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Puget Sound Vital Sign: Shoreline Armor

Shoreline armor is the most common type of shoreline modification on Puget Sound, including structures like bulkheads, seawalls and rip-rap. Shoreline armor directly alters geologic processes that supply sediment to build and maintain beaches. Armor also impacts erosion patterns on nearby beaches, alters beach substrate and hydrology and reduces availability of large wood on the beach. The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) compiled and reported on changes to shorelines over the past several decades in a change analysis in 2011. This data was updated with shoreline survey work conducted as part of the Beach Strategies project, resulting in a map of current armoring. Shoreline armor is present on 715 miles (29%) of Puget Sound shorelines (Figure 1).

Shoreline Armor Indicator Status - 2017

New and removed armor is tracked for this target using the Hydraulic Project Approval (HPA) permitting database maintained by the Washington Department of Fish and Wildlife (WDFW). Alterations to the shoreline are regulated primarily by two state laws, the Shoreline Management Act and the Hydraulic Code. Permits issued under the Hydraulic Code for riprap and shoreline construction activities include information on the length of added, replaced or removed armor. Washington Department of Fish and Wildlife has been tracking Hydraulic Project Approvals (HPAs) permits electronically since 2005. Thus, data reported here were compiled from HPAs issued from January 2005 through December 2017 by the Washington Department of Fish & Wildlife.

While other data from local studies and shoreline permits under the Shoreline Management Act may have more detailed information on the local level, the HPA database is the most consistent and accessible for assessing all of Puget Sound. Despite having the most accurate and comprehensive data available to track shoreline armoring, the HPA database has some shortcomings. The HPA database was developed to track permit applications and processing, and was not developed to track shoreline armor data specifically. Data are based on when a HPA permit was obtained for a project and does not indicate when or if a project was ultimately implemented. In addition, the database does not include projects for which a HPA was not required (e.g. some federal projects, projects on tribal lands, pollution remediation projects) or if a project was constructed in compliance with the permitted action or without obtaining permits. Additional information on current data collection and analysis is available in the data methods report associated with the indicator report. Efforts to improve methods to track the shoreline armor indicator are currently underway by the Puget Sound Partnership, WDFW and other collaborators.

The target for this indicator is:
- From 2011 to 2020, the total amount of armor removed should be greater than the total amount of new armor in Puget Sound (total miles removed is greater than the total miles added).

The length of shoreline armor in Puget Sound increased from 2011 – 2017 by 0.4 miles (2158 feet). However, projects involving removal of shoreline armor are on the increase, with 4.25 miles (2345 feet) removed since 2005 and 0.75 miles (4093 feet) in 2017. More armor was permitted for removal in 2014, 2016 and 2017 than permitted for new shoreline armor construction (Figure 2).

Project Applicants for Shoreline Armor Projects

We generalized “applicant type” for obtaining permits to remove or construct new shoreline armor, and compiled the data for 2005-2017. New armor is particularly extensive along residential shorelines for single-family residences, accounting for 59% of the total new shoreline armor length. Government agencies applied for 20% of the permitted new armor, often associated with bank protection along road corridors. Commercial/industrial, multi-family residences, and non-profit agencies collectively accounted for 11% of the total length of new shoreline armor permits from 2011-2017 (Figure 4).

In contrast, shoreline armor removal applicants were typically non-profit and government agencies. Together, these applicants accounted for 95% of the total length of shoreline armor removal. Single-family residences applicants comprised only 23% of the total, although non-profit and government agencies are often working in partnership with residential landowners on armor removal projects. Commercial also accounted for 11% of the shoreline armor removal (Figure 5).

Shoreline Armor Replacement Projects

Replacement of existing shoreline armor is the most common permitted project from 2005 – 2017. Additional projects to repair existing shoreline armor were also permitted but not included in the results as the projects were small and did not alter the footprint, type or length of armor. In contrast, projects categorized as replacement shoreline armor were larger than repair projects and could involve removal and/or replacement of existing armor that changed the length, types of materials involved or altered the alignment relative to the shoreline (i.e. landfill or seawalls of the existing structure).

Nearly 14 miles (22,300 feet) of shoreline armor was replaced from 2011-2017, as compared to 4.1 miles (21,752 feet) new armor or 3.7 miles (19,634 feet) of removed armor. From 2005 - 2017, replacement shoreline armor projects accounted for an average of 75% of the shoreline armor projects permitted by HPA. In 2017, 75% were replaced in the same location relative to tidal elevation, while 23% were replaced landward of the former armor location, uncovering upper beach (Figure 3).

Additional Resources:
- Puget Sound Partnership Vital Sign website: http://www.psp.wa.gov/vitalsigns/

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