Technical Summary

Mapped Simulations of Sea Level Rise Projected for Shorezones of Pacific County and Grays Harbor County in Southwest Washington

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Summary

The Nature Conservancy mapped sea level rise (SLR) above Mean Higher High Water (MHHW) surface elevations at 1-meter pixel resolution for southwest Washington using NOAA's mid-level sea level rise projections for Toke Point, Washington. Results are viewable on the Coastal Resilience web portal. Projections were provided through direct communications following the published report "NOAA Technical Report NOS CO-OPS 083" (Sweet et al. 2017). Projected SLR for southwest Washington at Toke Point ranges from 4-27 cm by 2030, 8-73cm by 2050, and 19-289 cm by 2100. The table below lists the SLR values used here.

Table. NOAA's sea level rise projections in meters for The Nature Conservancy's mapped simulations.

Scenario	***2010 Baseline***	***2030***	***2050***	***2100***
Extreme	0	27	73	289
High	0	22	59	229
Intermediate	0	11	25	83
Low	0	4	8	19

This mapping effort employed a "bathtub" method for simulating sea levels. The advantage of the bathtub method is its relative simplicity and ability to simulate sea level rise across a broad extent when used with high precision surface elevation models. Here, The Nature Conservancy utilized a 1-meter gridded LiDAR elevation model (Greenberg 2009) originally acquired by FEMA in 2009 and downloaded from the Puget Sound LiDAR Consortium web portal. TNC transformed the NADV88 vertical datum to MHHW for meaningful decision-making on the ground. The datum transformation involved a combination of NOAA's VDatum grids (Xu 2010) with a customized method for expanding the area of datum transformation beyond the VDatum extent to the full extent of the input elevation model.

Low-lying areas disconnected from tidal waters have been mapped in addition to the simulated extent of possible inundation under SLR. The low-lying areas are landward elevations below the projected MHHW surface that are blocked from tidal inundation due to higher elevation features such as dikes, roads, and hills. These locations should be considered at risk of inundation particularly during extreme tidal events that may overtop or breach the blocking features. In some situations, as with tidal gates, the low-lying areas behind them may be connected to seawaters and should be considered vulnerable to inundation even if the LiDAR data did not adequately capture that dynamic.

Caveats

- This bathtub simulation does not account for hydrodynamic or geomorphic factors apart from those used by NOAA to model SLR at point locations, e.g. Toke Point. As a result, the extent of inundation should be considered possible but not necessarily absolute. For example, where tides have to spread water thinly across long distances of flatlands, the energy required to spread that water fully across those flatlands may not be ample in reality. Similarly, the time and energy required to push water bottlenecks like culverts and open tide gates realistically may not allow enough water to inundate an area behind those features.
- Open tide gates have not been accounted for. If the input elevation model maps a feature (e.g. dike, road) crossing over a low area or a water feature, those features may be considered to disconnect landward areas from the tidal waters. These areas will be mapped as disconnected "low-lying areas". In some cases, such as high and open bridges, the LiDAR acquisition may have captured elevations beneath the features and therefore do not map them accurately as disconnecting features.
- Land use and management are not considered in the bathtub simulations. For example, if a dike or sea wall is planned for removal or creation, that information has not been included in the simulations. Likewise, tide gates are not considered except as they were mapped during the LiDAR data acquisition, which typically captures them as disconnecting features.
- The highly erosive nature of sandy beaches and dunes on Washington's outer coast may create a challenge to confidently model SLR at those locations. Erosive forces such as storm surges, ocean currents, and circulating currents at the bay inlets change the outer coast beaches and may make SLR more or less impactful.
- Washaway Beach at the Willapa Bay Inlet is highly affected by eroding forcing of a circular current originating from within the bay itself. For more information, see Washington Department of Ecology's Washaway webpage and the Southwest Washington Coastal Erosion Study.

References

Greenberg, H. 2009. SW Washington 2009 coastal LiDAR gridded [bare_earth]. LiDAR acquired by FEMA through the Oregon LiDAR Consortium. Published online by the Puget Sound LiDAR Consortium. Online access: http://pugetsoundlidar.ess.washington.edu/lidardata/restricted/nonpslc/swwash2009/swwash2009.html.

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Xu, J., E. Myers, and S. White. 2010. VDatum for the Coastal Waters of North/Central California, Oregon and Western Washington: Tidal Datums and Sea Surface Topography. NOAA Technical Memorandum NOS CS 22.