Case Study: Shoreline Stabilization

Chinook, Washington

A line of root wads defends against erosion and collects sediment. Pictured at low tide.
(Photo credit: Jackson Blalock, The Nature Conservancy)

At a Glance

Location	Chinook, Washington
Hazard(s) Addressed	Coastal Erosion and Flooding
Shoreform	Beach
Adaptation Strategy	Structural Accommodation
Adaptation Action	Natural and locally sourced materials create a soft-armor shoreline structure spanning four properties. This structure dissipates wave energy and promotes the accretion of sand along an eroding beach.
Lessons Learned	• Working with multiple property owners can increase a project's impact. • If time and money are available, find an experienced design engineer, architect or professional. This can save resources in the long run. • If stability is desired, ensure that structural elements (root wads, logs) are stable and cannot move after installation. • Preserve mature shoreline vegetation to prevent erosion. • Pay attention to connections between materials or where materials meet the substrate. Overlap, bury or connect these points to prevent water from moving through openings. Water movement can cause scour and erosion, move materials and weaken a structure.
Project Team	Pacific Conservation District, private homeowners
Budget	$62,500
Time	March 2014 to February 2017
Contact	Tom Kollasch, Pacific Conservation District tkollasch@willapabay.org

Context and Motivations

The community of Chinook, Washington resides along the lower Columbia River estuary. Chinook's sandy shores experience chronic erosion, caused by gusty ocean storms, wind and wave impacts over a long fetch, and water flowing parallel to the shore in the Columbia River's north channel. Low-lying homes are at risk of permanent destruction if the beach continues to erode.

Chinook homeowners have battled shoreline erosion for decades and have lost over 150 feet of land in the last 25 years. The Port of Chinook and adjacent homeowners have installed hard armoring, which may actually contribute to erosion. Homeowners adjacent to the armoring partnered with the Pacific Conservation District to craft a solution that would benefit both the environment and affected homeowners.

The site's location in Washington (left), along the Columbia River estuary (center) and in Chinook (right). (Image credit: Google Earth)

Aerial photographs of the site from 2002 (left) and 2016 (right) show shoreline trees lost to erosion. Note presence of shoreline armoring in 2016 photograph—shoreline stabilization structure was later installed on the beach to the right of this armoring. (Image credit: Washington State Department of Ecology's Coastal Atlas)

Partners, Permits and Funding

Project Lead: Pacific Conservation District

Partners: Private homeowners adjacent to shoreline

Permits: Hydraulic Project Approval (Washington Department of Fish and Wildlife), Pacific County Shoreline Permit. Consultation with U.S. Army Corps of Engineers and Washington State Department of Ecology, via Joint Aquatic Resources Permit Application (JARPA).

Funding: $50,000 (Pacific Conservation District), and
$12,500 ($3,125 from each private homeowner)

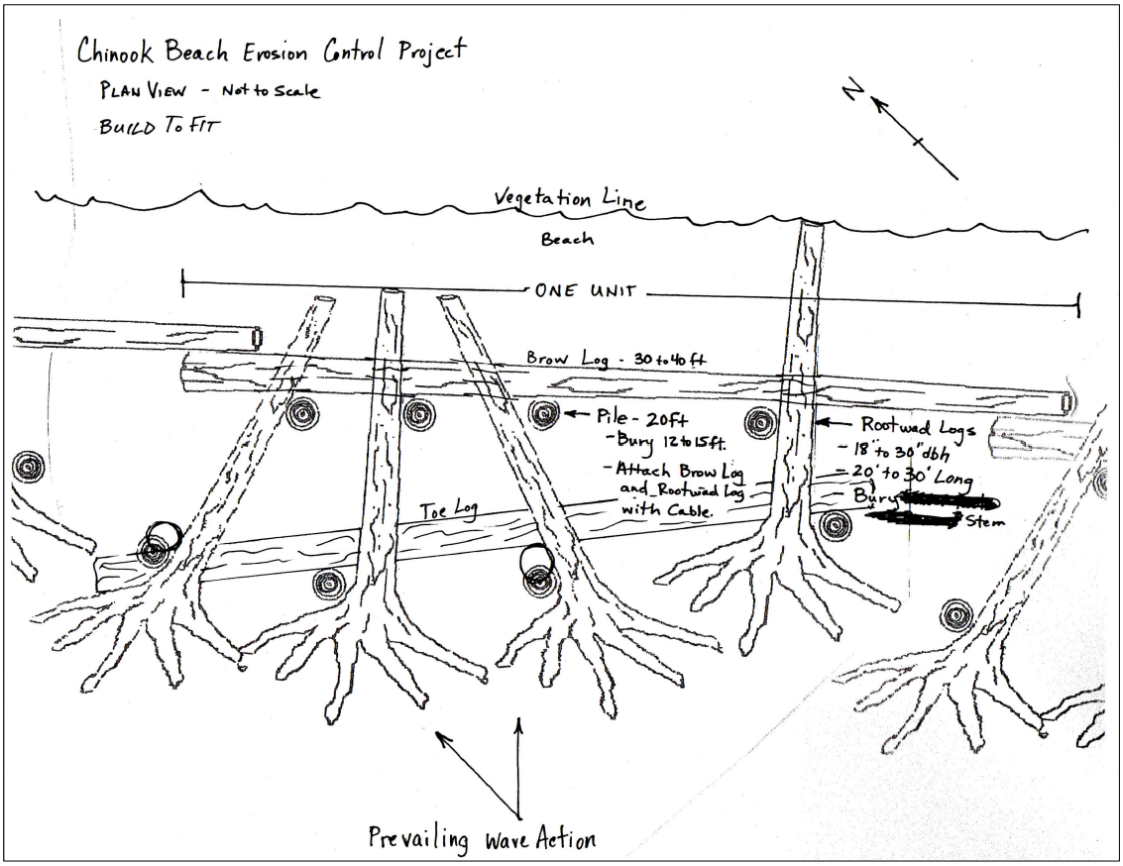
While coastal erosion has been threatening this stretch of waterfront homes for several decades, this project didn't begin until 2014, when homeowners reached out to the Pacific Conservation District for help combating the issue. The homeowners were connected with the Conservation District after initially reaching out to a local biologist with the Washington Department of Fish and Wildlife. The Conservation District used a cost-share approach with the homeowners. This approach helped the four homeowners complete work they could not have afforded themselves.

Description of Work Completed

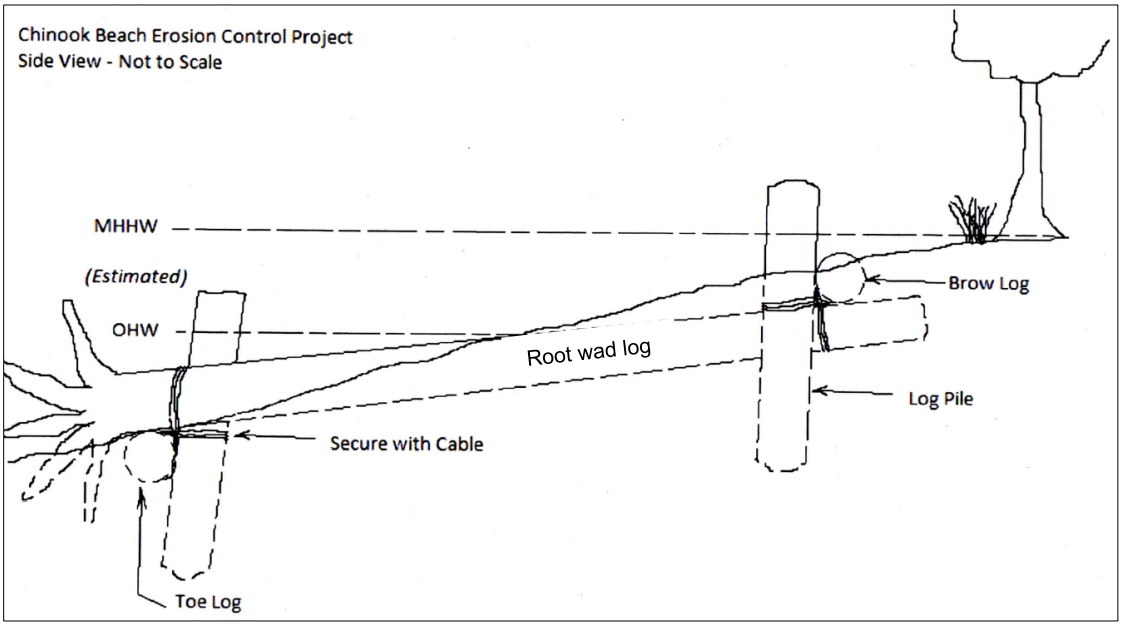
This project was the first nature-based erosion control structure on Pacific County's Columbia River shoreline. The Conservation District created several designs and continuously adapted them until choosing a final version: a framework of logs anchored to sunken piles, placed parallel to the shoreline in order to support additional logs with large root wads facing out toward the waves. Both the root wads and the toe logs (logs parallel to the shoreline, on the bottom layer of the structure) break waves, reducing energy and causing sediment to drop from the water. In this project, the root wads, toe logs, and brow logs came from Sitka spruce trees (*Picea sitchensis*), and the pile logs were from Douglas firs (*Pseudotsuga menziesii*).

During the planning and implementation process, the homeowners made sure that the logs and materials used were locally sourced, native species. The homeowners also requested that the project fit within the budgeted cost and that the materials could be transported to the shoreline site with minimal disturbance to the beach. Future success of this erosion mitigation strategy will largely depend on the homeowners maintaining the project as needed, such as adding sand to areas of the structure that have become washed out or breached.

Root wads with intact trunks face the water, helping dissipate wave energy.
(Photo credit: Jackson Blalock, The Nature Conservancy)



Top-view drawing of project, showing how logs were arranged along shore.
(Image credit: Pacific Conservation District)



Side-view drawing of project, showing how logs were anchored together and into substrate.
Note: in as-built design, through-bolted threaded rods connect structural elements, instead of cable. In as-built design, the brow log is below the root wad log, similar to the toe log placement.
(Image credit: Pacific Conservation District)

Lessons Learned

Designing the project in-house was a challenge for the Pacific Conservation District (CD) because of a tight budget and limited time. As a result, the CD had to create and test the design with fewer resources than it would prefer to use. For future projects, the CD recommends, if possible within time and budget constraints, to hire an engineering consultant who has experience with similar design work.

Technical recommendations for undertaking a project with a similar design include:

- Ensure root wads do not move by anchoring them from multiple angles. In this project, this was accomplished by bolting root wads, log piles, and toe/brow logs together with threaded rods running through both structural elements. As a result, bolted connections sit perpendicular to each other, providing improved stability.
- Toe logs should be sufficiently buried to prevent water from flowing below them and scouring sediment.
- Link or overlap toe logs to prevent scour in gaps or spaces between them due to wave action.

Top left: Scour is evident where water passes through gaps in the structure, making the structure less stable.
Top right: threaded rods (blue) bolted through structure at perpendicular angles.
Bottom: Tom Kollasch of Pacific Conservation District shows how the structure dampens waves during a winter high tide. Note the pile of material that has been deposited landward of the structure.
(Photo credit: Jackson Blalock, The Nature Conservancy)

Erosion control structure at high tide, with eroding shoreline on right half of image. Note homes on right side of image. (Photo credit: Jackson Blalock, The Nature Conservancy)

This document was produced as part of the Washington Coastal Resilience Project, working to increase the state's capacity to prepare for coastal hazards related to sea level rise. The project was led by the Washington State Department of Ecology and Washington Sea Grant, with funding provided by NOAA Regional Coastal Resilience Grants Program (grant #NA16NOS4730015)