

Liquefaction

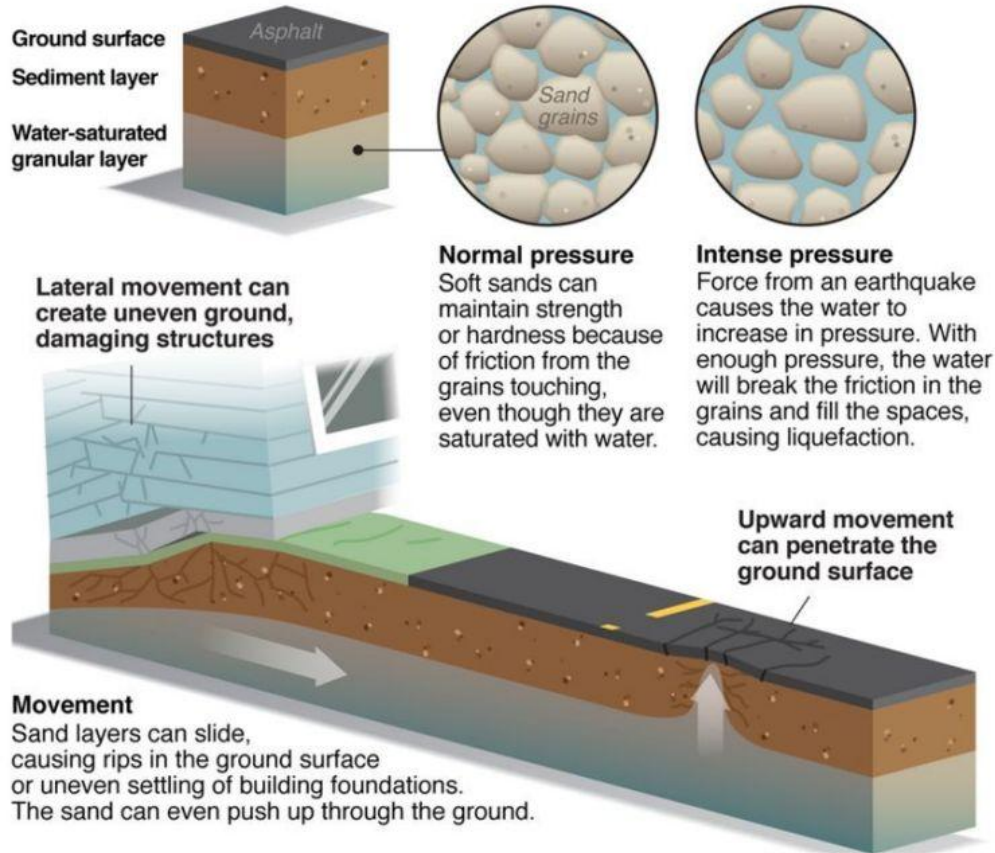
**The Island's Biggest
Earthquake Threat**

Liquefaction

- Hayden Island will suffer **SEVERE** liquefaction
- Liquefaction causes soil to **behave like quicksand**
- **Water is forced out from underground**, lubricating the soil

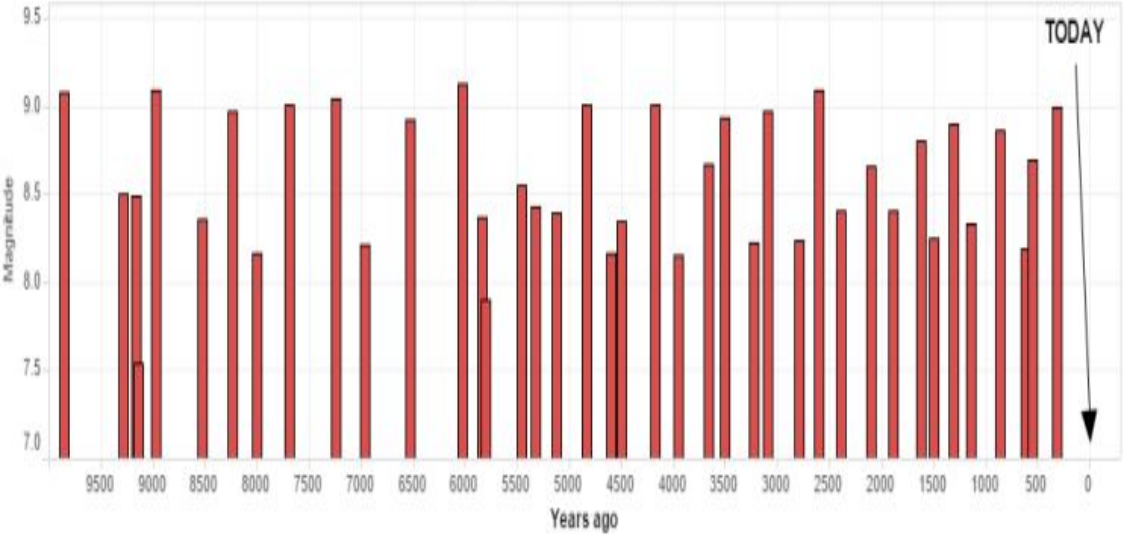
Soil liquefaction

Liquefaction is a phenomenon in which water-saturated sandy layers of earth act like liquids due to the pressure created by earthquakes.

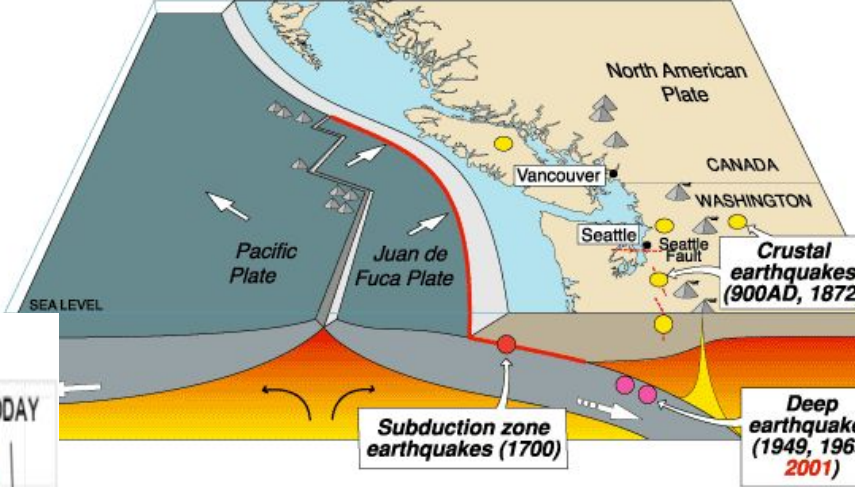


We're Due!

Average quake is every 246 years



Cascadia earthquake sources



Source	Affected area	Max. Size	Recurrence
Subduction Zone	W.WA, OR, CA	M 9	500-600 yr
Deep Juan de Fuca plate	W.WA, OR,	M 7+	30-50 yr
Crustal faults	WA, OR, CA	M 7+	Hundreds of yr?

Alaska 1964 Quake: Severe Liquefaction



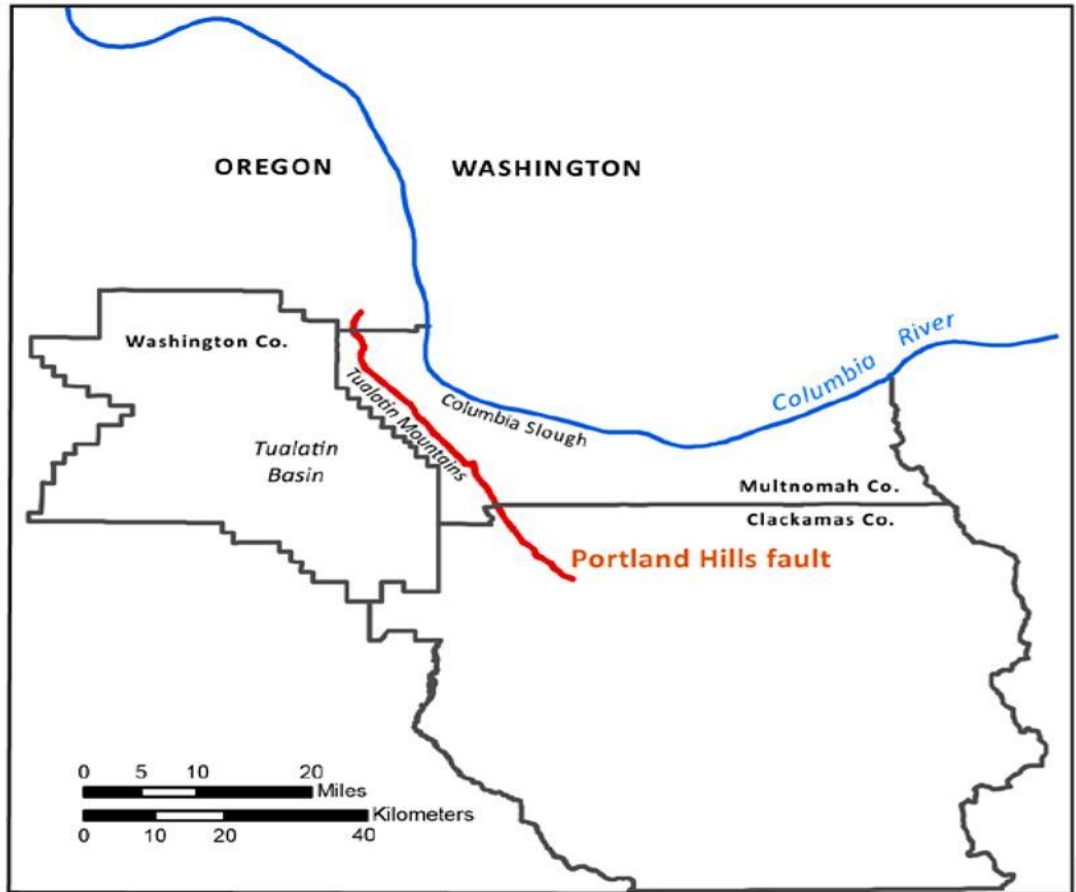
Washington's Nisqually Quake: Severe Liquefaction



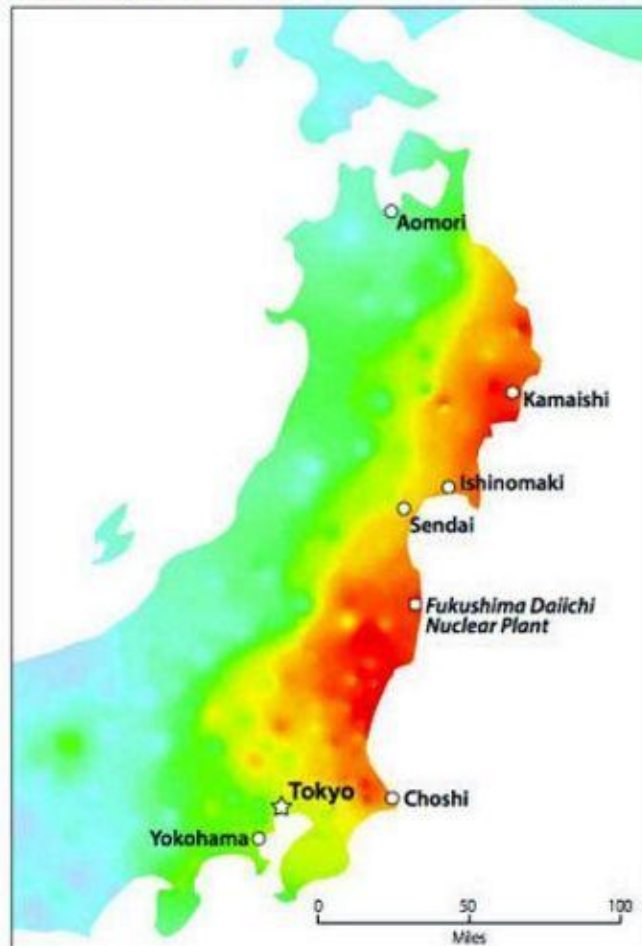




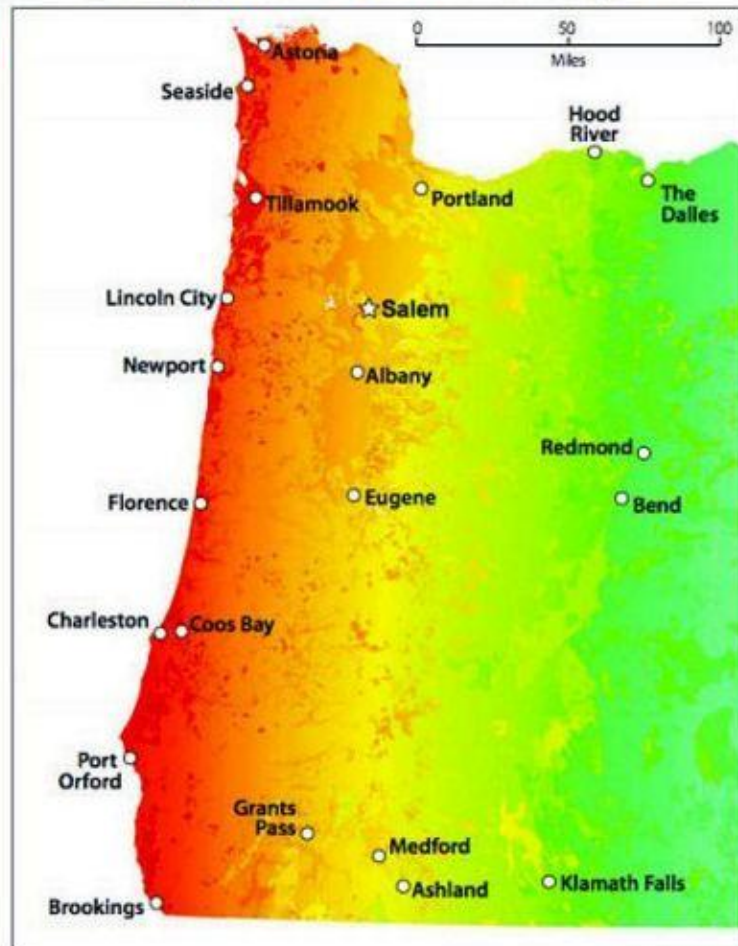
Fault Lines



ShakeMap for March 11, 2011 Tōhoku M9 earthquake

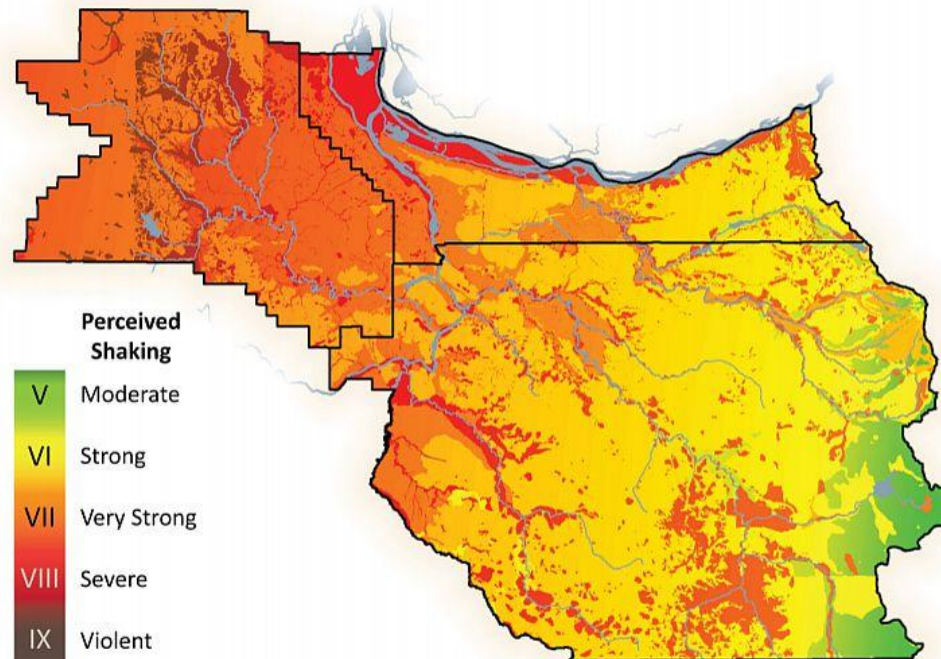


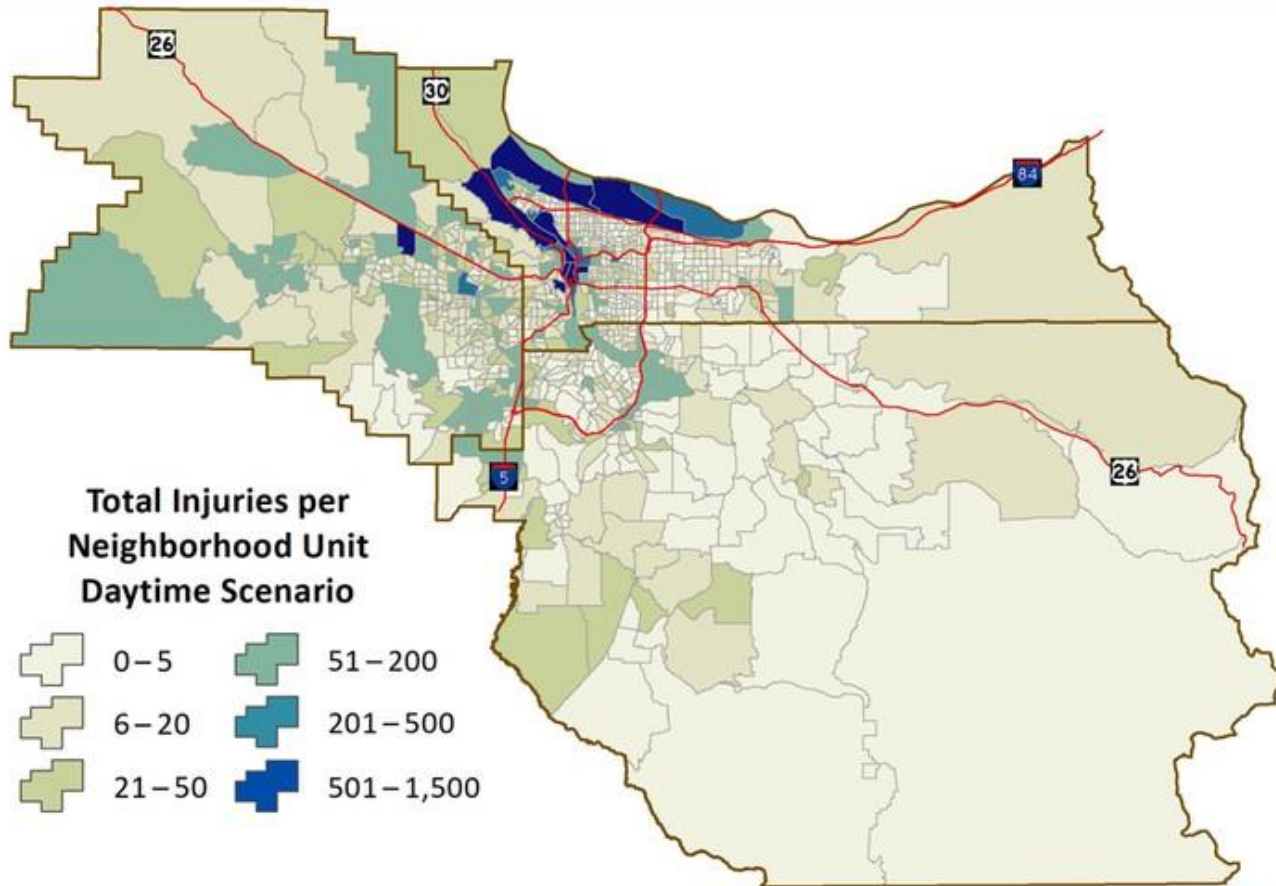
ShakeMap for SIMULATED M9 Cascadia earthquake



EARTHQUAKE REGIONAL IMPACT ANALYSIS FOR CLACKAMAS, MULTNOMAH, AND WASHINGTON COUNTIES, OREGON

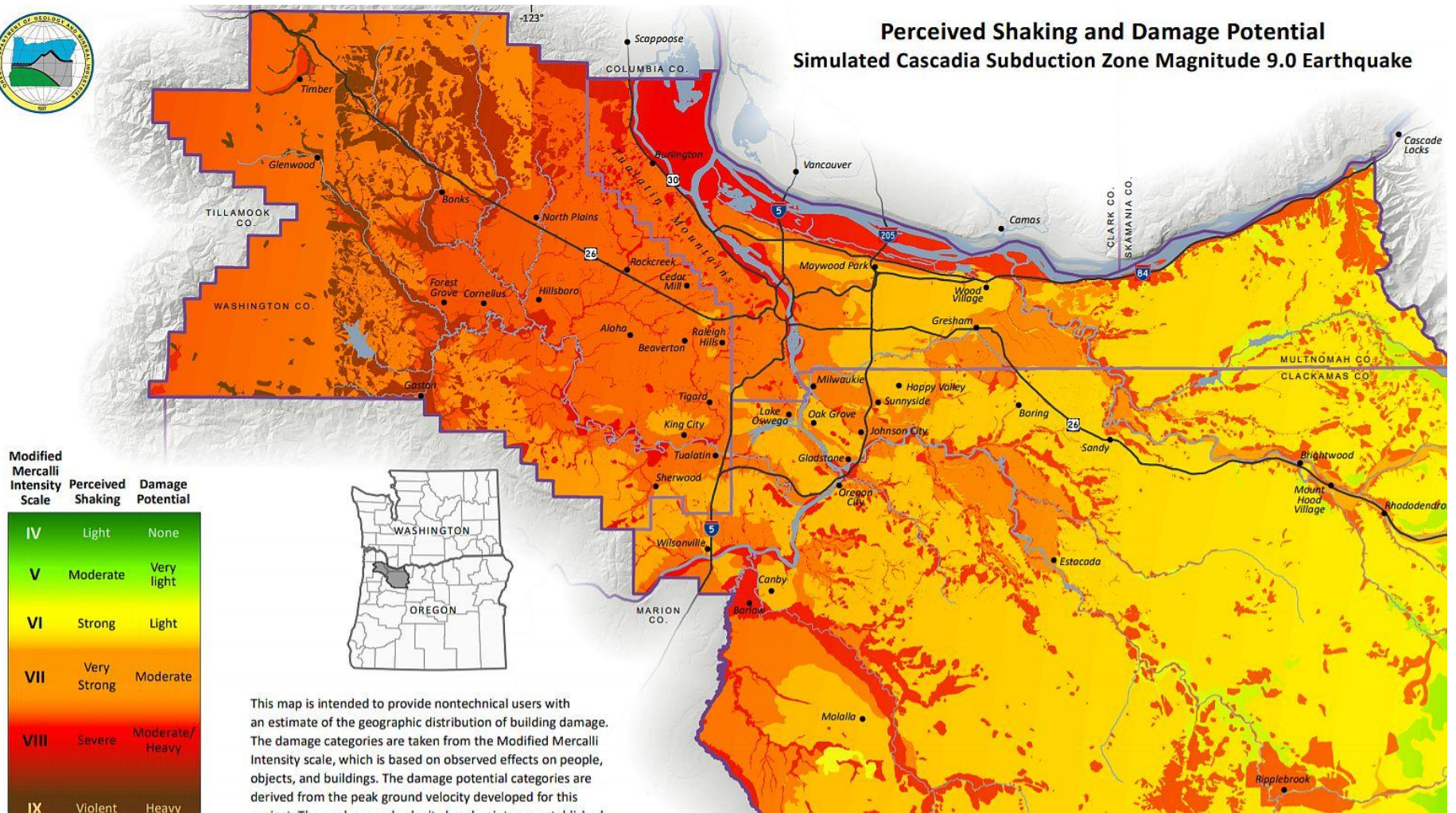
by John M. Bauer¹, William J. Burns¹, and Ian P. Madin¹







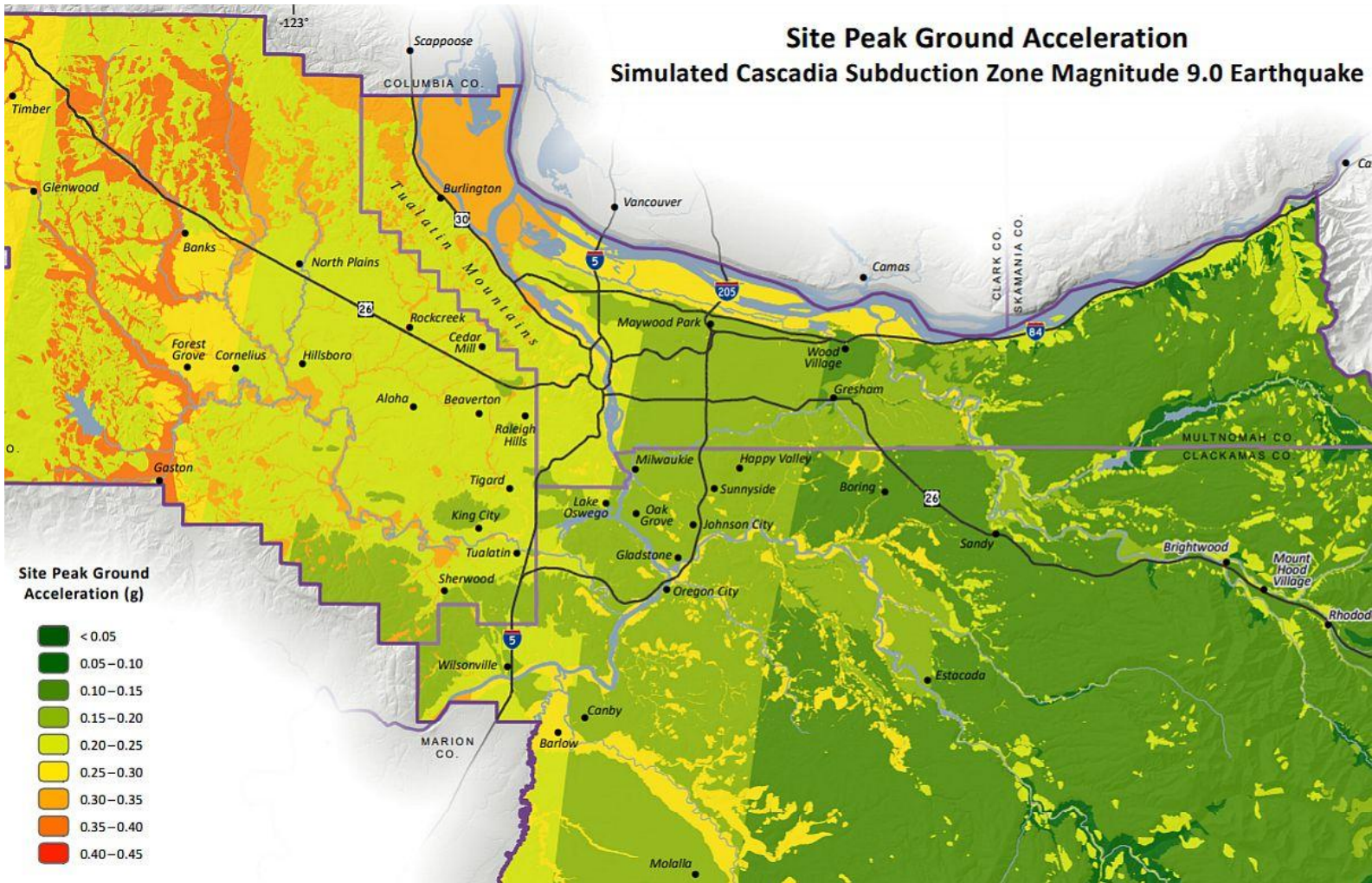
Perceived Shaking and Damage Potential Simulated Cascadia Subduction Zone Magnitude 9.0 Earthquake

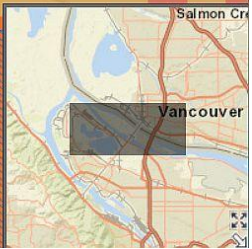
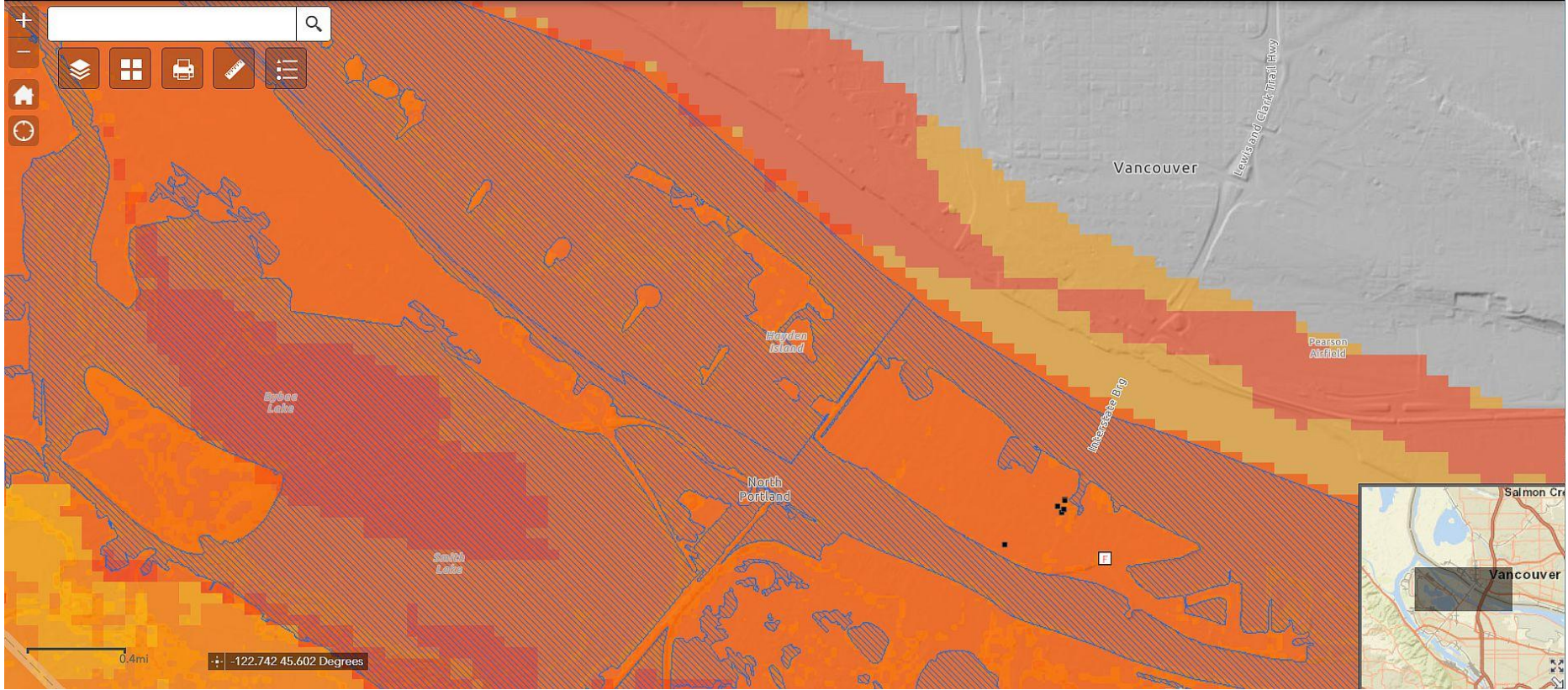


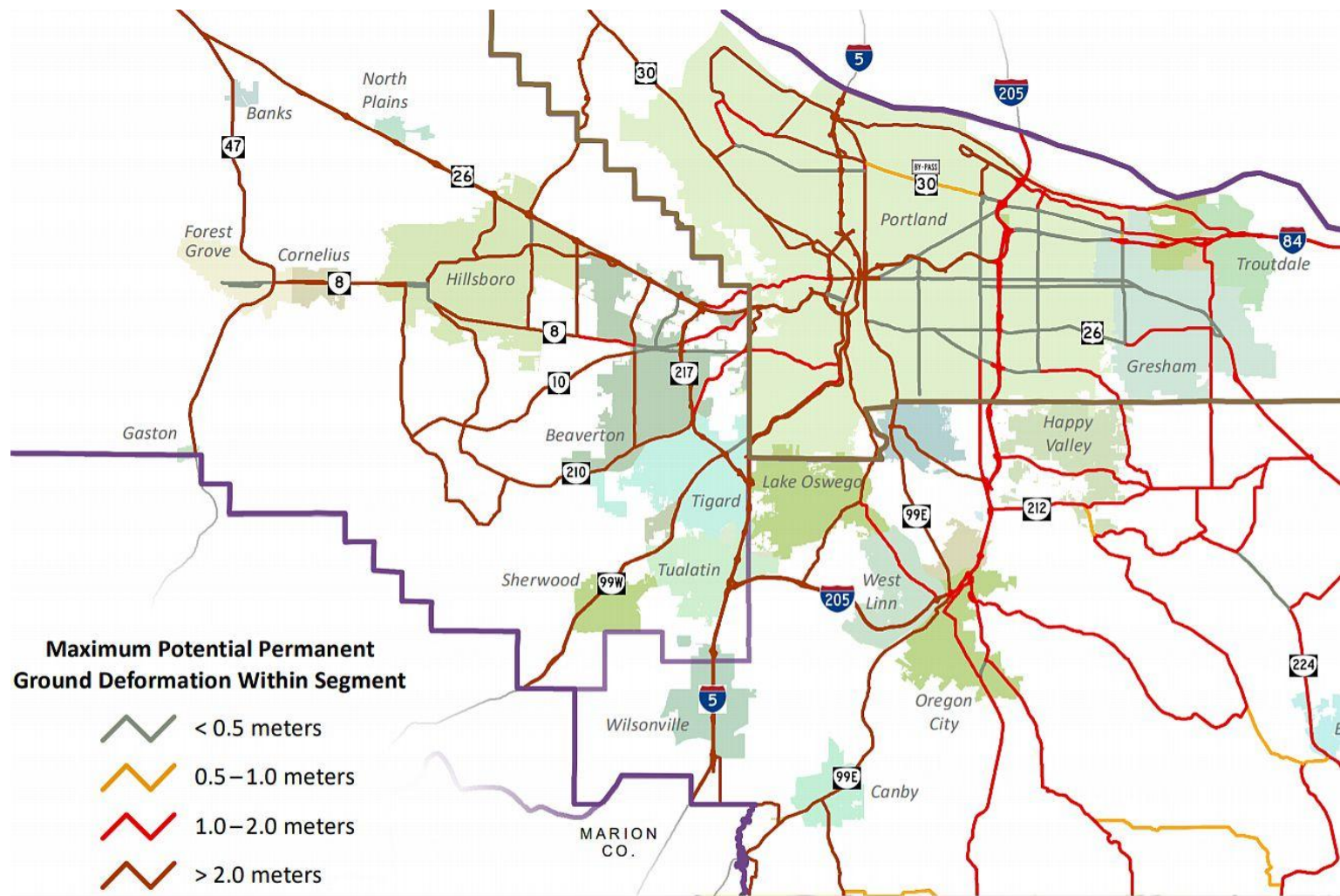
Modified Mercalli Intensity Scale	Perceived Shaking	Damage Potential
IV	Light	None
V	Moderate	Very light
VI	Strong	Light
VII	Very Strong	Moderate
VIII	Severe	Moderate/Heavy
IX	Violent	Heavy

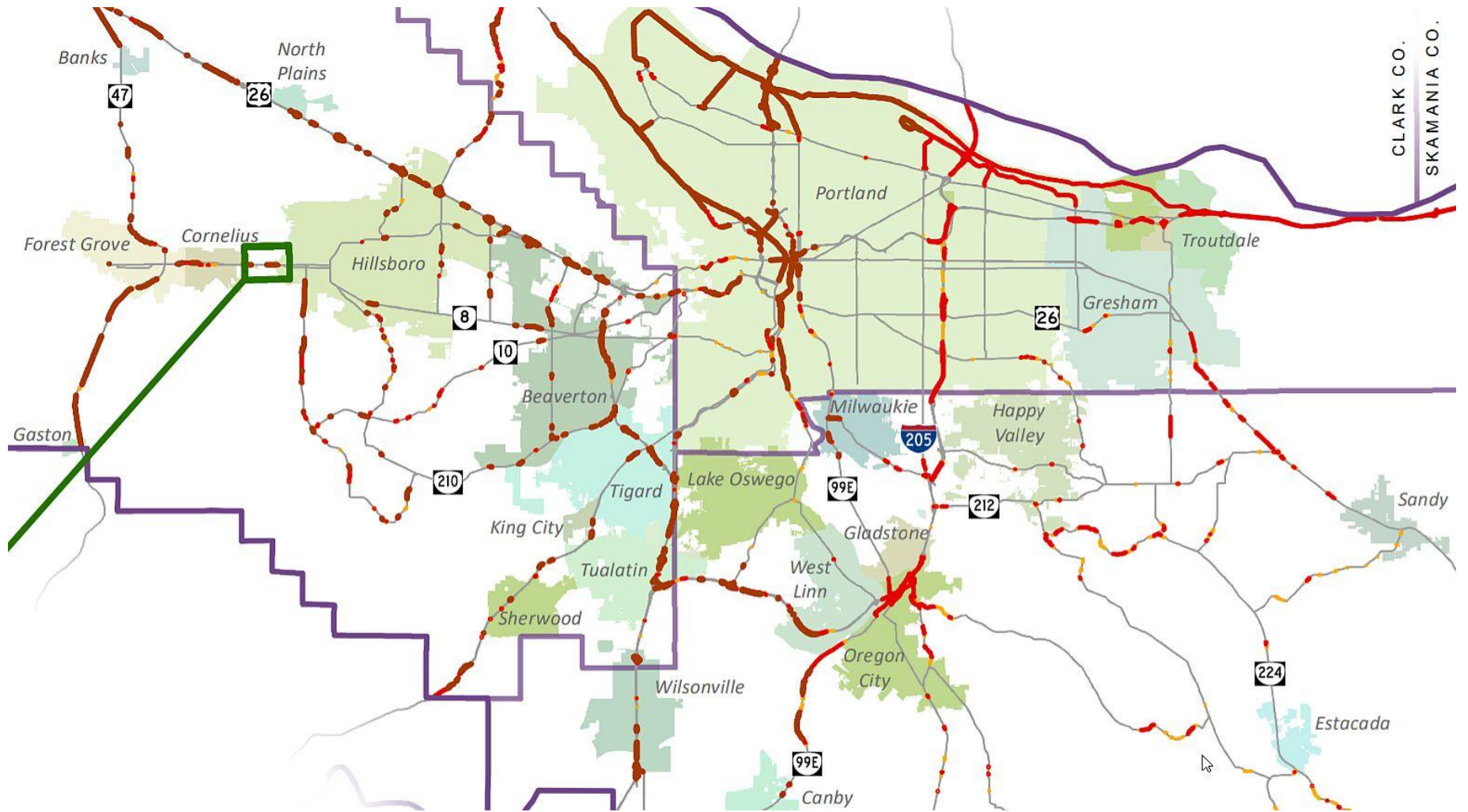
This map is intended to provide nontechnical users with an estimate of the geographic distribution of building damage. The damage categories are taken from the Modified Mercalli Intensity scale, which is based on observed effects on people, objects, and buildings. The damage potential categories are derived from the peak ground velocity developed for this

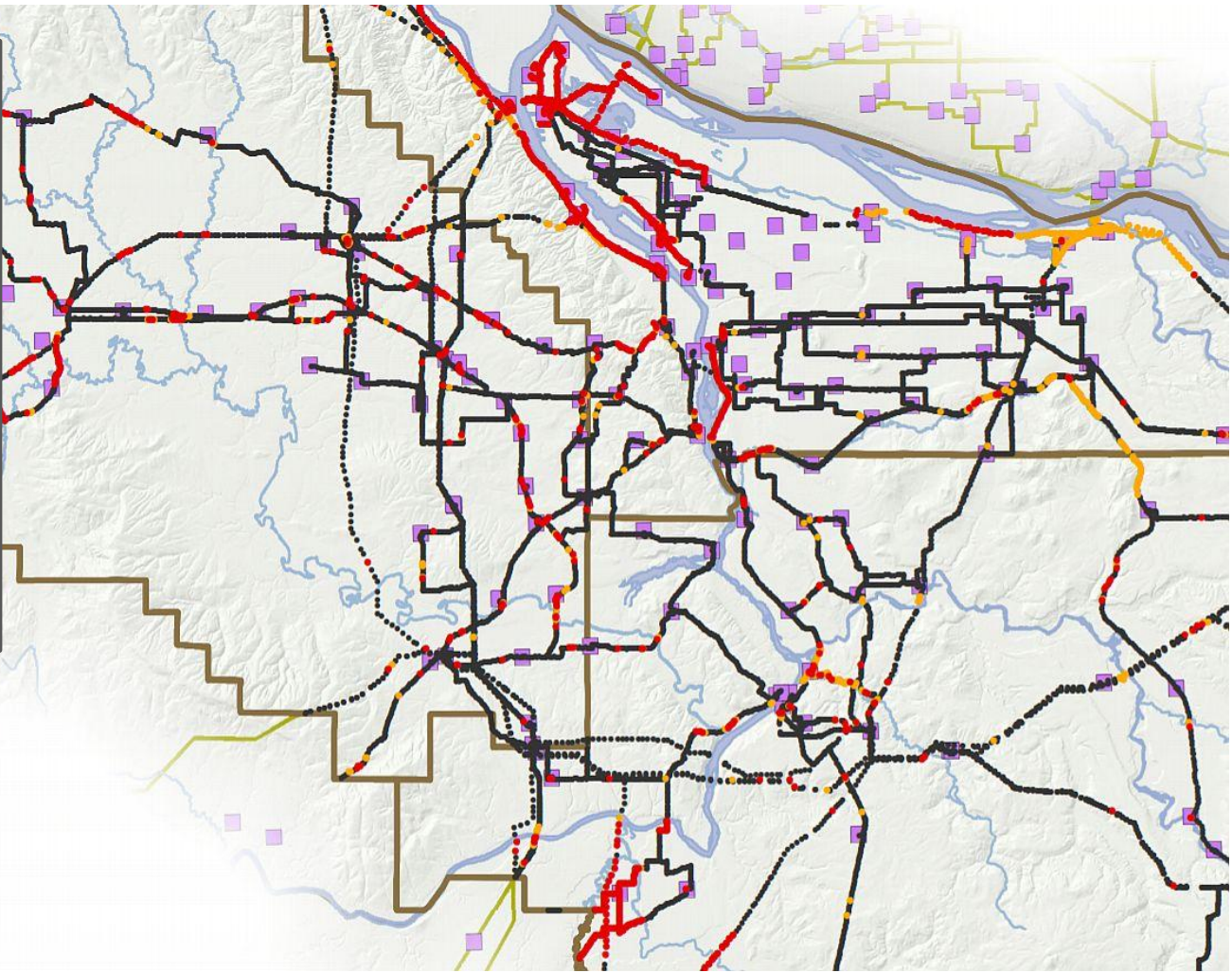
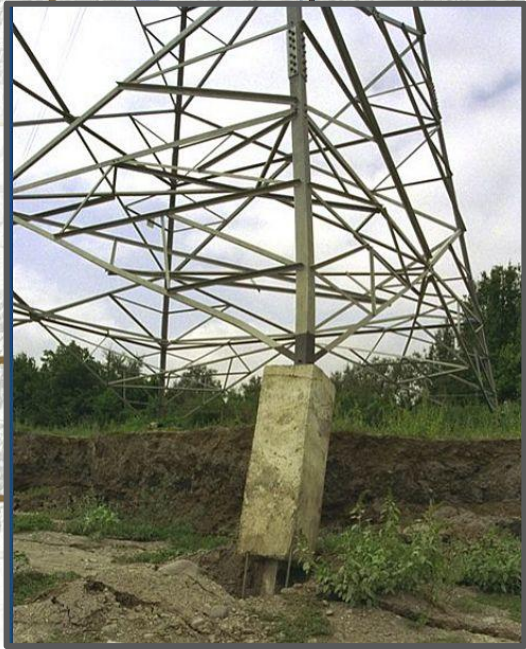
Site Peak Ground Acceleration Simulated Cascadia Subduction Zone Magnitude 9.0 Earthquake











**Potential Permanent Ground Deformation at
Electrical Transmission Pole/Tower**

- < 1.0 meter
- 1.0–2.0 meters
- > 2.0 meters

Learn how to turn off your gas and water

BEFORE an Earthquake:

- Secure your gas equipment to minimize movement during a quake.
- Replace semi-rigid gas connectors with flexible connectors.
- Move combustibles away from appliances.

AFTER an Earthquake:

- If you detect a natural gas odor, leave the area on foot and then call NW Natural at 800.882.3377.
- *ONLY, turn off your gas, if it is safe to do so.*
- If you turn off your gas, **DO NOT** turn it back on yourself. Leave it off and contact NW Natural.

Regarding Earthquake Shut-off Valves:

- **If you choose** to install an earthquake shut-off valve, be sure to use a qualified, licensed contractor.
- Earthquake shut-off valves must be installed on the customer's side of the meter, not on NW Natural's.
- If the shut-off valve has closed you will need to contact a qualified, licensed contractor to reset the valve and relight your natural gas appliances.

How to turn-off your meter:



What to do:

Take cover under a table

Stay inside

Watch for falling objects

Pull off to the side of the road

Check for injuries and hazards

Smell for gas

Turn off water

What do I do?

DURING AN EARTHQUAKE YOU SHOULD:

If you are indoors, DROP and take **COVER** under a sturdy table or other furniture. **HOLD ON** to it and stay put until the shaking stops.

Stay clear of items that can fall and injure you, such as windows, fireplaces, and heavy furniture.

Stay inside. You may be injured by breaking glass and falling objects if you run outside.

If you are at the coast, walk to higher ground away from the ocean as soon as it is safe for you to move.

If you are driving, move your car as far out of the normal traffic pattern as possible **and stop** if it is safe. Stay away from structures or objects that could fall on you, such as bridges, overpasses, light posts, power lines, or trees. Stay inside your car.

If you are in the mountains, or near unstable slopes, be alert for falling rocks, trees, or landslides that could be loosened by the earthquake.



AFTER AN EARTHQUAKE YOU SHOULD:

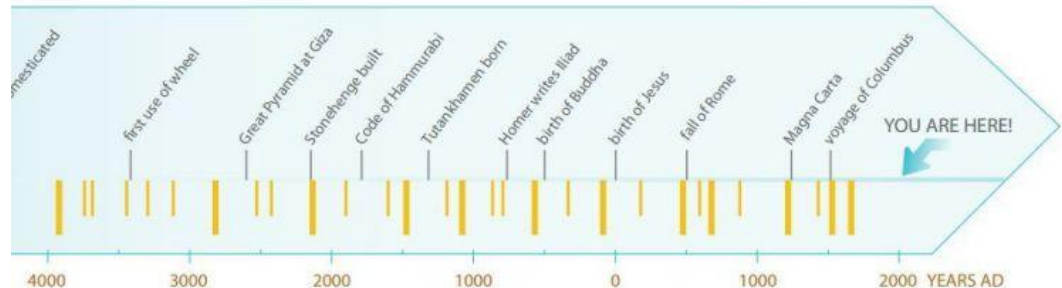
EVACUATE if you are in a TSUNAMI HAZARD ZONE. Walk inland or to higher ground as soon as it is safe to do so. Do not wait for official notification. Stay away from the coast until officials permit you to return.

Check for injuries. Do not move seriously-injured persons unless they are in immediate danger.

Check for hazards such as fires, gas leaks, downed utility lines, and fallen objects.

Clean up any potentially harmful material spills.

Expect aftershocks. Aftershocks following large earthquakes can be large and damaging.



TSUNAMI!

WHAT OREGON BOAT OWNERS

NEED TO KNOW

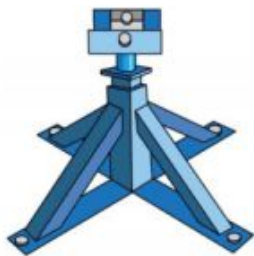


Port of Brookings, Ore., following wave surges from the March 11, 2011 tsunami off the coast of Japan. Photo: Jamie Francis/The Oregonian



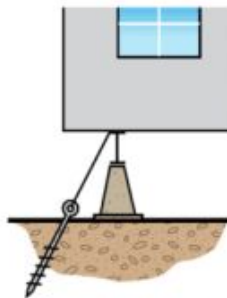
Marina damage near Chetco River, Ore., following wave surges from the March 11, 2011 tsunami off the coast of Japan. Photo: U.S. Coast Guard

Reduce or prevent collapse



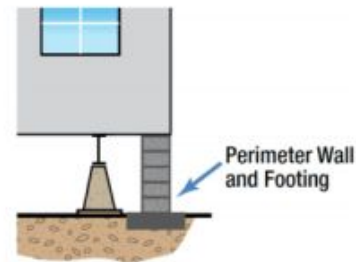
Good: Earthquake Resistant
Bracing System (ERBS)
\$3,000-\$5,000

OR



Better: Engineered Tie-down
System (ETS)
\$1,000-\$2,000

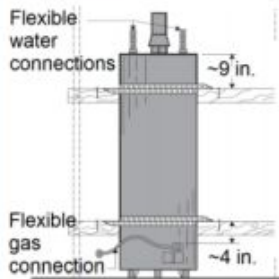
OR



Best: Reinforced concrete or
reinforced masonry foundation
\$5,000-\$50,000

Perimeter Wall
and Footing

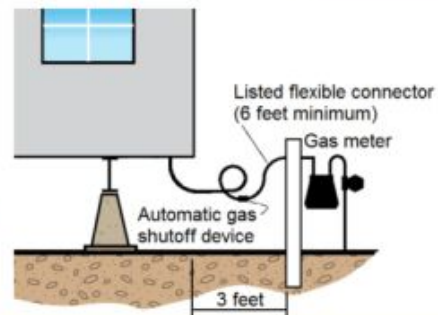
Reduce or prevent fire



◀ Brace water heater (\$35-\$200)

AND

Flexible gas connection (\$100) ▶





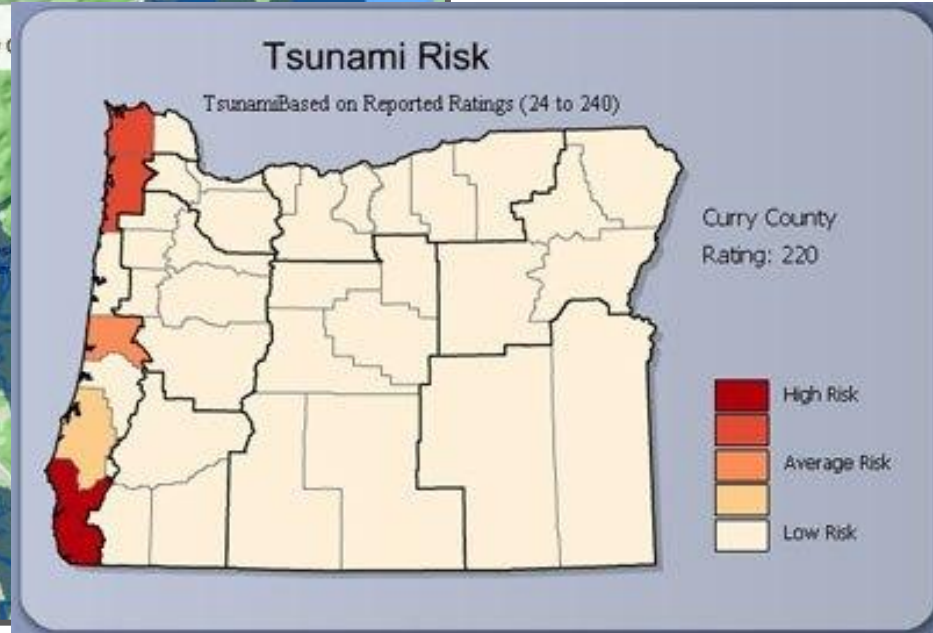
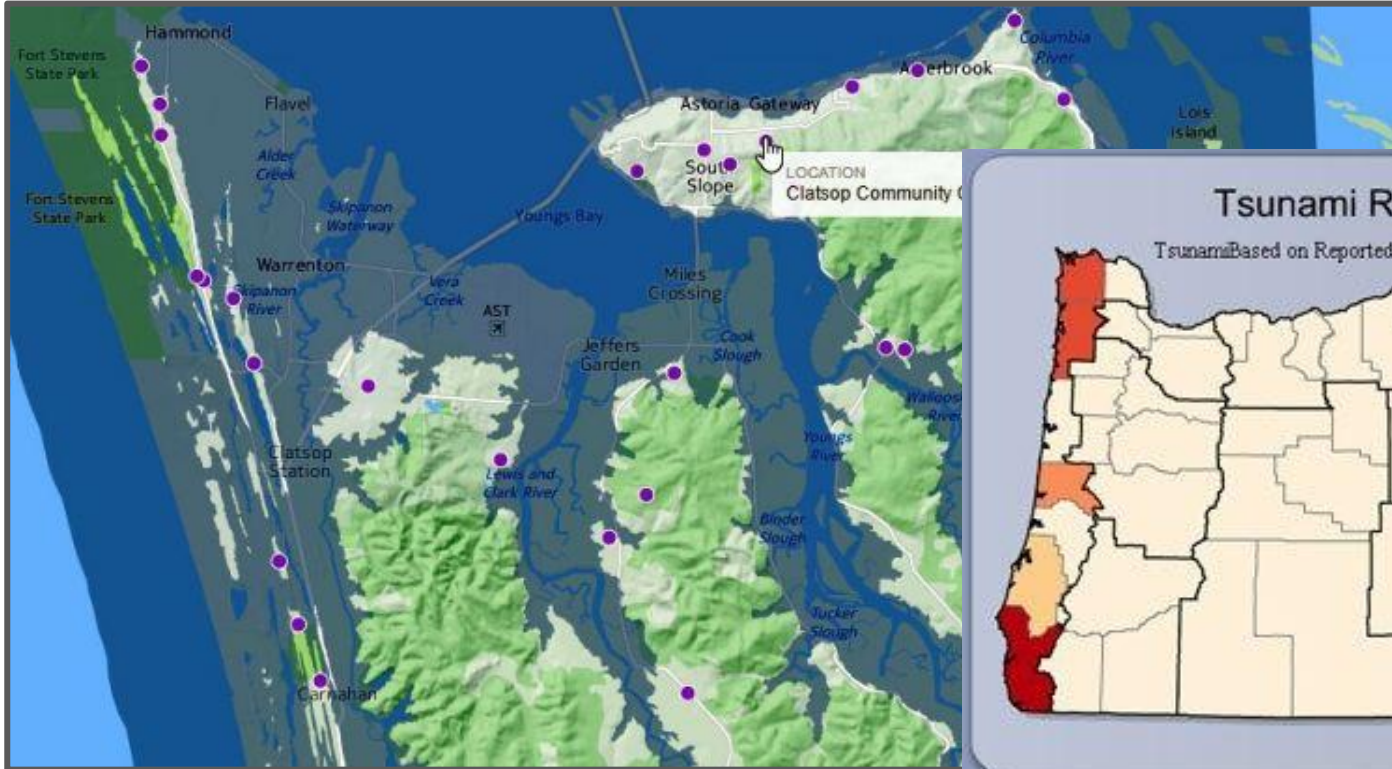
Additional Items to Consider Adding to an Emergency Supply Kit:

- Prescription medications and glasses
- Infant formula and diapers
- Pet food and extra water for your pet
- Important family documents such as copies of insurance policies, identification and bank account records in a waterproof, portable container
- Cash or traveler's checks and change
- Emergency reference material such as a first aid book or information from www.ready.gov
- Sleeping bag or warm blanket for each person. Consider additional bedding if you live in a cold-weather climate.
- Complete change of clothing including a long sleeved shirt, long pants and sturdy shoes. Consider additional clothing if you live in a cold-weather climate.
- Household chlorine bleach and medicine dropper – When diluted nine parts water to one part bleach, bleach can be used as a disinfectant. Or in an emergency, you can use it to treat water by using 16 drops of regular household liquid bleach per gallon of water. Do not use scented, color safe or bleaches with added cleaners.
- Fire Extinguisher
- Matches in a waterproof container
- Feminine supplies and personal hygiene items
- Mess kits, paper cups, plates and plastic utensils, paper towels
- Paper and pencil
- Books, games, puzzles or other activities for children

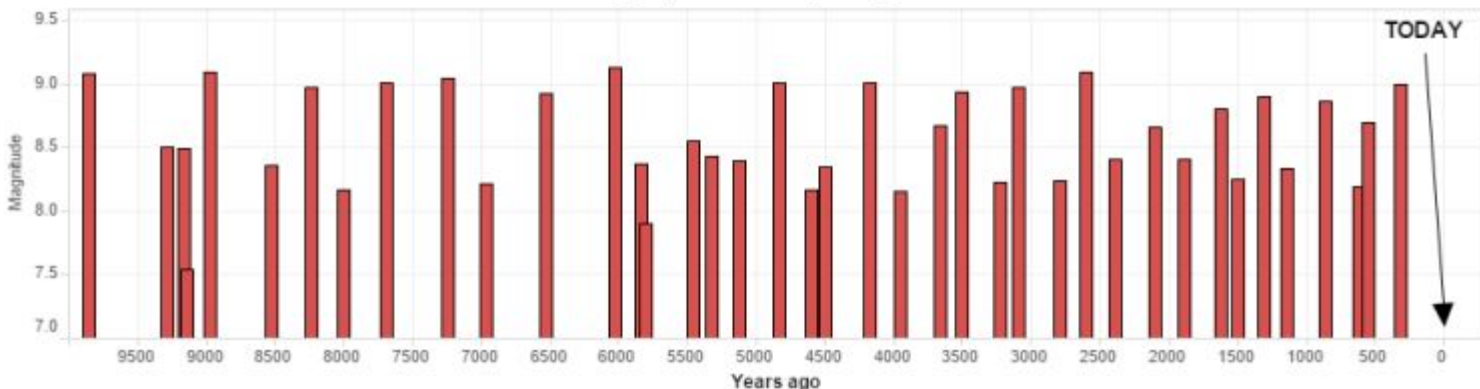
Make an Emergency Kit, Family Plan, Store Food & water



Tsunami Risk: Mostly at the coast



Average quake is every 246 years



Area of Operation	Injuries			Fatalities		
	Earthquake	Tsunami	Total	Earthquake	Tsunami	Total
Coastal	5,000	1,500	5,500	300	4,500	4,800
I-5 corridor	9,000	0	9,000	400	0	400
Oregon total	14,000	1,500	15,500	700	4,500	5,200

Source: FEMA CSZ Response Plan (2013) and Wood - see Methodology section for more detail

Get Ready for the Big One

You'll sleep better.

Join the Hayden Island NET team. It's fun!

<https://www.opb.org/news/article/npr-portland-earthquake-study-estimates-wide-variation-in-impact-depending-on-timing/>

<https://www.oregongeology.org/pubs/ofr/p-O-18-02.htm>

<https://youtu.be/GviJkVEMfwQ>

<https://youtu.be/RJCidfj-x9M>

https://www.oregongeology.org/pubs/ofr/O-18-02/O-18-02_report.pdf

hayden-island.net

