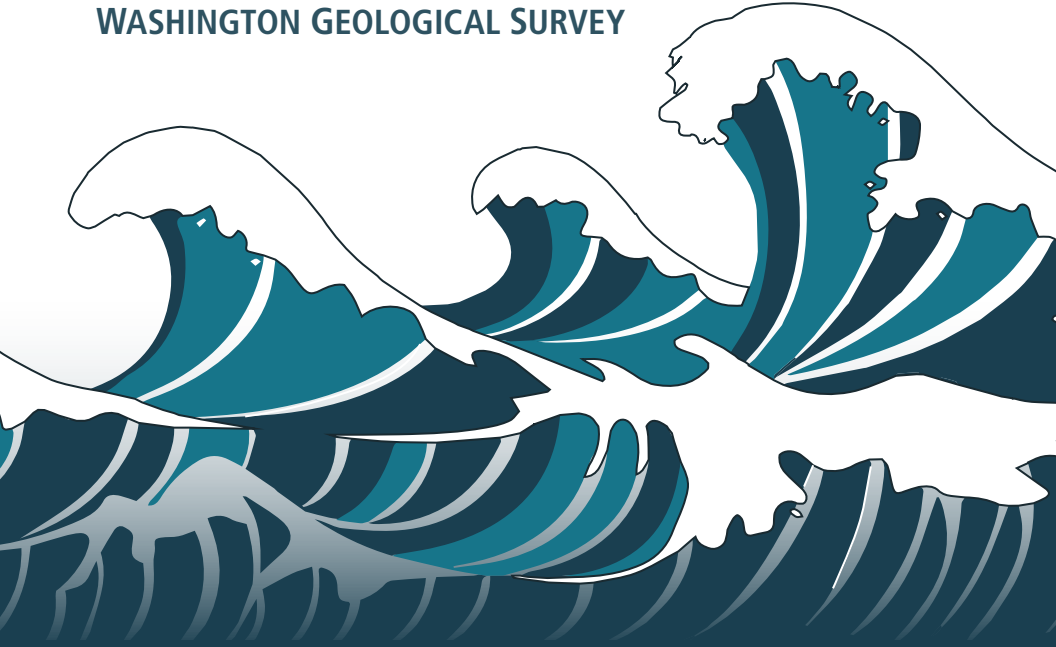


Tsunami Hazards in Washington State



WASHINGTON GEOLOGICAL SURVEY



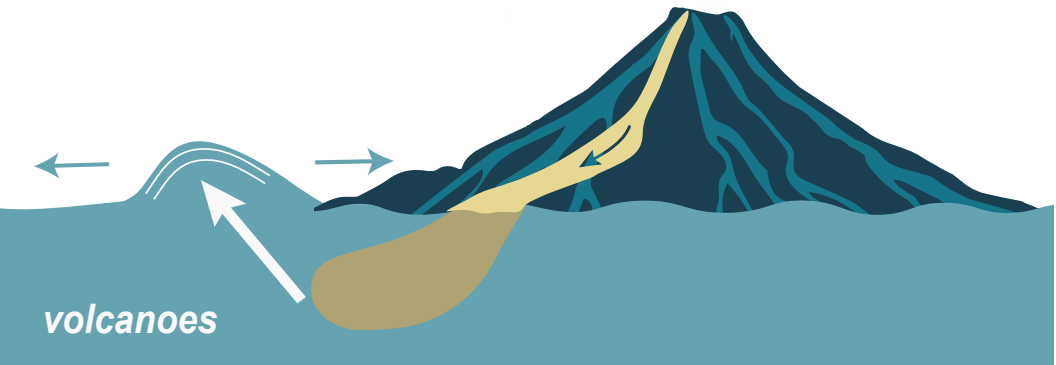
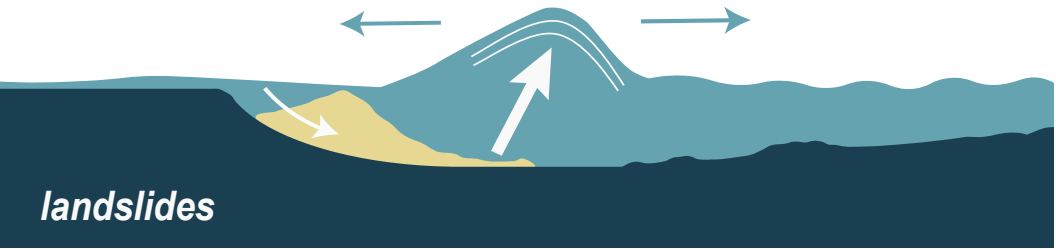
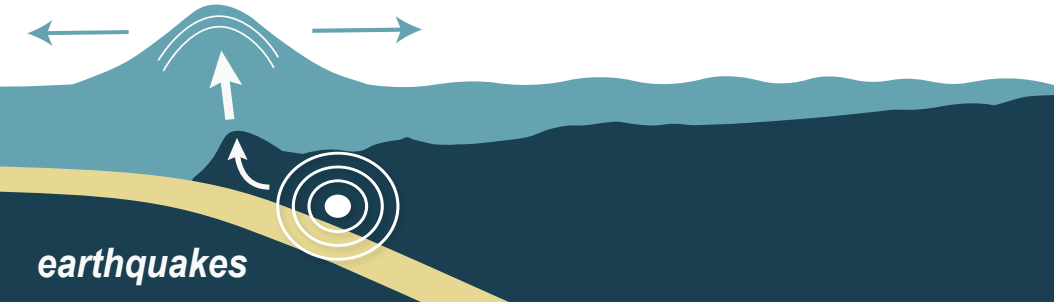
WHAT IS A TSUNAMI?

A tsunami is a series of waves most commonly caused by an earthquake beneath the seafloor. As tsunamis enter shallow water near land, they increase in height and can cause great loss of life and property damage.

Tsunamis have struck the Washington coast in the past and will do so again. They can occur at any time of the day or night, under any and all weather conditions, and in all seasons.

If you feel an earthquake and you're near the water, get to high ground!

Tsunamis occur when large quantities of water are displaced, most commonly because of earthquakes, landslides, or volcanic eruptions. Tsunamis can also be produced by atmospheric disturbances or meteorite impacts, but these are rare.



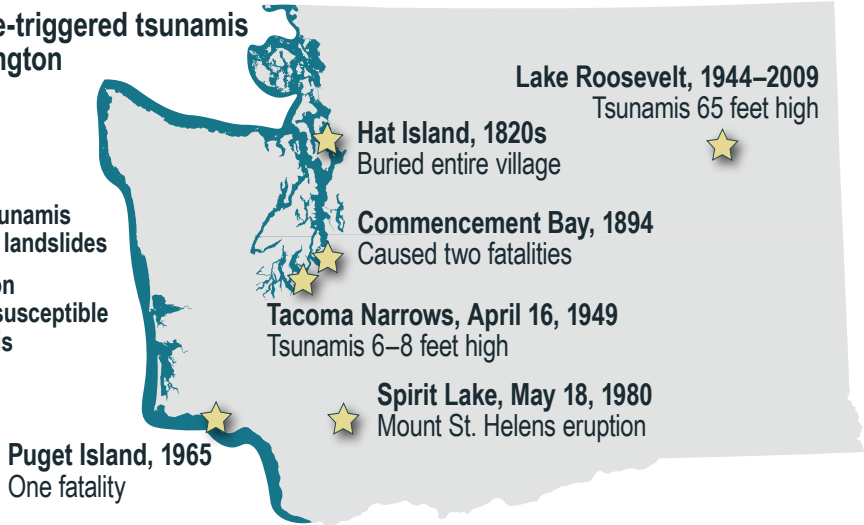
Washington has multiple earthquake sources that could cause tsunamis, including the deep, mega-thrust earthquakes produced by the Cascadia subduction zone and shallower faults within the continental crust such as the Seattle and Tacoma faults.

The map below shows that all coastal areas can be impacted by tsunamis. Tsunamis can also occur within inland bodies of water such as lakes, reservoirs, and rivers. Many of the historically damaging tsunamis shown below were caused by landslides.

Landslide-triggered tsunamis in Washington

★ Notable tsunamis caused by landslides

Washington coastline susceptible to tsunamis

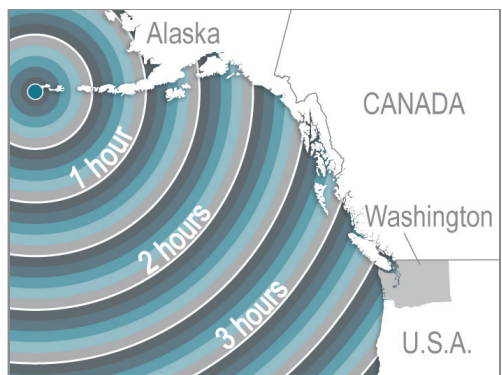
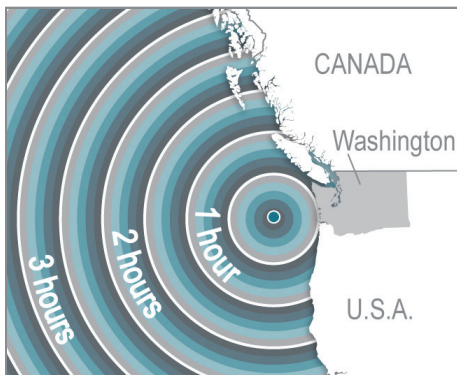


LOCAL VS. DISTANT SOURCES FOR TSUNAMIS

When a tsunami is generated locally, its first waves would reach the coast within minutes. Feeling an earthquake could be your only warning, so move to high ground immediately after the shaking subsides.



When a tsunami is generated by a distant source event, you will not feel an earthquake. If the tsunami poses a risk to Washington, a warning will be issued that provides several hours of advance notice.



Tsunamis won't impact every part of the coastline in the same way. The shape of the seafloor and the shapes of bays and coastlines can cause tsunami waves to grow before they reach land. Similarly, the topography of the land onshore and the amount of vegetation on land can also affect the wave height and inland distance that the tsunami travels.



Tsunami waves reach farther inland along gently sloping coastlines

This diagram illustrates a cross-section of a coastline with a gentle slope. A blue wave is shown on the left, moving towards the land. The wave's crest is depicted as a wavy line that extends significantly inland, reaching a distance of about two-thirds of the way up the slope. The land is represented by a grey area that tapers to a point on the right.



Tsunami waves are blocked by steep coastlines

This diagram shows a cross-section of a coastline with a very steep slope. A blue wave is on the left, but its crest is blocked by the land, which rises sharply to a vertical cliff on the right. The wave does not reach inland.



Tsunami waves are dampened by vegetation

This diagram depicts a coastline with a moderate slope. A blue wave is on the left, moving towards the land. In the middle of the slope, there is a row of five green pine trees. The wave's crest is shown as a wavy line that is significantly lower and shorter than in the first diagram, indicating that the trees have reduced the wave's energy. The land is represented by a grey area that slopes upwards to the right.

TSUNAMI WAVES ARE NOT LIKE REGULAR WAVES

- Tsunamis involve multiple waves—the **first tsunami wave may not be the biggest in the series.**
- Tsunami waves are huge in width, length, and depth, meaning that the wave front is followed by miles of water that are just as tall. When tsunami waves come onshore, they keep coming.
- The tsunami may not cease for hours to days.
- Tsunamis create powerful currents that cause damage and carry large, hidden objects within them. You cannot swim through a tsunami.

TSUNAMI ALERT LEVELS

When possible, centers in Alaska and Hawaii forewarn of tsunamis. Floating buoys, deep-ocean sensors, tide gauge stations, and seismic networks may detect tsunamis before they reach shore. The following alerts indicate potential tsunami hazards:

WARNING

Danger! Tsunami imminent!

Move to high ground or inland.



ADVISORY

Strong currents and dangerous waves.

Avoid the water and get to high ground.

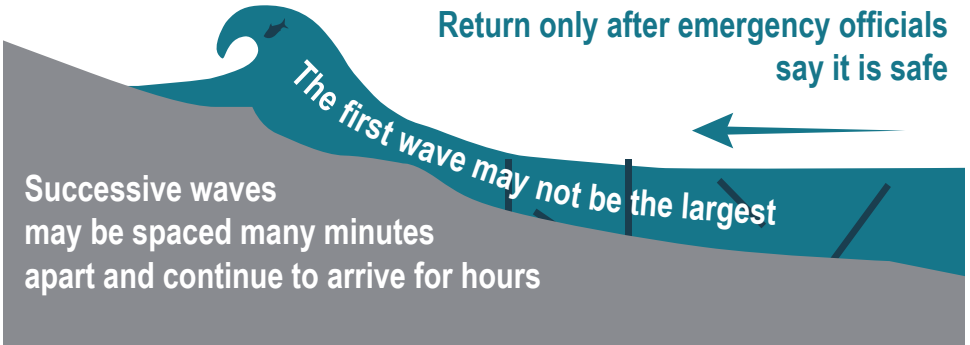
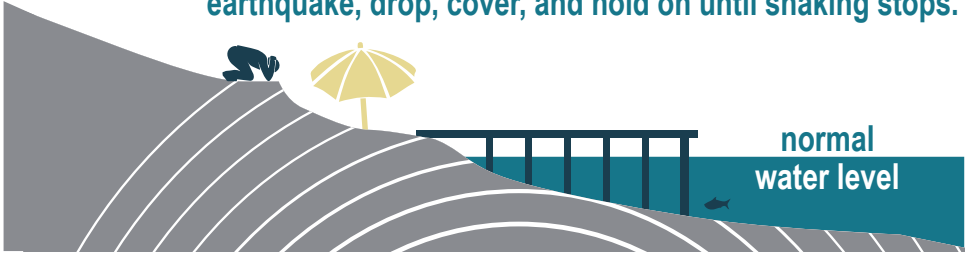


WATCH

Tsunami possible.

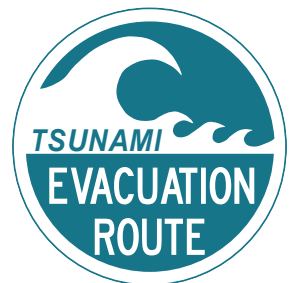
Be prepared to take action.

Feeling an earthquake or hearing a loud roar coming from the ocean could be your only warning for an incoming tsunami. If you feel an earthquake, drop, cover, and hold on until shaking stops.



WHAT DO THE EVACUATION SIGNS MEAN?

Ideally, you should know the evacuation routes for your area ahead of time. If not, evacuation signs along many roads also point toward higher ground. There may be multiple routes to reach safety.



CAR EVACUATION IS NOT RECOMMENDED

Damaged roads and power lines, debris, or traffic will likely prevent an evacuation by car. If this is the case, evacuate on foot directly to the nearest high ground. Avoid lakes and wetlands, which are prone to flooding and liquefaction.



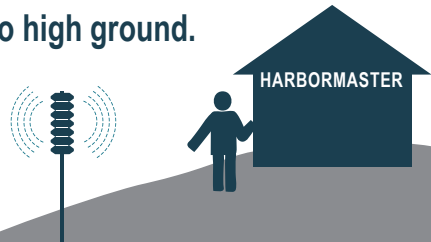
MARITIME PREPAREDNESS

- Make sure you can receive tsunami warnings when you're on the water. These will be broadcast on marine VHF radio **channel 16**.
- Make a plan and have an emergency kit on board.
- Consult with your harbormaster, port captain, U.S. Coast Guard, and local emergency management agencies for safety information for your area.

In general:

If you're docked or near a dock, move to high ground.

Tsunami waves interact with the coast in unpredictable ways.



If you're out at sea, get to deeper water.

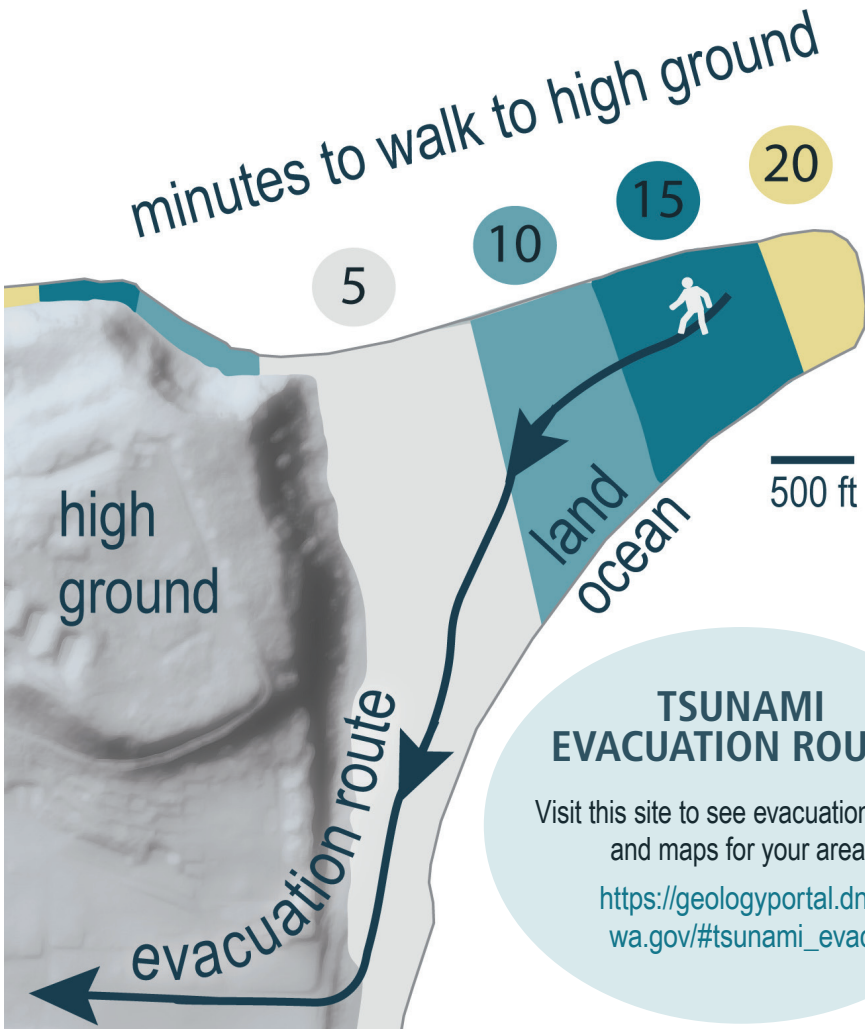
Tsunami waves are much smaller in the open ocean.



WHERE DO I EVACUATE TO?

Go to the nearest high ground—at least 60 feet above sea level, if possible. If you don't have time to travel to high ground, but are near a multi-story building, go to an upper level. If you are on the beach and unable to get to high ground, go inland as far as you can (at least 2 miles).

Below is an example of a tsunami evacuation map. The colored areas along the coastline show how many minutes it would take to walk (at a slow pace of 24 minutes to walk 1 mile) to high ground.



ALL-HAZARD ALERT BROADCAST SIRENS

Many coastal communities have **All Hazard Alert Broadcast (AHAB)** sirens that warn of tsunamis. If you are outside and hear a siren, follow the siren's verbal instructions (move to higher ground). Note that these systems are periodically tested. Actual alerts are a loud wailing sound followed by verbal instructions. You may not hear this siren indoors.

Be aware that most isolated areas do not have warning sirens.



SIGN UP FOR EMERGENCY ALERTS

Many communities have emergency alert systems in place that will automatically notify you of hazardous events either by phone, radio, or text message. There is also a federal alert system to view and sign up for alert messages at tsunami.gov. Get signed up!

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION EMERGENCY WEATHER RADIO



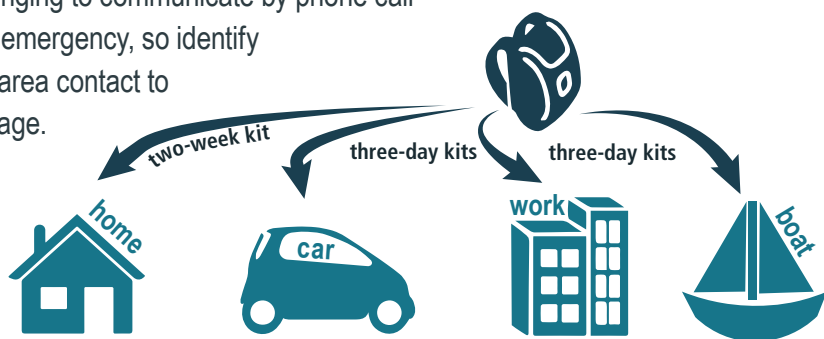
The National Weather Service's NOAA Weather Radio program provides broadcasts of tsunami warnings. To take advantage of this service, you will need a NOAA Weather Radio Receiver. Ask your emergency manager for more information and check weather.gov/nwr.

WHAT ARE THE NOAA WEATHER RADIO FREQUENCIES?

All frequencies are between **162.4 and 162.55 MHz**. Find the specific radio frequencies for your area here: weather.gov/nwr/washington

WHAT CAN I DO TO PROTECT MYSELF FROM A TSUNAMI?

- Find out if you live, work, or travel within a tsunami hazard zone (see page 8).
- Develop a family disaster plan and practice it regularly. Everyone needs to know what to do on their own to protect themselves in case of disaster.
- Check with city or county emergency management agencies and familiarize yourself with their plans. Identify evacuation routes to get out of tsunami hazard zones for locations you frequent, and practice walking them.
- Prepare emergency kits for your home, automobile, work, and boat, if applicable.
- Take a first aid course and learn survival skills. Knowledge is your greatest defense against potential disaster.
- It is challenging to communicate by phone call during an emergency, so identify an out-of-area contact to text message.



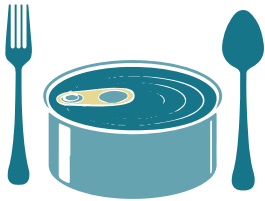
WHAT CAN I DO TO PROTECT MY HOME FROM A TSUNAMI?

Standard homeowner's insurance usually does not cover damage from earthquakes or floods—and not all flood insurance includes tsunamis. Check your policy and consider the additional cost to purchase earthquake and flood insurance, especially if you live within a tsunami inundation zone.



WHAT SHOULD I HAVE IN MY EMERGENCY KIT?

You should prepare an emergency kit with at least a 14-day supply of necessary items for each member of your family, including pets. The kit should be adapted to your needs, but keep it light and manageable in case you must evacuate on foot. Have it accessible for immediate evacuation. Possible supplies include:



Non-perishable food and cooking and eating utensils, including can opener



Water and a water purification kit



First-aid kit, medication, and glasses



Important documents



Money, cell phone, and portable chargers

Dental and personal hygiene items



clothes and shoes



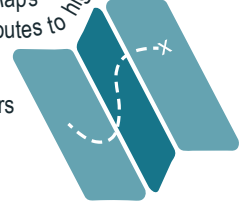
sleeping bag & tent

EMERGENCY KIT



Plastic bags for storage & waste

Maps showing safe routes to high ground



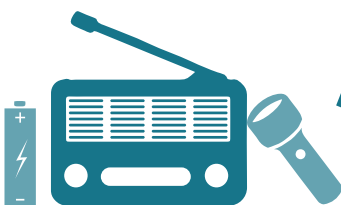
Baby supplies and diapers



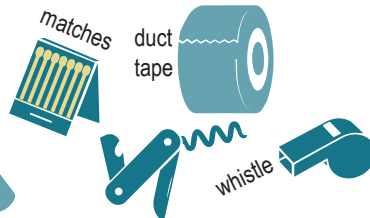
Pet food and supplies



gloves



Radio, headlamp/flashlight, and batteries

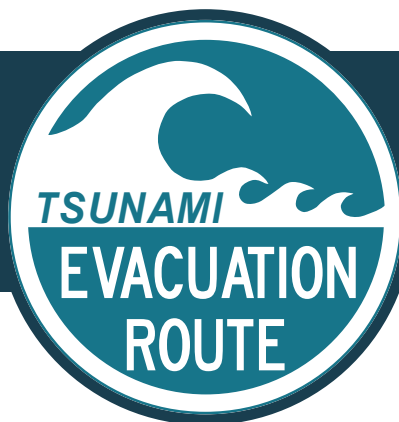


pocket knife

FOR MORE INFORMATION

IN THE EVENT OF A TSUNAMI:

- Evacuate and head for higher ground
- Do not return to the inundated area until given the all-clear from emergency personnel



TSUNAMI RESOURCES

WASHINGTON GEOLOGICAL SURVEY

Tsunamis

<https://www.dnr.wa.gov/tsunami>

U.S. GEOLOGICAL SURVEY

Preparing for Tsunami Hazards on Washington's Pacific Coast

<https://www.usgs.gov/news/preparing-tsunami-hazards-washington-s-pacific-coast>

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. Tsunami Warning System

<http://www.tsunami.gov/>

WASHINGTON STATE EMERGENCY MANAGEMENT DIVISION

Tsunami

<https://mil.wa.gov/tsunami>

CHECK WITH YOUR CITY AND COUNTY EMERGENCY MANAGEMENT DIVISIONS ABOUT LOCAL ALERTS AND EMERGENCY PLANNING

WHO CAN I CONTACT FOR MORE INFORMATION?

WASHINGTON GEOLOGICAL SURVEY

360.902.1450

www.dnr.wa.gov/geology



WASHINGTON STATE DEPT OF
NATURAL RESOURCES
WASHINGTON
GEOLOGICAL SURVEY

WASHINGTON MILITARY DEPARTMENT

1.800.562.6108

<http://www.mil.wa.gov/preparedness>

