Mitigation and Recovery Projects in California

NTHMP Meeting
Mitigation and Education Subcommittee

July 25, 2018

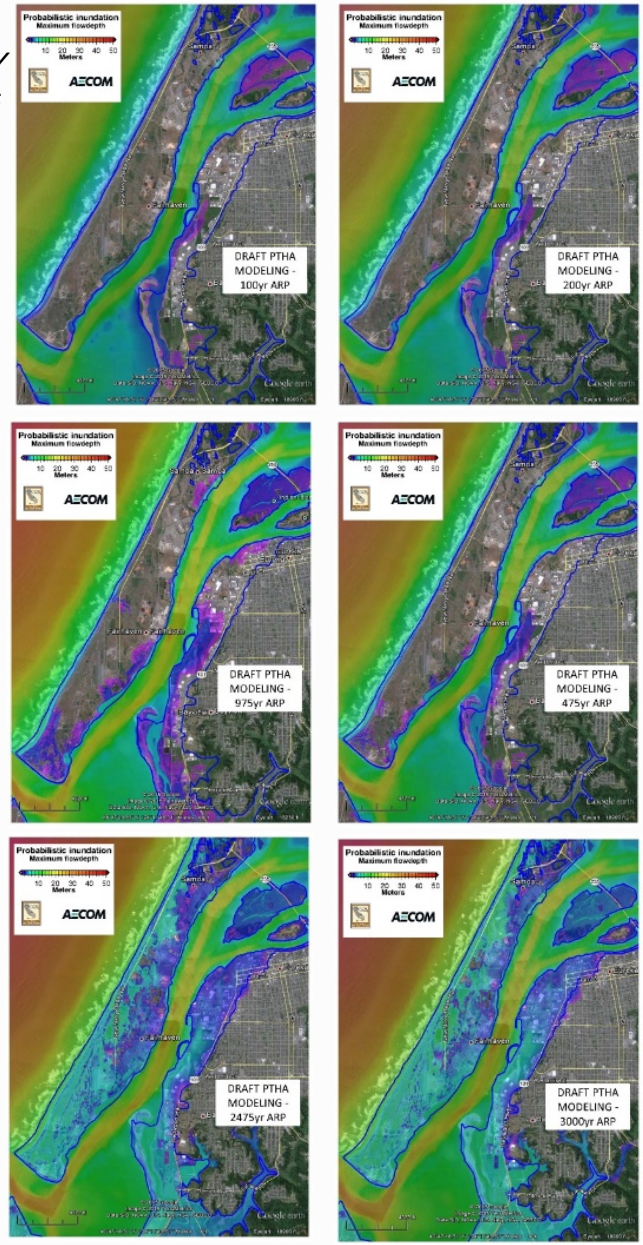
California Geological Survey
California Governor's Office of Emergency Services
California Coastal Commission
USC AECOM LJCR

Federal Emergency Management Agency

PRELIMINARY Model Results

AECOM for CGS (2015-18)

Probabilistic Tsunami Hazard Analysis in Humboldt Bay; blue line is 2009 state inundation map line



New Probabilistic Tsunami Hazard Maps

Single-set of accurate Probabilistic Tsunami Hazard Analysis maps/products for multiple applications:

- California Geological Survey – "zones of required investigation" and resulting mitigation measure through the Seismic Hazard Mapping Act (start 2019).

- California Building Standards Commission – maps for Tsunami Design Zones for use in the 2019 update to the California Building Code, for essential (schools) and critical facilities (hospitals) (new maps available 2018; possibly code implementation 2019).

- CalOES – for evaluating and updating existing tsunami inundation maps for evacuation planning, assisting communities with vertical evacuation structure planning and land-use planning (initiated).

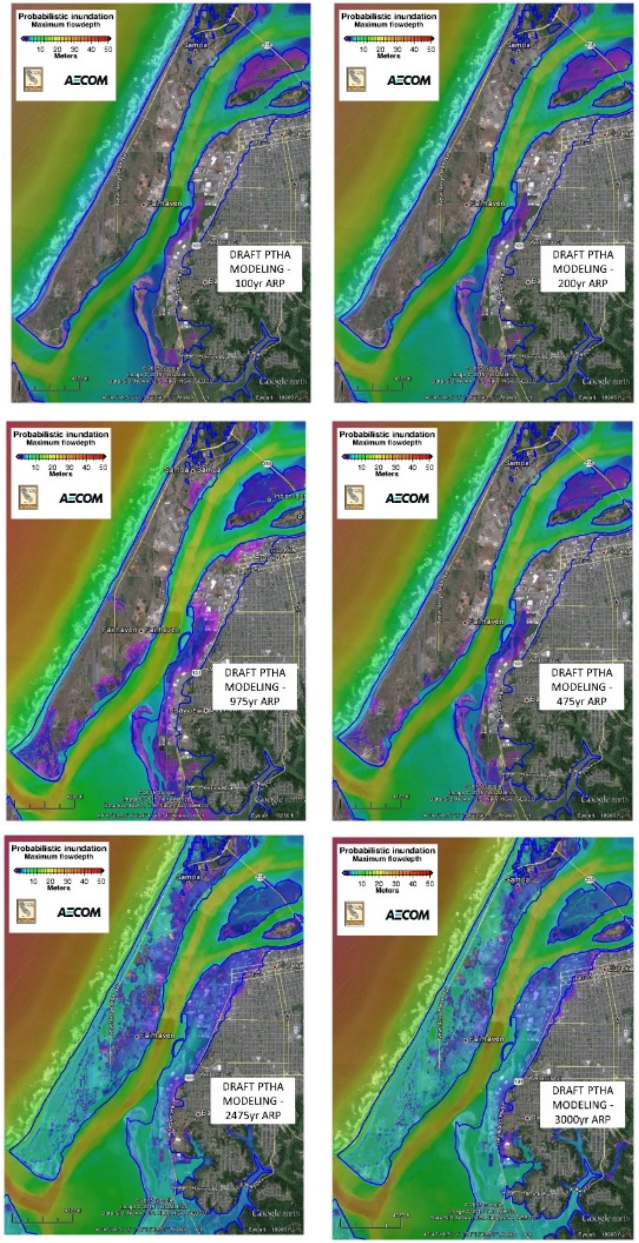
- Federal Emergency Management Agency – RiskMAP products as equivalent and comparison to existing Flood Insurance Rate Maps, and HAZUS runs (some data provided 2018).

- **Additional benefits and uses for community and state-level planning (initiated)**

PRELIMINARY Model Results

AECOM for CGS (2015-18)

Probabilistic Tsunami Hazard Analysis in Humboldt Bay; blue line is 2009 state inundation map line



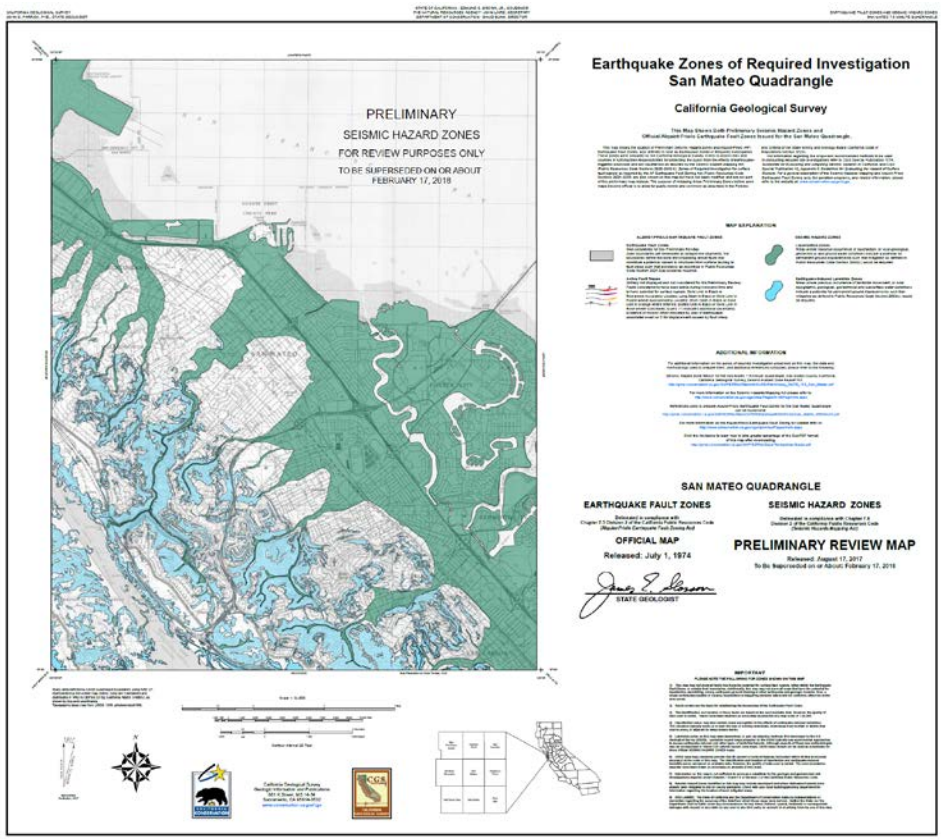
New Probabilistic Tsunami Hazard Maps

Application to Seismic Hazard Mapping

- Following the April 25, 1992 Cape Mendocino Magnitude 7.2 earthquake, language was added to the SHM Act to address hazards related to tsunamis and seiches.

- SECTION 2692.1: The State Geologist may include tsunami maps/zones/planning when "information becomes available" and that "information is appropriate for use by local government."

- Project regulations for cities/counties:
  - Regulate certain development projects within zones.
  - Require site-specific analysis of hazard and provide mitigation strategy for life-safety.
  - Require sellers of real property within a mapped hazard zone to disclose at the time of sale that the property lies within such a zone.



New preliminary Seismic Zone Maps for San Mateo County. Tsunami Hazard Zones may be added to these maps in the future.

Pedestrian Evacuation for Time to Safety

- USGS Hazard Vulnerability Team – running pedestrian evacuation model for 475, 975, 2475yr data
- Compare evacuation data to tsunami travel times to determine population vulnerability
- "Time to safety" provides context for Seismic Hazard Zone creation

Draft pedestrian evacuation model results for Harbor Island, San Diego Bay (yellow=0-15min; orange=15-30min; red>30min)

County	Local	Cascadia	Alaska-Aleutians
Del Norte	10 min	10 min	4.0 hr
Humboldt	10 min	10 min	4.1 hr
Mendocino	10 min	30 min	4.2 hr
Sonoma	15 min	40 min	4.4 hr
Sonoma (bay)	1.0 hr	1.5 hr	5.2 hr
Marin	15 min	50 min	4.6 hr
Marin (bay)	40 min	1.2 hr	5.0 hr
San Francisco	20 min	1.0 hr	4.8 hr
Alameda (bay)	40 min	1.2 hr	5.0 hr
Napa (bay)	1.2 hr	1.7 hr	5.4 hr
Solano (bay)	1.3 hr	1.8 hr	5.5 hr
Contra Costa (bay)	50 min	1.3 hr	5.1 hr
Santa Clara (bay)	1.2 hr	2.0 hr	5.8 hr
San Mateo	20 min	1.2 hr	5.0 hr
San Mateo (bay)	40 min	1.2 hr	5.0 hr
Santa Cruz	10 min	1.4 hr	5.1 hr
Monterey	10 min	1.5 hr	5.2 hr
San Luis Obispo	15 min	1.8 hr	5.5 hr
Santa Barbara	10 min	2.0 hr	5.7 hr
Ventura	10 min	2.1 hr	5.8 hr
Los Angeles	15 min	2.2 hr	6.0 hr
Orange	15 min	2.3 hr	6.1 hr
San Diego	15 min	2.5 hr	6.3 hr

Approximate tsunami travel times for local, Cascadia, and Alaska-Aleutians sources to each county along the coast

Consequence Guidance on ASCE* Risk Categories of Buildings for Building Code and Other Construction

*American Society of Civil Engineers

Risk Category I	**Up to 2 persons affected** **(e.g., agricultural and minor storage facilities, etc.)**
Risk Category II	**Approximately 3 to 300 persons affected** **(e.g., single/multi-family structures, office buildings, condominiums, hotels, etc.)**
Risk Category III	**Approximately 300 to 5,000+ affected** **(e.g., Public assembly halls, arenas, high occupancy educational facilities, some public utility facilities, etc.)**
Risk Category IV	**Over 5,000 persons affected** **(e.g., hospitals and emergency shelters, emergency operations centers, first responder facilities, air traffic control, toxic material storage, etc.)**

1 mile/1.6 kilometer
ASCE Tsunami Design Zone and California PTHA Inundation Zone for Huntington Beach Area
2,475yr ARP (CA)
2,475yr ARP (ASCE)
Data USGS
Google Earth

Example of Potential Performance-based Approach Using New PTHA Maps

Risk level (in years ARP)	Annual rate of exceedance	Response/ Evacuation	Mitigated	Structure Specific in Building Code			
				Operational	Immediate Occupancy	Life Safety	Collapse Prevention
100	40% in 50yr		FEMA FIRM	Building Risk Cat. IV	Building Risk Cat. III	Building Risk Cat. II	
200	22% in 50yr						
475	10% in 50yr		Seismic Hazard Mapping Act and FEMA FIRM				
975	5% in 50yr	CalOES	Seismic Hazard Mapping Act and Caltrans				
2475	2% in 50yr	CalOES	Seismic Hazard Mapping Act		Vertical Evacuation Buildings	Building Risk Cat. IV	Building Risk Cat. III and II (over certain height)
3000	1.67% in 50yr	CalOES					

All risk levels will be available for use by communities for Local Coastal Plans (LPCs), the California Coastal Commission for evaluating LCPs, and in the HAZUS analysis applications.

Ongoing and Future PTHA Work

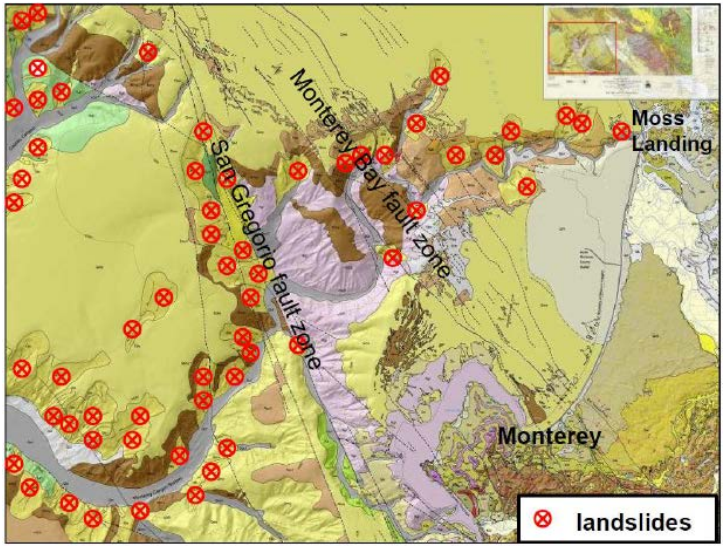
Short Term Goals (2018-19)

- Work with counties/communities updating evacuation plans, Local Hazard Mitigation Plans, and Local Coastal Plans using the new PTHA maps.
- Form Technical and Application Advisory Committees
- Develop SHMA tsunami zone criteria and guidelines
- Revise SHMA Regulations to include tsunami hazards
- Work with CA Building Code users in tsunami zone
- Develop overarching guidance for multiple uses (performance based approach)

Newport Elementary School, Balboa Peninsula, Newport Beach

Longer Term Goals (2019-future)

- Integrate into next ASCE guidance and CA Building Code
- Evaluate local probabilistic sources (offshore seismic and landslides)
- Re-evaluate and improve distant probabilistic sources
- Work with other states and national programs to develop and use PTHA



Initial inventory of landslides in Monterey Bay (source: CGS)

Page 3 of Maritime Tsunami Response and Mitigation Playbooks

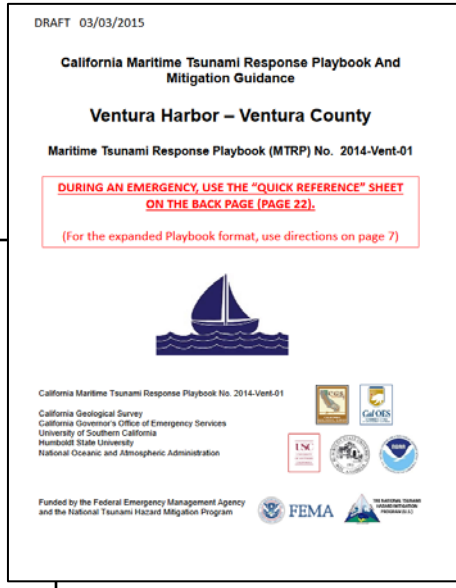
Mitigation Measures for Reducing Impacts in Maritime Communities

Real-time response ("soft") mitigation measures

- Reposition ships within harbor
- Move boats and ships out of harbors
- Remove small boats/assets from water
- Shut down infrastructure before tsunami arrives
- Evacuate public/vehicles from water-front areas
- Restrict boats from moving during tsunami
- Prevent boats from entering harbor during event
- Secure boat/ship moorings
- Personal flotation devices/vests for harbor staff
- Remove hazardous materials away from water
- Remove buoyant assets away from water
- Stage emergency equipment outside affected area
- Activate Mutual Aid System as necessary
- Activate of Incident Command at evacuation sites
- Alert key first responders at local level
- Restrict traffic entering harbor; aid traffic evacuating
- Identify/Assign rescue, survey, and salvage personnel
- Identify boat owners/live-aboards; establish phone tree, or other notification process

Permanent ("hard") mitigation measures

- Increase size and stability of dock piles
- Fortify and armor breakwaters
- Replace flotation portions of docks and dock cleats
- Increase flexibility of interconnected docks
- Improve movement along dock/pile connections
- Increase height of piles to prevent overtopping
- Deepen/Dredge channels near high hazard zones
- Move docks/assets away from high hazard zones
- Widen size of harbor entrance to prevent jetting
- Reduce exposure of petroleum/chemical facilities
- Strengthen boat/ship moorings
- Construct flood gates
- Prevent uplift of wharfs by stabilizing platform
- Install debris deflection booms to protect docks
- Ensure harbor structures are tsunami resistant
- Construct breakwaters further away from harbor
- Install Tsunami Warning Signs
- Identify equipment/assets (patrol/tug/fire boats, cranes, etc.) to assist response activities


DRAFT 03/03/2015

California Maritime Tsunami Response Playbook And Mitigation Guidance

Ventura Harbor – Ventura County

Maritime Tsunami Response Playbook (MTRP) No. 2014-Vent-01

DURING AN EMERGENCY, USE THE "QUICK REFERENCE" SHEET ON THE BACK PAGE (PAGE 22).

(For the expanded Playbook format, use directions on page 7)

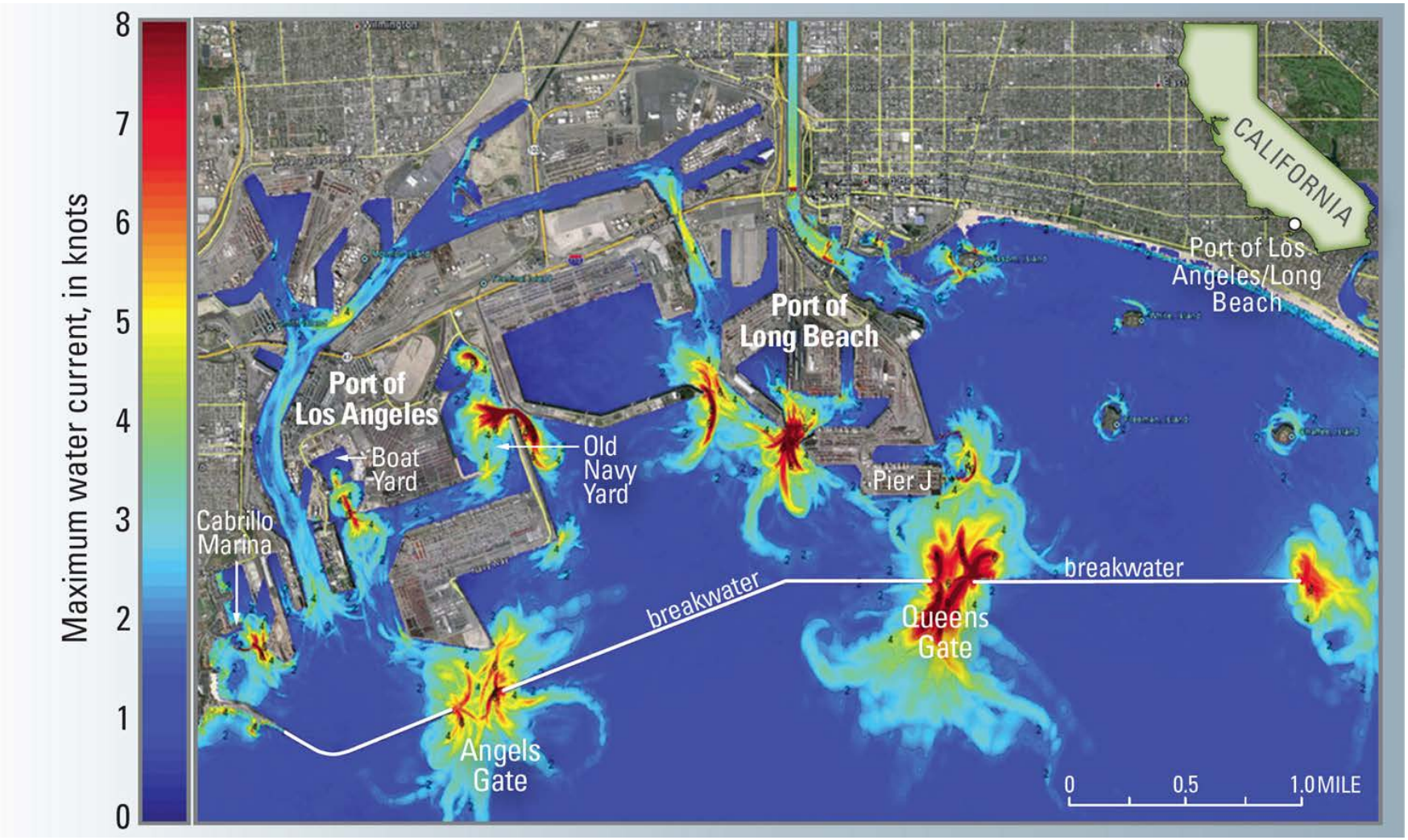
California Maritime Tsunami Response Playbook No. 2014-Vent-01

California Geological Survey
California Governor's Office of Emergency Services
University of Southern California
Humboldt State University
National Oceanic and Atmospheric Administration

Funded by the Federal Emergency Management Agency and the National Tsunami Hazard Mitigation Program

FEMA

Harbor Damage Assessments

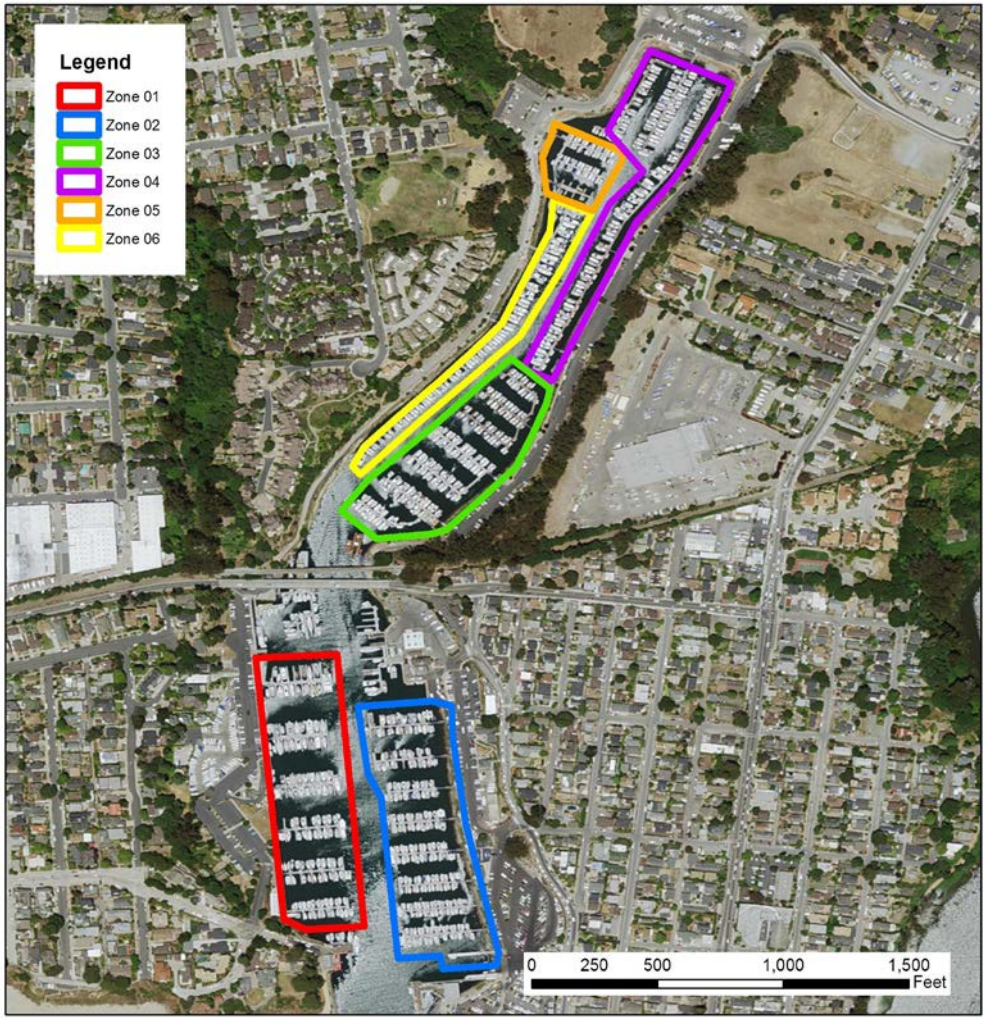


These modeling results describe the hazard level, but what about the *vulnerability*?

For this we move towards an engineering analysis, attempting to quantify the potential damage to various components at different hazard levels, and develop "Harbor Improvement Reports" for mitigating hazards

Harbor Improvement Reports

Tsunami Damage Assessments



Map of Santa Cruz Harbor identifying failure potential study zones.

Cleat Damage Estimate

Tsunami Event	Zone					
	1	2	3	4	5	6
2010 Magnitude 8.8 Chile Event (Historical)	Low	Low	Low	Low	Low	Moderate
Magnitude 9.0 Cascadia Scenario	Moderate	Moderate	Low	Moderate	Low	High
2011 Magnitude 9.0 Japan Event (Historical)	Low	Low	Moderate	Moderate	Low	Moderate
Magnitude 9.4 Chile North Scenario	Low	Moderate	Moderate	Moderate	Low	Moderate
Magnitude 9.2 Eastern Aleutian-Alaska Scenario	Moderate	Moderate	Moderate	Moderate	Moderate	High

Pile Guide Damage Estimate

Tsunami Event	Zone					
	1	2	3	4	5	6
2010 Magnitude 8.8 Chile Event (Historical)	Low	Low	Low	Low	Low	Moderate
Magnitude 9.0 Cascadia Scenario	Moderate	Moderate	Moderate	Moderate	Low	High
2011 Magnitude 9.0 Japan Event (Historical)	Moderate	Low	High	Moderate	Low	Moderate
Magnitude 9.4 Chile North Scenario	Moderate	Moderate	High	Moderate	Moderate	Moderate
Magnitude 9.2 Eastern Aleutian-Alaska Scenario	High	Moderate	Moderate	Moderate	Moderate	High

Keen, Adam S., et al. "Monte Carlo–Based Approach to Estimating Fragility Curves of Floating Docks for Small Craft Marinas." Journal of Waterway, Port, Coastal, and Ocean Engineering (2017): 04017004.

Harbor Improvement Reports

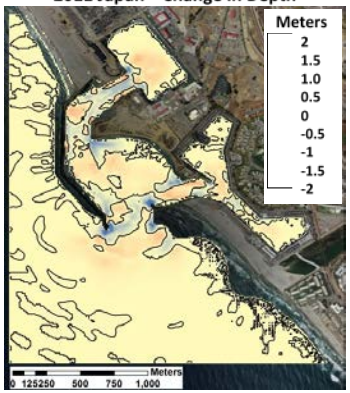
Sediment Movement Analysis

Model the sediment erosion, transport, and deposition during a tsunami

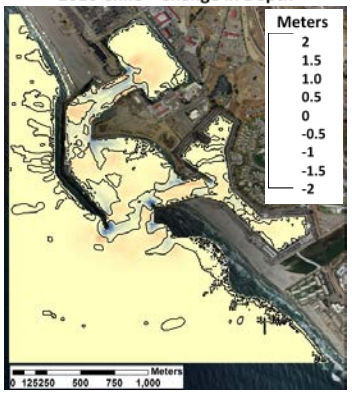
HIRs and possibly Playbooks will include maps of seafloor elevation change for a set of scenarios

Identify likely areas of high scour and areas of high deposition, where vessel clearance and long-term recovery issues post-tsunami may arise

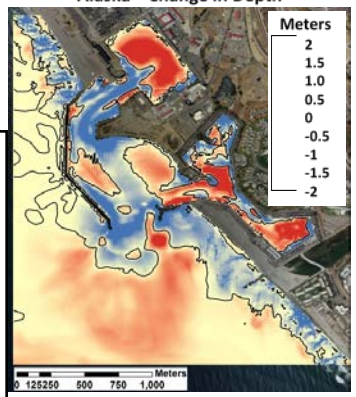
2011 Japan – Change in Depth



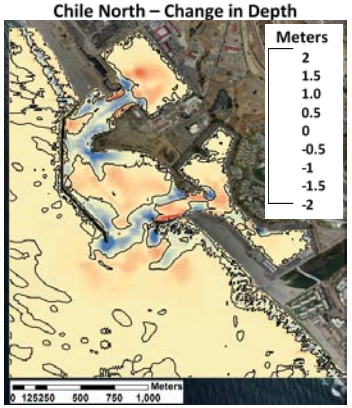
2010 Chile – Change in Depth



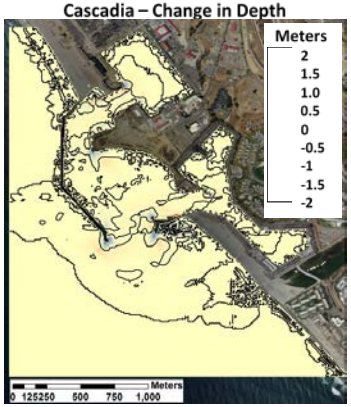
Alaska – Change in Depth



Chile North – Change in Depth



Cascadia – Change in Depth



Harbor Improvement Reports

Debris Movement Assessments

Using engineering analysis, we know approximately when to expect damage to initiate in ports and marinas

Potential debris mapping provides an estimate of the likely location of debris during and immediately after a tsunami

Harbor Improvement Reports (HIRs)

- Detailed harbor hazard analysis, includes Local Hazard Mitigation Plan Section with specific mitigation measures for direct input
- Recommendations address multiple hazards, including tsunami, sea-level rise, and storm surge for harbors
- Collaborate with harbor and community to get HIRs into LHMPs and request funding
- Contacted harbors about active 2017-18 Hazard Mitigation Grant Program funding opportunity available in CA (winter storms, fires, debris flows)

Harbor Improvement Report

Maritime Tsunami and Coastal Hazard Mitigation Guidance
For Harbor Engineers and Emergency Managers

Noyo Harbor – Mendocino County
Harbor Improvement Report (HIR) No. 2017-Mendo-01

Draft Completed June/2017

By California Geological Survey
University of Southern California
California State Lands Commission
California Governor's Office of Emergency Services

Funded through a Cooperative Technical Partnership with the Federal Emergency Management Agency

FEMA

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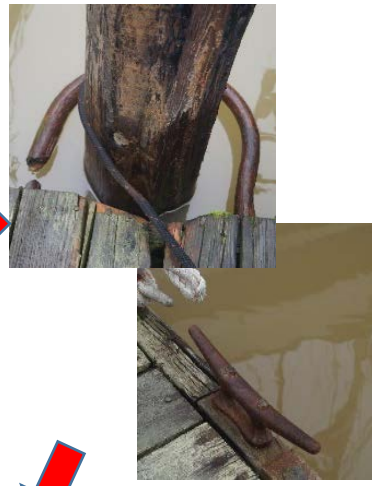

Model Run	Dock								
	A	B	C	D	E	F	G	H	I
Magnitude 9.2 Eastern Aleutian-Alaska Scenario	Moderate	High	High	High	High	Moderate	Moderate	Moderate	Low
Magnitude 9.0 Cascadia Scenario	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low
2010 Magnitude 8.8 Chile Event (Historical)	Low	Moderate	Low	Low	Low	Low	Low	Low	Low
Magnitude 9.4 Chile North Scenario	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low
2011 Magnitude 9.0 Japan Event (Historical)	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Low

Description of Mitigation Activity	Prioritization (High, Medium, Low) and Timeframe	Hazards Addressed	Responsible Agency	(B/C) Benefits-Costs (TF) Technical Feasibility
Maintain and/or replace old cleats and mooring lines for all docks within the harbor.	High Short term	Tsunamis		B/C: Cleat and mooring line failures are common during moderate to large tsunamis, but the cost of replacing these features is relatively minor. TF: Replacing cleats and mooring lines is a simple process.

Harbor Improvement Reports (HIRs)

Table format from FEMA's "Local Mitigation Planning Handbook"

Specific mitigation measure categories for funding request include:

tsunami education materials
reduce exposure of chemical containers
cleats and mooring lines
assessment and protections
response plans
harbor inspections
dock pile guides
sediment and debris movement
reinforcing fuel docks
dock pile extenders
critical infrastructure

Description of Mitigation Activity	Prioritization (High, Medium, Low) and Timeframe	Hazards Addressed	Responsible Agency	(B/C) Benefits-Costs (TF) Technical Feasibility
Maintain and/or replace old cleats and mooring lines for all docks within the harbor.	High Short term	Tsunamis		B/C: Cleat and mooring line failures are common during moderate to large tsunamis, but the cost of replacing these features is relatively minor. TF: Replacing cleats and mooring lines is a simple process.
Maintain and/or replace old dock pile guides with the harbor.	High Short term	Tsunamis; Extreme tides		B/C: Dock pile guides are a common point of failure during tsunamis where strong surges and moderate water-level fluctuations occur. The cost of replacing pile guides is minor to moderate. TF: Replacing all or part of the pile guides is a simple process.
Install dock pile extenders on piles less than ____ feet.	Medium Short term	Tsunamis; Potential long-term sea-level rise		B/C: Pile extensions may be costly but they may be required to address sea-level rise in the long term in order to keep the harbor functional. TF: Although feasible, installing pile extenders will take time and likely shut down the docks being worked on for a period of time.

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California Harbor Notice of Interest (NOI) Applications for October 2017 Wildfires (DR-4344)

1. **Richmond/Marina Bay** (Contra Costa County)
   a. replacement of existing components on the docks (cleats and pile guides)
   b. ongoing maintenance items at the marina
   c. wave attenuator (around $2 million)
2. **Oceanside** (San Diego County)
3. **Ft. Bragg** (Mendocino County)

Supporting analysis:

- BCA > 1.0 (for vertical evac. structure)
- **<u>Harbor & Pier Improvement Reports</u>**
- Maritime Playbook Reports
- Probabilistic Tsunami Hazard Analysis

Crescent City Harbor

2006:	Damaged by Kurile Islands Tsunami	$20 Million
2011:	Destroyed by Japan Tsunami	$30 Million
2014:	Resilient Harbor Completed	

KQED Science NEWS PROGRAMS & BLOGS EDUCATION RESOURCES

Three Years After Disaster, Crescent City Sports a New 'Tsunami-Resistant' Harbor

By Craig Miller
MARCH 11, 2014

PRINT SHARE

Crescent City is 1st tsunami-resistant port on West Coast

By David Perlman Updated 7:32 am, Saturday, March 22, 2014

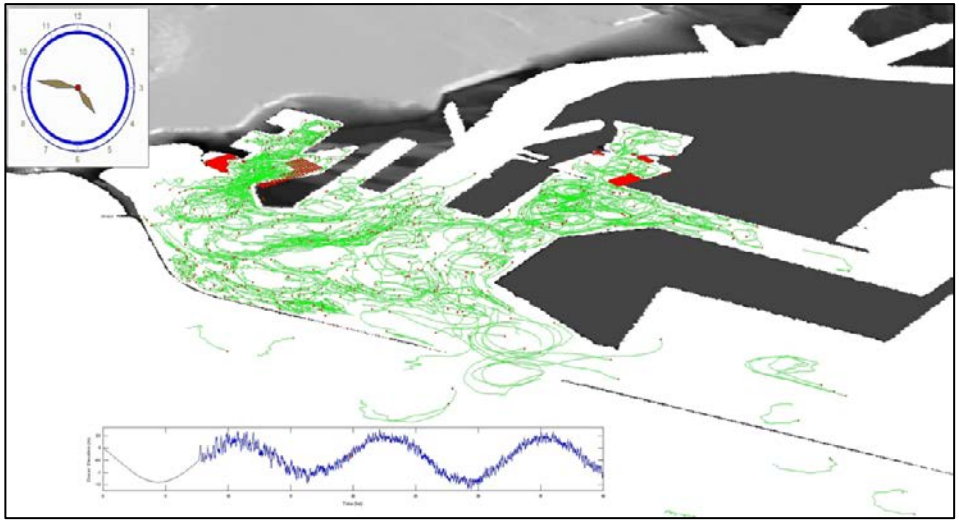
USA TODAY San Francisco Chronicle

California city building 'tsunami-resistant' port

AP Published 11:18 p.m. ET Nov. 22, 2012 | Updated 4:17 a.m. ET Nov. 23, 2012

- 36-inch piles designed to survive tsunami forces, erosion, and overtopping.
- Need to re-drive/replace piles avoided
- Docks may float away and be replaced.
- Project design life requirement was for a 50-year tsunami recurrence interval.
- Robustness, resiliency and redundancy were key attributes of the dock system.
- Saving money and recovery time in future tsunamis

Maritime Tsunami Recovery Guidance



Model of potential debris movement in Port of Los Angeles during large Alaska tsunami; can use this information to determine where debris will accumulate

March 2014: Rebuild in "tsunami resistant" Crescent City Harbor

Guidance for harbors, communities, and state to produce recovery plans for large local- (Cascadia) and distant-source events.

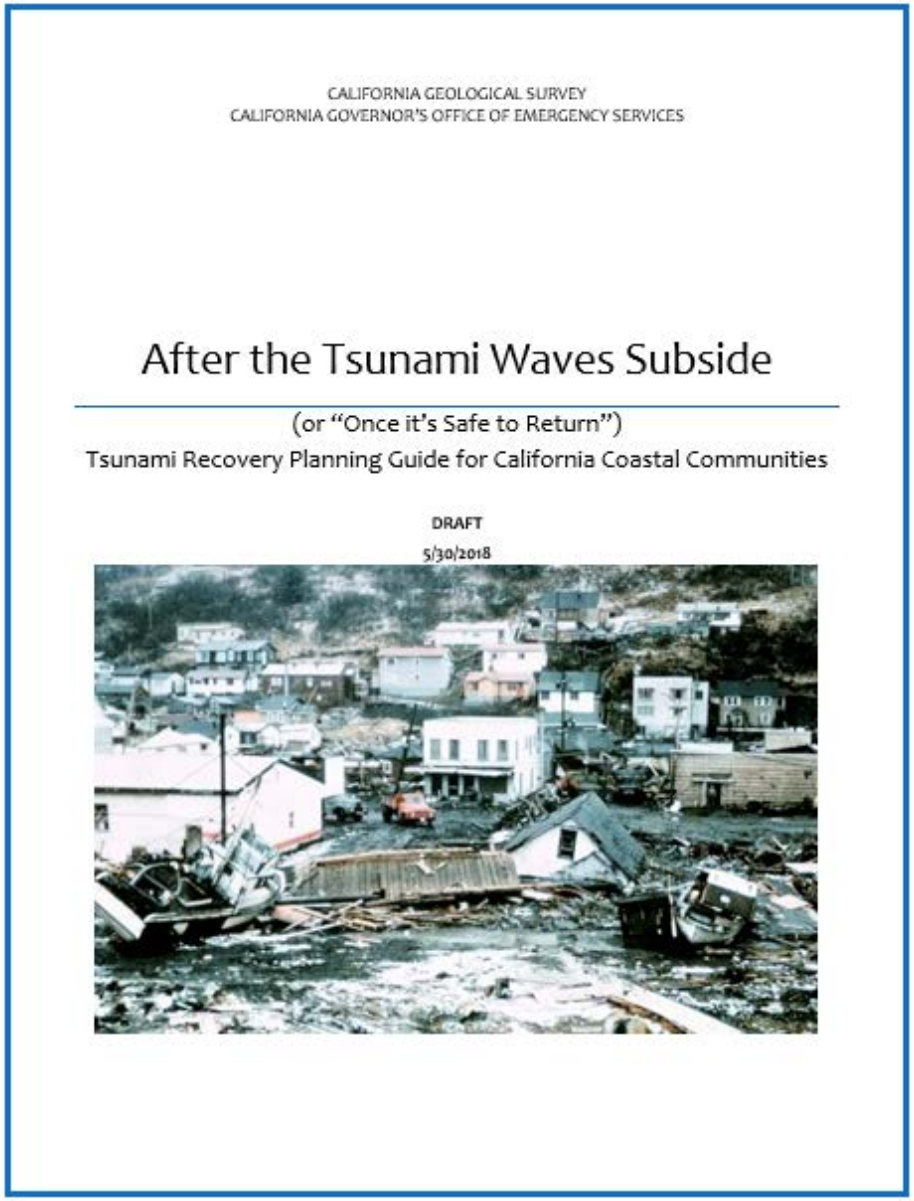
Direct Impacts (Damage):

- Vessels, docks, and harbor infrastructure damage
- Permanent land change in large local source EQ
- Debris in water and on land
- Sedimentation and scour
- Contaminants in water and sediment

Indirect Impacts (Time):

- Commercial fishing and shipping disruption
- Waterfront business disruption
- Regulatory redundancy and delays
- Limited resources and funding for recovery
- Loss of business and workforce over time

Community Recovery Guidance Document for Tsunamis



CALIFORNIA GEOLOGICAL SURVEY
CALIFORNIA GOVERNOR'S OFFICE OF EMERGENCY SERVICES

After the Tsunami Waves Subside

(or "Once it's Safe to Return")

Tsunami Recovery Planning Guide for California Coastal Communities

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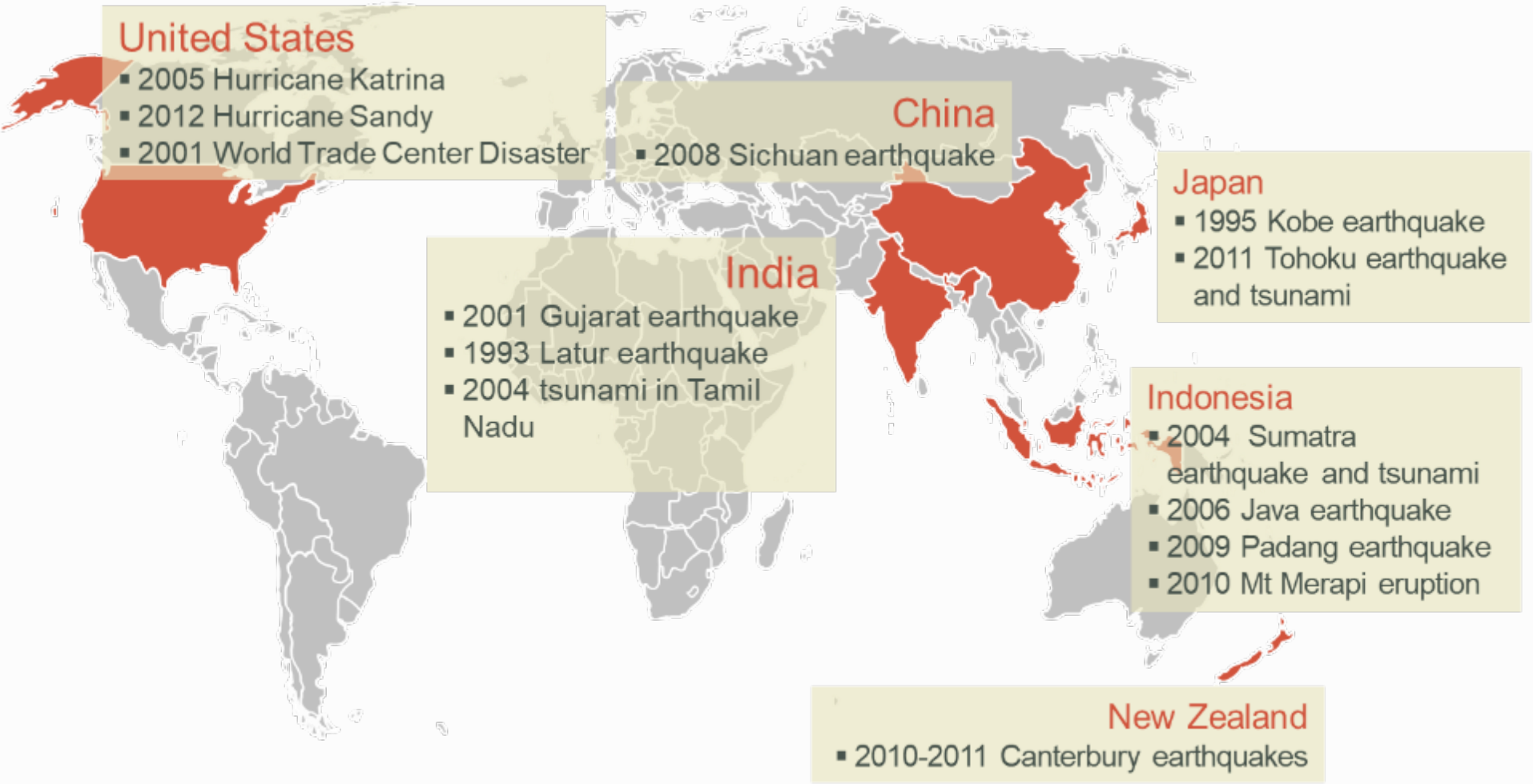
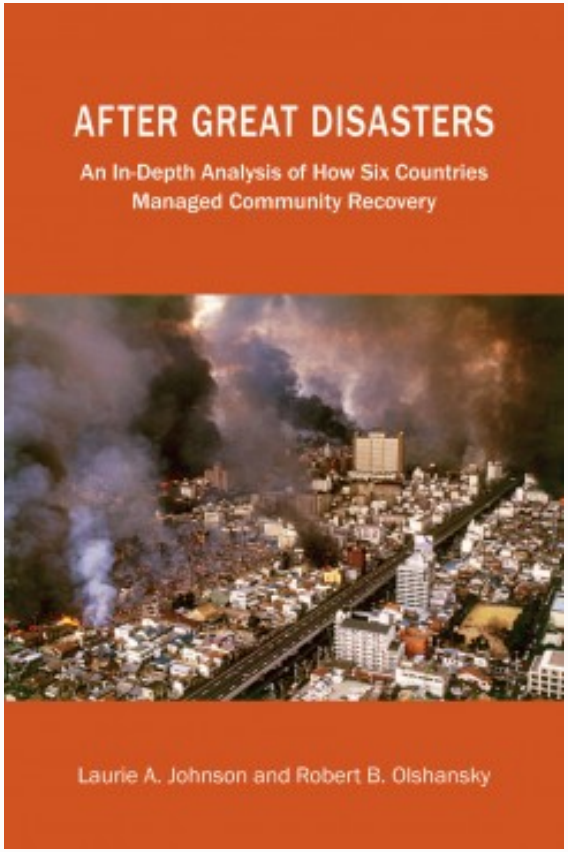
5/30/2018

After Great Disasters: An In-depth Analysis of How Six Countries Managed Community Recovery

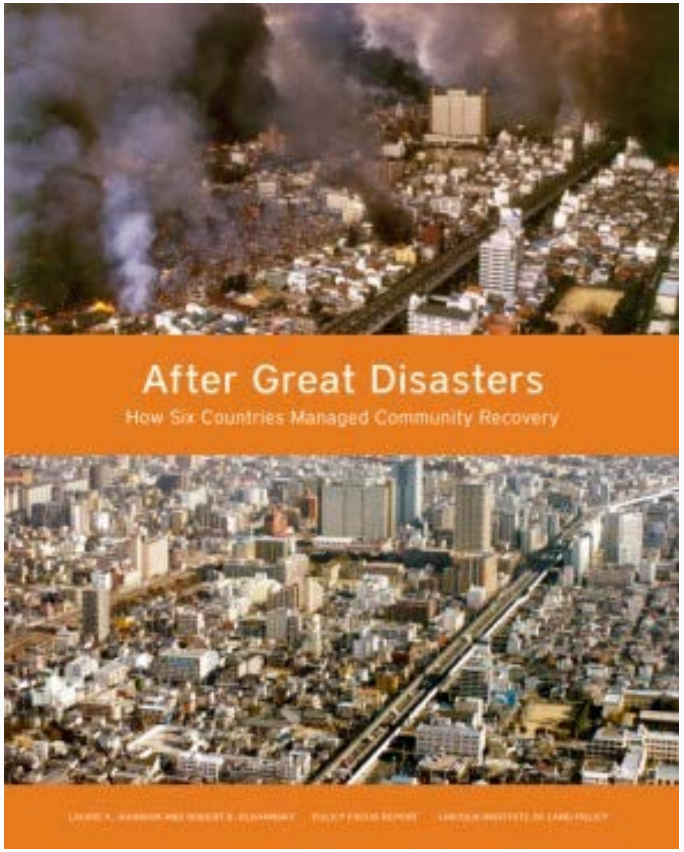


Free for download:

Book



Policy Focus Report



Lincoln Institute of Land Policy

http://www.lincolninst.edu/publications/

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5. Implementation Considerations

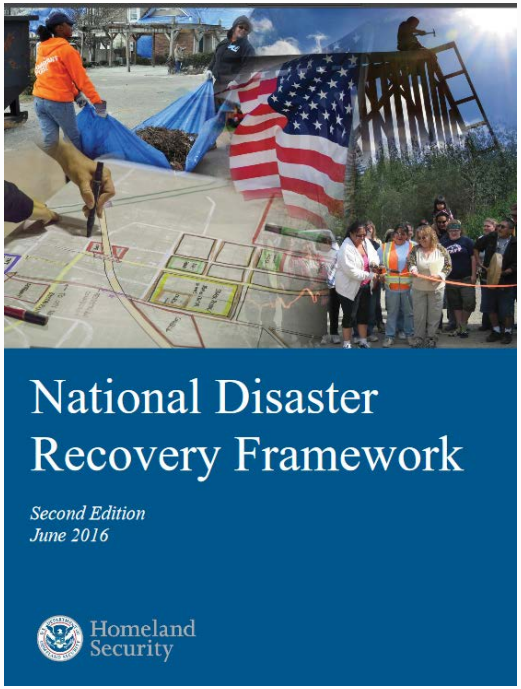
- Managing Recovery
- Financial Considerations
- Monitoring Recovery Progress
- Key Resources

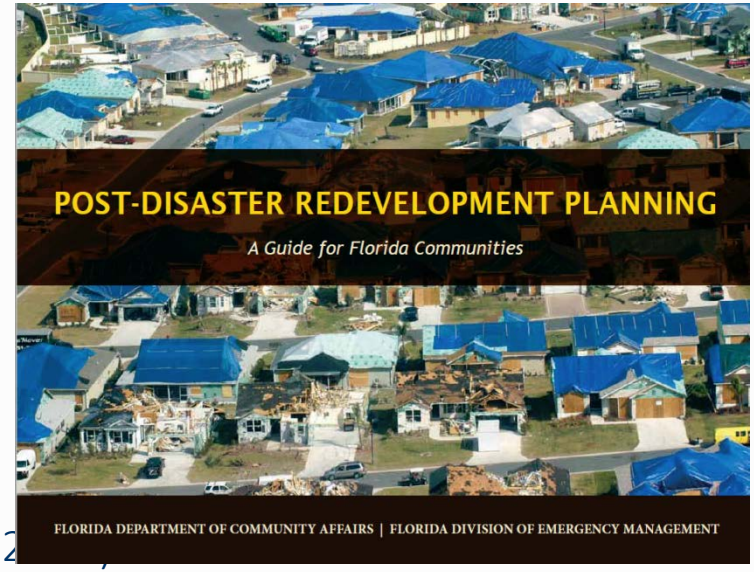
6. Additional Resources

7. References

Key Resources

- National Disaster Recovery Framework (FEMA, 2nd edition 2016)
- Pre-disaster Recovery Planning Guide for Local Governments (FEMA, February 2017)
- Post-disaster Redevelopment Planning: A Guide for Florida Communities (Florida Department of Community Affairs, 2010)
- Planning for Post-disaster Recovery: Next Generation (American Planning Association, 2014)
- (DRAFT) California Disaster Recovery Framework
- SAFRR Tsunami scenario (USGS) and Cascadia scenario (CREW)
- California Cascadia Subduction Zone Earthquake and Tsunami Response Plan (US DHS, FEMA Region IX, and Cal OES, September 2





Question: What other resources would you recommend?

2. Assessing Tsunami Risk in Your Community

- California's Tsunami Hazards
  - Time-Critical Near-Shore Tsunami Sources
  - Distant Tsunami Sources
  - California Tsunami Inundation Maps
  - California Probabilistic Tsunami Hazard Data
  - ASCE tsunami provisions for structures
- Community Exposure and Vulnerability to Tsunami Hazards
  - People at Risk of Tsunamis
  - Buildings, Businesses, Infrastructure and Other Assets at Risk
  - Analyzing risk and estimating losses (i.e. using Hazus)
- How Does Tsunami Risk Compare to Other Hazards?
- Completing a Community Tsunami Risk Assessment
- Key Resources

Question: What other data or tools should be highlighted?

3. Disaster Recovery and Recovery Planning

- Overview of Recovery and the Recovery Planning Process
- Initiating the Planning Process
- Organizing Public Participation
- Conducting Research and Analysis
- Facilitating Input
- Implementing the Plan
- Value of Recovery Planning
- Nexus between Recovery Planning, Local Coastal Planning, General Plan Safety Elements, Local Hazard Mitigation Plans and Other Planning Efforts
- Preparing for a Community Tsunami Recovery Planning Effort
- Key Resources

STEPS	KEY ACTIVITIES
Form a Collaborative Planning Team	Define collaborative planning team and scope of planning activities
	Develop and implement partner engagement strategy
Understand the Situation	Determine community risks, impacts, and consequences
Determine Goals and Objectives	Assess community's capacity and identify capability targets
Develop the Plan	Determine leadership positions and define operations necessary
	Establish processes for post-disaster decision-making and policy setting
Prepare, Review, and Approve the Plan	Write the local pre-disaster recovery plan
	Approve the pre-disaster recovery plan and associated regulations
Implement and Maintain the Plan	Identify ongoing preparedness activities

FEMA 2017

Questions: What additional planning efforts should be covered?

4. Tsunami Recovery Plan Topics, Tasks and Challenges

- Natural Environment
- Community Damage Assessment and Clearance
- Land Use and Post-Disaster Planning
- Housing
- Infrastructure and Public Facilities
- Health and Social Services
- Economy

Questions: What other planning topics should be covered?

Natural Environment

- Areas of Concern: Bays and estuaries, Beaches, Wetlands, Rivers, and Marine Life
- Potential Impacts: Coastal flooding (currents and extreme fluctuations), erosion and scour, sedimentation, free-floating debris, coseismic effects, long-term climate change effects
- Recovery Topics – Environmental Contamination, Environmental and Historical Site Review, Habitat Restoration, Green Rebuilding
- Key Resources

Achievement Levels Used in this Guide

Essential. Any items marked as essential achievement level are suggested to be undertaken first in tsunami recovery planning.

Enhanced. If resources are available, these items should be addressed in the next planning cycle.

Advanced. These items are for communities to commence after a solid foundation for hazard mitigation and disaster recovery is already established.

Japan (2011)

- Inundated area: 560km^2
- Liquefaction and Fire

Boston Globe

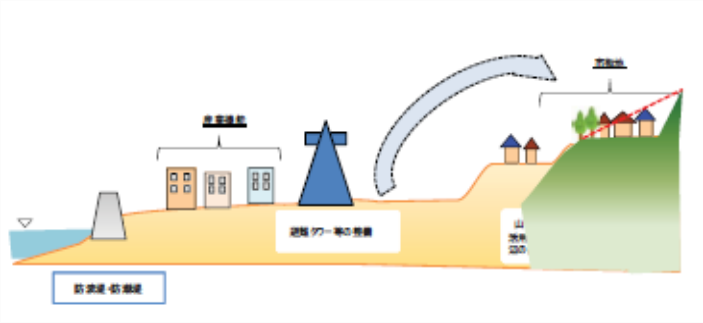
Prof. Yasuda, Tokyo Dentsu University

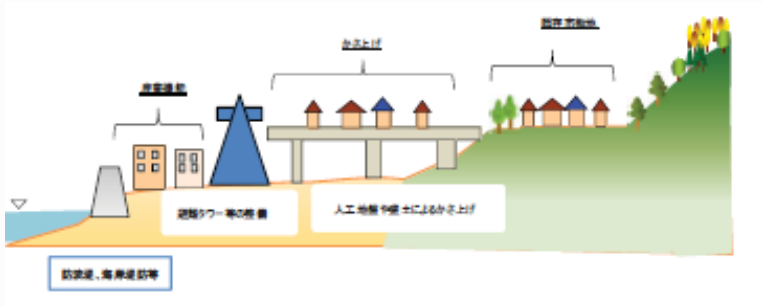
Land Use and Post-Disaster Planning

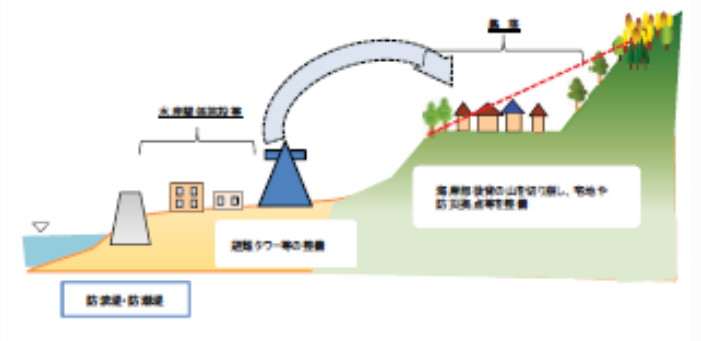
- Areas of Concern: Tsunami inundation areas; Repair and rebuilding policies, procedures and standards; Land use planning and development regulations; Environmental review and historic preservation
- Potential Impacts: Land loss and reuse challenges; Building repair and rebuilding challenges; Financing for repairs and rebuilding challenges
- Recovery Topics: Prioritizing areas for post-disaster planning; Incorporating hazard mitigation and resilience into recovery; Retreat and buyout programs; elevating structures; standards for substantially damaged structures and non-conforming uses; Streamlined permitting and expedited review; Environmental review, Historic preservation and restoration; Large-scale reconstruction and redevelopment; Managing blight
- Key Resources

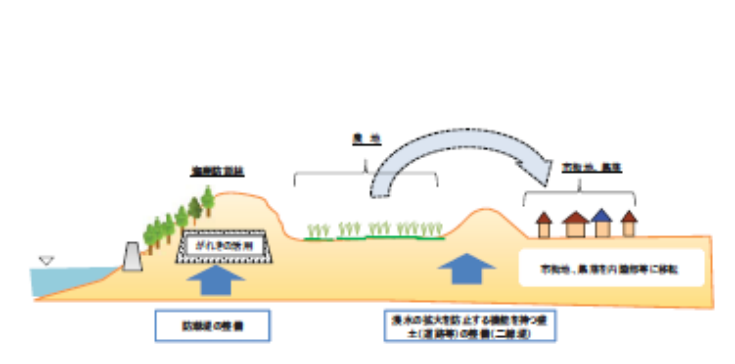
Japan (2011)

- First, national gov't initiated recovery visioning (June 2011)
  - Key Principles
    - Primacy of local governments
    - **Two-level disaster mitigation approach (Structural & Non-Structural)**
    - Models on reconstruction in different geographic areas



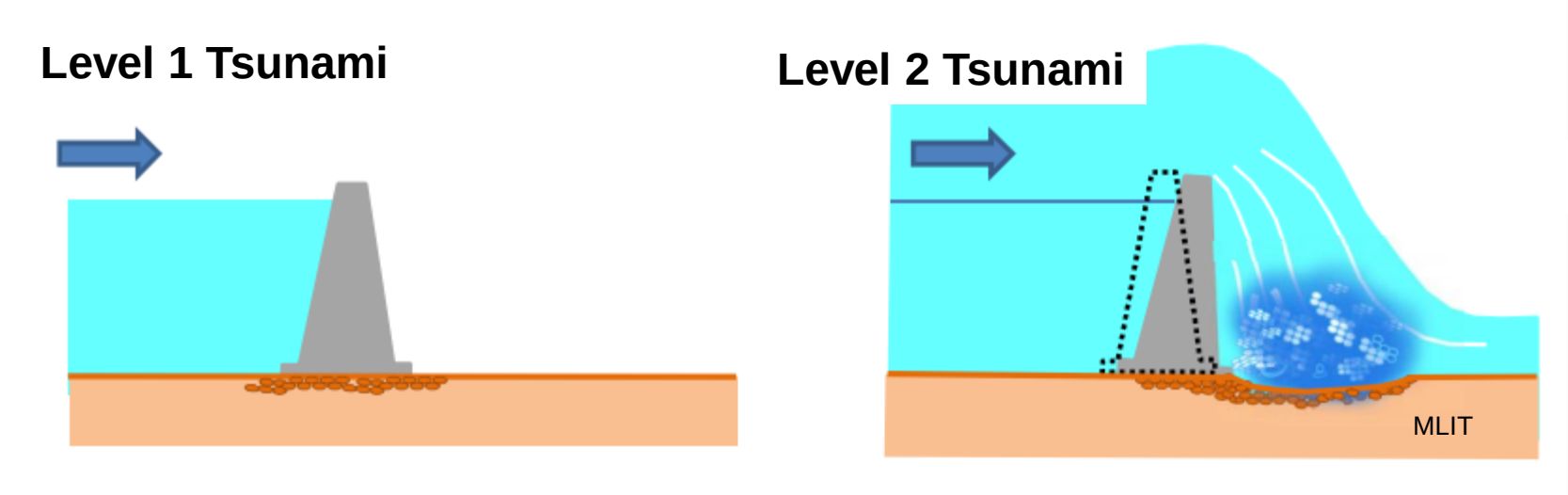






- Second, basic principle (concept) to cope with “tsunami” risk was nationally introduced:
  - Rebuilding to protect land and people against Level 1 and Level 2 tsunami

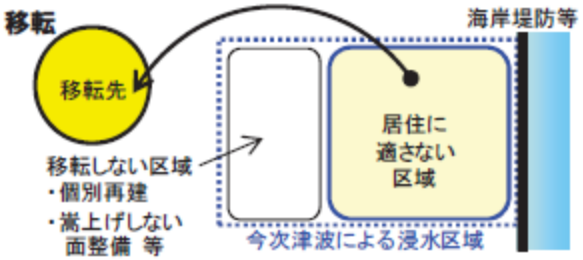
Level 1 tsunami	Level 2 Tsunami
Frequency •once every 1/10 ～ 1/100 years	**Frequency** •Once every 1/100 ～1/1000 years
Structural approach •Constructing levees	**Structural + non-structural approach** •Levee construction and **land use** regulations



– Details on land use were also strategized at national level

A. Relocation

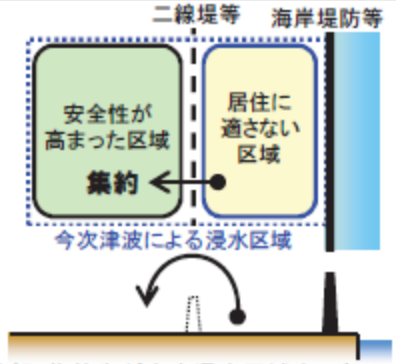
今次津波による浸水区域の中で、居住を認めない区域を設定し、浸水区域外へ住宅を移転。



・移転跡地等の沿岸部で、産業系用途のため整備（嵩上げがある場合を含む）が行われる場合も集団で移転する場合はAとする。
・海岸堤防等の整備に伴い移転が生じた場合は、集団的な移転のための移転先が計画的に確保される場合はAとする。

B. Aggregating on site

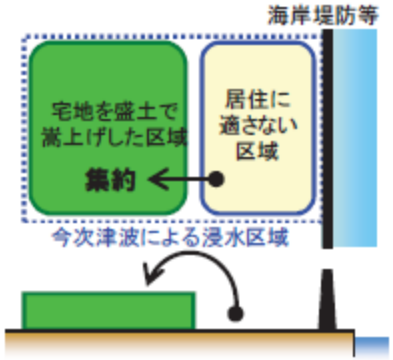
今次津波による浸水区域の中で、海岸堤防や二線堤等の整備により津波に対する安全性が高められた区域に居住地を集約。



・住宅の移転・集約先が今次浸水区域内であっても、農地等が間にあるなど被災区域から離れている場合は、Aとする。

C. Aggregating with land raising

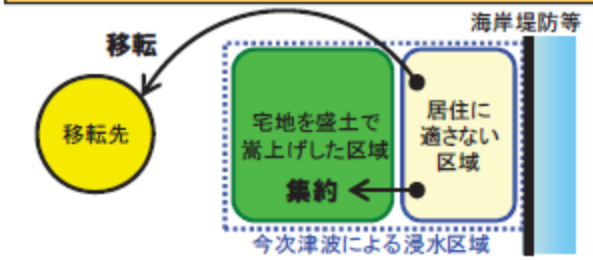
上げし、そこに居住地を集約。



・今回分類では、住宅用地について行われる宅地の嵩上げを「嵩上げ」として分類。
・地盤沈下への対応や内水排除を目的とするもの、あるいは個別の敷地単位で行われるものは、今回分類での「嵩上げ」には含まない。

D. Relocating & Raising

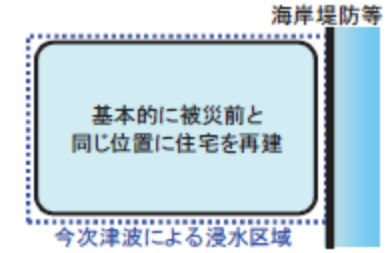
移転と嵩上げの組合せ。住宅の区域外への移転と、区域内での嵩上げ区域への集約を同時に実施。



・移転と嵩上げが同時に計画されている場合で、いずれか一方の住宅地の規模が明らかに大きい場合は、大きい方を主としてA又はCに分類する。

E. *In Situ* rebuilding

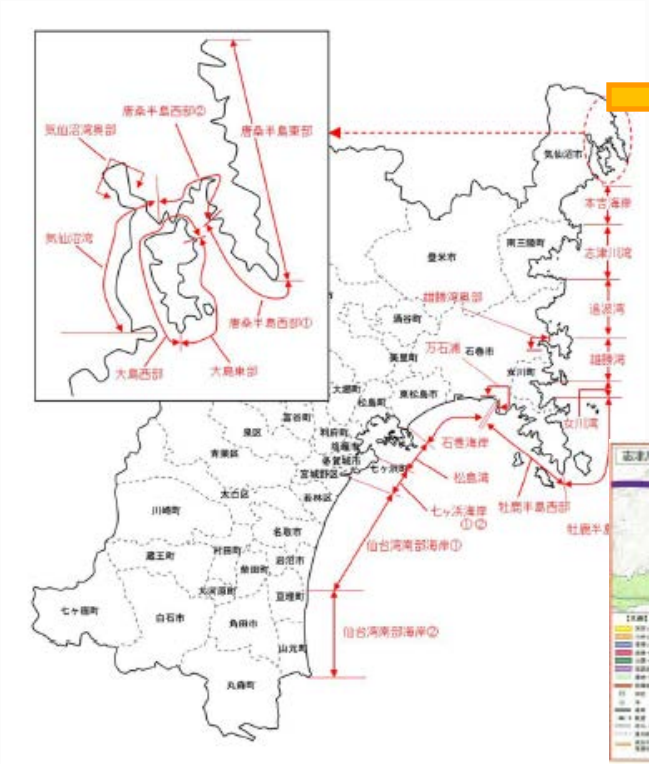
海岸堤防等の整備により津波に対する安全性を確保した上で、基本的に被災前と同じ位置に住宅を再建。



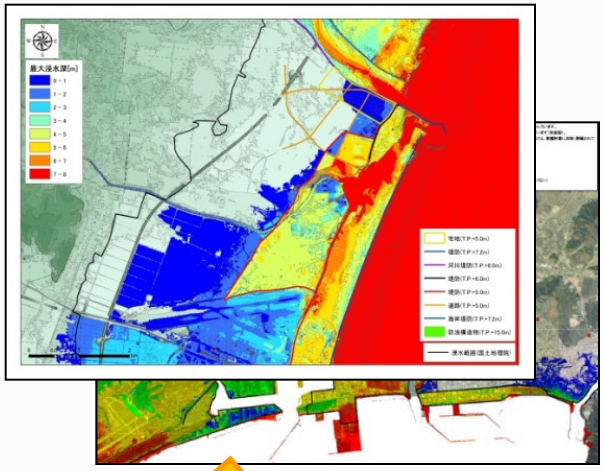
・市街地の面的な整備が行われる場合で、その目的が海岸堤防等施設の整備や道路等の基盤整備であり、津波対策としての土地利用の再編や宅地の嵩上げが行われない場合は、Eとする。

Source: MLIT

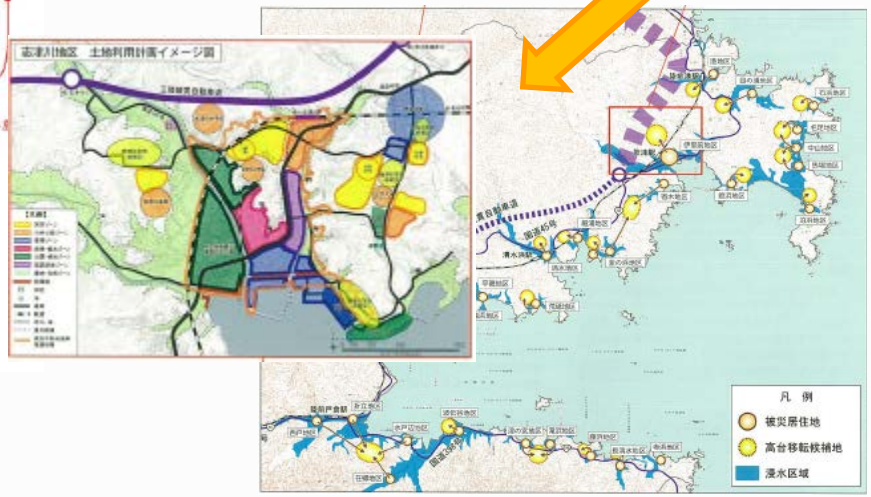
- Third, prefecture and municipalities quickly crafted plans, with a focus on tsunami risk management
  - Focused on levee heights and associated land use
  - By Dec. 2011, Prefectural (6) and local governments(43) recovery plans finished



Miyagi Prefecture

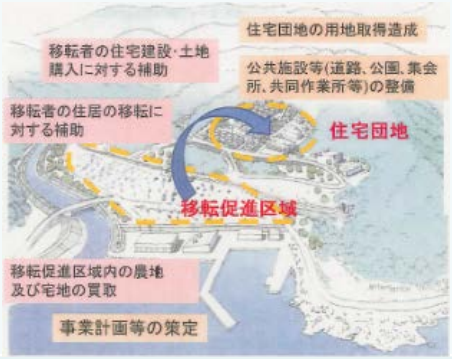


Natori City



Minami Sanriku Town

- Prefectures and local governments decided on reconstruction programs identified by the national government, including:

Land use and housing programs	Project Scheme, responsibilities	
Land Readjustment program	【municipalities】 Raise coastal land to safe level against level 1 tsunami 【individuals】 Adjust former land use to new one by the owners, constructing houses	
Collective relocation program	【municipalities】 Collectively relocate coastal communities inland or hillsides; land construction 【individuals】 housing construction by individuals	
Public housing program	【municipalities】 Prepare houses for those who can not afford to pay for new homes with the former two programs 【individuals】 Monthly payment upon living	

Source: http://www.kantei.go.jp/fukkou/organization/reconstructiongrant.html

Housing

- Areas of Concern: Temporary and interim housing, Long-term housing
- Potential Impacts: Land loss and reuse challenges, Flood inundation and scouring effects, Contamination and mold issues, Building repair and rebuilding challenges, Financing for repairs and rebuilding challenges
- Recovery Topics: Plan for interim housing, Expedited post-disaster permitting and inspection processes, Rapid repairs and rebuilding, Incorporate mitigation into rebuilding, Affordable housing Resource and financing assistance, NFIP Flood Insurance and Community Rating System programs
- Key Resources

Questions: Comments about the general approach and content?

- Public housing (apartment complex)

- Completed Jan 2015
- First public housing in Kesennuma City

Photo: K. Iuchi

- Collective relocation

First community to decide collective relocation program in Kesennuma city

Photo: K. Iuchi

Photo: K. Iuchi

Most of the former neighbors decided to relocate and rebuild together

- Mixed relocation – collective relocation + public housing

Photo: K. Iuchi

5. Implementation Considerations

- Managing Recovery – Leadership and Decisionmaking, Organizational Structure, Public and Stakeholder Involvement
- Financial Considerations – Public and private resources, NFIP, FEMA Public Assistance, Links to long-term capital planning
- Monitoring Recovery Progress
- Key Resources

Questions: Comments about the general approach and content?

Discussion Questions

- *Who has done or is preparing a state disaster recovery framework?*
- *Who has or is incorporating tsunami scenarios/hazards into disaster recovery planning?*
- *Who is incorporating tsunami hazards into coastal planning?*

Discussion Questions

- *What other data or tools should be highlighted?*
- *What additional planning efforts should be covered?*
- *What other planning topics should be covered?*
- *Comments about the general approach and content of the document?*
- *Comments about the level-approach to task descriptions?*

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