

## Coastal Flooding: An Introduction

What is coastal flooding?

How may coastal flooding affect me?

How much coastal flooding should I expect, and when?

Why should I care now?

What can I do about it?

Where can I learn more about coastal flooding in Washington?

**Coastal flooding can be exacerbated by increased river flows, sea level rise, or tsunamis.**

**The probability of flooding is described by "recurrence intervals." Recurrence intervals describe the likelihood (percentage) that water levels will reach a specific magnitude in a year.**

### **Prepare for coastal flooding:**

- **Be aware of historic flooding and future sea level rise.**
- **Support local planning efforts.**
- **Adapt your project to coastal flooding.**

## What is coastal flooding?

**Coastal flooding** occurs when low-lying land is flooded by seawater. Multiple factors can combine to cause coastal flooding:

1. **Storm surge** – changes in atmospheric pressure can elevate seawater levels during a storm, pushing more water toward the shore.
2. **Wind-driven waves** – wind can push water higher and further onto land, causing coastal flooding.
3. **High tides and king tides** – high tides can combine with other factors to cause coastal flooding. King tides are exceptionally high tides caused by one or more astronomical events happening at the same time.
4. **Sea level rise** – as daily tides become higher smaller magnitudes of storm surge, wind and other factors will result in coastal flooding.
5. **Increased river flows** – increased river discharge (caused by changes in rainfall, groundwater storage, and melting snowpack) can combine with seawater levels to flood coastal areas.
6. **Tsunamis** – these giant waves (caused by earthquakes and large landslides) can lead to particularly disastrous coastal flooding.

Topography (the specific shapes and features of land surfaces) affects how coastal flooding occurs. Washington is a geologically varied area with steep rocky coastlines, sandy shores, bays and estuaries. The variation in our shorelines means that coastal flooding has different intensities at different locations along our coastlines, which is amplified by changing wind conditions.



*Multiple factors can cause coastal flooding. Seattle's Alki Beach is shown here during clear weather with no flooding (left), a windy day with flooding (center) and calm weather with flooding (right) (left source: [westseattleblog.com](http://westseattleblog.com), center source: Melissa Poe, Washington Sea Grant, right source: Ian Miller, Washington Sea Grant).*

### How may coastal flooding affect me?

In Washington, thousands of acres of coastal lands sit less than 4 feet above average high tides. During extreme events or when multiple factors combine, these lands can be flooded with seawater. As sea levels continue to rise, these areas will be flooded more frequently.

If you live in a coastal community, coastal flooding may damage your house, vehicle, business or other private property. Even if your possessions are out of the harm's way, coastal flooding can damage infrastructure that you and many others rely on: wastewater treatment plants, stormwater outfalls, ferry terminals, coastal roads, rail transportation, and more. Coastal flooding can also cause increased erosion, exacerbating the effects of flooding.



*On January 18-19, 2018, waves pummeling the Westport jetty and caused flooding on several blocks of Westhaven Drive (source: Dan Hammock, The Daily World).*

## How much coastal flooding should I expect, and when?

Coastal flooding is influenced by many factors. Some of these factors are more likely to occur seasonally, such as winter-time storm surge, king tides, and increased river flows. Others occur over a long period of time, such as sea level rise, while others occur instantaneously regardless of seasonality or predictability, such as tsunamis.

Disregarding tsunamis, the likelihood of flooding in your area can be described by “recurrence intervals.” Expressed as percentages, recurrence intervals describe the likelihood that water levels will reach a specific magnitude during a specific time range. These percentages are sometimes referred to in terms of years, such as the term “100-year flood.” This term means that there is a 1-in-100 (1%) chance that an extreme flood of this magnitude will happen in any given year. A “20-year flood” means that there is a 1-in-20 (5%) chance, and a “5-year flood” means that there is a 1-in-5 (20%) chance. You can visualize these numbers on a map by visiting NOAA's Sea Level Rise Viewer.

(<https://coast.noaa.gov/slr/#/layer/slr>) While this app is meant for sea level rise, the slider can portray local increases in water level due to many factors.

As sea levels rise, extreme coastal water levels will occur more often. This means that a “100-year flood” may become a “20-year flood.” With sea level rise, today’s extreme flood event could become tomorrow’s high tide. Storms will combine with these frequent high tides, causing extreme high waters to occur more often. This will result in coastal flooding that lasts longer, has higher water levels, and has impacts further inland. For more, see our Sea Level Rise Introduction.

(<https://wacoastalnetwork.com/chrn/coastal-hazards/sea-level-rise/>)

A tsunami will result in coastal flooding to a larger degree than discussed here. For more information on tsunamis, see our Tsunami Introduction. (<https://wacoastalnetwork.com/chrn/coastal-hazards/tsunami/>)

Recurrence interval	Annual exceedance probability	<b><i>Puget Sound Extreme Still Water Level Magnitudes (ft above MHHW)</i></b>	<b><i>Coast Extreme Still Water Level Magnitudes (ft above MHHW)</i></b>
1 year	100%	+1.2 feet	+2 feet
5 year	20%	+2.6 feet	+3.3 feet
20 year	5%	+2.9 feet	+3.7 feet
50 year	2%	+3.1 feet	+3.9 feet
100 year	1%	+3.2 feet	+4 feet

*Recurrence intervals, probabilities of occurrences, and the associated water levels for coastal and Puget Sound shorelines. Still water level refers to water levels as measured at tide gauges, and driven by tides, storm surges, seasonal and annual water level cycles, as well as the long-term mean sea level trend. This does not include wave runoff, or the elevation that water is pushed onto land due to topographic variations.*

### Why should I care now?

There are many strategies that can help keep your community safe from coastal flooding. Private landowners or neighborhood groups may be able to implement some strategies themselves. However, comprehensive community-wide strategies are often identified through local planning meetings, which are organized by local planning commissions or jurisdictions. Planning can take a long time, and large projects are expensive, so the time to act is now! With wise and proactive planning, communities can develop strategies to address specific local issues.

Wise planning can conserve and restore coastal ecosystems, ensuring that these protective buffers are not lost to flood-prone development. By considering which areas are susceptible to flooding, coastal communities can develop a diversified set of strategies to adapt to high waters such as: structural flood protection measures (e.g., dikes and levees), early warning systems, risk-informed land planning, nature-based solutions (e.g., natural floodplains, wetlands, and oyster reefs), and social protection and risk financing instruments (e.g., flood insurance). These strategies can make your community more resilient to flooding.

### What can I do about it?

- **Educate yourself:**
  - Pay attention to high waters in your area, to see what normal water levels may look like in the future. For example, you can attend a local King Tides Viewing Party, sponsored by Washington Sea Grant. (<http://wsg.washington.edu/kingtides>)
  - Learn about the latest coastal hazards science and risks via the Washington Coastal Hazards Resilience Network (this website!). (<https://wacoastalnetwork.com/chn/coastal-hazards/overview/>)
  - Attend Shoreline and Coastal Planners Group (<https://www.coastalplanners.org/>) meetings or a Coastal Training Program course. (<http://www.coastaltraining-wa.org/>)
- **Get involved in local coastal planning:**
  - Contact local planners, planning commissions or Marine Resource Committees to share experiences, voice concerns, recommend that public projects account for sea level rise or attend a public meeting. (<https://wacoastalnetwork.com/events/>)
  - Engage with local Shoreline Master Program (<https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-Master-Programs>) or Comprehensive Plan (Growth Management Act) updates to encourage wise planning for the future. (<https://www.commerce.wa.gov/serving-communities/growth-management/periodic-update/>)
  - Download the MyCoast app (<https://mycoast.org/wa>) to document storm surge, king tides, changes to your local shoreline, and more. This information is used to better understand coastal hazards and their impacts, while raising awareness among decision-makers and stakeholders.
- **Adapt your project to coastal flooding:**
  - Consider sea level rise early in a project, when new permits are required, during renovations or during repairs.
  - Visit the Washington Coastal Hazards Risk Reduction Project Examples (<https://waecy.maps.arcgis.com/apps/Shortlist/index.html?appid=58bac8d897ea48559>)

[d624eb06836a0d2](#)) to see how other people in Washington have adapted to coastal hazards or connect with an expert via the Washington Coastal Hazards Resilience Network. (<https://wacoastalnetwork.com/chrn/other-projects/connect-with-a-chrn-member/>)

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