

## Coastal Erosion and Deposition: an Introduction

Many of Washington State's bluffs, beaches, and estuary mouths are already eroding, which will likely increase as sea levels rise.

Hardened shores are designed to protect homes from erosion, but they can sometimes contribute to erosion and flooding.

Sea level rise will contribute to this issue.

### Prepare for erosion:

- Use appropriate setback distances when building structures.
- Preserve natural shorelines and vegetation.
- Attend planning meetings to ensure that development considers erosion.

### What are coastal erosion and deposition?

**Coastal erosion** is the loss of coastal land. It occurs when sediments and other shoreline materials are picked up and moved away from the coast by water, wind, ice, or gravity. **Coastal deposition** is the opposite of coastal erosion: the creation of new landforms or topography along the shoreline. This occurs when materials such as sediments and woody debris are dropped in place, deposited by water, wind, or gravity. As these materials must be moved from their original location, erosion is directly related to deposition, and vice versa.

**Erosion and deposition** are natural processes, but human settlements and environmental change can make these processes problematic. Coastal erosion and deposition varies by location, so different communities, habitats, and materials will be impacted differently. Some of the many causes of coastal erosion and deposition are:

1. **Longshore currents** – when ocean currents move parallel to shore, they move water and materials along shorelines. Sections of shoreline where materials are transported from a source area to a deposition area are called “drift cells.”
2. **Storms** – high-energy waves and extreme water levels can erode the land and affect how material moves within drift cells, streams, and other coastal waterways.
3. **Flooding** – inundation can carry away sediment, redistributing it elsewhere. Conversely, river flooding can carry sediment to the coast, leading to deposition.
4. **Sea Level Rise** – as water levels increase, tides and high energy waves may reach further inland, potentially causing erosion in new places.
5. **Human Activities** – shoreline development, shoreline armoring (such as riprap—large rocks—and bulkheads—wood, concrete, or metal walls), removal of vegetation, recreation (such as hiking on sensitive bluffs or boating with large wakes), and other activities can increase the rate of erosion in a given location.



*North Cove, WA faces significant coastal erosion. The community has been creating solutions to combat the erosion that threatens their homes, cranberry bogs, and main highway (source: Jackson Blalock, The Nature Conservancy).*

### How may coastal erosion and deposition affect me?

In the US alone, annual property losses from **coastal erosion** (<https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion>) cost approximately \$500 million. If you are a resident in a coastal community, you or your community may be at risk due to coastal erosion. Coastal erosion moves material from shorelines, which can destabilize soils and cause structures to fail. Erosion can create a chain reaction as plants become unrooted in destabilized soils, are lost to erosion, and further erosion occurs in newly exposed soils. These shoreline changes can have expensive impacts on housing, commercial/industrial activities, and infrastructure (roadways, utilities, and more) – sometimes causing the loss of entire properties or areas of shoreline. These changes can also cause the loss of valuable habitat which buffers shorelines from additional coastal hazards. As erosion moves material away from shorelines, water movements will change correspondingly and may increase risk of flooding or other hazards.

**Coastal deposition** can also change shorelines, though it is not usually considered as destructive as coastal erosion. Coastal deposition can create or extend landforms such as beaches, spits, islands, wetlands and mudflats. Coastal deposition can also change the shape of tidal streams, intertidal zones and navigation channels. These changes can affect how humans and other species use tidal, intertidal, and marine areas. For example, coastal deposition can impact aquaculture, disrupt navigation or use of marinas, create new wetlands, and affect how fish move through sloughs. As sediments are deposited in new areas, water may flow to new areas and increase risk of flooding or other hazards.



*A home in North Cove, WA that faced significant coastal erosion (source: Kit Swartz).*

### What are signs of erosion?

**Below are some guiding questions to help you identify if erosion is occurring along a shoreline:**

- Do you notice land or shoreline disappearing (or receding) over multiple days, months, or years?
- Do you see non-vegetated banks?
- Are there exposed tree roots or leaning trees along the shoreline?
- Are there signs from previous landslides near your shoreline, such as non-vegetated banks or debris piles at the base of banks?
- Is the shoreline near bulkheads or riprap? While these shoreline armoring structures can prevent some erosion, they deflect this energy elsewhere. This deflected energy can cause erosion along neighboring shorelines and/or cause scour at the base of shoreline armoring.

**If you answered yes to any of these questions, you may already have erosion occurring at your site.**



*Aerial photographs of a Chinook, WA shoreline from 2002 (left) and 2016 (right) show shoreline trees lost to erosion. Note the presence of shoreline armoring (riprap, circled) in the 2016 photograph, which was placed to reduce erosion. This armoring may have increased erosion rates at the neighboring beach (source: Washington State Department of Ecology's Coastal Atlas).*

#### Some helpful tools to identify vulnerable shores and track shoreline changes over time are:

- Google Earth Engine (<https://earthengine.google.com/timelapse/>) is a free website that has used satellite images to create a continuous time-lapse of the earth's surface. By navigating to your location and pressing "play," you can see decades-long shoreline changes happen before your eyes. Coast Nerd Gazette (<http://coastnerd.blogspot.com/2017/06/>) highlights many of Washington's changing shorelines and gives a helpful introduction to this tool.
- Google Earth (<https://www.google.com/earth/versions/>) is a free and easy-to-use program that allows you to see satellite views of shorelines. By using the "Historical Imagery" tool (<https://support.google.com/earth/answer/148094?hl=en>), users can see satellite images from multiple years and note how shorelines have changed over time. This program is like Google Earth Engine, but allows users to zoom in closer, look at older satellite images, and select specific years. It does not, however, have an animated time-lapse like Google Earth Engine.
- You can track your own shoreline changes by taking photographs of a shoreline before and after storms, before and after king tides, or over multiple years. Keep in mind that a summer shoreline will look different than a winter shoreline, so you can best understand shoreline changes by comparing photos of the same season from different years. With the MyCoast (<https://mycoast.org/wa>) website and mobile app, you can submit photos of shorelines and compare them with shoreline photos from others.

#### Why should I care now?

Coastal erosion is happening now and will likely increase as sea levels rise. Fixing coastal erosion can be extremely expensive, as it occurs on a large scale (often involving many landowners) and involves powerful forces. However, you can help ensure there are protective measures and cost-effective approaches in place by planning for the future. Plan for future coastal erosion by ensuring future

development is far enough away from the shoreline. Acting now can help reduce costs over the life of the project.

### What can I do about it?

#### Educate yourself:

- Contact your local city planner, county government, conservation district, or environmental non-profit to access local resources about coastal erosion or other coastal hazards.
- Learn about the latest coastal hazards science and risks via the Washington Coastal Hazards Resilience Network (<http://wacoastalnetwork.com/>) (this website!).
- Attend Shoreline and Coastal Planners Group (<https://www.coastalplanners.org/>) meetings or a Coastal Training Program (<http://www.coastaltraining-wa.org/>) course.

#### Get involved in local coastal planning:

- Contact local planners, planning commissions, or Marine Resource Committees (Pacific Coast MRCs (<https://wacoasteconomist.com/blog/2019/9/26/north-pacific-coast-mrc-request-for-proposals>) or Straits and Sound MRCs (<https://www.nwstraits.org/get-involved/marine-resources-committees/>)) to share experiences, voice concerns, recommend that public projects account for coastal erosion, or attend a public planning 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) (<https://www.commerce.wa.gov/serving-communities/growth-management/periodic-update/>) updates to encourage wise planning for the future.
- Download the MyCoast app (<https://mycoast.org/wa>) to share images of local shoreline change, storm surge, king tides, 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 erosion:

- Consider coastal erosion early in a project, when new permits are required, or during renovations and repairs.
- Stabilize shoreline soils naturally by preserving existing vegetation, planting new vegetation, placing or anchoring woody debris, or other methods to protect vulnerable banks from eroding.
- Visit the Washington Coastal Risk Reduction Project Mapper (<https://waecy.maps.arcgis.com/apps/Shortlist/index.html?appid=58bac8d897ea48559d624eb06836a0d2>) to see how other people in Washington have adapted to coastal hazards, or connect to an expert (<https://wacoastalnetwork.com/chrn/other-projects/connect-with-a-chrn-member/>) via the Washington Coastal Hazards Resilience Network.

#### Talk and collaborate with your neighbors:

- In many cases, erosion does not just affect you and your property, but your neighbors as well. Having a discussion with your neighbors to understand if their shorelines are changing can provide reflection for your own property and options to adapt.
- In some cases, folks and neighbors have worked with their local conservation districts to create projects to address erosion across multiple properties.

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