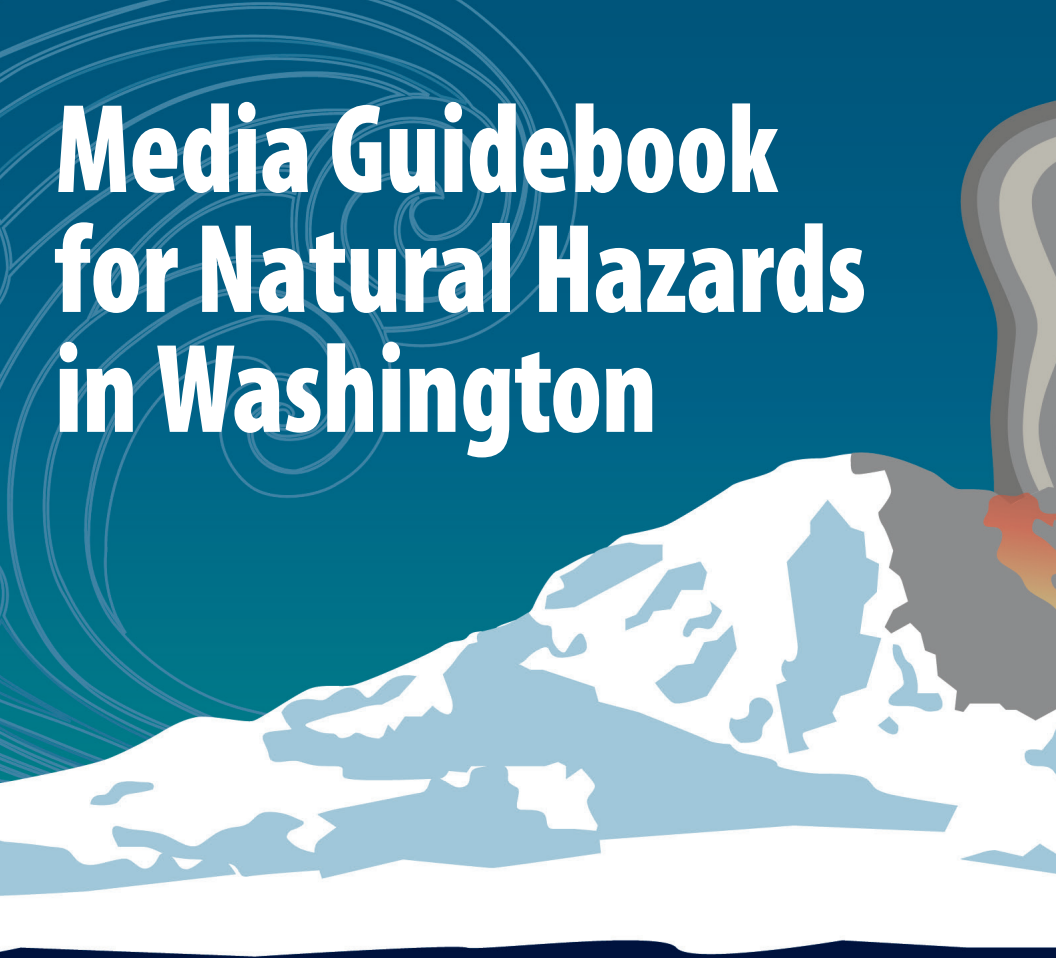
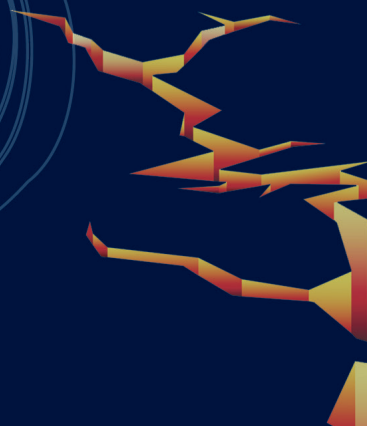
Media Guidebook for Natural Hazards in Washington



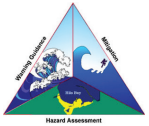
Addressing the threats of Tsunamis, Volcanoes and Earthquakes



Washington Military Department
Emergency Management Division

Media Guidebook for Natural Hazards in Washington

Washington Military Department
Emergency Management Division



National Tsunami Hazard Mitigation Program

U.S. Geological Survey

ISSUE DATE: APRIL 2006

Table of Contents

This booklet addresses the threats of Tsunamis, Volcanoes and Earthquakes. Each of the three categories begins with blue category sheets, such as **TSUNAMI HAZARDS**. The table of contents below uses "**BOLD FACE TYPE**" **[TAB]** to signify a tabbed divider sheet.

TSUNAMI HAZARDS

VOLCANO HAZARDS

EARTHQUAKE HAZARDS

Introduction

The Pacific Coast of Washington is at risk from tsunamis. These destructive waves can be caused by coastal or submarine landslides or volcanism, but they are most commonly caused by large submarine earthquakes.

Tsunamis are generated when these geologic events cause large, rapid movements in the sea floor that displace the water column above. That swift change creates a series of high-energy waves that radiate outward like pond ripples. Local offshore tsunamis would strike the adjacent shorelines within minutes. The Pacific Coast is at risk both from locally and distantly generated tsunamis.

A tsunami is a series of waves that can generate surges of water along shorelines causing dangerous inundations that can last minutes, hours or even days. Later waves can be as dangerous as the first wave. This is especially true for later waves arriving during the next high tide.

Warnings

Local vs. Distant Warnings

Local: If the earthquake occurs off our coast, there may be no time to send out hazard warnings and may make alert and notification systems inoperable. The first waves could arrive within 30 minutes of the earthquake. The only tsunami warning might be the earthquake itself.

Distant: When an earthquake that might generate a Pacific Coast tsunami is detected, the West Coast/Alaska Tsunami Warning Center calculates the danger to the northeast Pacific Coast and notifies the communities at risk.

Along the Pacific coast, the only tsunami warning stemming from a local earthquake might be the earthquake itself. Distant earthquakes typically allow adequate time to notify communities at risk.

Broadcasters

This guidebook provides a concise overview of the notification process used to send tsunami alerts to public information broadcasters, local jurisdictions and the public. It includes a Tsunami Warning Flow Chart that shows how information is sent to broadcasters, a contact list of tsunami experts who can provide credible tsunami information during a tsunami event, and Washington coastal community maps of regions most susceptible to tsunamis.

A DVD, *Tsunamis Preparedness in Washington* (running time: 32 minutes) accompanies this guidebook (located in the binder sleeve).

Coastal Tsunami Inundation Maps

Washington coast maps appear in geographic order by county name. Each map includes a symbol key that pinpoints tsunami hazard zones, evacuation routes, and safer assembly areas for people.

Tsunami Warning Flow Chart

HOW THE TSUNAMI WARNING SYSTEM WORKS

West Coast / Alaska Tsunami Warning Center (Palmer, Alaska)

→ ***TSUNAMI WARNING MESSAGE*** →

NWS sends Tsunami EAS Message
State EOC *and*
Local Jurisdictions *and*
Broadcasters *and*
Citizens (via NOAA Weather Radio)

↓

State EOC sends Prescripted Message

EMD/COUNTY/TRIBAL TSUNAMI WARNING

To: Local Jurisdictions
Broadcasters
Citizens (via NOAA Weather Radio)

↓

State EOC sends Prescripted Message

ACTIVATE AHAB RADIOS

Washington Military Department
Emergency Management Division

WC/ATWC:	**West Coast/Alaska Tsunami Warning Center (Palmer, Alaska)**
State EOC:	**State Emergency Operation Center**
NWS:	**National Weather Service Coastal Offices**
AHAB:	**All Hazards Alert Broadcast**
EAS:	**Emergency Alert System**

Local Subject Matter Expert Contacts

TSUNAMI NUMERICAL MODELING

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NOAA Center for Tsunami Research
NOAA/PMEL - UW/JISAO
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Fax: 206-526-6485

Diego Arcas
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NOAA Center for Tsunami Research
7600 Sand Point Way NE
Seattle WA 98115

TSUNAMIS GENERAL

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INUNDATION MAPPING

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Department of Natural Resources
Geologic Hazards
Email: Tim.walsh@dnr.wa.gov
Tel: 360-902-1432
Cell: 360-791-3130

EARTHQUAKE/TSUNAMI HISTORIAN

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U.S. Geological Survey at Department of Earth and Space Sciences
University of Washington
Box 351310
Seattle, WA 98195-1310
Tel: 206-553-2927
Email: atwater@usgs.gov

(Continued next page)

Local Subject Matter Expert Contacts

TSUNAMI WARNING CENTER

West Coast/Alaska Tsunami Warning Center

PALMER, ALASKA

Tel: 907-745-4212
(Warning Center)

ANCHORAGE, ALASKA

Tel: 907-271-4767
(NWS Alaska Region PIO)

EMERGENCY ALERT SYSTEM (EAS) OF TSUNAMI MESSAGE

National Weather Service

SEATTLE

Tel. 206-526-6857
(unlisted media line)

PORTLAND

Tel. 503-261-9248
(unlisted media line)

Tsunami Bulletin (Example)

From West Coast/Alaska Tsunami Warning Center

WEAK51 PAAQ 031705
TSUAK1

BULLETIN
PUBLIC TSUNAMI MESSAGE NUMBER 1
NWS WEST COAST/ALASKA TSUNAMI WARNING CENTER PALMER AK
905 AM PST SUN FEB 3 2013

...A TSUNAMI WARNING IS NOW IN EFFECT...

...A TSUNAMI ADVISORY IS NOW IN EFFECT...

WARNINGS/ADVISORIES/WATCHES - UPDATED

TSUNAMI WARNING IN EFFECT FOR...

* THE COASTAL AREAS OF CALIFORNIA FROM THE CALIFORNIA-MEXICO BORDER TO DAVENPORT CALIFORNIA/LOCATED 10 MILES NW OF SANTA CRUZ/

TSUNAMI ADVISORY IN EFFECT FOR...

* THE COASTAL AREAS OF CALIFORNIA FROM DAVENPORT CALIFORNIA/LOCATED 10 MILES NW OF SANTA CRUZ/ TO THE OREGON-CALIFORNIA BORDER

* FOR OTHER US AND CANADIAN PACIFIC COASTS IN NORTH AMERICA - THE LEVEL OF TSUNAMI DANGER IS BEING EVALUATED. FURTHER INFORMATION WILL BE PROVIDED IN SUPPLEMENTARY MESSAGES.

PRELIMINARY EARTHQUAKE PARAMETERS
---
* MAGNITUDE 7.7
* ORIGIN TIME 0803 AKST FEB 03 2013
  0903 PST FEB 03 2013
  1703 UTC FEB 03 2013
* COORDINATES 33.6 NORTH 118.2 WEST
* DEPTH 2 MILES

(continued next page)

* LOCATION 85 MILES NW OF SAN DIEGO CALIFORNIA
30 MILES S OF LOS ANGELES CALIFORNIA

IMPACTS FOR TSUNAMI WARNING AREAS
---

* WIDESPREAD DANGEROUS COASTAL FLOODING ACCOMPANIED BY POWERFUL CURRENTS IS POSSIBLE AND MAY CONTINUE FOR MANY HOURS AFTER TSUNAMI ARRIVAL.

* THE FIRST WAVE MAY NOT BE THE LARGEST.

IMPACTS FOR TSUNAMI ADVISORY AREAS
---

* A TSUNAMI CAPABLE OF PRODUCING STRONG CURRENTS OR WAVES DANGEROUS TO PERSONS IN OR VERY NEAR THE WATER IS EXPECTED.

* CURRENTS MAY BE HAZARDOUS TO SWIMMERS... BOATS... AND COASTAL STRUCTURES AND MAY CONTINUE FOR MANY HOURS AFTER THE TSUNAMI ARRIVAL.

* THE FIRST WAVE MAY NOT BE THE LARGEST.

RECOMMENDED ACTIONS - UPDATED
---

* IF YOU ARE IN A WARNING AREA - MOVE INLAND TO HIGHER GROUND.

* IF YOU ARE IN AN ADVISORY AREA - MOVE OFF THE BEACH AND OUT OF HARBORS AND MARINAS. WIDESPREAD INUNDATION OF LAND IS NOT EXPECTED FOR ADVISORY AREAS.

* BE ALERT TO INSTRUCTIONS FROM YOUR LOCAL EMERGENCY OFFICIALS.

* DO NOT GO TO THE COAST TO OBSERVE THE TSUNAMI.

* DO NOT RETURN TO THE COAST UNTIL LOCAL EMERGENCY OFFICIALS INDICATE IT IS SAFE TO DO SO.

(continued next page)

FORECASTS AND/OR OBSERVATIONS OF TSUNAMI ACTIVITY

SITE	FORECAST START OF OF TSUNAMI
* CALIFORNIA	
SAN PEDRO	0912 PST FEB 3
LA JOLLA	0931 PST FEB 3
SANTA BARBARA	0951 PST FEB 3
SAN FRANCISCO	1119 PST FEB 3
CRESCENT CITY	1142 PST FEB 3

NEXT UPDATE AND ADDITIONAL INFORMATION
---

* THIS MESSAGE WILL BE UPDATED IN 30 MINUTES.

* REFER TO THE INTERNET SITE WCATWC.ARH.NOAA.GOV FOR MORE INFORMATION.

* PACIFIC COASTAL RESIDENTS OUTSIDE CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO THE PACIFIC TSUNAMI WARNING CENTER MESSAGES FOR INFORMATION ON THIS EVENT AT PTWC.WEATHER.GOV.

$$

Tsunami Bulletin (Example)

From Washington State Emergency Operation Center

"THIS IS NOT A TEST. A TSUNAMI WARNING HAS BEEN ISSUED FOR THE COASTAL AREAS OF WASHINGTON. A TSUNAMI CAN CAUSE DANGEROUS FLOODING. IF YOU ARE IN A LOW COASTAL AREA YOU ARE AT RISK AND MUST MOVE TO HIGHER GROUND OR INLAND NOW. DO NOT RETURN UNTIL DIRECTED TO DO SO. CLOSELY MONITOR LOCAL RADIO STATIONS FOR ADDITIONAL INFORMATION. THIS IS NOT A TEST. A TSUNAMI WARNING HAS BEEN ISSUED FOR THE COASTAL AREAS OF WASHINGTON. MOVE TO HIGHER GROUND OR INLAND NOW."

Know the types of tsunami bulletins issued by the West Coast / Alaska Tsunami Warning Center

A Tsunami Warning

A tsunami warning is issued when a tsunami with the potential to generate widespread inundation is imminent, expected, or occurring. Warnings alert the public that dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after initial arrival. Warnings alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic information.

A Tsunami Advisory

A tsunami advisory is issued when a tsunami with the potential to generate strong currents or waves dangerous to those in or very near the water is imminent, expected, or occurring. The threat may continue for several hours after initial arrival, but significant inundation is not expected for areas under an advisory. Appropriate actions to be taken by local officials may include closing beaches, evacuating harbors and marinas, and the repositioning of ships to deep waters when there is time to safely do so. Advisories are normally updated to continue the advisory, expand/contract affected areas, upgrade to a warning, or cancel the advisory.

Know the types of tsunami bulletins issued by the West Coast / Alaska Tsunami Warning Center

A Tsunami Watch

A tsunami watch is issued to alert emergency management officials and the public of an event which may later impact the watch area. The watch area may be upgraded to a warning or advisory - or canceled - based on updated information and analysis. Therefore, emergency management officials and the public should prepare to take action. Watches are normally issued based on seismic information without confirmation that a destructive tsunami is underway.

A Tsunami Information Statement

A tsunami information statement is issued to inform emergency management officials and the public that an earthquake has occurred, or that a tsunami warning, watch or advisory has been issued for another section of the ocean. In most cases, information statements are issued to indicate there is no threat of a destructive tsunami and to prevent unnecessary evacuations as the earthquake may have been felt in coastal areas. An information statement may, in appropriate situations, caution about the possibility of destructive local tsunamis. Information statements may be re-issued with additional information, though normally these messages are not updated. However, a watch, advisory or warning may be issued for the area, if necessary, after analysis and/or updated information becomes available.

Know the terms used by the West Coast / Alaska Tsunami Warning Center

An Information Statement (Example)

WEAK53 PAAQ 031750
TIBAK1

PUBLIC TSUNAMI INFORMATION STATEMENT NUMBER 1
NWS WEST COAST/ALASKA TSUNAMI WARNING CENTER PALMER AK
950 AM PST SUN FEB 3 2013

...THIS IS A TSUNAMI INFORMATION STATEMENT FOR ALASKA/ BRITISH COLUMBIA/ WASHINGTON/ OREGON AND CALIFORNIA...

EVALUATION
---

* THERE IS NO TSUNAMI DANGER FOR THE AREAS LISTED ABOVE.

* BASED ON THE DEPTH OF THE EARTHQUAKE A TSUNAMI IS NOT EXPECTED.

* AN EARTHQUAKE HAS OCCURRED WITH PARAMETERS LISTED BELOW.

PRELIMINARY EARTHQUAKE PARAMETERS
---

* MAGNITUDE	7.2				
* ORIGIN TIME	0844	AKST	FEB	03	2013
	0944	PST	FEB	03	2013
	1744	UTC	FEB	03	2013
* COORDINATES	30.0 SOUTH	178.2 WEST			
* DEPTH	71 MILES				
* LOCATION	KERMADEC ISLANDS NEW ZEALAND				

(continued next page)

NEXT UPDATE AND ADDITIONAL INFORMATION
---

* THIS WILL BE THE ONLY WCATWC MESSAGE FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

* REFER TO THE INTERNET SITE WCATWC.ARH.NOAA.GOV FOR ADDITIONAL INFORMATION.

* PACIFIC COASTAL REGIONS OUTSIDE CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO THE PACIFIC TSUNAMI WARNING CENTER MESSAGES AT PTWC.WEATHER.GOV.

$$

Washington Coast

Tsunami Inundation Maps: The following map pages are organized by county in geographic order beginning with Point Roberts in Whatcom County

Note: Bold number following the site name indicates page location of map.

Whatcom County, WA

Point Roberts

Whatcom County, WA

Lummi Reservation

Whatcom County, WA

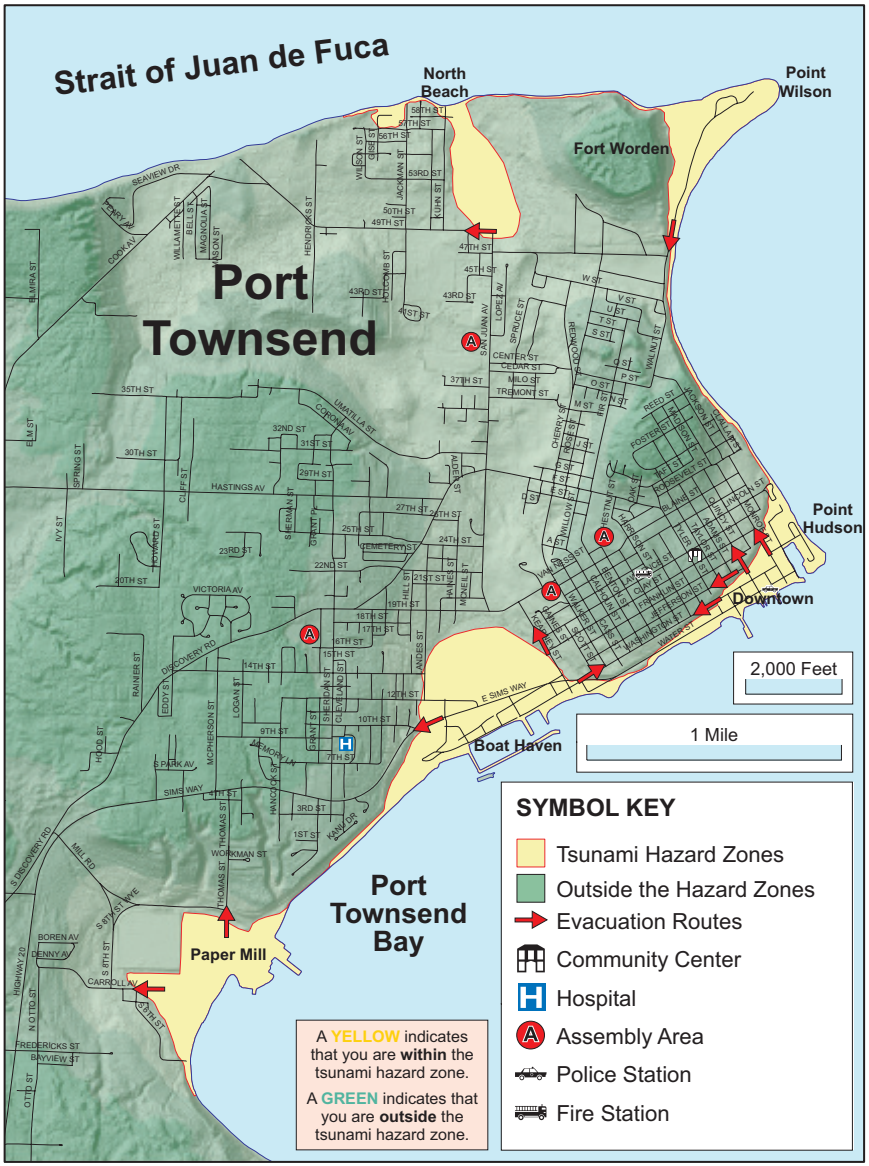
Sandy Point

Whatcom County, WA

Bellingham

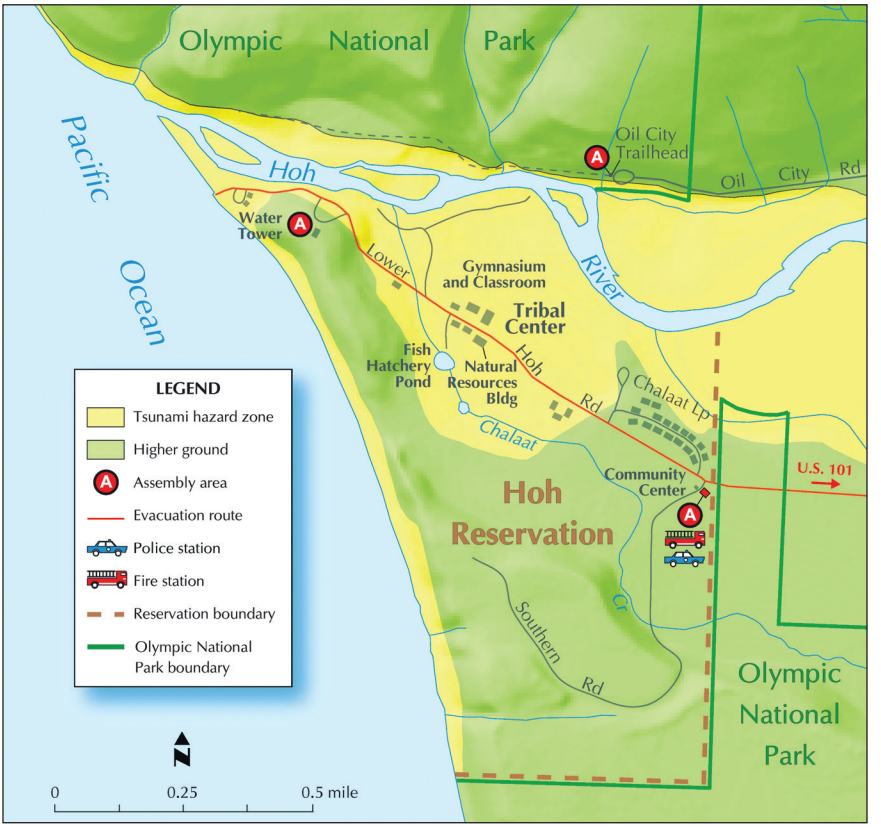
Jefferson County, WA

Port Townsend



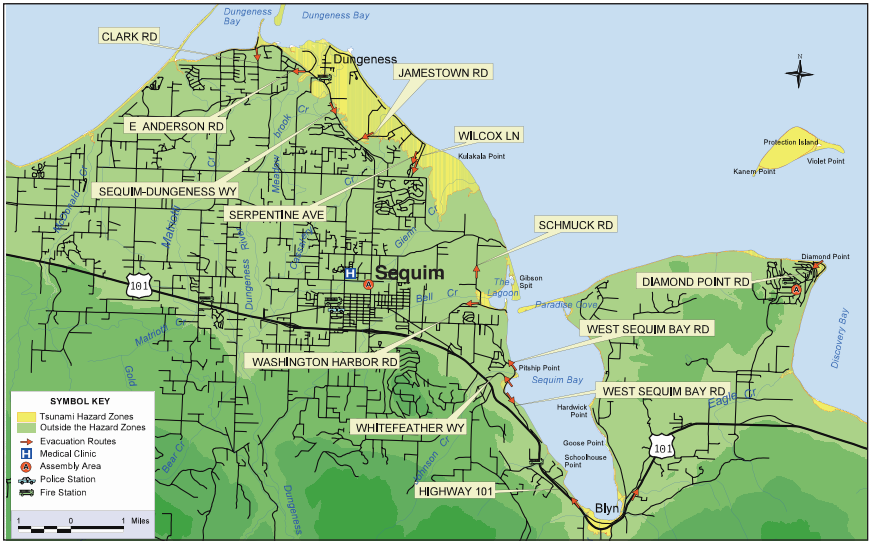
Jefferson County, WA

Hoh Reservation



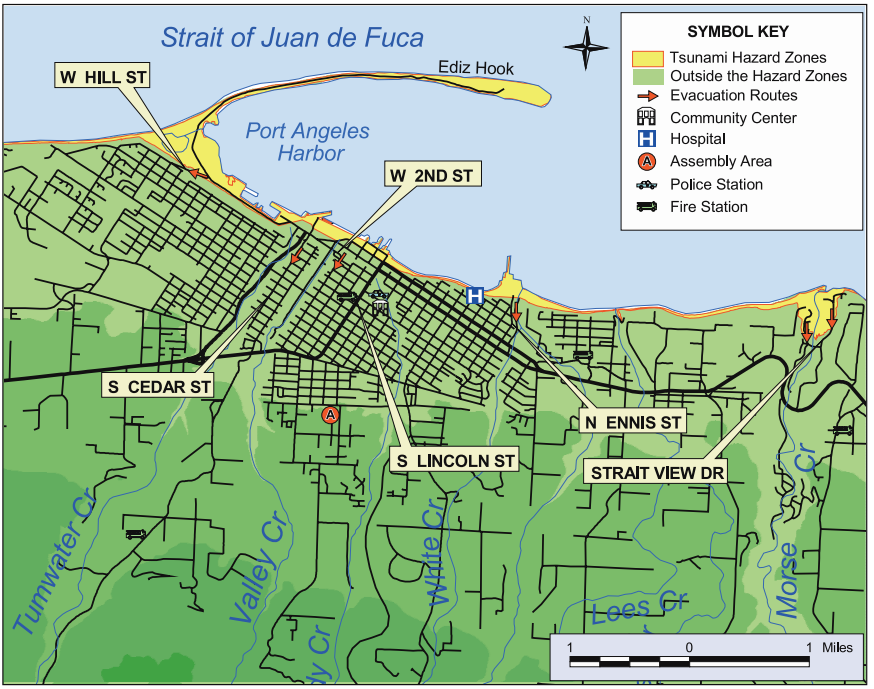
Clallam County, WA

Sequim



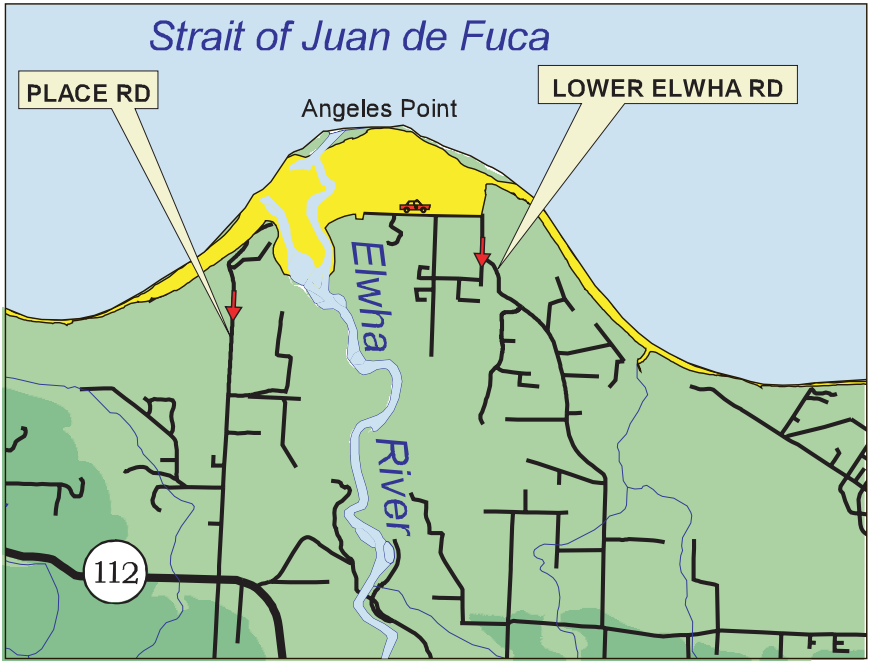
Clallam County, WA

Port Angeles



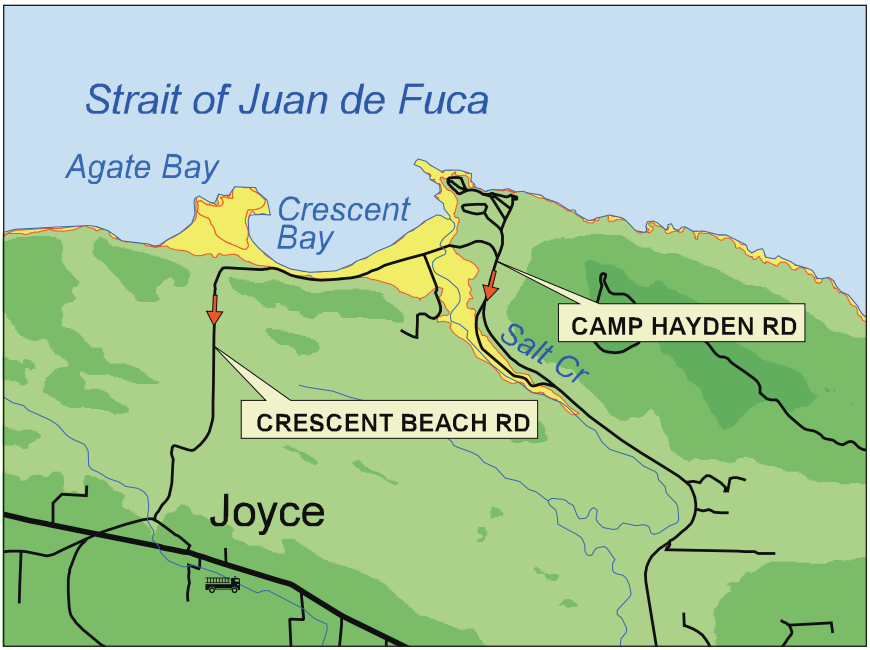
Clallam County, WA

Angeles Point



Clallam County, WA

Agate Bay / Crescent Bay (Crescent Beach)



Clallam County, WA

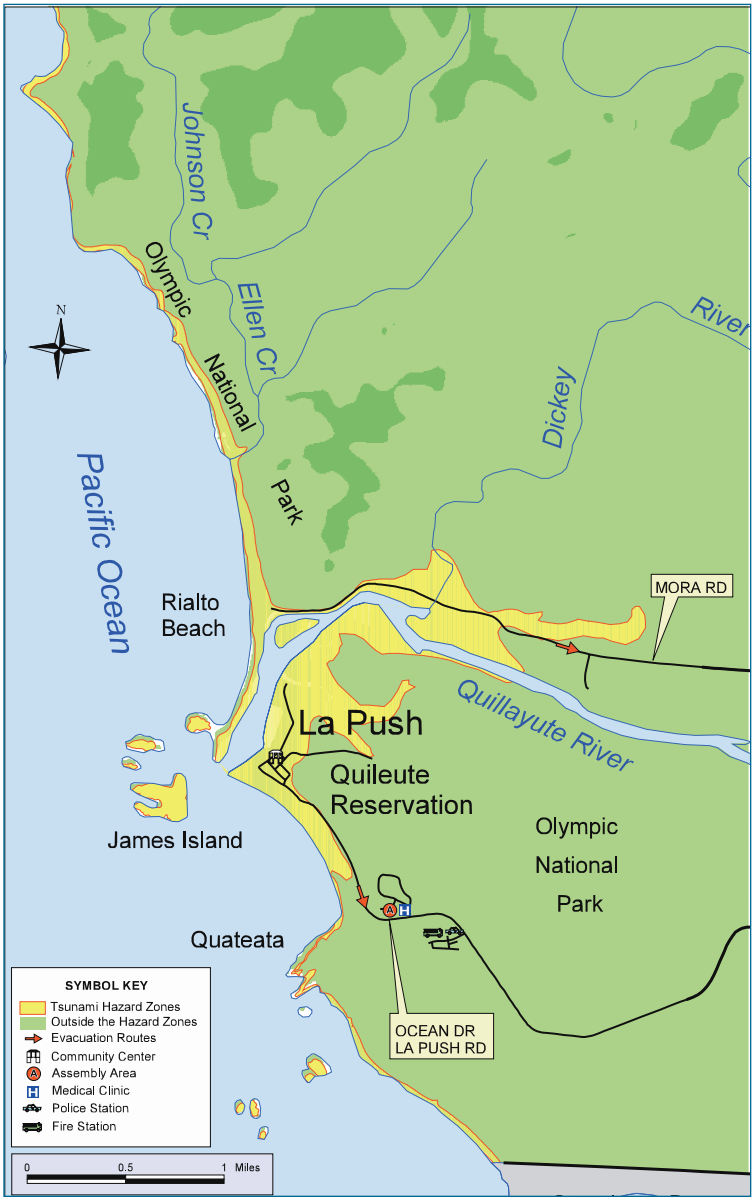
Clallam Bay / Kydaka Point

Clallam County, WA

Neah Bay / Makah Bay

Clallam County, WA

La Push



Grays Harbor County, WA

Copalis Beach / Ocean City

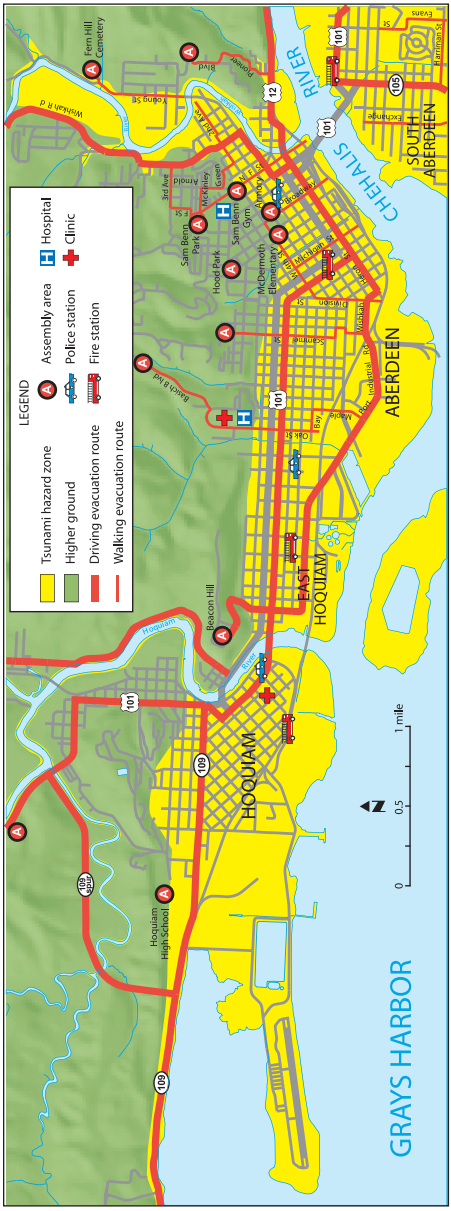
Grays Harbor County, WA

Oyhut / Ocean Shores

ISSUE DATE: APRIL 2006

Grays Harbor County, WA

Hoquiam / Aberdeen

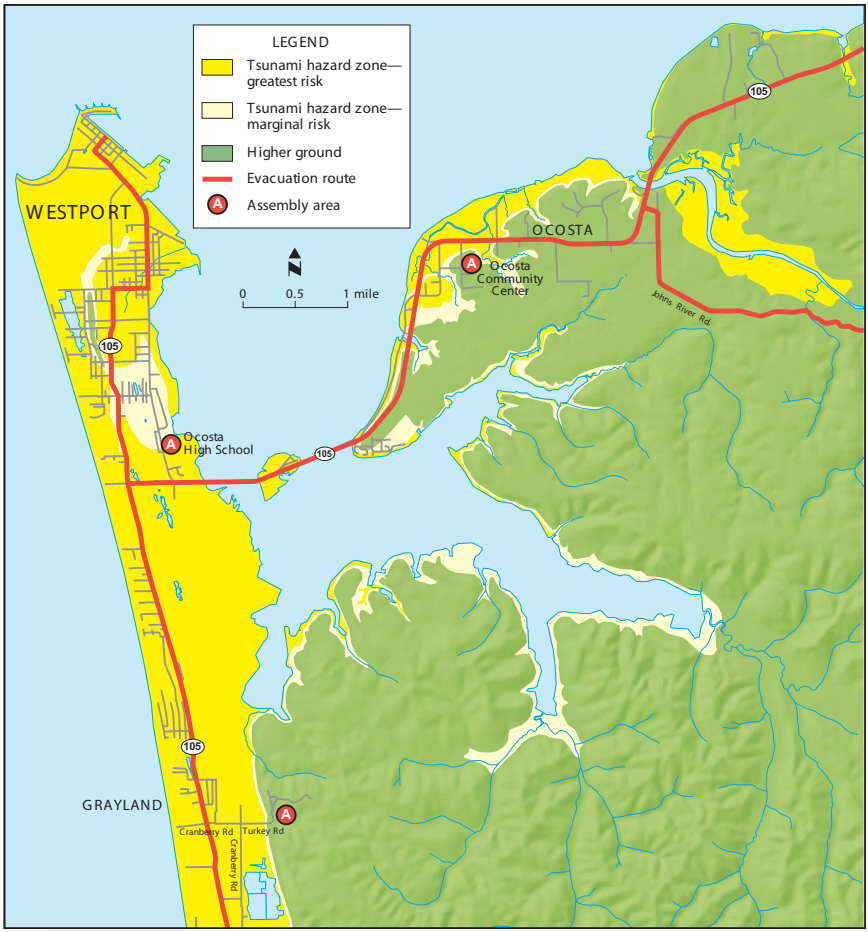


Grays Harbor County, WA

South Aberdeen / Cosmopolis

Grays Harbor County, WA

Westport / Grayland

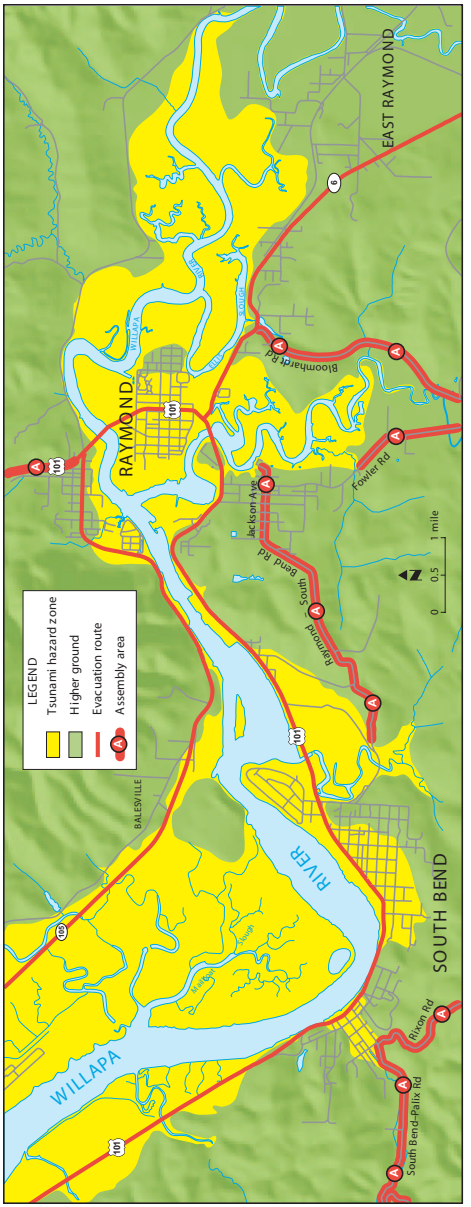


Pacific County, WA

North Cove / Shoalwater Bay / Tokeland

Pacific County, WA

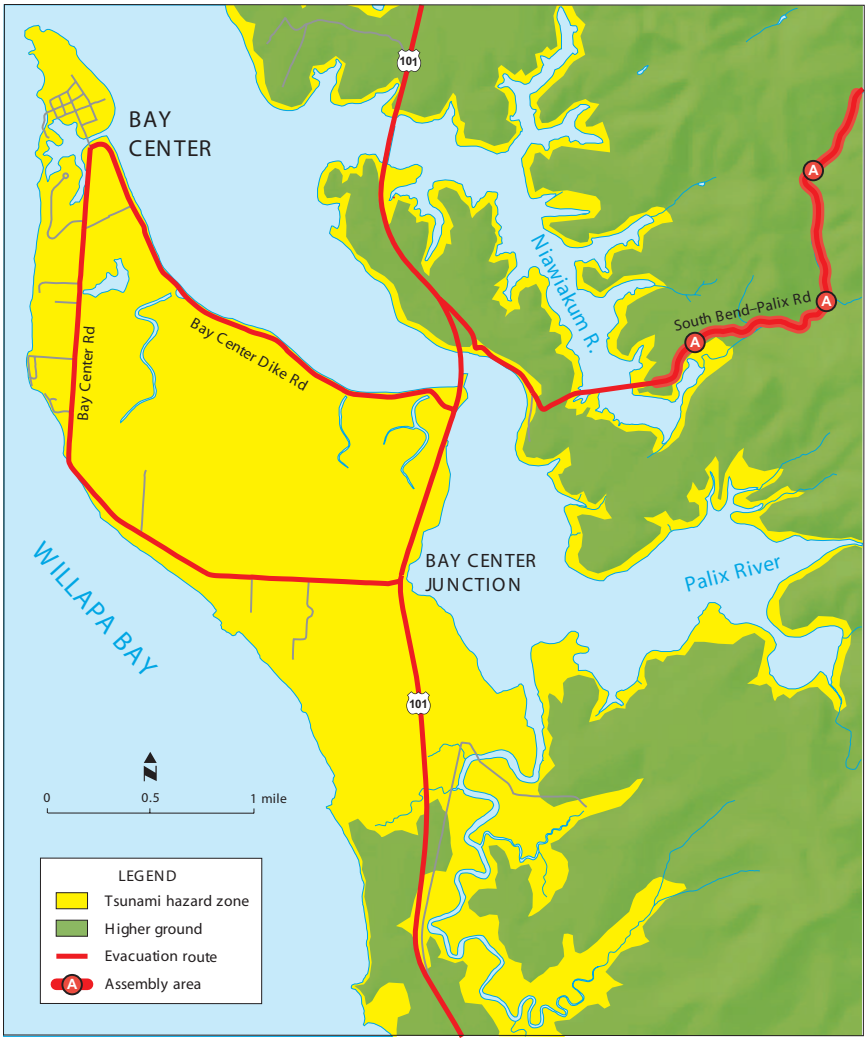
Raymond / South Bend



ISSUE DATE: APRIL 2006

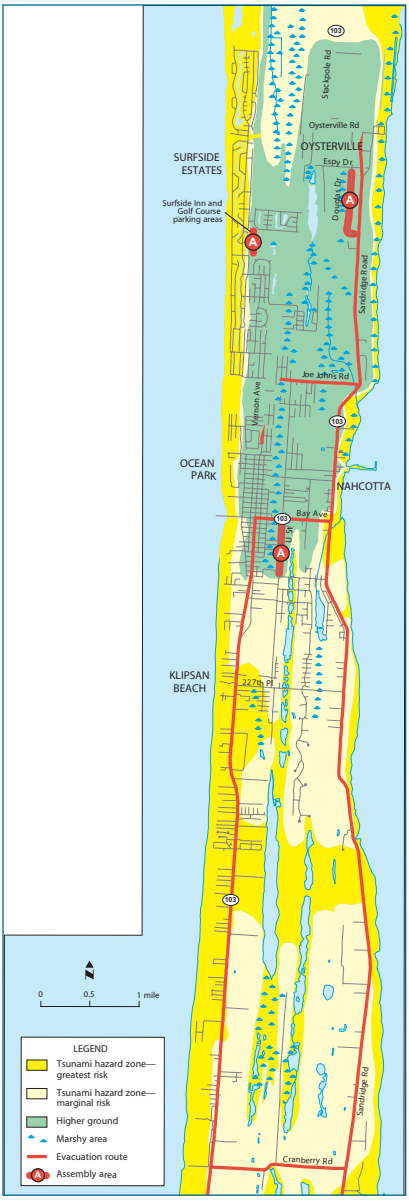
Pacific County, WA

Bay Center



Pacific County, WA

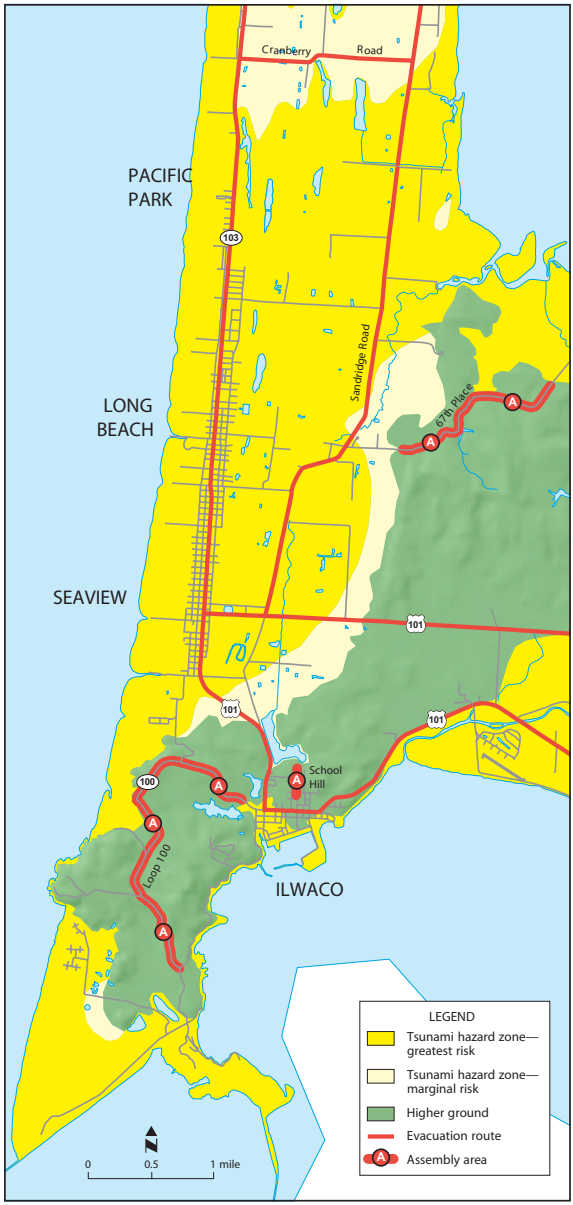
Surfside / Ocean Park / Klipsan Beach



ISSUE DATE: APRIL 2006

Pacific County, WA

Pacific Park / Long Beach / Seaview / Ilwaco



Tsunami Fact Sheet

What is a tsunami?

A tsunami is a series of waves typically generated by vertical displacement of the sea floor or lake bed caused by an earthquake. Tsunamis can cause significant death and destruction, with the greatest impact in areas closest to the source. The initial tsunami wave can arrive on shore within minutes of an earthquake, or up to several hours later, depending upon distance from the source.

Have we experienced a tsunami?

Yes. Tsunamis from locations across the Pacific Ocean basin and from the Cascadia Subduction Zone off the Washington coast have hit coastal communities. Tsunamis generated by sources such as an earthquake on the Seattle Fault or the eruption of Mount St. Helens struck Puget Sound and other inland waters. Tsunamis hit Washington's shorelines in the 900-930 era, 1700, the 1890's, 1944-1953 era, 1949, 1960, 1964, and 1980.

Will a tsunami strike again?

Yes. Great earthquakes in the Pacific Ocean basin generating tsunamis that could impact Washington's outer coast and Strait of Juan de Fuca occur at a rate of about six every 100 years. In the Cascadia Subduction Zone, there is a 10 to 14 percent chance of a magnitude 9 earthquake and tsunami in the next 50 years. A rate of occurrence for local earthquakes and landslides that generate tsunamis has not been determined.

Who is at risk?

Communities along the Pacific Coast and Strait of Juan de Fuca, including a number of coastal Indian tribes, are at greatest risk. In a Cascadia Subduction Zone earthquake, the level of the coastal region could fall up to six feet, and tsunami waves could reach 30 feet, overtopping several low-lying coastal communities. At-risk population is more than 43,000 on the outer coast, excluding tourists and transient populations that could increase the number significantly.

Special note:

In its earthquake and tsunami potential, the Cascadia Subduction Zone resembles the Sunda Trench off the coast of Sumatra Island, Indonesia. The Sunda Trench produced giant earthquakes and tsunamis in December 2004 and March 2005 that killed more than 284,000 people and displaced another 1.1 million people in the Indian Ocean basin. Waves from the December 2004 tsunami reached 100 feet in places and traveled inland as far as five miles on Sumatra. The tsunami was measured around the world.

This information taken from the 2008 edition of the Washington State Enhanced Hazard Mitigation Plan, Washington Military Department, Nov. 2007.

Tsunami Resources

NTHMP Media Corner
http://nthmp.tsunami.gov/media-corner/guidebook.php

Washington State Emergency Management
http://www.emd.wa.gov/hazards/haz_tsunami.shtml

PMEL-NOAA Center for Tsunami Research
http://nctr.pmel.noaa.gov

National Weather Service Forecast Office, Seattle, WA
http://www.wrh.noaa.gov/sew/tsunmiday.php

NOAA National Buoy Center
http://www.ndbc.noaa.gov/dart.shtml

West Coast and Alaska Tsunami Warning Center
http://wcatwc.arh.noaa.gov

Tsunami.gov
http://www.tsunami.gov

International Tsunami Information Center
http://itic.ioc-unesco.org/index.php

Department of Natural Resources (DNR)
http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/tsunamis.aspx