

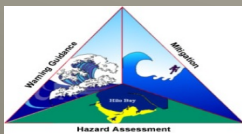
State & National Tsunami Hazard Mitigation Programs... Increasing our Nation's Overall Resilience to Tsunamis



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NTHMP Mitigation & Education Subcommittee Co-Chair



Washington Military Department

Emergency Management Division



WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

***Why Prepare United States
Coastal Communities for
Tsunami Hazards?***

Because over the last 66 years in the United States...

Date, Source Region, and Moment Magnitude of Significant Tsunamigenic Earthquakes in Pacific Ocean (since 1900)*	Earthquake Magnitude World Ranking (since 1900; T=tied)*	Tsunami Impact on Pacific Ocean States and Territories (AS, AK, CA, HI, OR, WA)**		
		Fatalities*	Damage Estimate (at time of earthquake, in millions of dollars)	Damage Estimate (adjusted to 2011 cost, in millions of dollars)
April 1, 1946 Aleutians Mw 8.1	#31T	165	\$26M	\$300M
November 4, 1952 Kamchatka Mw 9.0	#5	0	\$2M	\$17M
March 9, 1957 Aleutians Mw 8.6	#11	0	\$5M	\$40M
May 22, 1960 Chile Mw 9.5	#1	64	\$24M	\$182M
March 27, 1964 Alaska Mw 9.2	#2	128	\$123M	\$895M
September 29, 2009 Samoa Mw 8.1	#31T	34	\$79M	\$79M
February 27, 2010 Chile Mw 8.8	#6	0	\$3M	\$3M
March 11, 2011 Japan Mw 9.0	#4	1	\$90M	\$90M
Total		392		+\$1.6 Billion

Because **TODAY**, our Estimated Population at Risk in Cascadia-related Tsunami Hazard Zones is...

Population Counts	Washington	Oregon	Northern California	Regional Total
Number of Residents	44,710	22,201	10,344	77,255
Number of Employees	17,021	14,857	9,389	41,267
Average Daily State Park Visitors	17,029	53,714	2,889	73,632
Totals	78,760	90,772	22,622	192,154

Number of Visitor Facilities	Washington	Oregon	Northern California	Regional Total
Number of Public Venues	135	60	67	262
Number of Dependent-care Facilities	149	43	32	224
Totals	284	103	99	486



* Assuming there are 100 people at a public venue and 50 people at a dependent-care facility, then there are approximately **another 37,400 people** in tsunami-prone areas.

** Numbers compiled from various USGS reports on community exposure to tsunamis (Oregon is based on 2000 data; Washington and California are based on 2010 data)

Because we know it is only a matter of time...

➤ DISTANT Tsunamis:

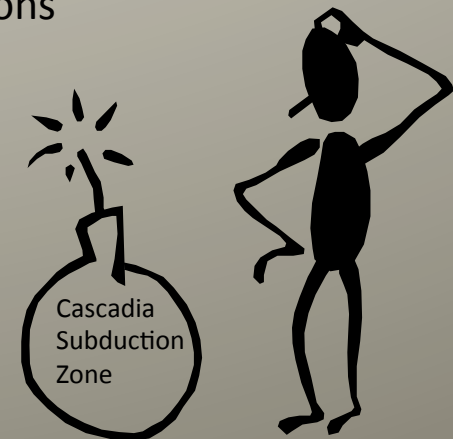
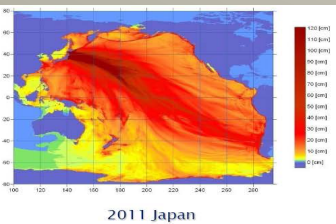
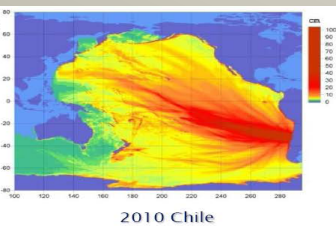
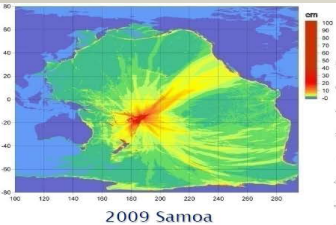
- Events with 2+ hours arrival time from around Pacific Rim
- Time & capability to issue 'official' warnings
- Much smaller than local tsunamis
- NOAA Tsunami Warning Centers (TWCs), Dart Buoys provide useful data

➤ LOCAL Tsunamis:

- Events with 5-30 min. arrival time & most casualties occur w/in 45 min.
- Massive tsunamis with large inland penetration possible
- People must be trained on life-safety protective actions & act immediately!
- TWCs & buoys ineffective for initial life-safety actions

➤ ***"The time's, they are a changin'?"***

- M8+ EQ in the next 50-years:
 - 10 – 14 % Northern CSZ (USGS)
 - 37 % Southern CSZ (C. Goldfinger)



Because, perhaps most importantly, for 90-95% of coastal populations... Local Tsunamis are Survivable.*

****Disclaimer: Provided, coastal residents, visitors, schools, etc:***

- 1. Know the 'natural warning signs'***
- 2. Know what areas are at risk***
- 3. Know where to escape***
- 4. Practice evacuations***

This Sounds Great! But...How?

Fortunately, since 1995, Congress recognized the clear and present danger tsunami hazards pose to United States coastal communities (& all 95,471 statute miles of U.S. tidal shoreline) and did something about it:

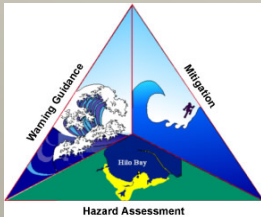
The National Tsunami Hazard Mitigation Program (NTHMP)



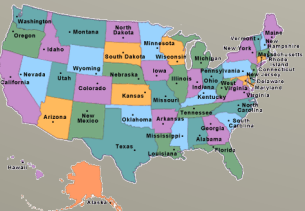
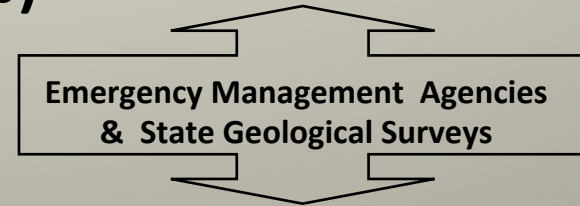
The NTHMP framework ensures effective collaboration, coordination, & response between and across all levels of government.



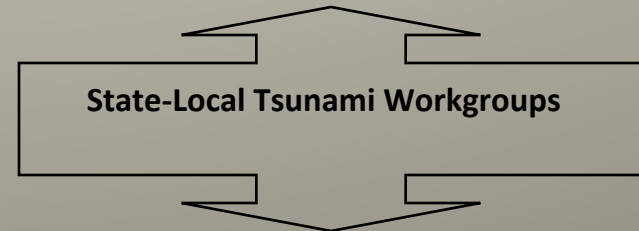
- NOAA



- National Tsunami Hazard Mitigation Program (Partnership)

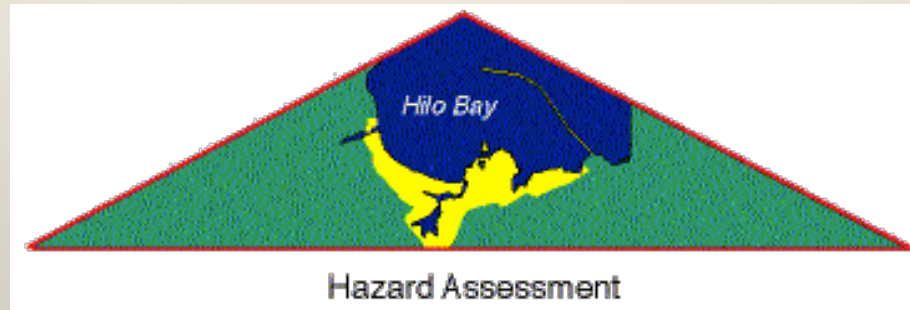


- State-Level Representation



- Local Jurisdictions and Tribes

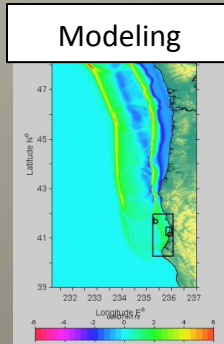
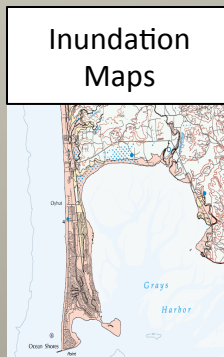
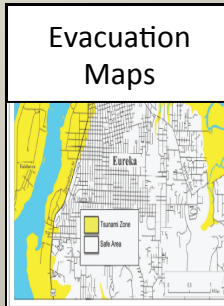
Hazard Assessment



State tsunami programs, in collaboration with federal, state, and local researchers conduct:

- Scientific Studies and Workshops
- Tsunami Modeling for 'Worst-case' Scenarios to Ensure Life-safety
- Tsunami Inundation Mapping
- Evacuation Mapping

State Developed Tsunami Inundation Maps are the Foundation of Loss/Risk Avoidance Activities



“Community-based” Preparedness & Mitigation Efforts

State tsunami programs, in collaboration with federal & local partners to:

➤ Provide Tsunami Education

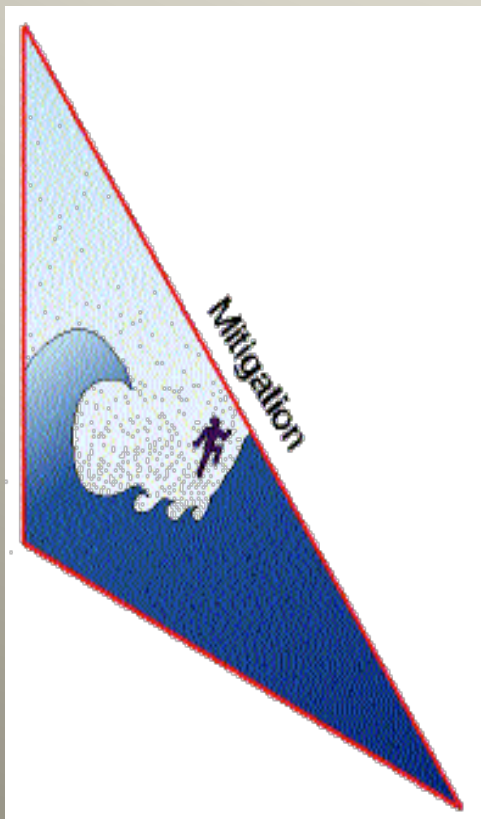
(Incorporate ‘evidence-based’ social science approaches)

Target Audiences:

- Coastal Residents
- Tourists
- Maritime Community
- First Responders
- School Aged Children
- Media Partners
- Hospitality Industry
- Local Businesses
- Land Use Planners

➤ Install Tsunami Signage

➤ Support Local Jurisdiction Needs



Tsunami Signage

- Pre-event Awareness
- Evacuation Routes
 - Driving & Walking
- Consistent Design & Message throughout U.S.
- Life Safety Signs



Tsunami Education = Lives Saved

“Children at the school had received tsunami training the Friday before the tsunami. When the teachers felt the quake, they led the children out the back of the school and up the hill”

“It saved the school,”

“Thank God those teachers knew what they were doing.”

- Peter Gurr of Maota, Samoa, 2009



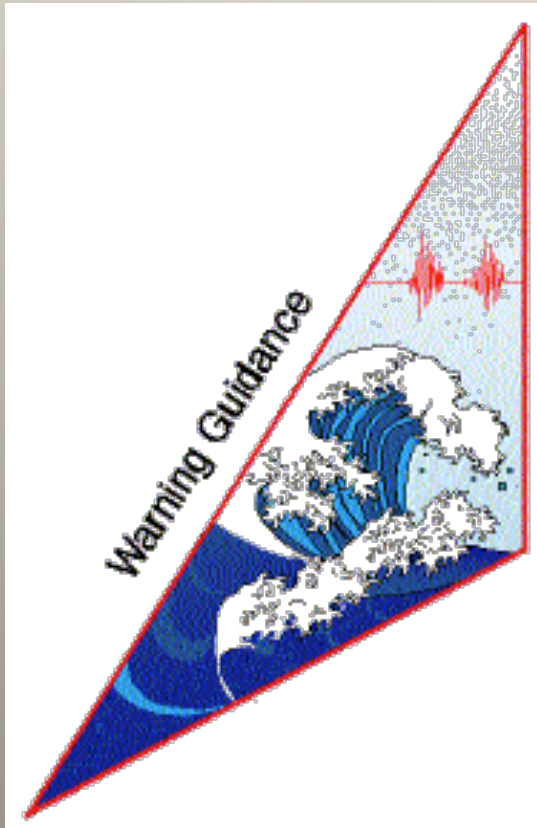
Source: Kamaichi city

“The pre-disaster education guided the pupils at primary and junior high schools in Ishinomaki-city (one of the cities completely washed away) to safety during the tsunami. Miszuhama area in Ishinomaki has a total of 380 residents and about 130 households. However, only one person died and eight remain missing. It has been revealed that **the people’s awareness of what do do at the event of an earthquake and regular conduct of (tsunami evacuation) exercises/drill had helped them**”

-Mr A. Koresawa, Asian Disaster Reduction Center

-Dr. Y. Kawaki, International Recovery Platform , Japan 2011

Warning Guidance



State tsunami programs in collaboration with federal, state, and local officials develop warning and response protocols:

➤ NOAA:

- Tsunami Detection
- Tsunami Bulletin Issuance

➤ State & Local Warning Points

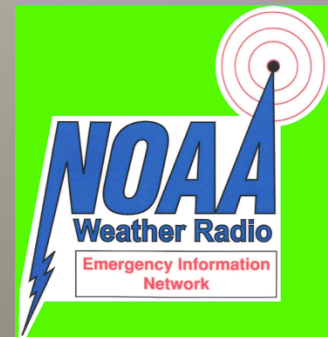
- Alert and Notification
- Evacuation Orders

Warning Systems & Protocols

State tsunami programs help ensure coordinated alert messages between Federal-to-State & State-to-Local warning points.

Assist in the development of warning protocols , exercises, & training for:

- Outdoor Notification Siren Systems
- Emergency Alert System (EAS)
- NOAA Weather Radios
- Outdoor Loudspeakers



*What about the Other **5-10%**
of Coastal Communities?*

Current Situation:

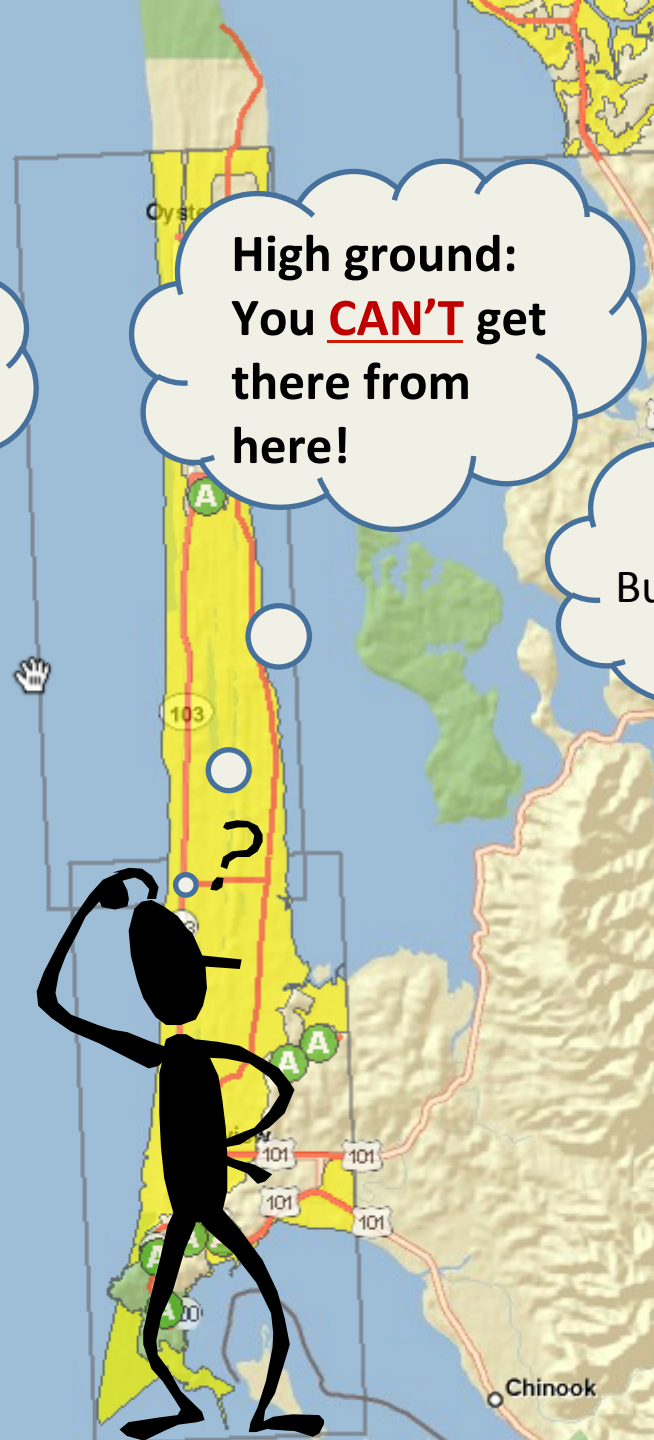
Local Earthquake!

Ah ha!

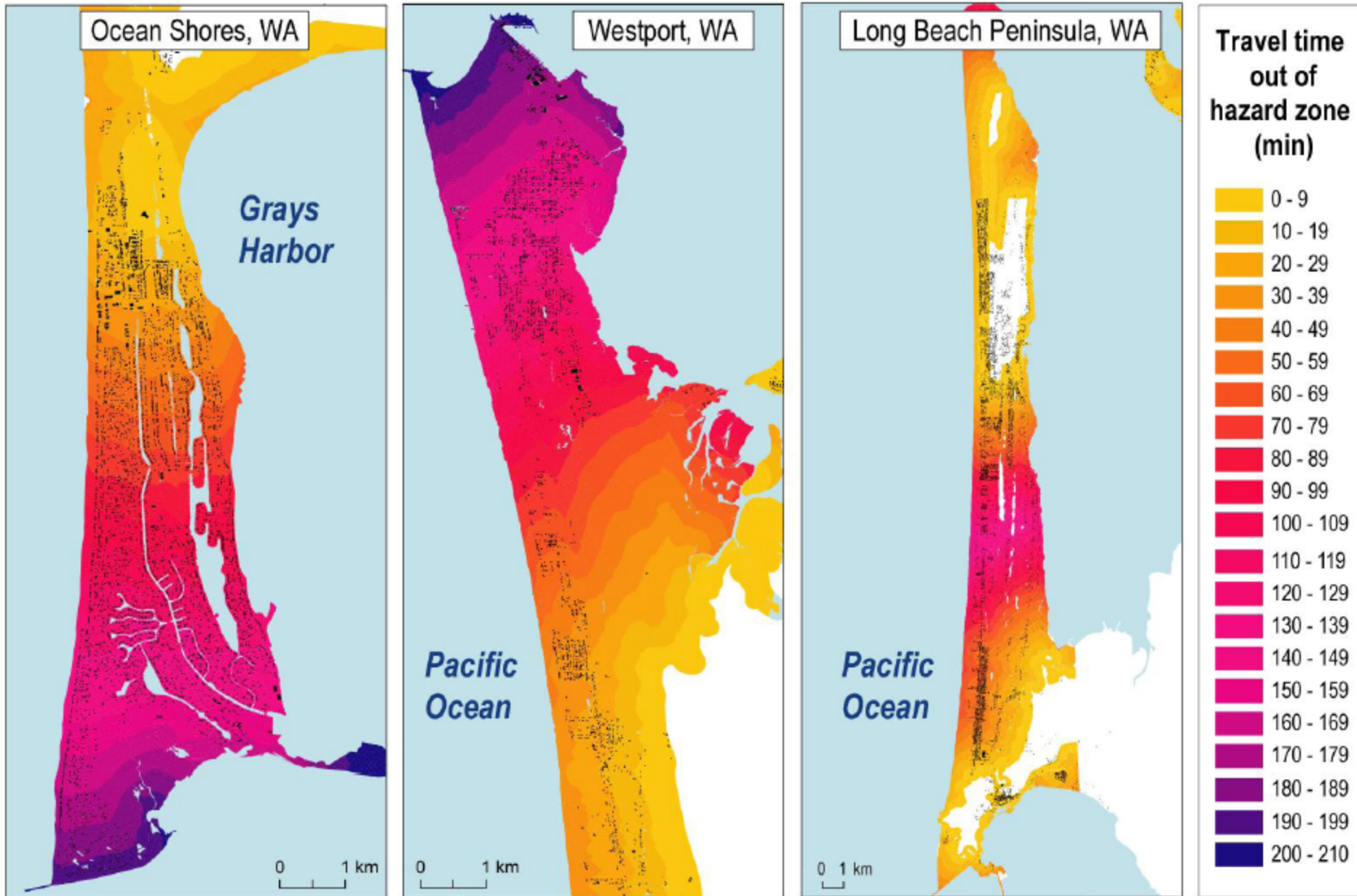


High ground:
You **CAN'T** get there from here!

Bummer!



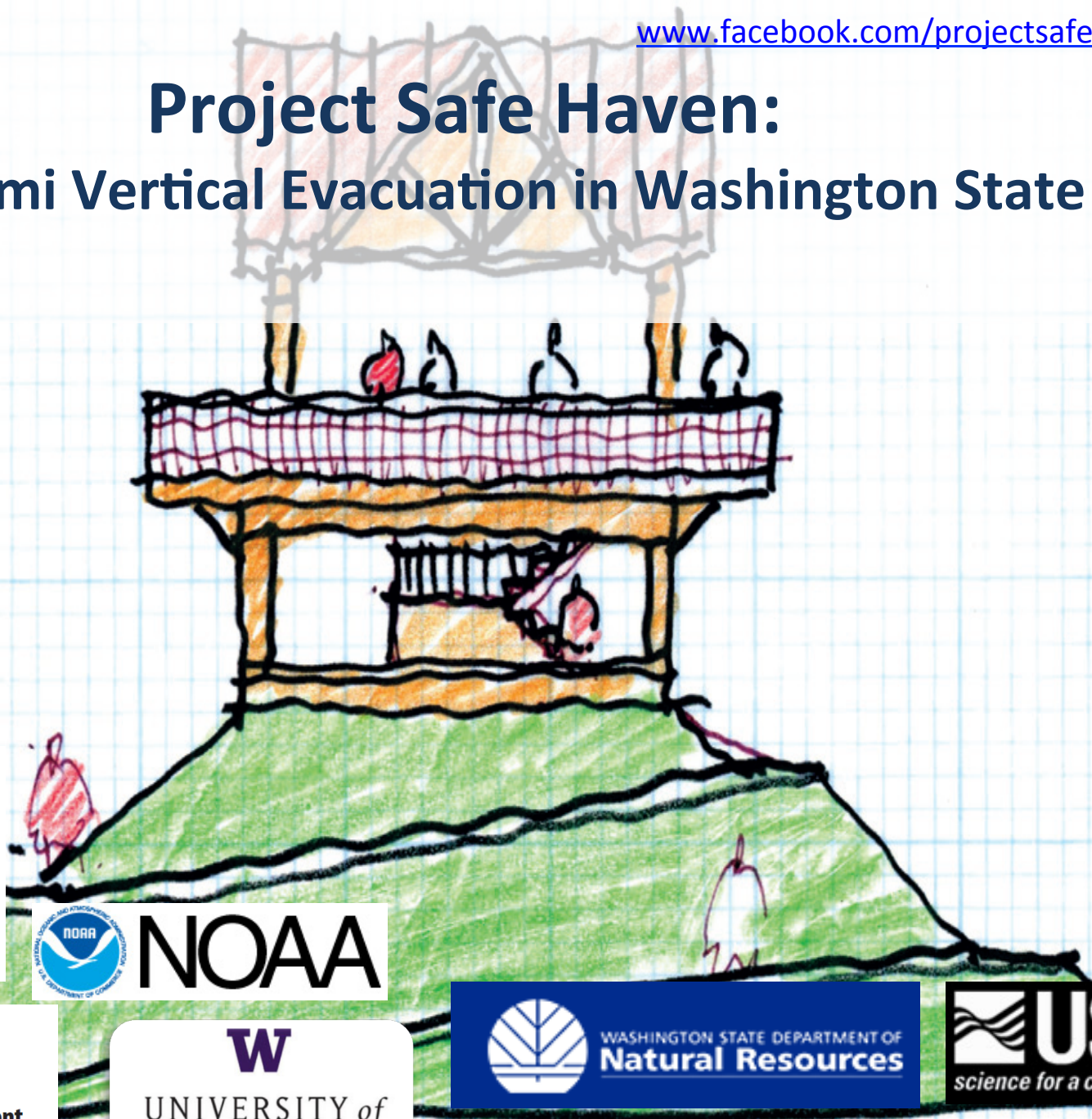
Hotspots of Evacuation Challenges



Source: Wood & Schmidlein, 2011

Based on 1.1 m/s travel speed

Project Safe Haven: Tsunami Vertical Evacuation in Washington State



National Tsunami Hazard
Mitigation Program



NOAA



Washington Military Department
Emergency Management Division

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UNIVERSITY of
WASHINGTON



WASHINGTON STATE DEPARTMENT OF
Natural Resources

USGS
science for a changing world

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**And how do we know this will work
here?**



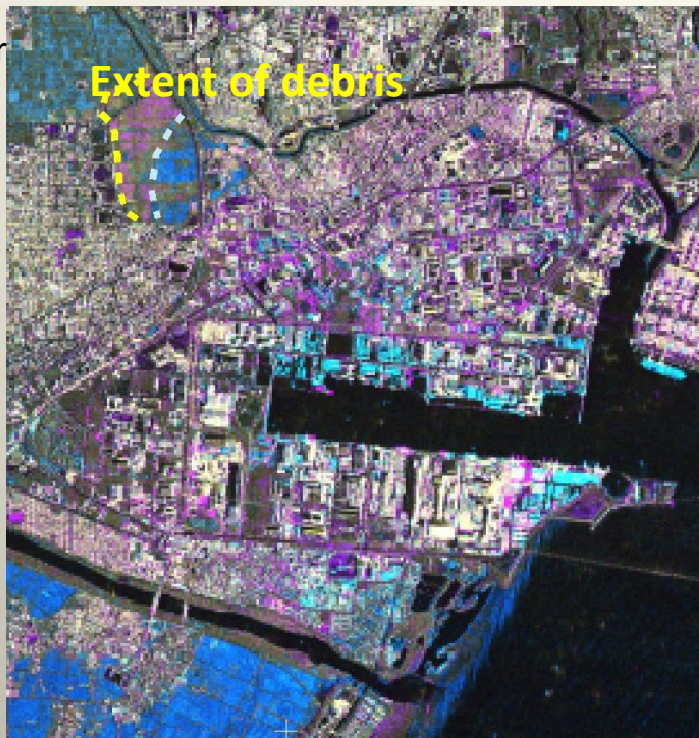
Because we've seen it work there (Kesenumma, Japan)



**We HAVE learned (*and are STILL learning*)
incredibly valuable lessons from Japan...
and Chile...and Samoa...and...technology
alone isn't always the answer.**

There is **NO SINGLE SOLUTION**: Technological Solutions **MUST** dovetail with Preparedness Solutions to Achieve the Desired Outcome





Tsunami Catalogue for the Sanriku District near the Sendai Area, mostly based upon Miyagi Showa Shinsho-Shi (Record of the Showa Earthquake and Tsunami in Miyagi Prefecture) and partially on Dr. Shuto's memory

"In 869. Giant earthquake in the Tohoku District. Tsunami flooded up to the Tagajo castle near Sendai. Over 1,000 drowned."

THE TAKEAWAY: IF WE CANNOT INCORPORATE NEW HAZARD INFORMATION INTO EXISTING PRODUCTS...WE PUT LIVES AT RISK.

The BIGGER question is this:

**Will the United States continue
to provide opportunities to
APPLY what we have learned
and truly become**

