Other Tsunami Sources in Washington

by

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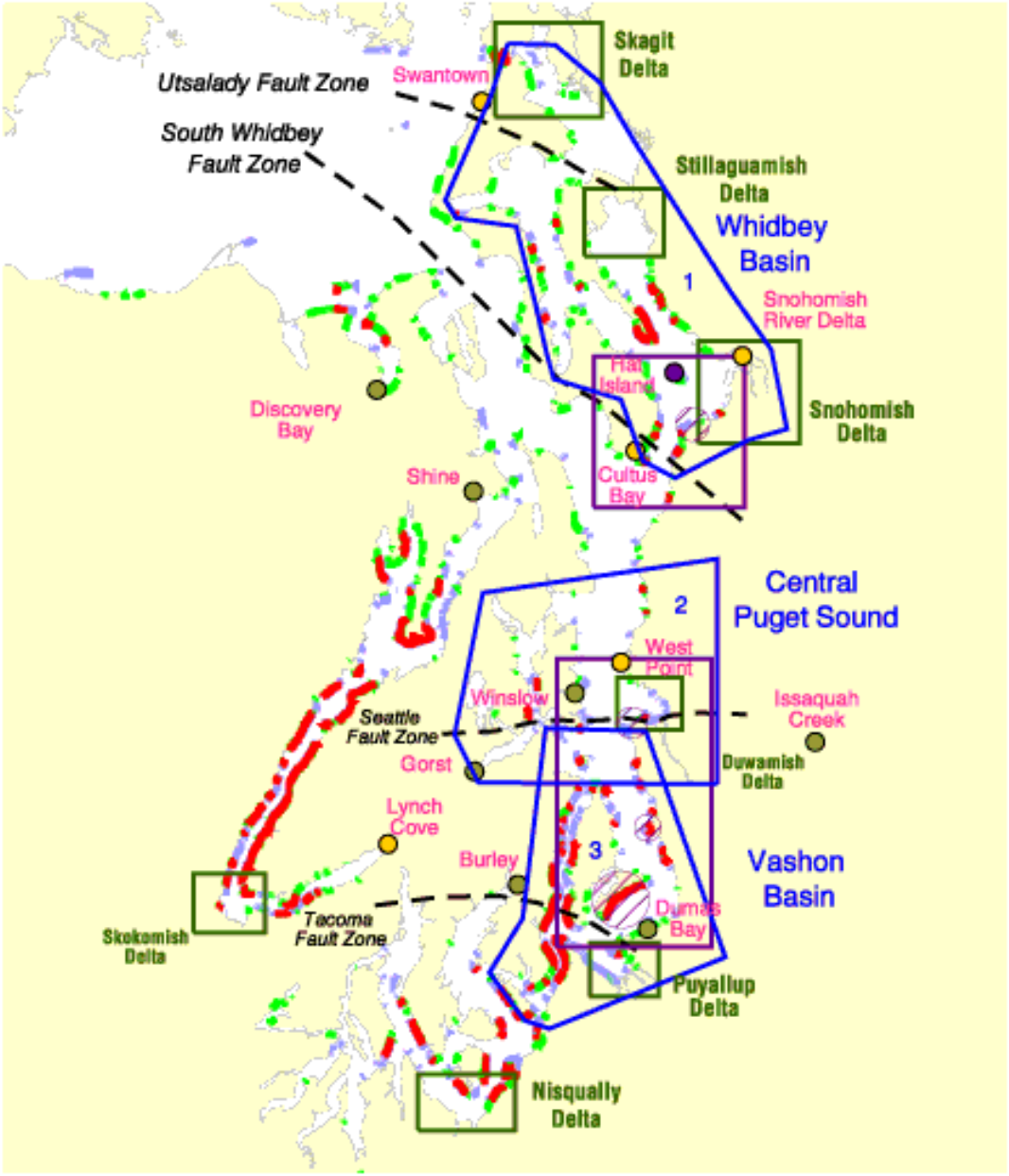
Puget Sound Tsunami Source Workshop - Source Scenarios and Evidence



Possible Source Zones

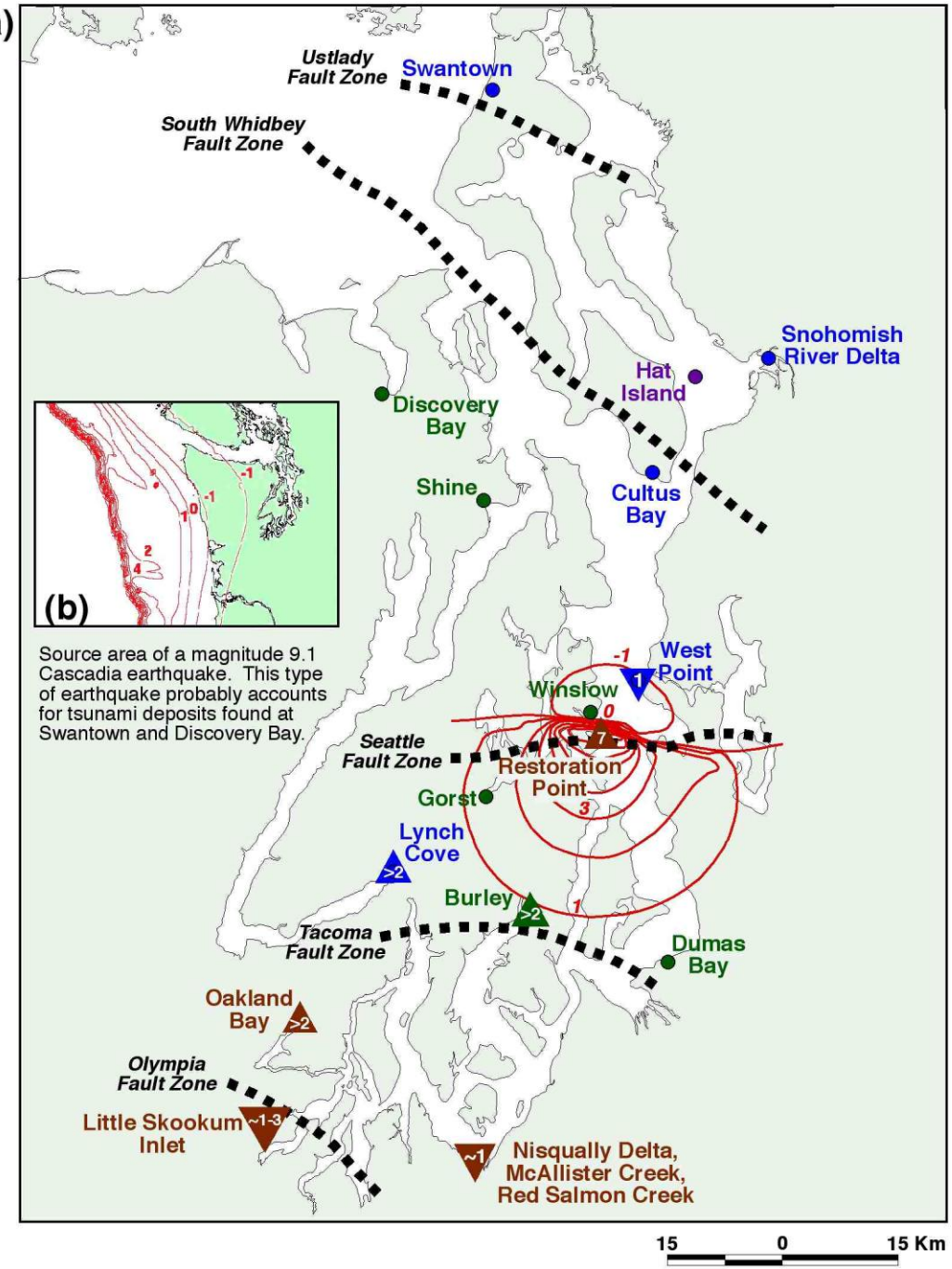
- High-Priority Area
- Submarine landslide zones
- River Deltas
- Fault Zones
- Steep and Deep
- Deep Water
- Steep Topography

Historical Evidence

- Geologic evidence for prehistoric tsunamis
- Tsunami deposit documented in journal article
- Candidate for tsunami deposit, seen in reconnaissance
- Large historical submarine landslides

NOAA TIME Center

Earthquakes



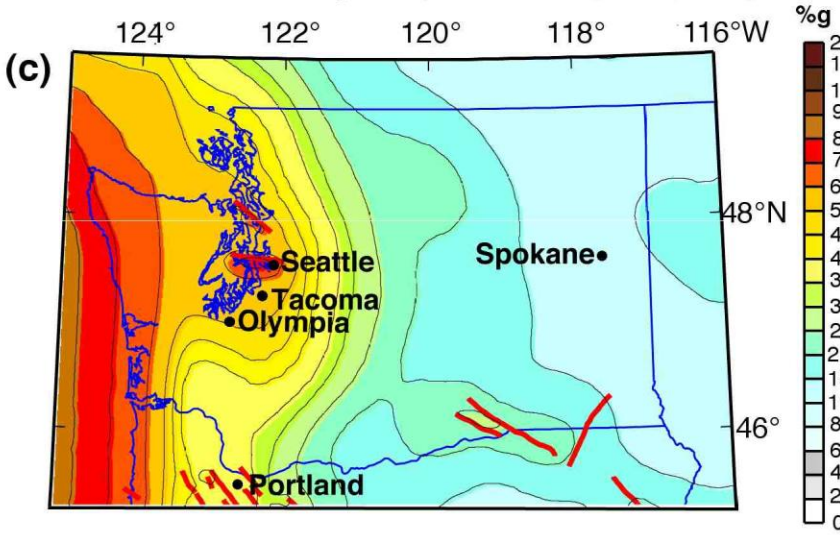
Tsunami Evidence

- Published geologic tsunami deposit
- Candidate geologic tsunami deposit seen in reconnaissance
- Native American Stories

Published co-seismic Vertical Deformation Estimates (Color-coded for Tsunami Evidence)

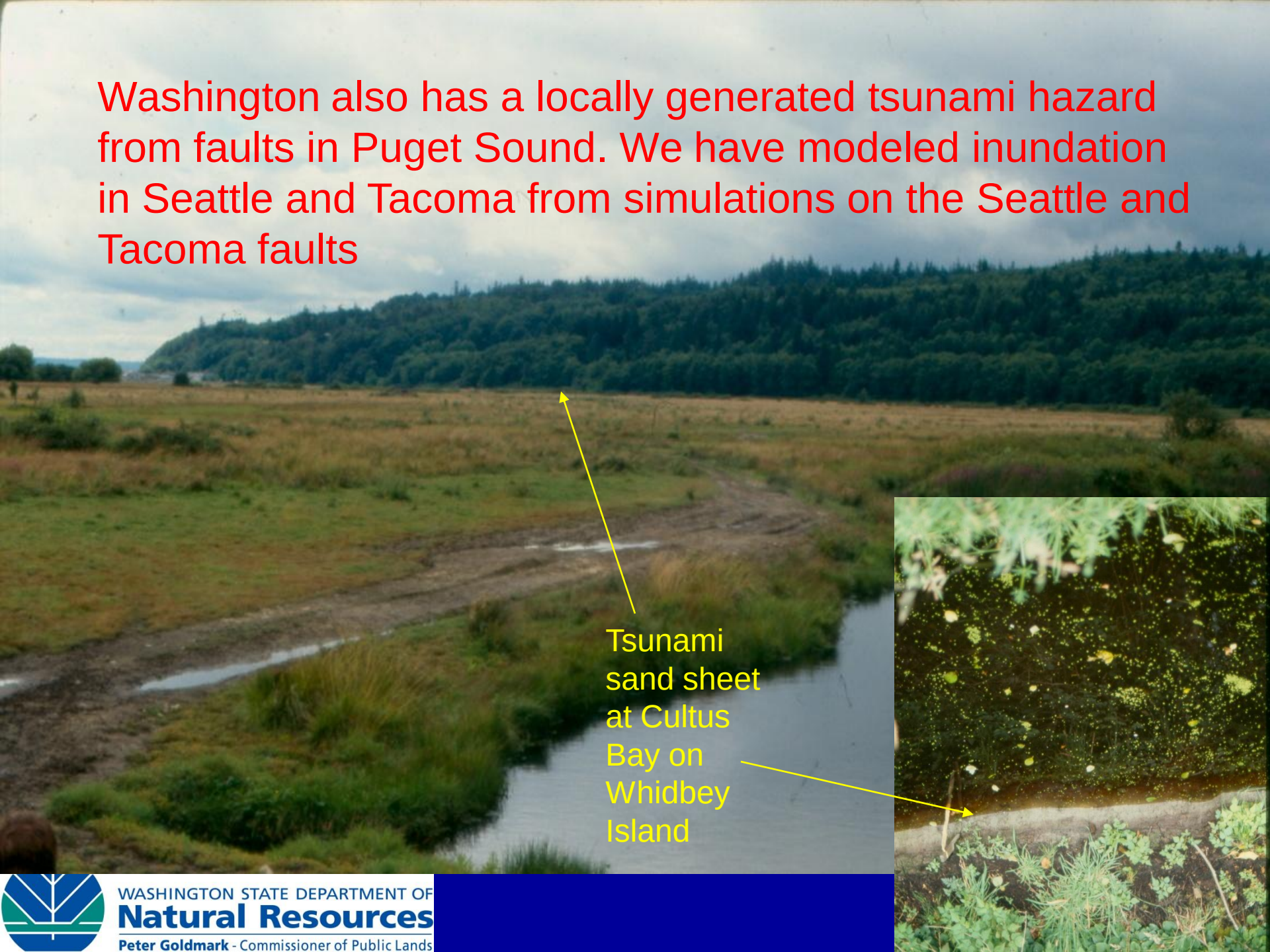
- Uplift of n meters
- Subsidence of n meters
- Fault Zones
- Vertical deformation for Mw 7.3 Seattle Fault

Peak Ground Acceleration with 2% probability of exceedance in 50 years (after Frankel, et al.,1996)

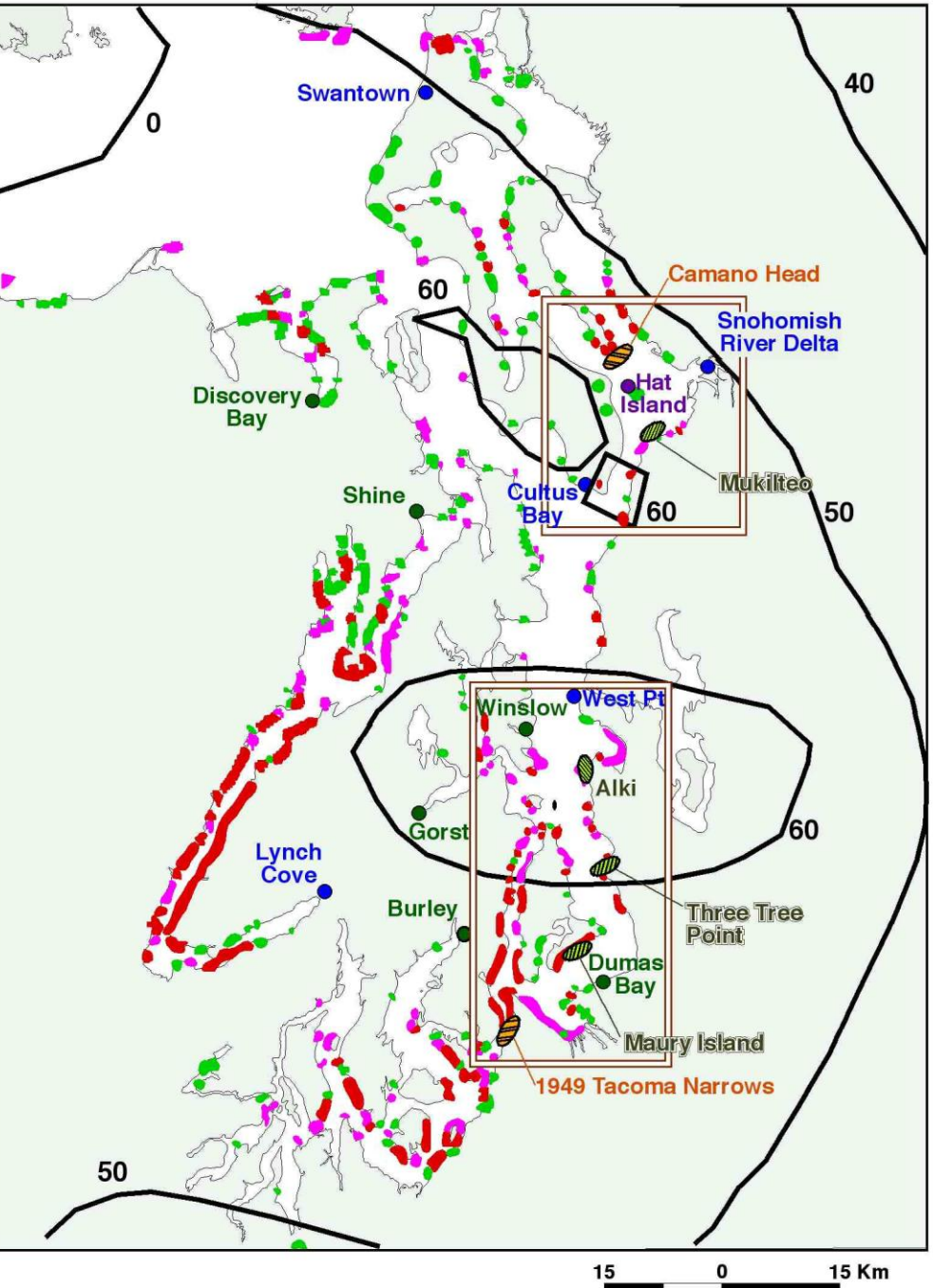


Map (a) is based on discussions held during the Puget Sound Tsunami Sources workshop held in Seattle, Washington on 10 June 2002, and on subsequent reviews and discussion by workshop participants. Contributing institutions included Kent State University, National Oceanic and Atmospheric Administration (NOAA), University of Nevada, University of Washington, U.S. Geological Survey (USGS), and Washington Division of Geology and Earth Resources. The workshop was organized by NOAA's Center for Tsunami Inundation Mapping Efforts (TIME), the USGS, Washington's Department of Natural Resources (WADN and Washington's Emergency Management Division (WAEMD).

Washington also has a locally generated tsunami hazard from faults in Puget Sound. We have modeled inundation in Seattle and Tacoma from simulations on the Seattle and Tacoma faults



Landslides



Potential landslide zones of concern identified at workshop

Large submarine landslides[1]

Subaerial landslides

60 Probabilistic shaking hazard contours[1]

Steep coastal topography

Deep coastal water

Steep topography near deep water

Tsunami Evidence

- Published geologic tsunami deposit
- Candidate geologic tsunami deposit seen in reconnaissance
- Native American Stories

[1] Unpublished data. See text.

[1] Acceleration in percent of gravity. Peak ground acceleration with 2% probability of exceedance in 50 years. Frankel, et al. 1997. Seismic-hazard maps for the conterminous United States, U.S. Geological Survey Open-File Report 97-131.

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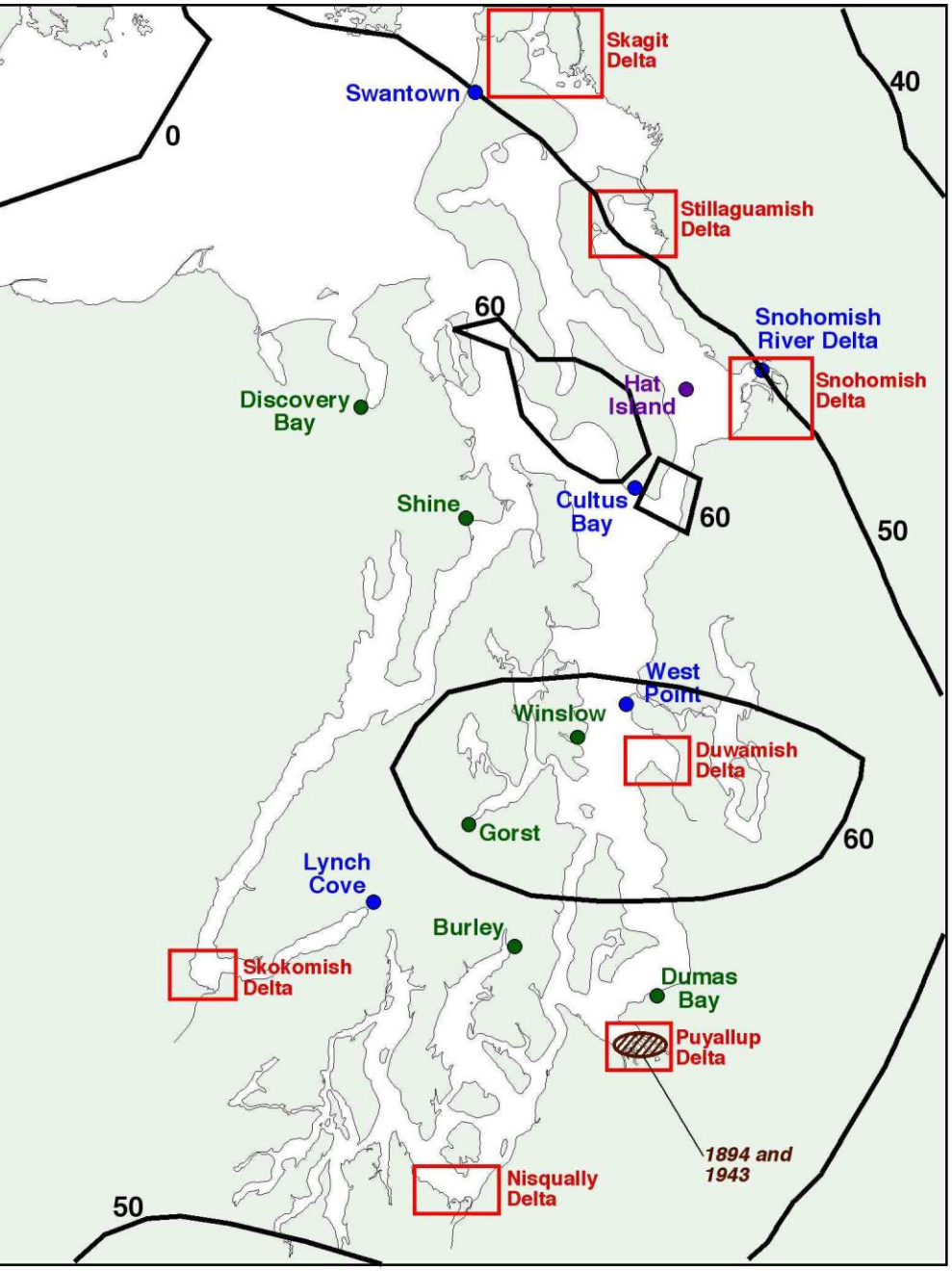
Landslide-induced tsunamis are also fairly common in western Washington

The bluff slid in. People at Hat Island in the early summer morning saw Camano Island bluff smoking; they couldn't see it for the smoke; and there was something black coming toward them, and then they saw it was a wave. They fled to high land. Some of the men and women, and some of the children were drowned (Tweddell, 1953, p. 67).

From Shipman, Hugh, 2001, The Fall of Camano Head: A Snohomish Account of a Large Landslide and Tsunami in Possession Sound During the Early 1800s: TsuInfo Alert, V. 3, No. 6, p. 13-14.

Qmw
Qb
Qguc
Qco?
Qb
Qgor
Qls
Qgasv
Qguc
Qgor
Qcw?
Qgpld
Qls
Qgasv
Qb
Qgpld
Qcw?
Qm
Qb
Qgtv
Qls
Pebble Beach
Qmw
Qmw
Qb
Qgtv
Qp
af
Qgome
Qb
Qgtv
Qguc
Qls
Qguc
Qgpld
Qcw?
Fig. 1
Qcpd?
Qls
Qb
Camano Head
elev. 89 ft
48 ft
covered
12 ft
Qcw?
stratified, fine-grained sand and silt
8 ft
Qcw?
fine-grained, stratified sand
15 ft
Qcw?
stratified, fine-grained sand and silt
elev. 6 ft
14C age: >41,360 yr B.P. (Table 1, loc. 5)

Delta Failures



15 0 15 Km

Historic Delta Failure

River Deltas

60 Probabilistic shaking hazard contours[1]

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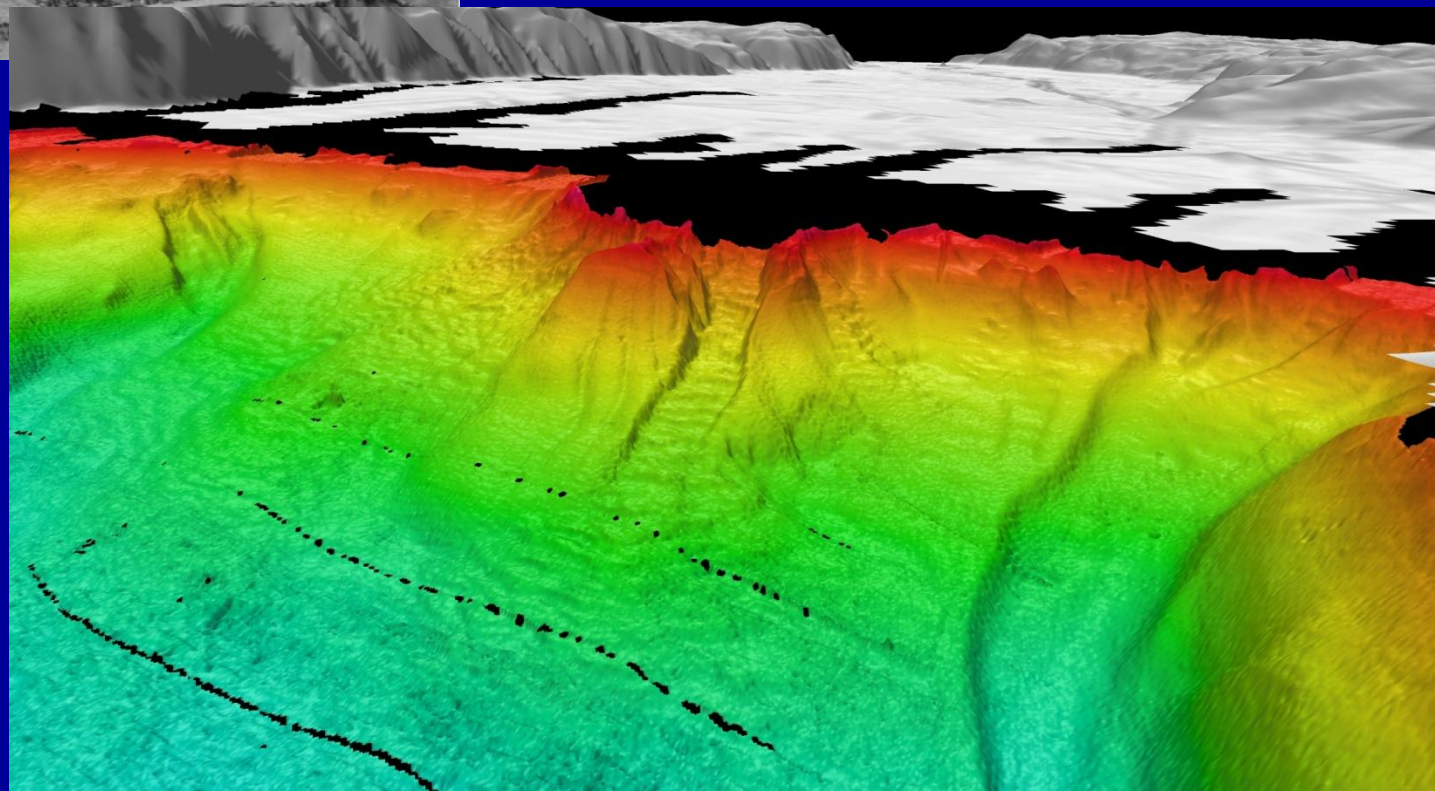
Commencement Bay -- 1894



Commencement Bay dump site 5x VE, looking SE

On Wednesday, August 25th, 2009, a large landslide occurred near the Blue Creek drainage on the Spokane Indian Reservation side of the Spokane Arm of the lake. Like the one that occurred on January 16th of this year, responding park staff found that a large section of hillside had broken free, creating a wave that was approximately 12 feet high by the time it hit Porcupine Campground on the southern shore less than a thousand yards across the lake.