Coastal processes and shoreline change around Port Townsend: Past, present, and future

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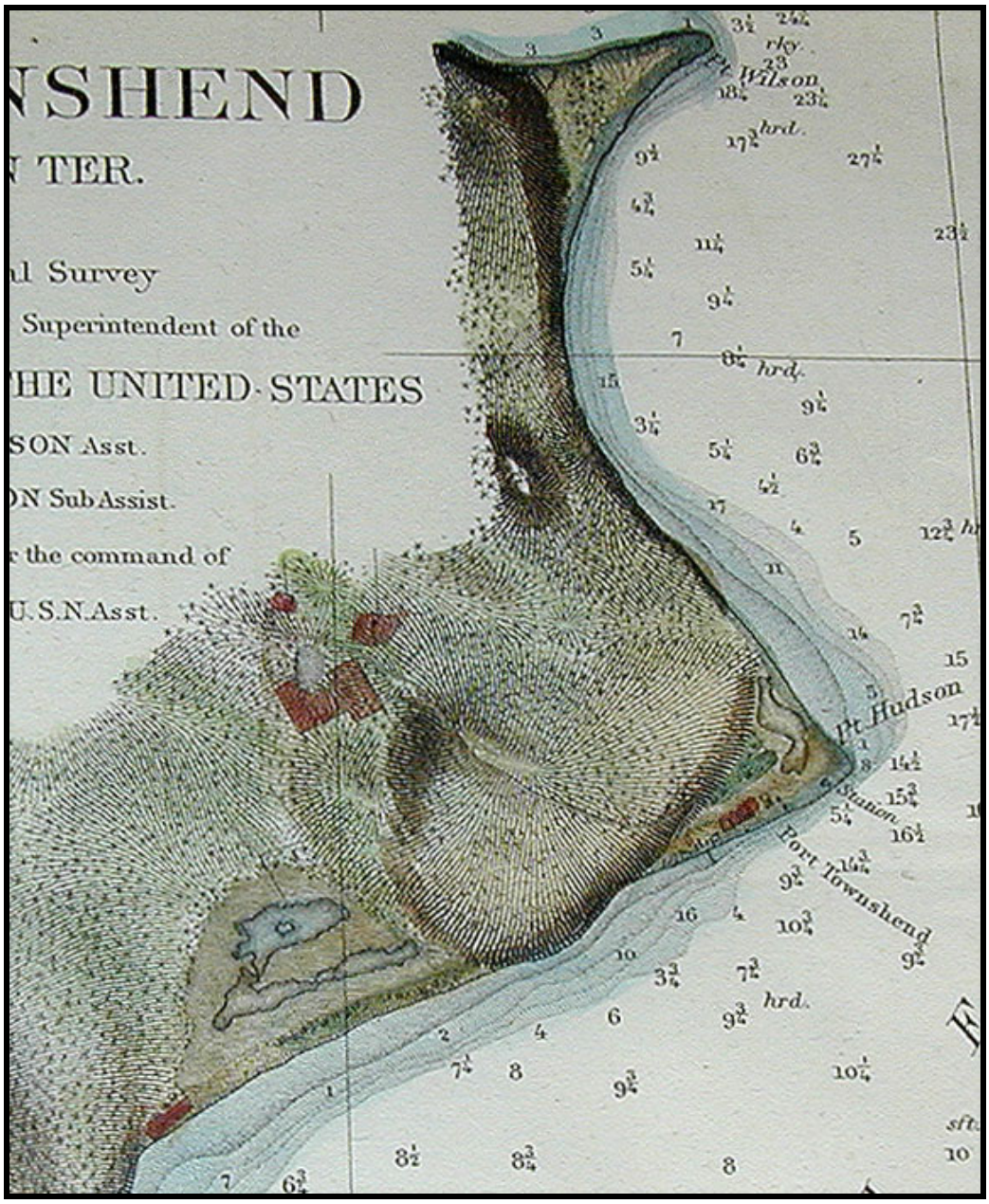
Beaches change continually as a result of waves, tides, and the movement of sand and gravel. Some of these changes are small and short-term, occurring with individual storms or with the seasons, but there are also consistent patterns of long-term change. These changes occur over thousands of years and shape the coastline itself – forming the complex distribution of steep bluffs, sand spits, and salt marshes that we see today. The processes that cause long-term shoreline change have not stopped -- they continue today, maintaining the health of nearshore habitats and the influencing the viability of human development actions.

In this workshop, we will look at how knowledge of geological and historical shoreline changes can help us better understand coastal processes, the distribution of nearshore habitats, and to make better decisions about how we manage and develop our shoreline.

Port Townsend Waterfront and Point Hudson **July 1994**

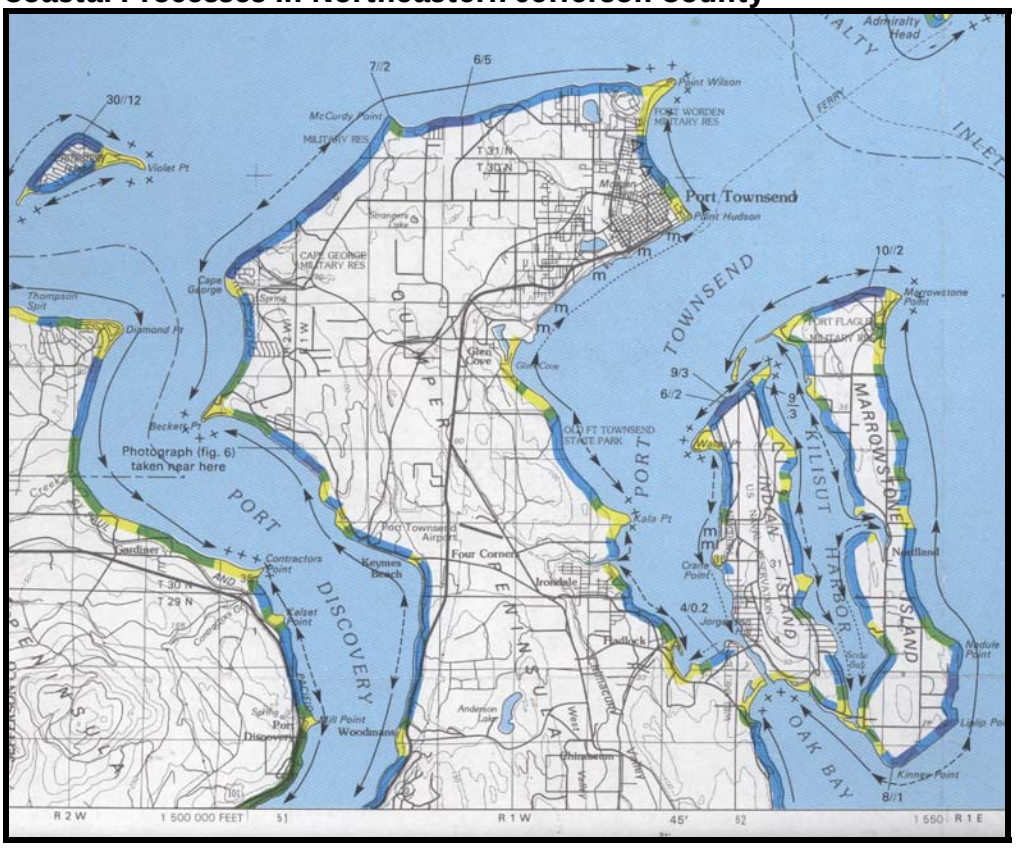


This 1858 Coastal Survey map provides a picture of the Port Townsend shoreline prior to any significant modifications.

- Downtown Port Townsend can be seen to be a low point of land – a curved spit – with a marsh or lagoon in the lowest portions below the bluff. The original community was built on the south-facing beach.

- The broad barrier beach southwest of town, where the Boat Haven marina is now located, separates Kah Tai Lagoon from the Bay. There does not appear to be any tidal inlet associated with the lagoon.

Coastal Processes in Northeastern Jefferson County



R. Keuler, USGS MI-1198E, 1988

This map illustrates the role of coastal processes – *erosion* and *longshore sediment transport* – in reshaping the shoreline. Erosion of coastal bluffs provide sand and gravel to the beaches. Waves then move sediment along the shoreline, depositing it in low-lying *sand spits* and *barrier beaches*. Although these processes have taken several thousand years to create the high bluffs and the large spits we see today, the processes remain active today.

On this map, darker blue indicates areas of greater erosion, green represents relatively stable shorelines, and yellow denotes depositional beaches. The arrows indicate the general pattern of sediment movement, which generally reflects the exposure of given reaches to wave action and storms.

Examples:

Point Wilson. The large spit that constitutes Point Wilson has formed from sediment transported westward along the northern shore of the Quimper Peninsula and northward from the shoreline of Port Townsend Bay.

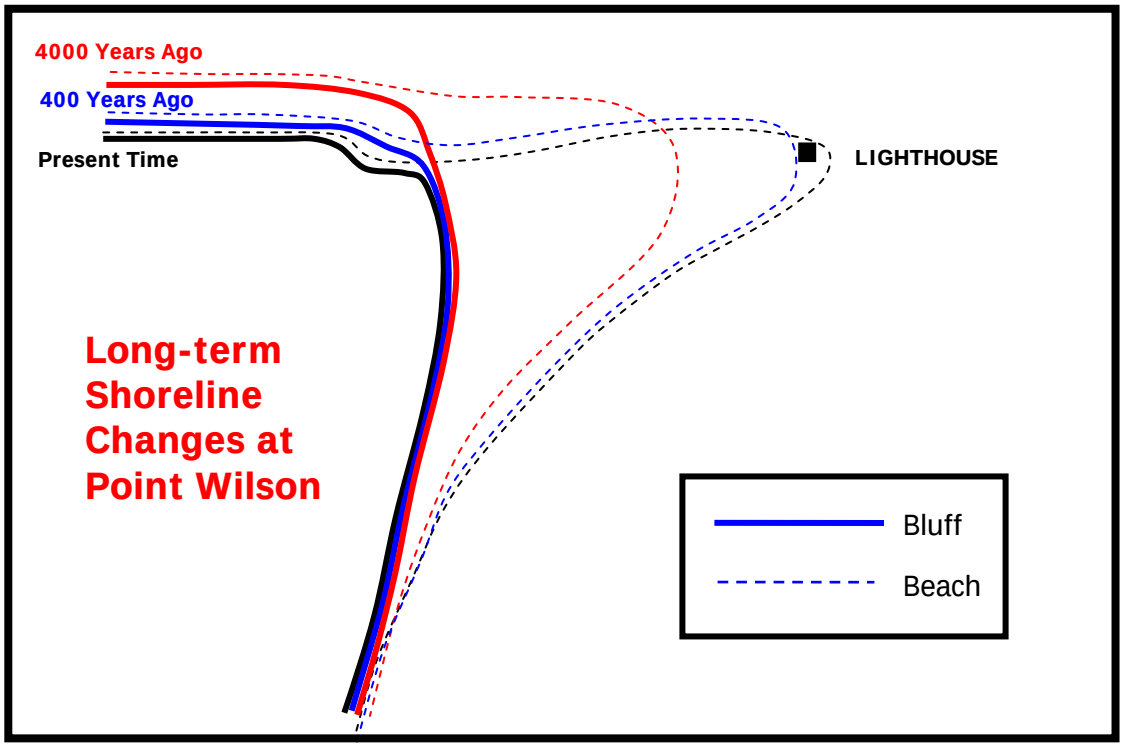
Fort Flagler. The bluffs along the northern shore of Marrowstone Island have eroded for thousands of years. Some of this material has been moved eastward to form Marrowstone Point, the remainder has been transported westward to form the spit that encloses the mouth of Kilisut Harbor.

Point Wilson

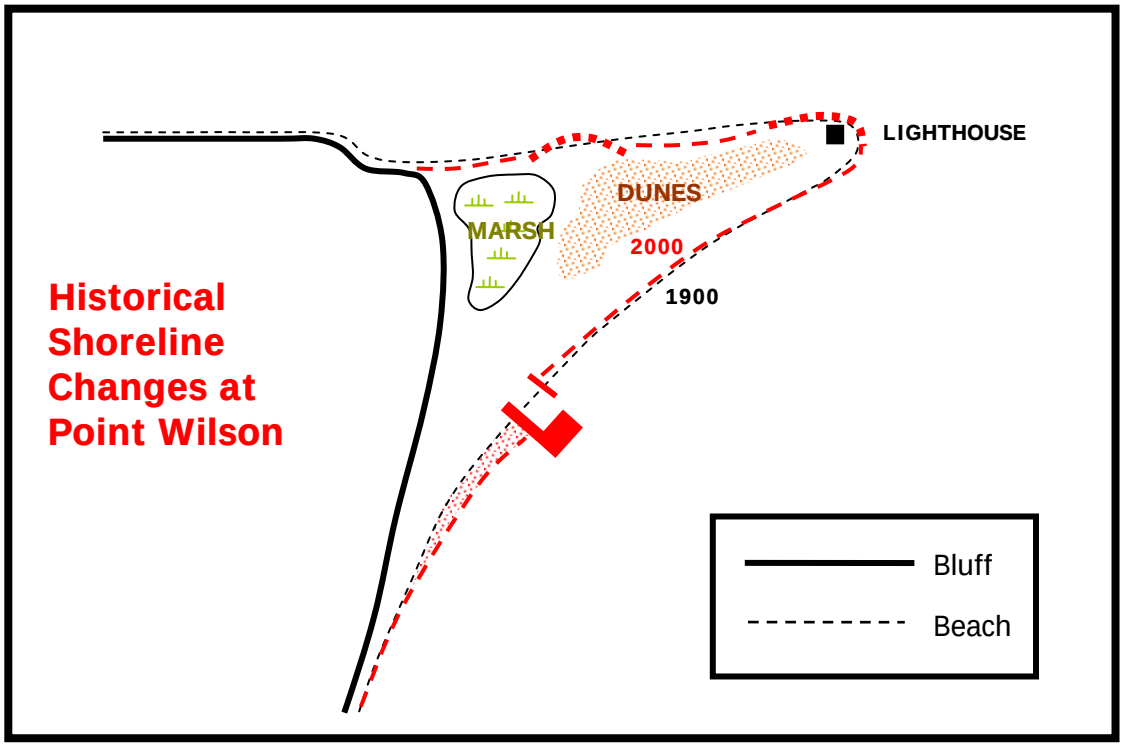
Photo: Gerald Thorsen (mid-1980s)

Geomorphologists classify Point Wilson as a *cuspate foreland*. Westerly winds and waves in the Strait of Juan de Fuca transport beach sediment from eroding bluffs between McCurdy Point and Fort Worden to the east, depositing it where the coastline bends sharply south at the entrance of Admiralty Inlet. At the same time, southerly wave action in Admiralty Inlet and Port Townsend Bay moves sediment northward around Point Hudson and along the Chetzamoka Park shoreline toward Fort Worden. The convergence of large volumes of sand and gravel over thousands of years has gradually built Point Wilson.

This photo shows how human efforts to protect the northern side of Point Wilson from erosion have resulted in segmentation of the beach and possible disruption of the natural patterns of sediment movement. Note how the riprap at the lighthouse has turned a smoothly curving beach into a rocky promontory.



Little information exists to re-create the geologic history of Point Wilson, but based on our understanding of geomorphologic processes, experience looking at other similar landforms around Puget Sound, and evidence from the Point itself, we suspect its history was something like what is shown. The spit has largely formed since sea levels stabilized about 5000 years ago. The bluffs on the north side of Fort Worden have gradually eroded landward and the beach on the north side has migrated southward at the same time. We know that the north beach was once farther even farther north because peat from an old marsh is exposed at low tide in that area.



We do not know exactly what the shoreline of Point Wilson looked like in 1900, prior to any substantial human modifications, but it probably looked something like this. A marsh was located at the base of the bluffs on the north side and dunes dominated the central portion of the point. Although the position of the shoreline had shifted over the centuries, this basic landscape configuration had not.

The building of the lighthouse and of the gun batteries, the subsequent addition of riprap to protect each of these from erosion, and the construction of the pier and boat basin on the south side, have altered the natural configuration of the shoreline, so that by the present time, the shoreline is similar to what is shown in red.

On the southern side of the point, the continuity of the shoreline has been disrupted and the natural movement of sand has been altered, but the beach itself appears to be in good condition. The orientation of the beach and its natural stability may have minimized the potentially detrimental effects of the pier and boat basin.

On the northern side, however, the modifications have more significant implications. This shoreline continues to erode, as it has for millennia. Efforts to protect backshore improvements from erosion have had limited success, albeit with considerable expansion and maintenance over the years, but will not in any way alter the underlying southward march of the beach. Over the decades, the riprapped segments have become promontories and the natural movement of sediment along the beach has been impeded.

Riprap had also been placed in the 1970s to protect the Park's northern loop road and parking from erosion. This riprap was removed in the late 1980s as part of larger project that included reconfiguring of the road and parking lot and partial restoration of the natural beach. Although this improved the beach and removed park improvements from harm's way (at least temporarily), it did not address the underlying shoreline change and erosion has continued.