

How Vulnerable is the City of Port Angeles to Tsunamis?

The Tsunami Hazard

Port Angeles faces two types of tsunami hazard:

- Tsunamis from distant earthquakes on the Pacific rim, such as the 2011 magnitude 9.0 earthquake near Japan. This type is the most common. Because the waves arrive hours after the quake, they are less likely to cause loss of life, but may inflict damage.
- Local tsunamis caused by a M8.0 (or greater) earthquake on the Cascadia subduction zone. This type poses the greatest danger: catastrophic waves, much larger than those from a distant quake, will strike the coast within 25–30 minutes, causing loss of life and widespread damage to property.

Much has been done to improve our understanding of tsunami hazards, develop warning systems, and educate the public. If coastal communities are to reduce the impacts of future tsunamis, they need to know how tsunamis will affect their people, property, economy, and infrastructure.



Figure 1. Aerial view of the community of Port Angeles and its harbor on Washington's north coast. The tsunami hazard zone is shaded in yellow; highways are marked by solid red lines.

WHAT IS THE CASCADIA SUBDUCTION ZONE?

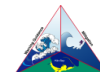
About 100 miles off Washington's outer coast, the Juan de Fuca plate is being pushed beneath the North American plate. An earthquake occurs along this zone when built-up pressure causes the plates to slip rapidly past each other. This massive movement pushes seawater along the zone upward, creating tsunamis at the surface.

All coastal communities along this zone, which extends from northern California to southern British Columbia, will be impacted by the next earthquake and tsunami. The zone has produced earthquakes measuring M8.0 and above at least seven times in the past 3,500 years. The intervals between quakes vary: from as little as 140 years to as much as 1,000. The last one occurred just over 300 years ago. Although scientists cannot predict when the next earthquake will occur, the region is within the window for a significant event.

Port Angeles' Vulnerability

To support local tsunami planning efforts, the U.S. Geological Survey and the Washington Military Department Emergency Management Division assessed variations in exposure of 24 communities along Washington's outer and Strait of Juan de Fuca coasts. They considered how much of a community's developed land and how many of its residents, visitors, and businesses are within the tsunami hazard zone. They also considered what percentage this represented of the community's total population and assets.

Port Angeles, for example, has about 0.3 square miles of developed land in the inundation zone. This represents 5% of the city's developed land. Only 1% of the city's residents and 7% of its employees are in the hazard zone, but this amounts to 209 residents and 864 employees who will need to be taught where and how to evacuate.



PORT ANGELES' VULNERABILITY TO TSUNAMIS			
People/Assets	Number or Amount in Tsunami Zone	% of Community Total in Tsunami Zone	% of Those in Tsunami Zone
All residents	209	1%	---
Residents under age 5	3	0%	2%
Residents over age 65	38	1%	18%
Renters	11	0%	18%
Employees	864	7%	---
Businesses	37	3%	---
Sales volume	\$153,642,000	10%	---

Table 1. Estimates of Port Angeles' population and other assets within the tsunami inundation zone. Economic data is derived from the year 2011; population numbers are based on the 2010 census.

The Most Vulnerable People

All people in the tsunami hazard zone are vulnerable to some extent, but some may be more vulnerable than others. Groups of concern include:

- Children under the age of five: They need direction and help to evacuate and are more likely to develop problems such as post-traumatic stress disorders after a tsunami.
- Adults over the age of 65: They are more likely to have health and mobility issues, to need special medical equipment, and to have limited resources to invest in recovery following a tsunami.
- Renters: Many may be less well prepared for disasters than homeowners and may also have fewer resources to invest in recovery.
- Visitors: Tourists and residents who are visiting public places, such as beaches, museums, medical facilities, grocery stores, and religious centers, may not be prepared for or understand how to respond to tsunami warnings.



Image: Washington State Department of Natural Resources

Figure 2. Aerial view of Port Angeles. The solid yellow line marks the tsunami hazard zone. Colored areas show intensity of development (based on land cover data).

- Water
- Open Space, grassland, pasture, cropland
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Forest
- Shrub/Scrub
- Wetlands

Economic Impacts

- Only 3% of Port Angeles' businesses are in the tsunami hazard zone, but the sales volume of these businesses is over \$153.6 million, so the loss of these businesses would affect the local economy. The sectors most likely to be directly impacted include tourism and manufacturing.
- A tsunami may also damage economically important natural resources, such as timber and fish.
- Many of Port Angeles' businesses are related to tourism. Depending on the season, large numbers of visitors will need to be taught what to do and where to go if an earthquake and tsunami occur.

ARE YOU READY? When you're prepared, you feel more in control and are better able to keep yourself and your family safe. How can you be ready?

- *KNOW WHETHER THE PLACES WHERE YOU LIVE, WORK, OR PLAY ARE IN THE TSUNAMI HAZARD ZONE.*
- *BE PREPARED WHEREVER YOU ARE.* Developing a plan and a disaster supply kit now can make a difference in how you survive.

LEARN MORE ABOUT WHAT YOU CAN DO: www.emd.wa.gov