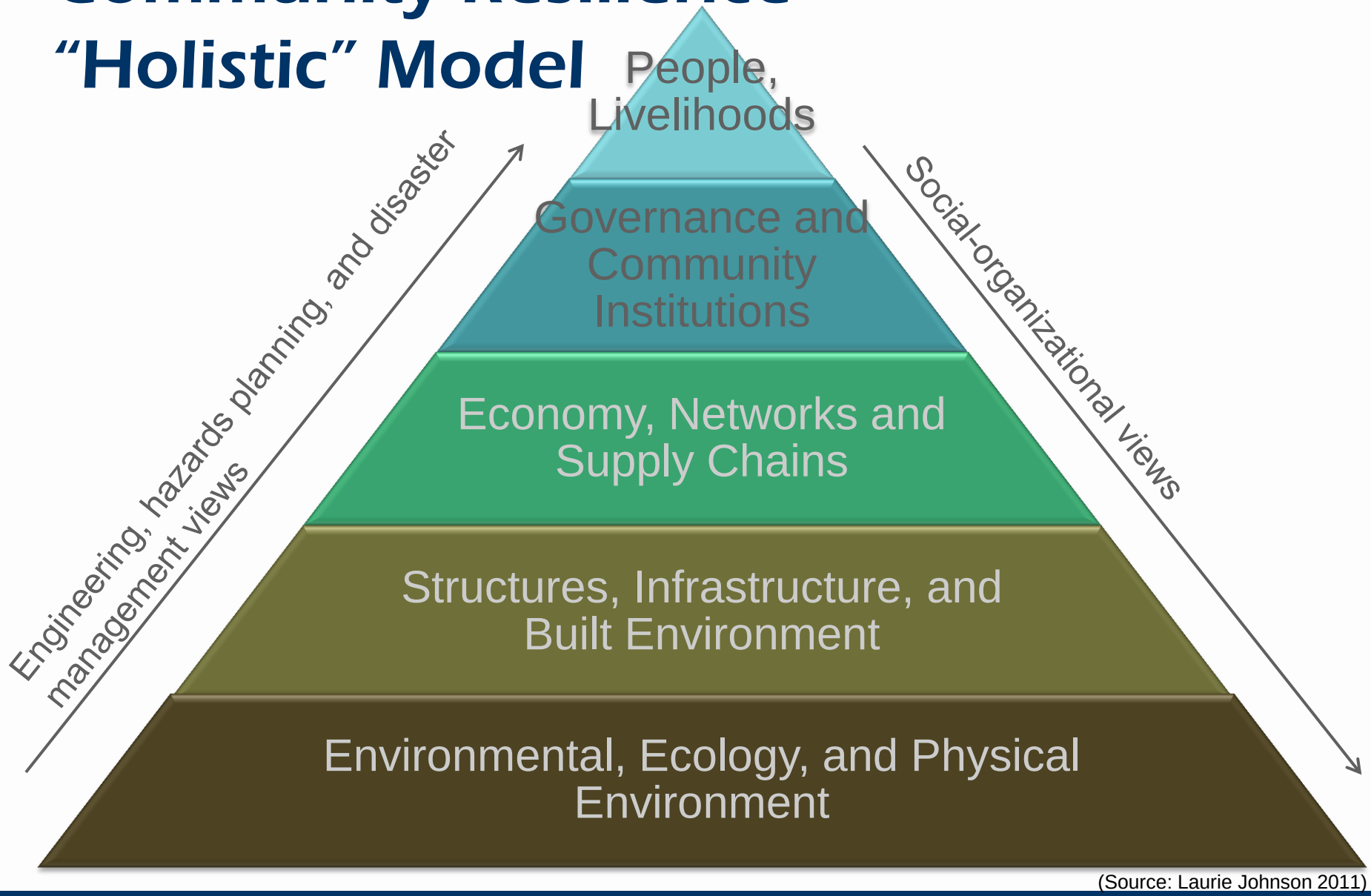
– Presidential Policy Directive 21 (PPD-21)

- Reduce the impact of hazard events
- Return to social functioning more quickly
- Reduce the time and cost of recovery
- Break the cycle of destruction and recovery

A. Maslow's Hierarchy of Needs: 5-Stage Model



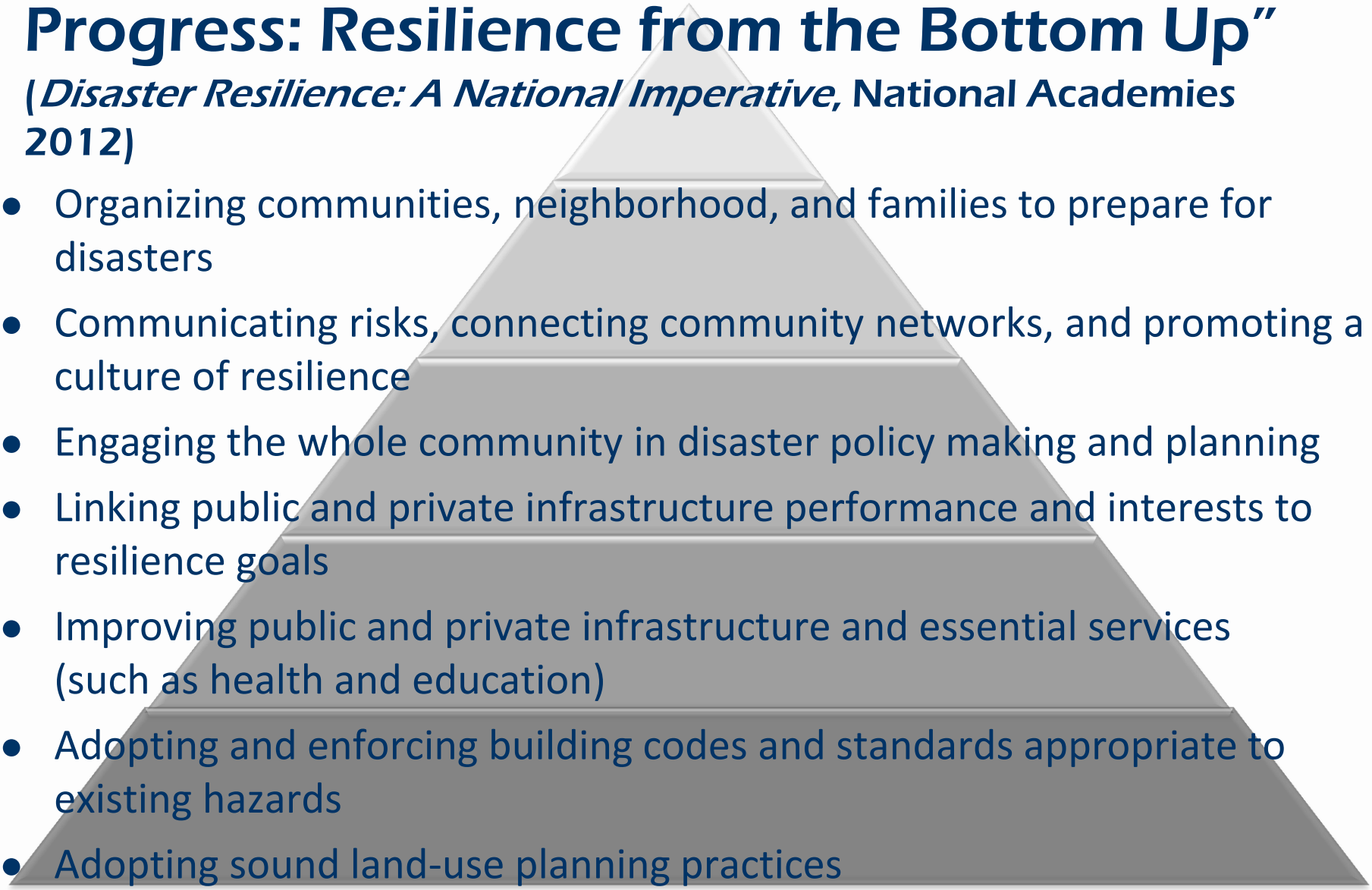
Community Resilience "Holistic" Model



(Source: Laurie Johnson 2011)

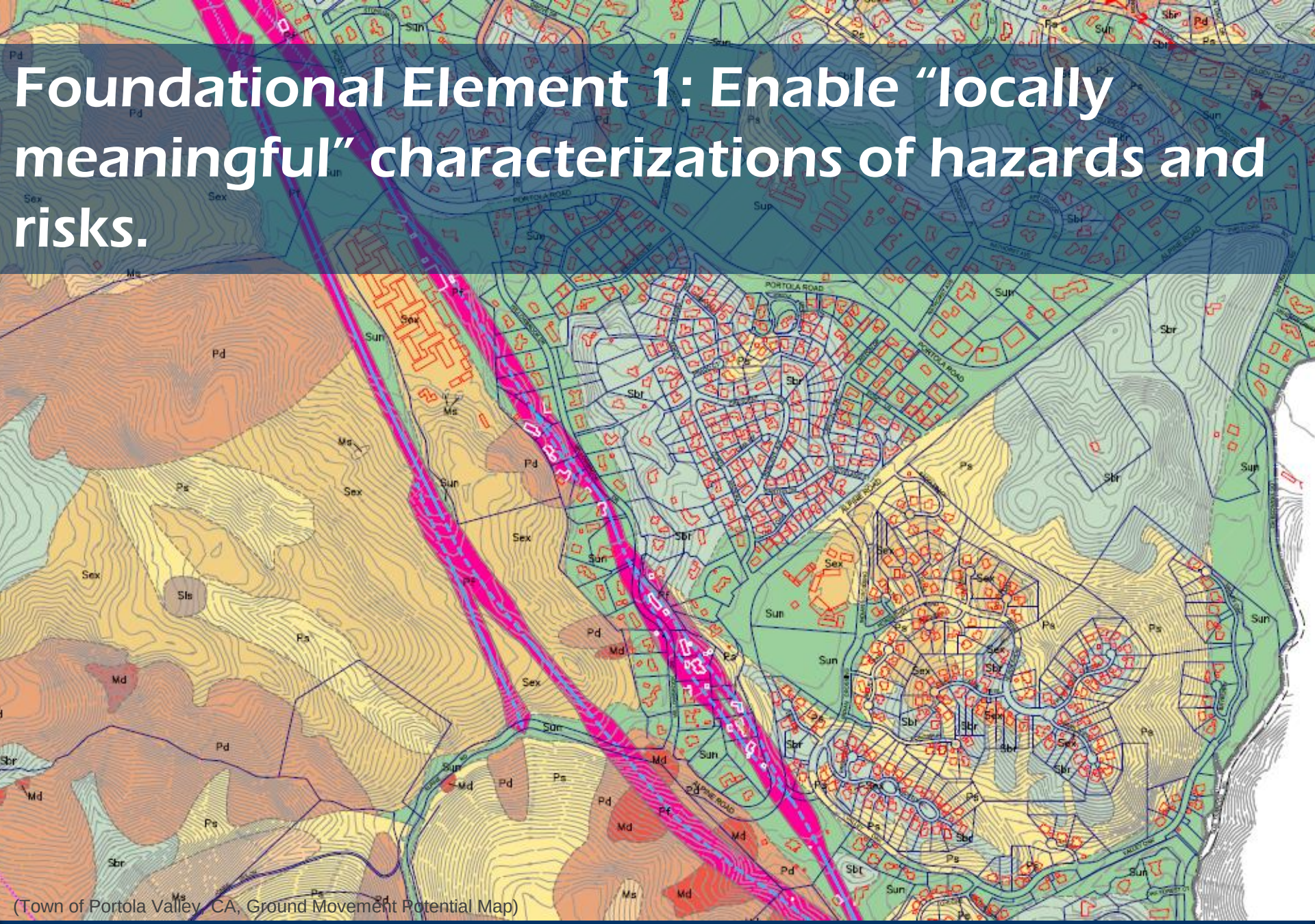
"Building Local Capacity and Accelerating Progress: Resilience from the Bottom Up"

(*Disaster Resilience: A National Imperative*, National Academies 2012)



- Organizing communities, neighborhood, and families to prepare for disasters
- Communicating risks, connecting community networks, and promoting a culture of resilience
- Engaging the whole community in disaster policy making and planning
- Linking public and private infrastructure performance and interests to resilience goals
- Improving public and private infrastructure and essential services (such as health and education)
- Adopting and enforcing building codes and standards appropriate to existing hazards
- Adopting sound land-use planning practices

Foundational Element 1: Enable "locally meaningful" characterizations of hazards and risks.



(Town of Portola Valley, CA, Ground Movement Potential Map)

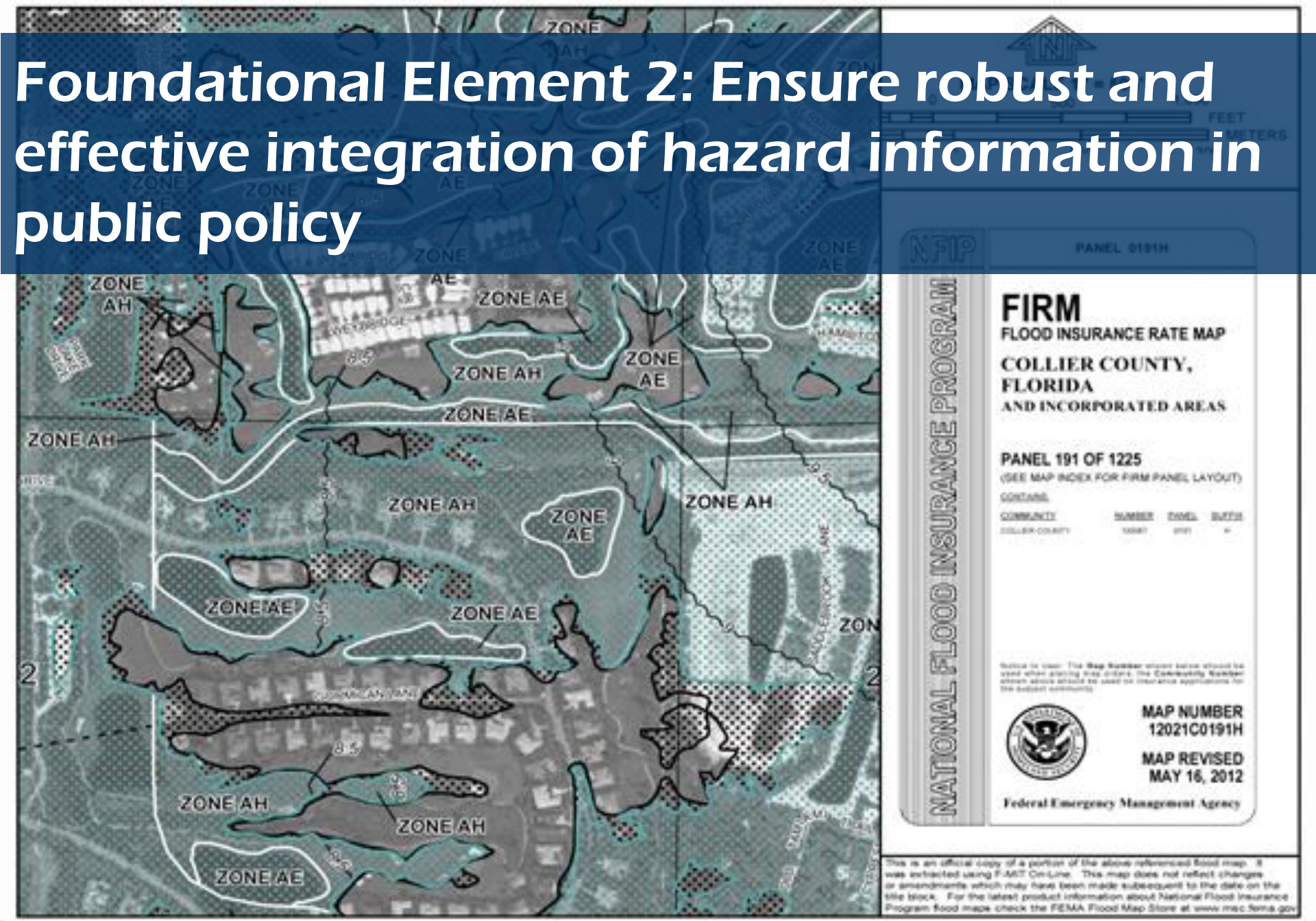
California Statewide Mandates for Seismic, Wildfire, and Flood Hazard Identification

(My Hazard, California Office of Emergency Services)

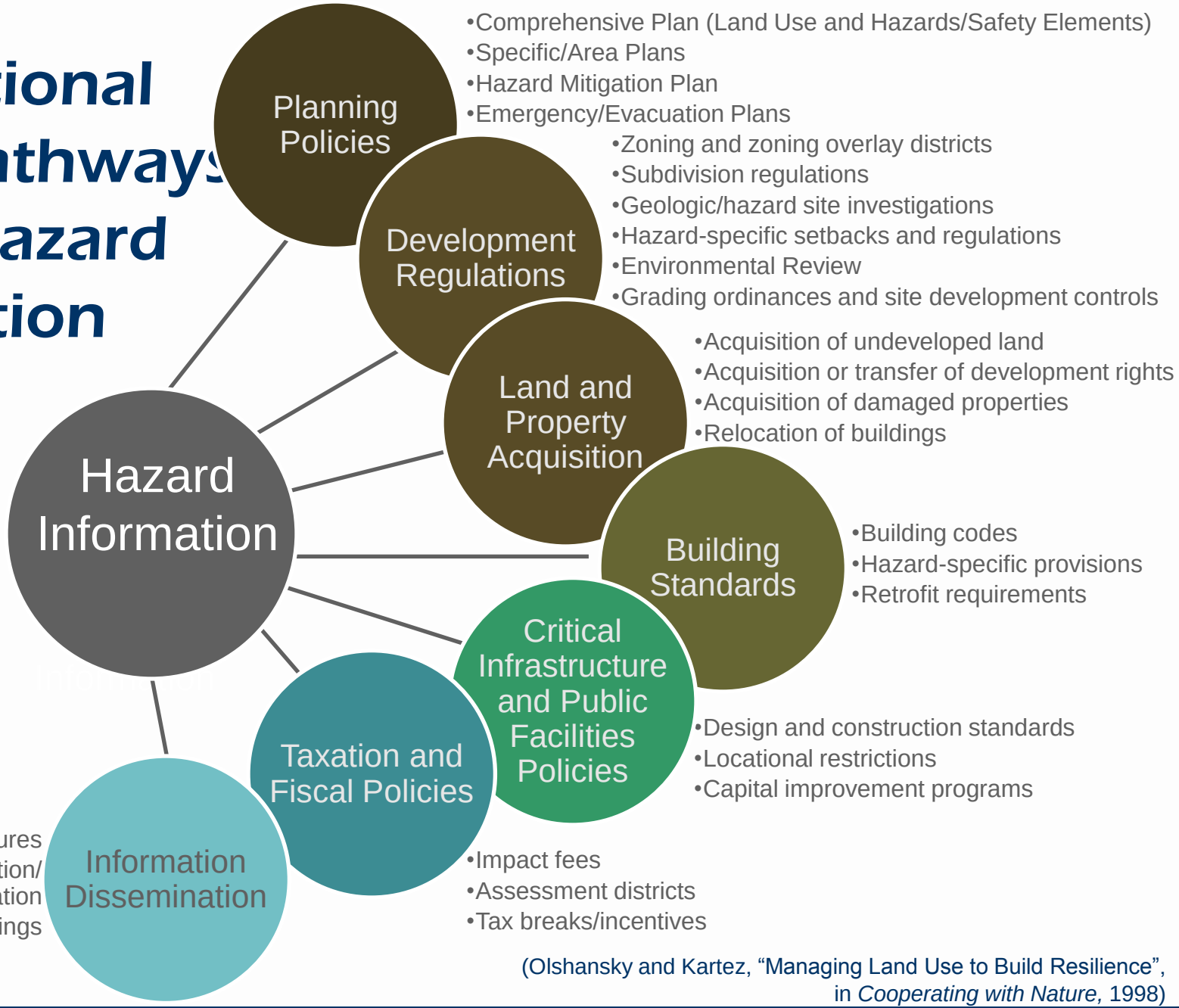
Considerable Variability in Hazard Mapping/Assessment Across the U.S.

- Hazard knowledge and ability to "map it" varies by peril: earthquake (faulting, liquefaction, landslide, strong shaking), flooding (riverine, dam/levee failure, storm surge, sea level rise), wildfire, landslides/debris flows, hurricane-force winds, tornadoes, hail, ice, subsidence, man-made, etc.
- Variations in mapping approach and accounting of uncertainty (inventory/identification, hazard/susceptibility, probabilistic, risk)
- Variations in mapping scales (regional to site-specific)
- Variations in legislative/policy controls: national, state, and local mandates requiring specific action versus informational or advisory only

Foundational Element 2: Ensure robust and effective integration of hazard information in public policy

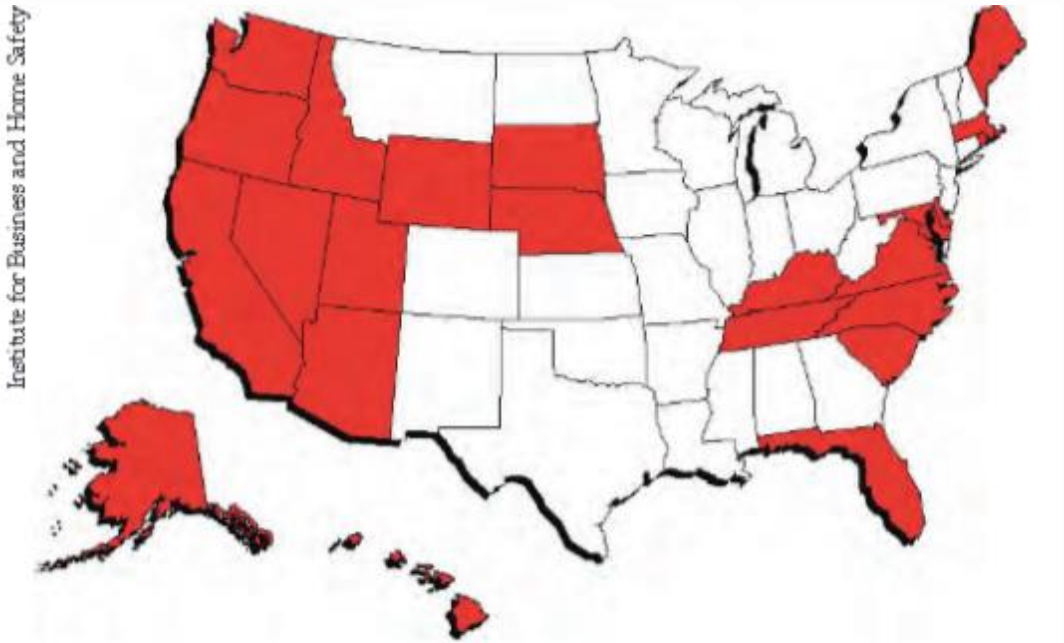


Foundational Policy Pathways for for Hazard Information

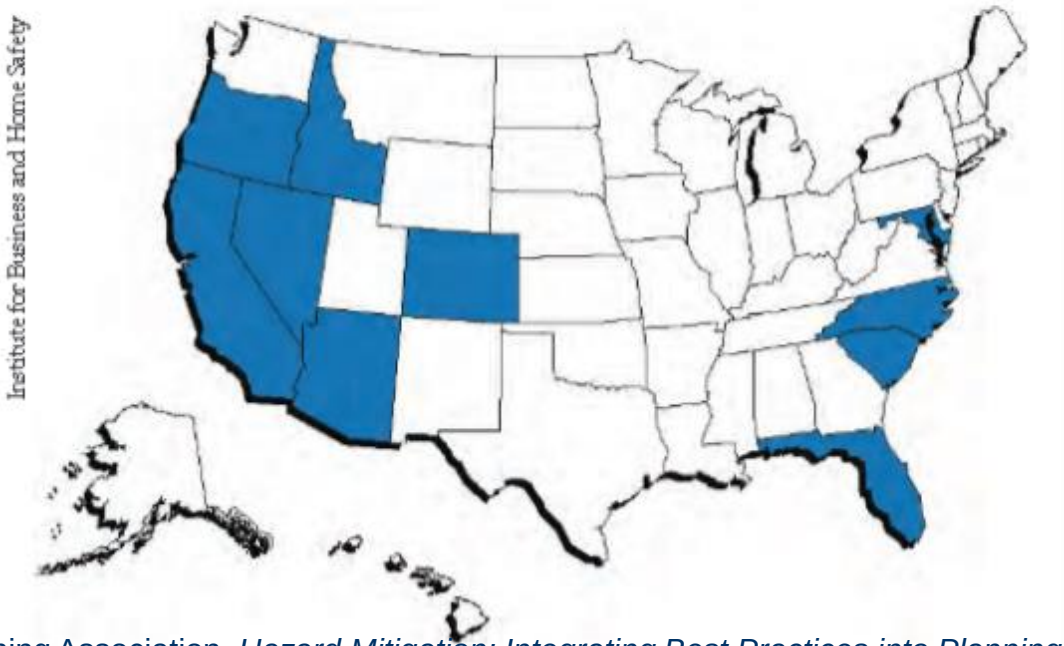


(Olshansky and Kartez, "Managing Land Use to Build Resilience", in *Cooperating with Nature*, 1998)

States requiring local comprehensive plans (2009)



States requiring local comprehensive plans to address hazards (2009)



(American Planning Association, *Hazard Mitigation: Integrating Best Practices into Planning*, 2010)

Coastal State Building Code Effectiveness Rating

(Insurance Institute for Business & Home Safety (IBHS), August 2013)

IBHS Ratings by State: Highest to Lowest

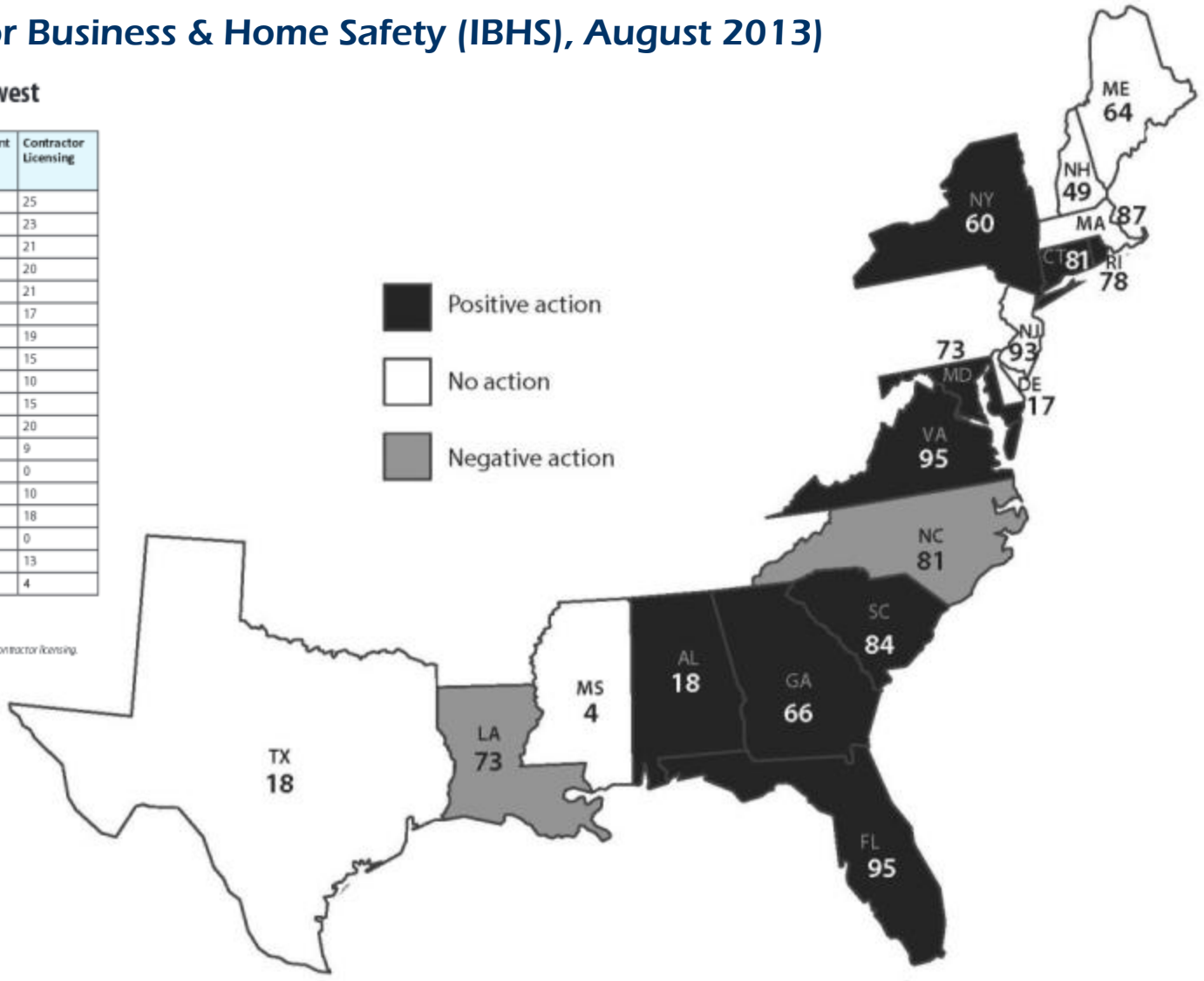
Scale 0-100*

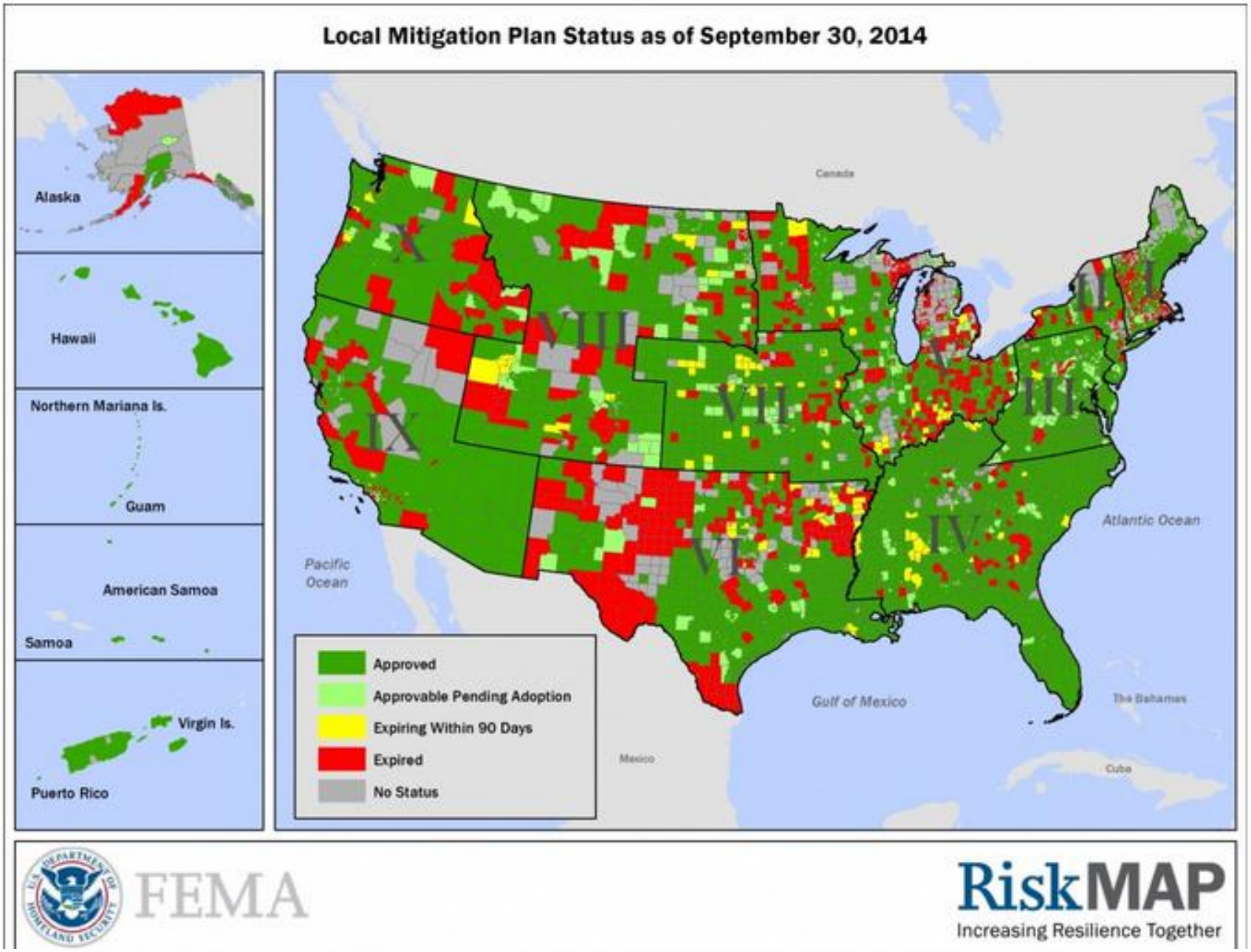
State	Total	Adoption of code, universality, and weakening provisions	Enforcement Officials	Contractor Licensing
Florida	95	48	22	25
Virginia	95	48	24	23
New Jersey	93	49	23	21
Massachusetts	87	46	21	20
South Carolina	84	45	18	21
Connecticut	81	40	24	17
North Carolina	81	40	22	19
Rhode Island	78	44	19	15
Louisiana	73	48	15	10
Maryland	73	43	15	15
Georgia	66	31	15	20
Maine	64	33	22	9
New York	60	37	23	0
New Hampshire	49	39	0	10
Alabama	18	0	0	18
Texas	18	18	0	0
Delaware	17	4	0	13
Mississippi	4	0	0	4

IBHS rankings were weighted based on the following variables:

- *50 percent for variables that relate to adoption and enforcement of building codes*
- *25 percent for variables that measure code official certification and training, and*
- *25 percent for variables that relate to on-site implementation, as measured by contractor and subcontractor licensing.*

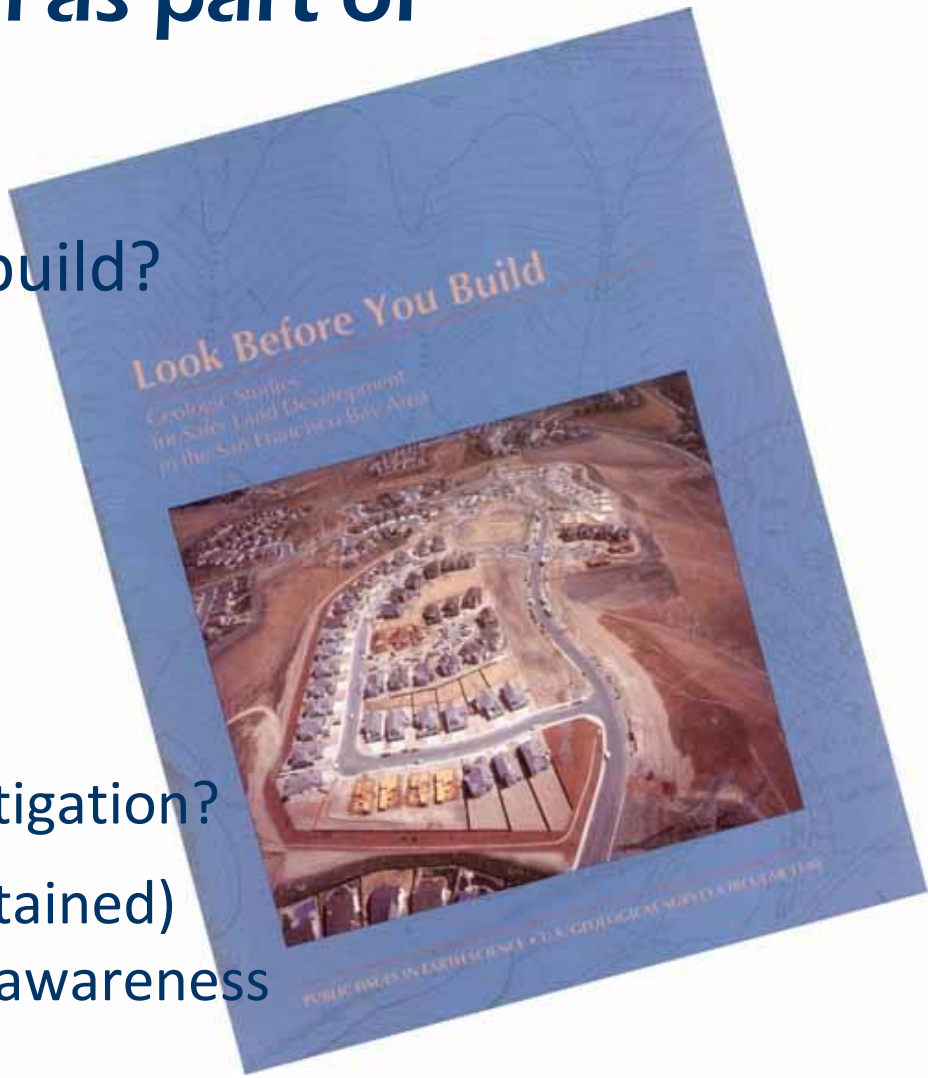
**See Appendix B for a complete list of questions used to assign points in state ratings.*




Local Mitigation Plan Status as of September 30, 2014
Alaska
Hawaii
Northern Mariana Is.
Guam
American Samoa
Samoa
Virgin Is.
Puerto Rico
Canada
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Mexico
The Bahamas
Cuba
X
VIII
IX
VII
VI
IV
III
II
Approved
Approvable Pending Adoption
Expiring Within 90 Days
Expired
No Status
FEMA
RiskMAP
Increasing Resilience Together

Are There Opportunities to Expand the Hazard/Risk Discussion as part of (Re)development?

- Where (more precisely) to build?
- What to build?
- How to build?
- Also, address:
  - Who pays for detailed investigations and hazard mitigation?
  - Who ultimately owns the (retained) risk and how to ensure their awareness and preparedness?

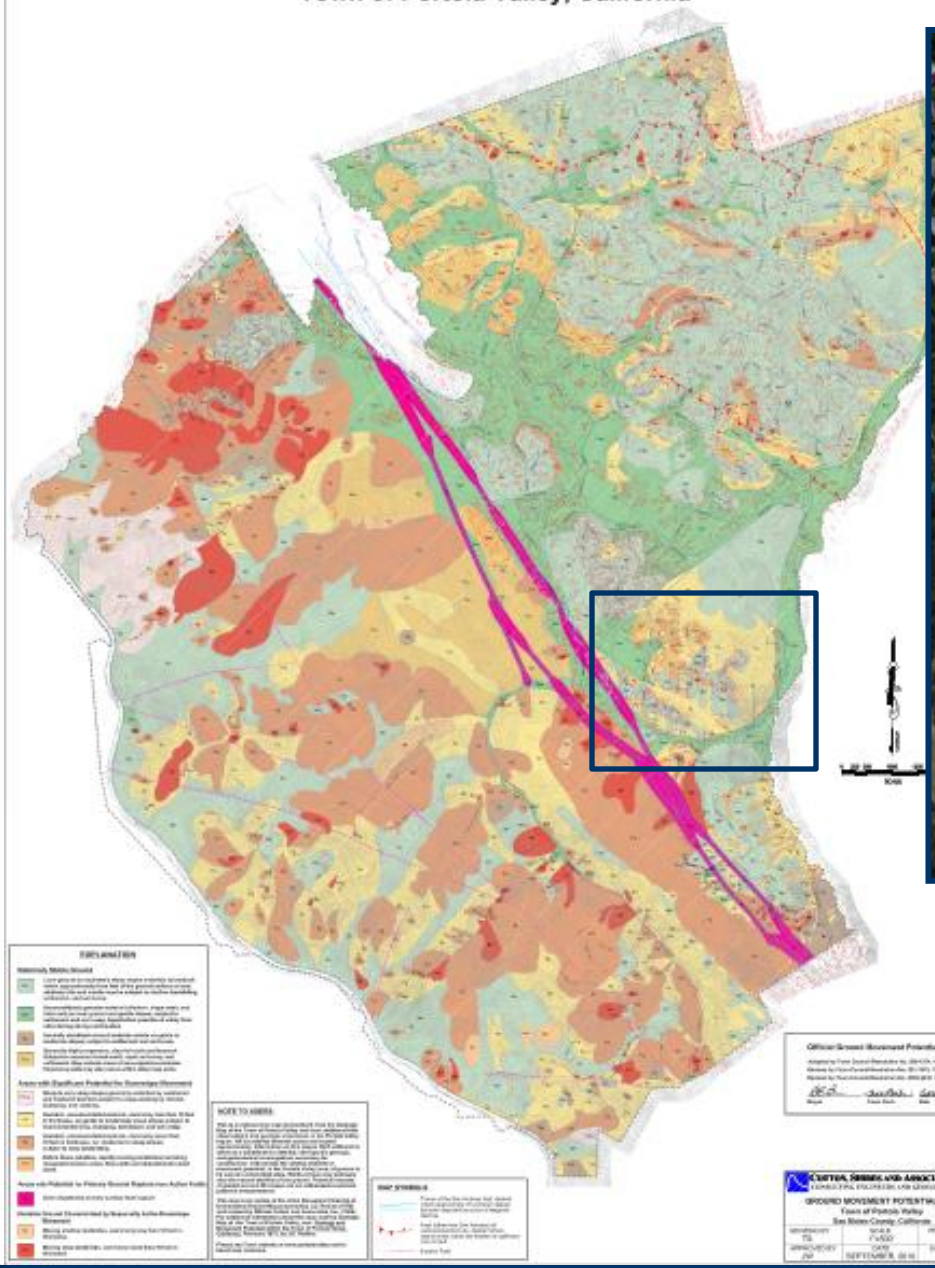


Town of Portola Valley, CA

Windy Hill Open Space Preserve
http://activerain.com/image_store/uploads/3/0/3/3/1/ar12702101313303.jpg

GROUND MOVEMENT POTENTIAL MAP

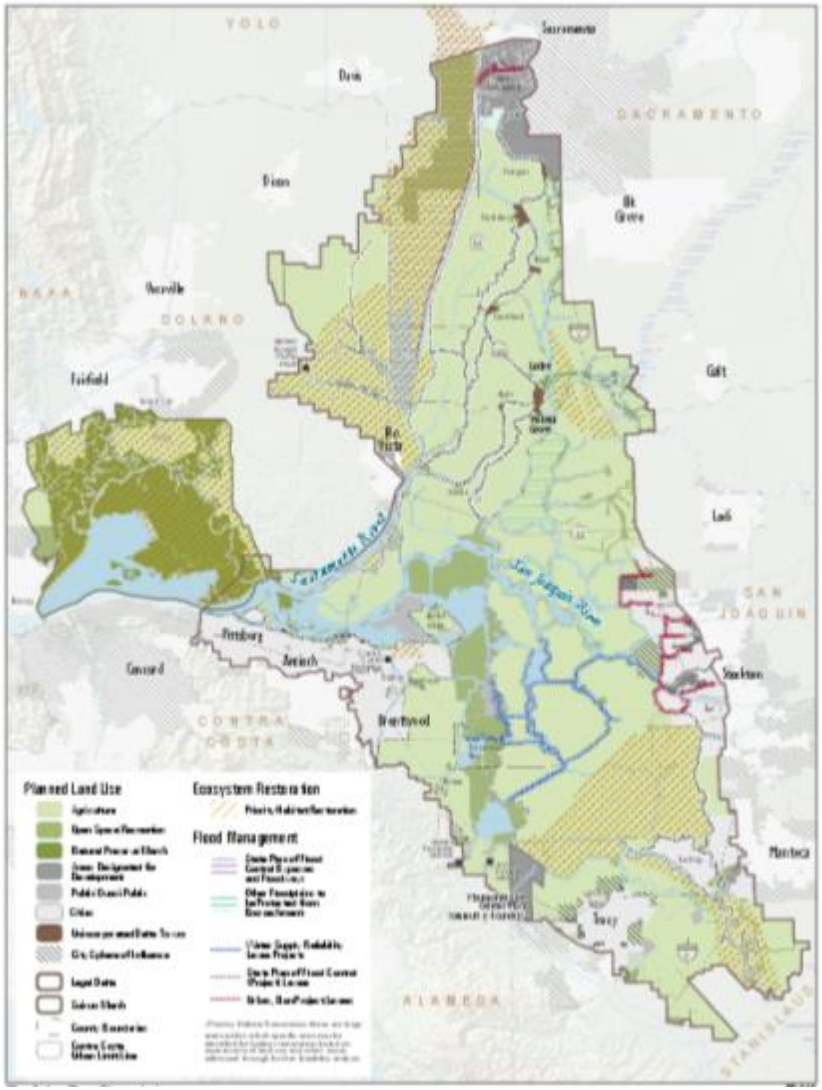
Town of Portola Valley, California



Midpeninsula Regional Open Space District

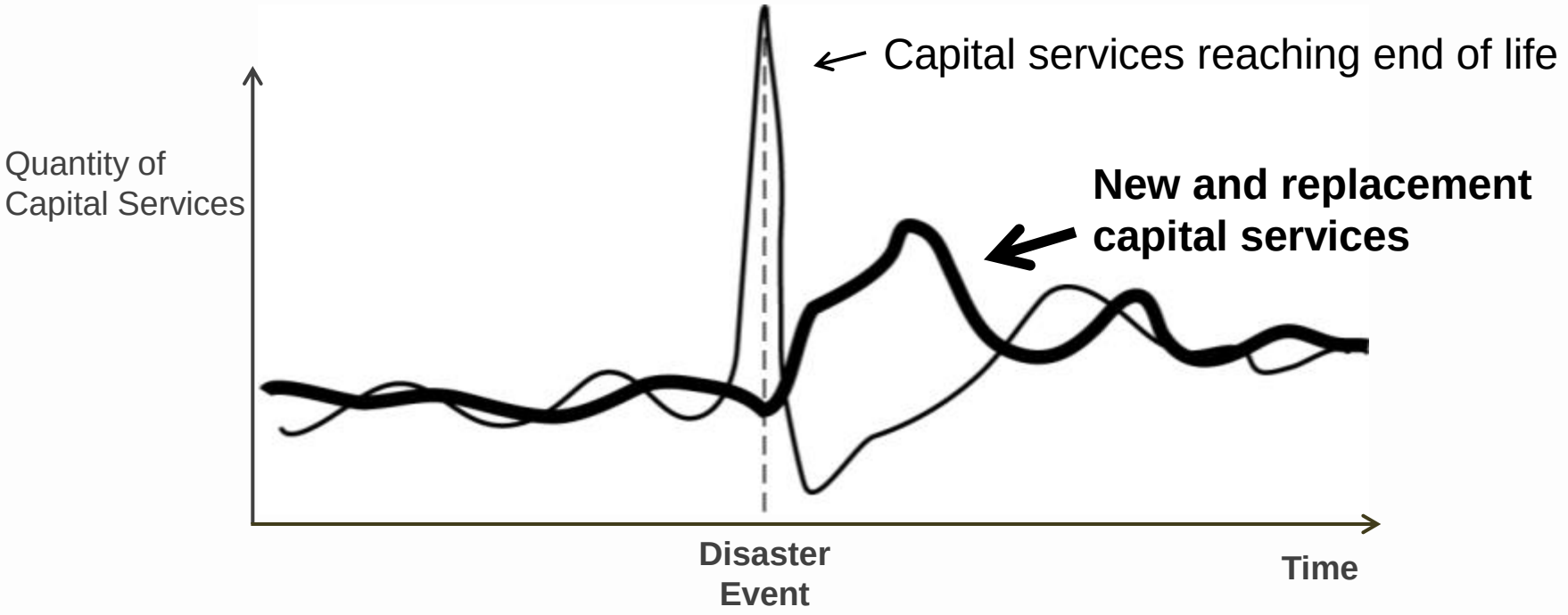
Delta Stewardship Council/ Delta Plan Central Valley, CA

- 2009 Delta Reform Act and allocation of $700 million annually
- Delta Stewardship Council created in legislation to achieve the state mandated coequal goals for the Delta*: "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem"*
- Delta Plan, adopted in 2013, comprehensive, long-term management plan that included a multi-hazard analysis
- Delta Science program and board – provide information for water and environmental decision-making in the Bay-Delta system
- California Water Bond $7.5 billion approved in November 2014



Source: Delta Plan 2013

Post-Disaster Resilience Building Experiences

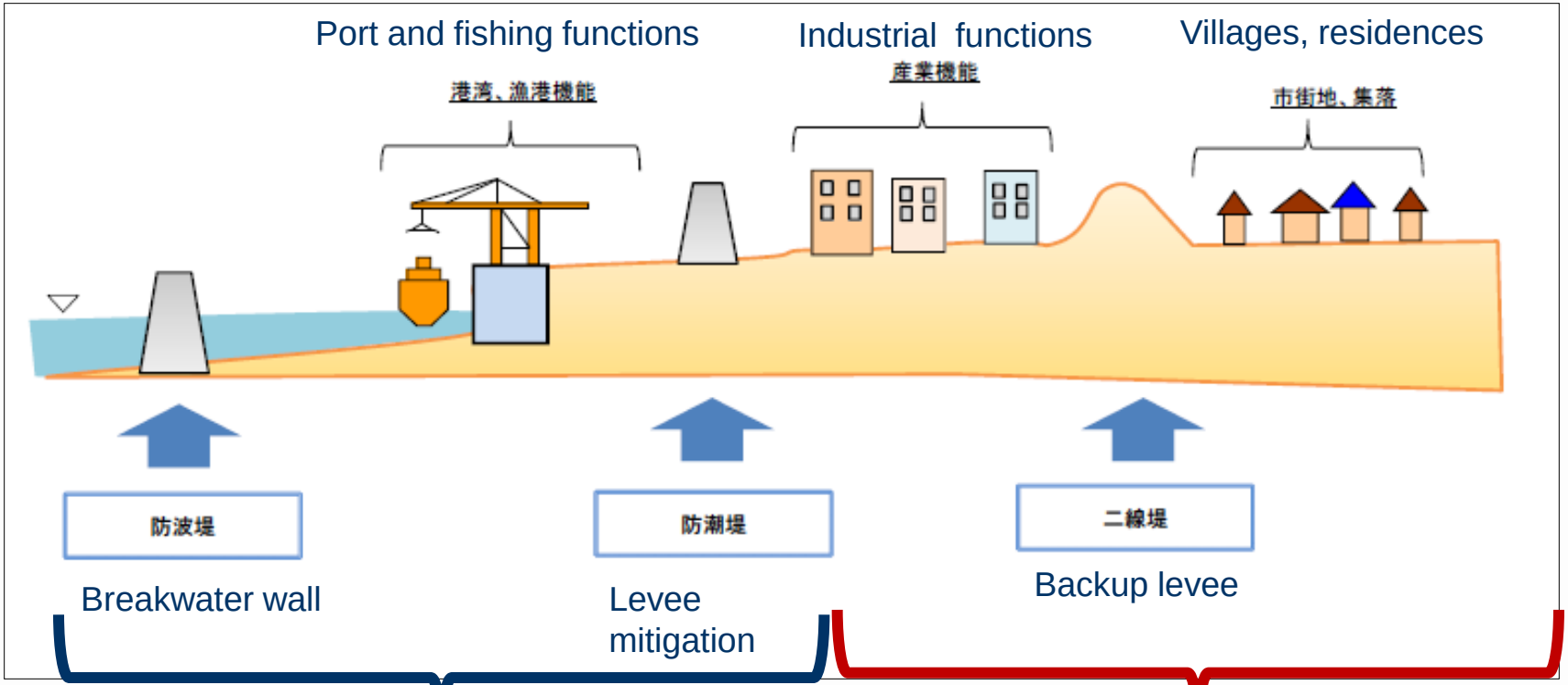


Time compression means that normal city building processes, in all their complexity, now must happen much more quickly (100 years → 10 years)

(Olshansky, Hopkins, & Johnson, Natural Hazards Review, August 2012)

Tohoku Region, Japan 2011 Earthquake and Tsunami Rebuilding

(Reconstruction Design Council in Response to the Great East Japan Earthquake, June 2011; translation by K. Iuchi)



Rikuzen Takada City, Japan

Raised land for commercial/ industrial use→

← Hillside residential relocation areas

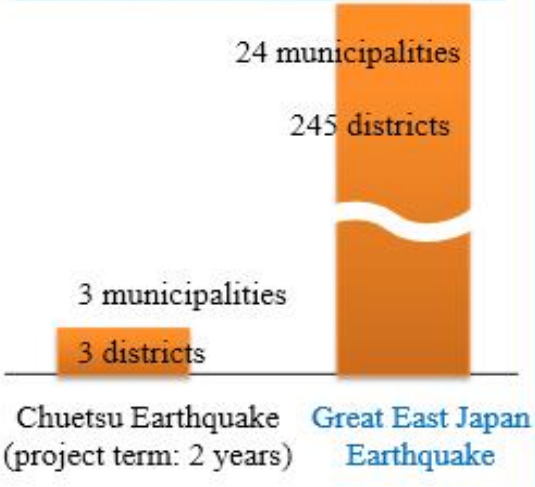
Source: http://www.japan-guide.com/g9/5038_03.jpg, April 2014

Tohoku Region, Japan

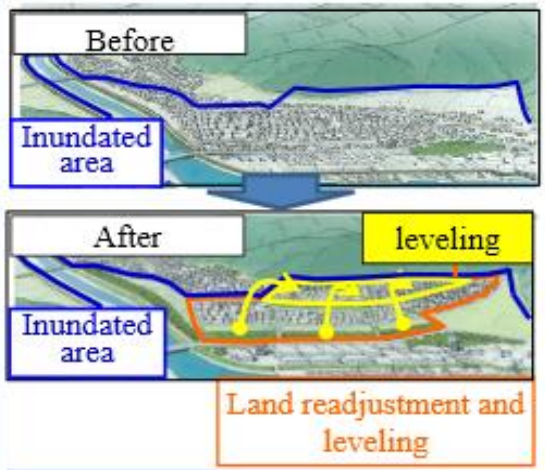
2011 Earthquake and Tsunami Rebuilding

http://www.reconstruction.go.jp/english/130528_CurrentStatus_PathToward_FINAL.pdf

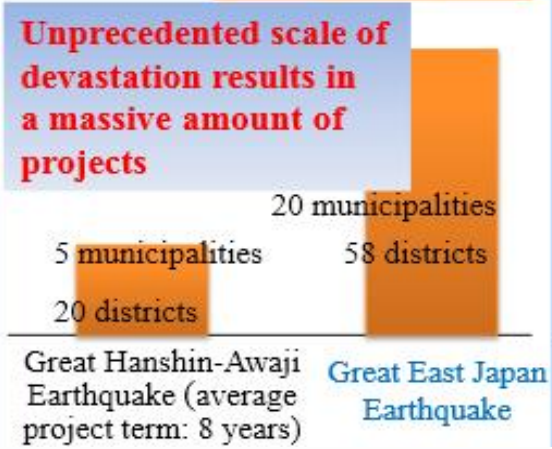
Collective household relocation



Land readjustment

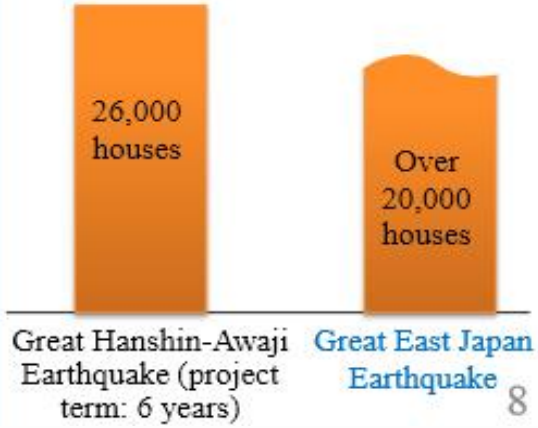


Unprecedented scale of devastation results in a massive amount of projects



Public housing development

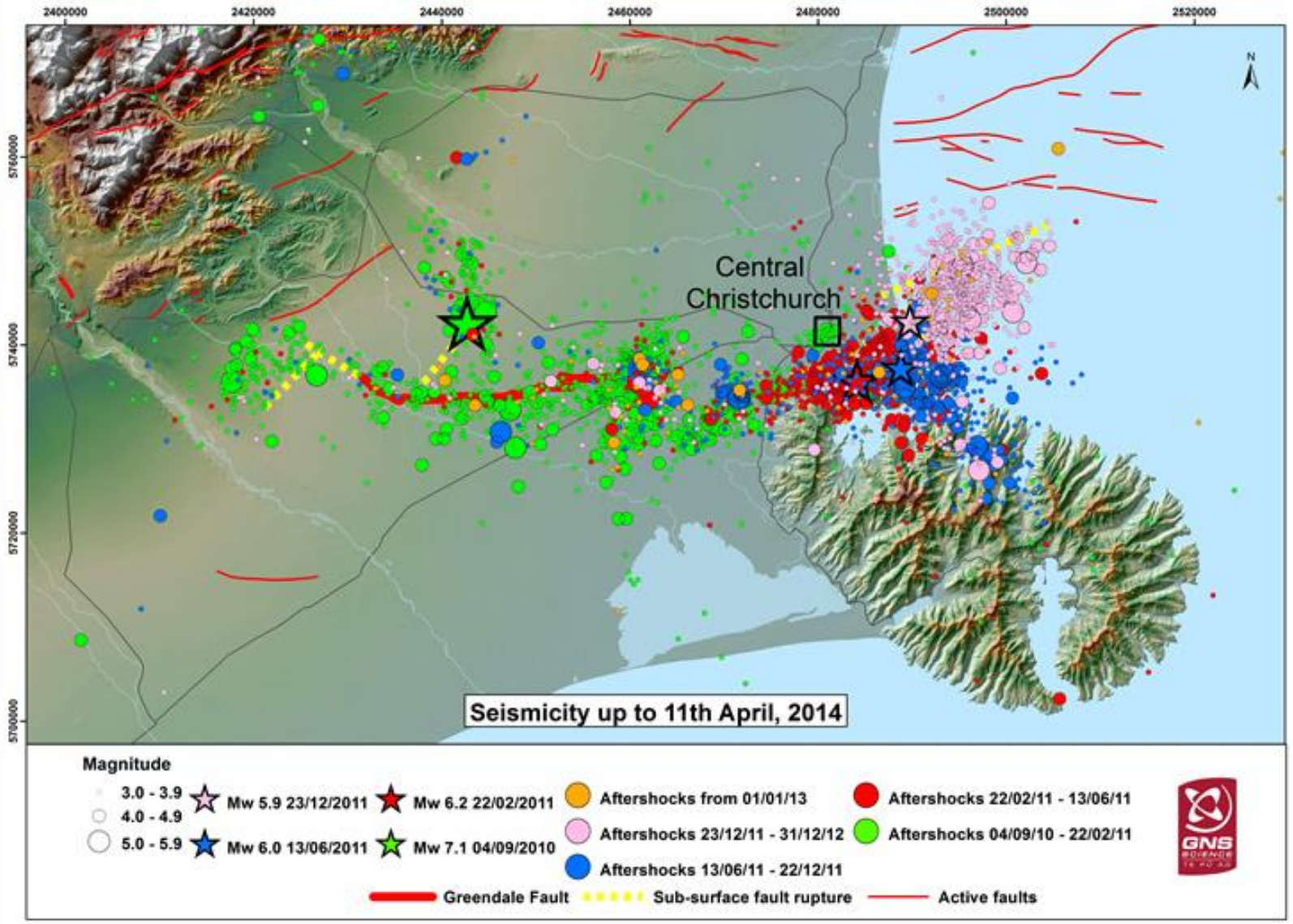
[Soma City, Fukushima Prefecture]
Construction : Feb. 2012 to Aug. 2012
Structure: Wooden flat compound for 12 houses



Canterbury Region, New Zealand
2010-2011 Earthquakes

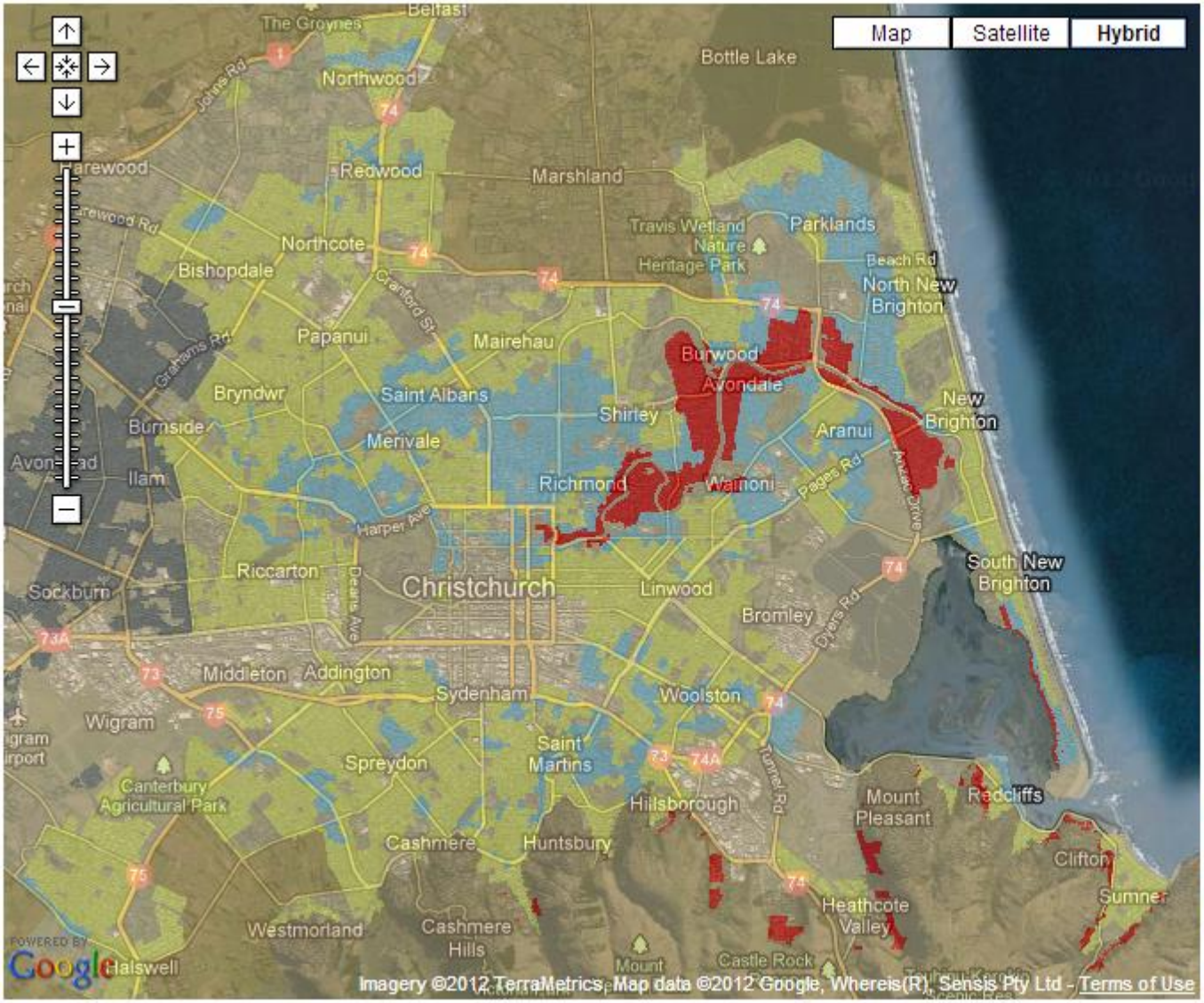
Dust cloud rising as building collapse in downtown Christchurch NZ on 2/22/11
Source: Gilly Needham

M7.1(9/4/10); M6.2(2/22/11); M6/M5.6(6/13/11); M5.9/M5.8 (12/23/11)



National Government-led “Red Zone” Buyout of >7,000 Homes and Significant Upgrades to Building Standards

http://cera.govt.nz/maps/technical-categories



Key

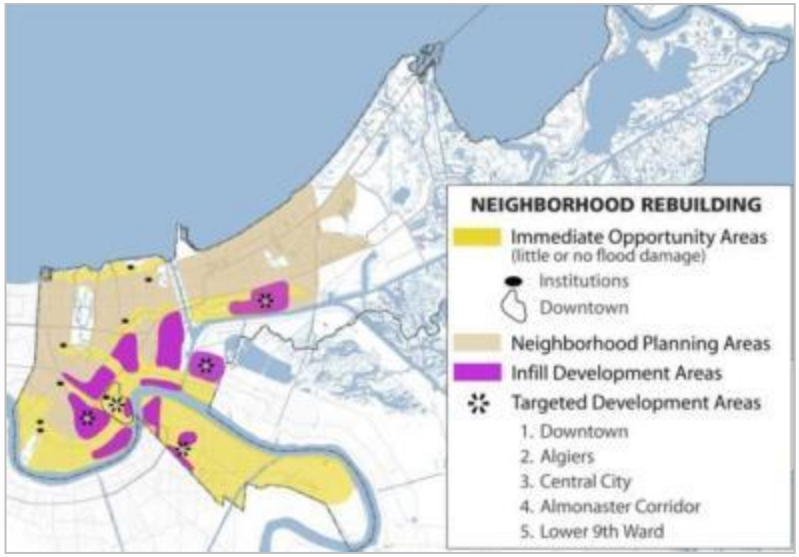
- Technical Category 1
  Future land damage from liquefaction is unlikely.
- Technical Category 2
  Minor to moderate land damage from liquefaction is possible in future significant earthquakes.
- Technical Category 3
  Moderate to significant land damage from liquefaction is possible in future significant earthquakes.
- N/A - Urban Nonresidential
- N/A - Rural & Unmapped
- Port Hills & Banks Peninsula
- Orange Zone
  Further assessment required.
- Red Zone
  Land repair would be prolonged and uneconomic.

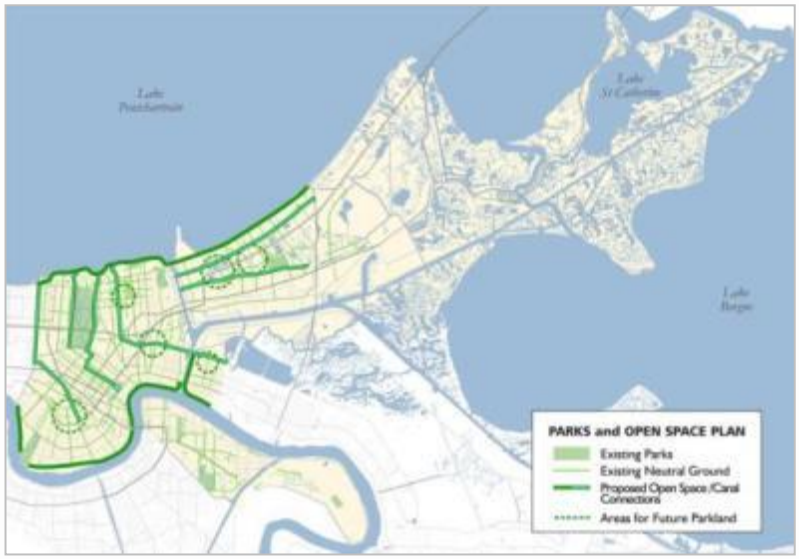
New Orleans, Louisiana

2005 Hurricane Katrina

http://commons.trincoll.edu/edreform/files/2012/05/flooding1.jpg

Bring New Orleans Back Commission's Proposed Recovery Plan January 2006





The Road Home
BUILDING A SAFER, STRONGER, SMARTER LOUISIANA

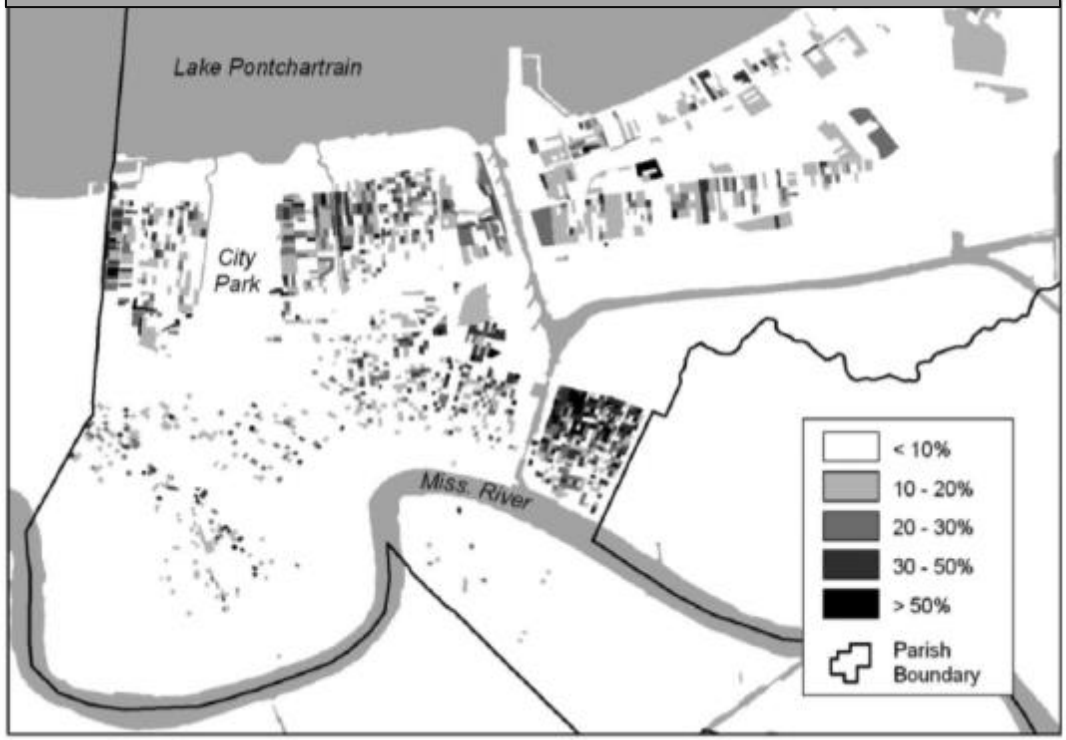
US$8.7 billion program
>128,000 participants (2011)

(Data from 123,917 closings as of July 2009):

>92% repairs, but 9,822 opted to sell home (20% of which left state)

In New Orleans, 4,683 homes sold increasing the pre-storm blight challenges of many neighborhoods

Sold Homes as a % of Owner-Occupied Households
(Green and Olshansky, 2012)



New York State
Post-Sandy Community Reconstruction Planning

Figure 3
Asset Inventory Worksheet

Asset Information							Landscape Attributes						
Asset Name	Address	Geographic Coordinates	Risk Area	Asset Class	Critical Facility	Community Value	**Erosion Rate:** Long-term average erosion rate ≥1 per year, or unknown	**Beach Width:** Waterline frequently at shore defense or upland vegetation	**Shore Defenses:** Absent, not constructed to anticipated conditions, below BFE, or deteriorating	**Protective Vegetation:** Dense, healthy vegetation, wetlands between asset and flood source absent	**Dunes or Bluffs:** Dunes absent, below BFE, discontinuous, eroding; Bluff slope unstable, partially vegetated	**Soils:** Asset located on a coastal barrier island or filled wetland	Additional Information

Table 2
Effect of Landscape Attributes on the Exposure of Assets

Landscape Attribute	Least Exposed	Most Exposed
Erosion Rate	Shoreline is accreting or minor erosion	Average annual shoreline erosion is 1 foot per year or more
Beach Width	The waterline is not in contact with shore defenses or upland vegetation or only in contact temporarily during storms	The waterline is in frequent or daily contact with shore defenses or upland vegetation
Shore Defenses	Constructed to anticipated conditions including storms and sea level rise and well maintained	Not constructed to anticipated conditions including storms and sea level rise or poorly maintained
Protective Vegetation	Healthy, dense upland or wetland vegetation, near the asset	Vegetation is sparse or distant from the asset
Dunes or Bluffs	Dunes are broad, above Base Flood Elevation, vegetated and have space to retreat. Bluff slope is stable and vegetated	Dunes are narrow and unvegetated, eroded (scarped), discontinuous, below Base Flood Elevation, or constrained by adjacent structures. Bluff slope is unstable and partially vegetated
Soils	Soils are stable and/or rocky	Sites of former wetlands that have been filled, or unconsolidated sand and fine sediment, or sandy coastal barriers

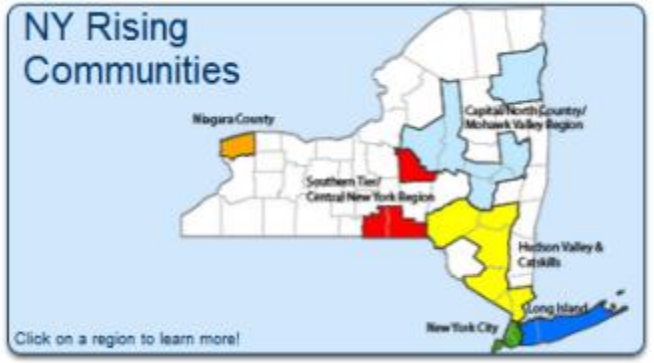
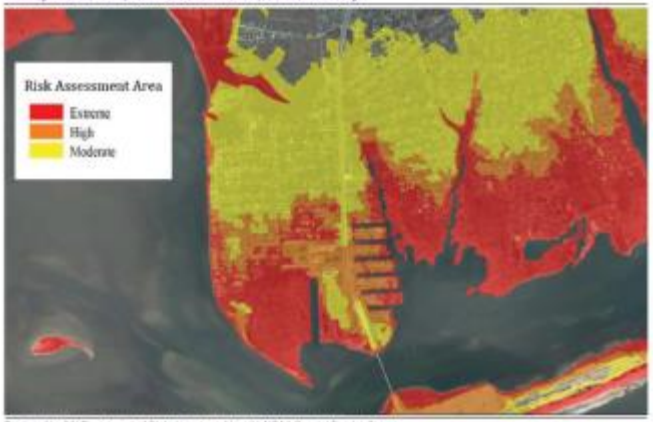
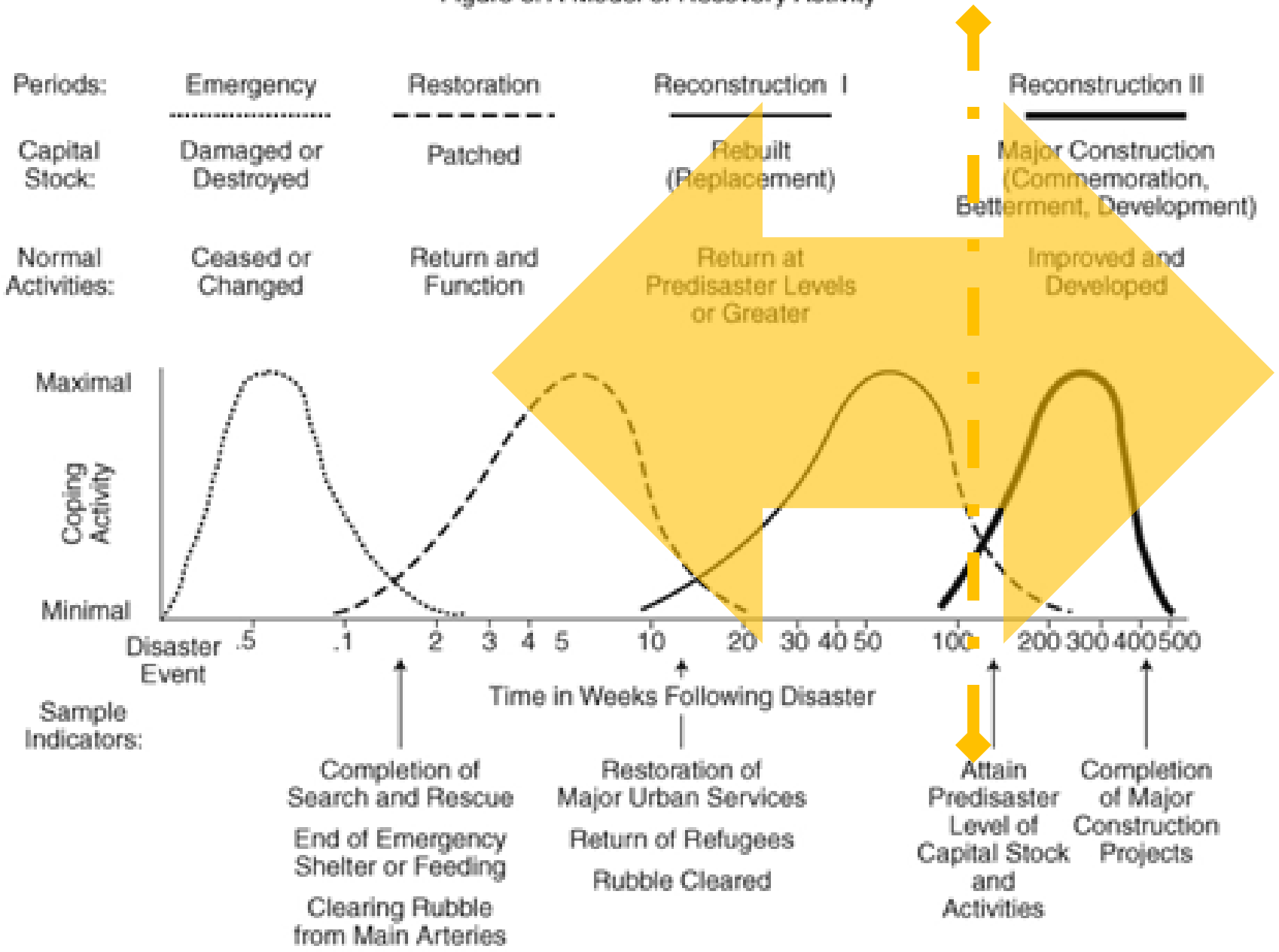


Figure 2
Shirley Mastic area, Town of Brookhaven, Suffolk County



Produced by NY Department of State in partnership with NOAA Coastal Service Center

Figure 6. A Model of Recovery Activity



(Source: Haas, Kates, and Bowden, 1977, Reconstruction Following Disaster)

Foundational Element 3. Strengthening governance capacity for community resilience and ensuring its sustainability.

Governance is "an intended activity undertaken by one or more actors seeking to shape, regulate or attempt to control human behavior in order to achieve a desired collective end."

(Jeroen van der Heijden, *Governance for Urban Sustainability and Resilience: Responding to Climate Change and the Relevance of the Built Environment*, 2014)

Three Key Governance Problems for Urban Sustainability/Resilience

(Jeroen van der Heijden, *Governance for Urban Sustainability and Resilience: Responding to Climate Change and the Relevance of the Built Environment*, 2014)

- Governments are slow to react to existing problems. It often takes a long time to develop and implement legislation and regulation and even longer for these to take effect.
- Introducing new legislation and regulation is often inconsequential. Cities (re)develop too slowly for most legislation and regulation to be meaningful.
- A “wicked set of market barriers” stand in the way of capitalizing the economic benefits that resilience can bring.

Getting Governance Right

(Jeroen van der Heijden, *Governance for Urban Sustainability and Resilience: Responding to Climate Change and the Relevance of the Built Environment*, 2014)

- Traditional governance – Direct regulatory interventions (regulation, subsidies, and taxes)
- Collaborative governance (networks, partnerships, and agreements and covenants)
- Voluntary programs and market-driven governance (best-of-class benchmarking and certification, tripartite financing, green leasing, contests and challenges, sustainable procurement)

Traditional vs. Collaborative Governance

(Innes and Booher, *Planning with Complexity*, 2010)

Traditional Governance	Collaborative/Network Governance
• More directive leadership model • Manager is organizer/controller. • Goals are clear, and success is attainment of the goals. • Linear/rational approach to planning • Public participation – Complies with legal requirements, educate the public, and obtain public support for proposals.	• More generative leadership model, creating conditions to bring teams together and help build collective capacity to learn about problems and find solutions together • Manager is a mediator and process manager • Goals are sometimes in conflict or likely to change as part of deliberation. Success is realization of collective action and capacity to adapt to change. • Non-linear approach to planning where goals may be revisited as part of analysis, policy development or implementation • Public participation – Engage in joint learning and deliberation; build public capacity for problem-solving and adaptation

Housing Affordability Crisis
Great Recession
"Dot com" Bubble
1991 Firestorm
1989 M6.9 EQ
World War II
Great Depression
1906 M7.8 EQ and Fire
1868 M6.8 EQ

Laurie Johnson PhD AICP Consulting | Research

nen Neighborhood Empowerment Network

Cal OES GOVERNOR'S OFFICE OF EMERGENCY SERVICES

Association of Bay Area Governments
Celebrating 50 Years of Service to the Region

CA.GOV Alfred E. Alquist SEISMIC SAFETY COMMISSION

SPUR IDEAS AND ACTION FOR A BETTER CITY
a member-supported nonprofit organization

san francisco card Building a Disaster-Resilient Community

Economy, Networks and Supply Chains

PEER PACIFIC EARTHQUAKE ENGINEERING RESEARCH CENTER

EERI Earthquake Engineering Research Institute
Dedicated to reducing earthquake risk

California Building Standards Commission

nehrp

California Environmental Quality Act

FloodSmart.gov The official site of the NFIP

CALIFORNIA COASTAL COMMISSION

bcdc San Francisco Bay Conservation and Development Commission

CGS CALIFORNIA GEOLOGICAL SURVEY

USGS science for a changing world

CAL FIRE

Physical Environment

Value of the NIST Disaster Resilience Framework

- Framework is a policy tool for defining and implementing a robust and defensible approach to resilience building at the community-level
- Opportunity to improve community-level hazard and risk characterization
- Opportunity to improve land use, building and infrastructure standards and practices, adoption and implementation
- Leverages the "Whole Community" – Collaboration on a "Large-scale": multi-disciplinary, multi-governmental, and non-governmental partnerships and alliances

Requires SUSTAINABILITY (political will, technical and financial resources, collaboration, metrics)

Resilience is formed through the interdependencies that evolve from established societal patterns and the work of building resilience both pre- and post-disaster

Thank you!

Email: laurie@lauriejohnsonconsulting.com

Windy Hill Open Space Preserve, Portola Valley, CA

http://activerain.com/image_store/uploads/3/0/3/3/1/ar12702101313303.jpg