Reservation Coast

The outer Tulalip Reservation coast stretches for approximately 10 miles along Possession Sound and Port Susan from Priest Point to just south of McKee Beach and includes tidelands. For the purposes of this discussion the area of climate change influence starts at the extreme low tide line and extends landward to a zone extending just past the top of the bluff.

The reservation coast is intermittently developed. Where room allows at the base of the bluff and on sandy spits fishing shacks have grown into multi-room homes so that coastal communities have emerged. Priest Point, Tulare, Tulalip Shores occupy low points along the coast. A set of houses was recently removed from Mission Beach. The top of the coastal bluff is densely developed at certain locations such as between Mission Beach and Mission Point, north of Hermosa Point and White Rock, north of Priest Point. Other portions of the bluff top are less densely built up.

Habitats include coastal bluff, salt/brackish marshes, tidal flats, beach and spit formations composed of wind and wave moved sand and gravel extending just above the high tide. Coastal bluffs on the Reservation are composed of glacially deposited silts, sand and gravel. They may rise as high as 350 feet above sea-level. Tidal flats may be unvegetated or vegetated with algae, such as rockweed (*Fucus sps*) and sea-lettuce (*Ulva sps*), and the marine flowering plant, eelgrass (*Zostera marina*). These flats serve as habitat for butter, horse, and native littleneck clams, as well as the invasive Varnish clam. They are critical habitat for juvenile salmon, herring, sandlance and crabs.

Erosion of coastal bluffs plays an important role in maintaining adjacent intertidal habitat. Eroding bluffs are termed “feeder bluffs” because they provide sediment of wave and wind driven sand in “drift cells” along the shoreline. Drift cells consist of sand and gravel beaches that maintains the nearshore tidal (and subtidal) flats, beaches and spits. Waves sort the sand and gravel into habitat patches composed of different sized material with characteristics preferred by the various marine species important for tribal subsistence.

The rate of erosion is controlled primarily by cohesion of glacial sand and gravel in the bluff face and the power of waves hitting the base. When the bluff face is saturated by the seepage of groundwater or overland flow, cohesion among the sand and gravel particles is weakened, causing sloughing. From the base of the bluff sand and gravel is distributed along the beach by wave action. The beach absorbs wave energy at most tidal stages, reducing the energy available to further erode the bluff. However, at the highest tides waves have access to the bluff itself and erode it directly. The power of waves is determined by the strength of the wind and the distance the wind can push waves through open water (fetch). Strong wind over long distances can build up big waves. Sites on the Reservation such as Hermosa Point face nearly eight miles of unobstructed fetch, producing large waves that move large amounts of bluff and beach material.

Though important for habitat maintenance, shoreline erosion also threatens homes built along the bluff tops and beaches. The usual response of home owners is to build a seawall to keep waves away and stop erosion. Seawalls change beach dynamics such that habitat creating processes are interrupted and support of marine resources is diminished. Seawalls may divert wave energy to the beach or nearby bluff base accelerating erosion at those locations.

Ownership and Development

Approximately one third of the outer coast is not developed, meaning that there are no structures at the top of the bluff, nor on the beach. There are no structures or infrastructure at risk from sea level rise in these areas. A little less than half of the reservation coast line is owned by tribal members or Tulalip Tribes. A little more than half is owned by non-tribal individuals. Nine tenths of the undeveloped shoreline is owned by Tulalip Tribes or members.

Climate Change Induced Risks

Coastal inundation and the rate of bluff retreat is expected to increase due to climate related intensification of the erosion processes described above. Bluff-face stability will decrease because of intensified winter storms producing more rain and, in turn, more groundwater and surface flow. Both surface runoff and groundwater emerging through the bluff strata will affect cohesion of the bluff face, leading to accelerated failures over time. This is probably already happening but not monitored. Winter storms will also produce storm surge and higher waves with more force to move material from the bottom of the bluff.

Sea level rise will exacerbate erosion even further. Higher high tides will erode the base of the bluff more often as the sea level rises. And it will lift the storm surge up so that it will occur at the level of the bluff more often (rather than at the beach face) and with more intensity, also accelerating removal of the bluff base. Wind driven wave energy will be enhanced during storms because deeper nearshore water reduces the ability of the beach face to moderate wave energy. All of these factors combine to accelerate bluff erosion. One study projects that the current rate of recession of coastal bluffs in nearby San Juan County will double between now and 2100 (National Research Council 2012). As with many climate related predictions, this may be underestimating the effect. We are regularly hearing reports that global warming and its consequences, such as sea level rise, are accelerating. This is the level of change we should anticipate.

Houses built near the edge of the bluff will eventually lose their footing, even under normal conditions, but sea level rise and increased storm intensity will accelerate the process. Residential areas built on beaches and spits are sitting on wave and wind created coastal structures. By necessity these buildings are very near the highest high water level. They are already subject to inundation during very high tides and storm surge. An additional 3 feet of tidal rise associated with sea level rise will inundate these structures during most high tides. While some areas that experience eroding bluffs are undeveloped, other bluffs, adjacent to residential neighborhoods, are reason for concern. Figures 1 and 2 show bluff top homes in the Hermosa Point area bordering heavily eroding bluffs and homes at Priest Point at risk of inundation with sea level rise and storm intensification.

Tulalip Bay is a special case. The bay is shallow and less exposed to wave energy because Mission and Hermosa Points limit fetch. Nevertheless, sea level rise threatens shoreline houses. Erosion within the bay is also a concern.

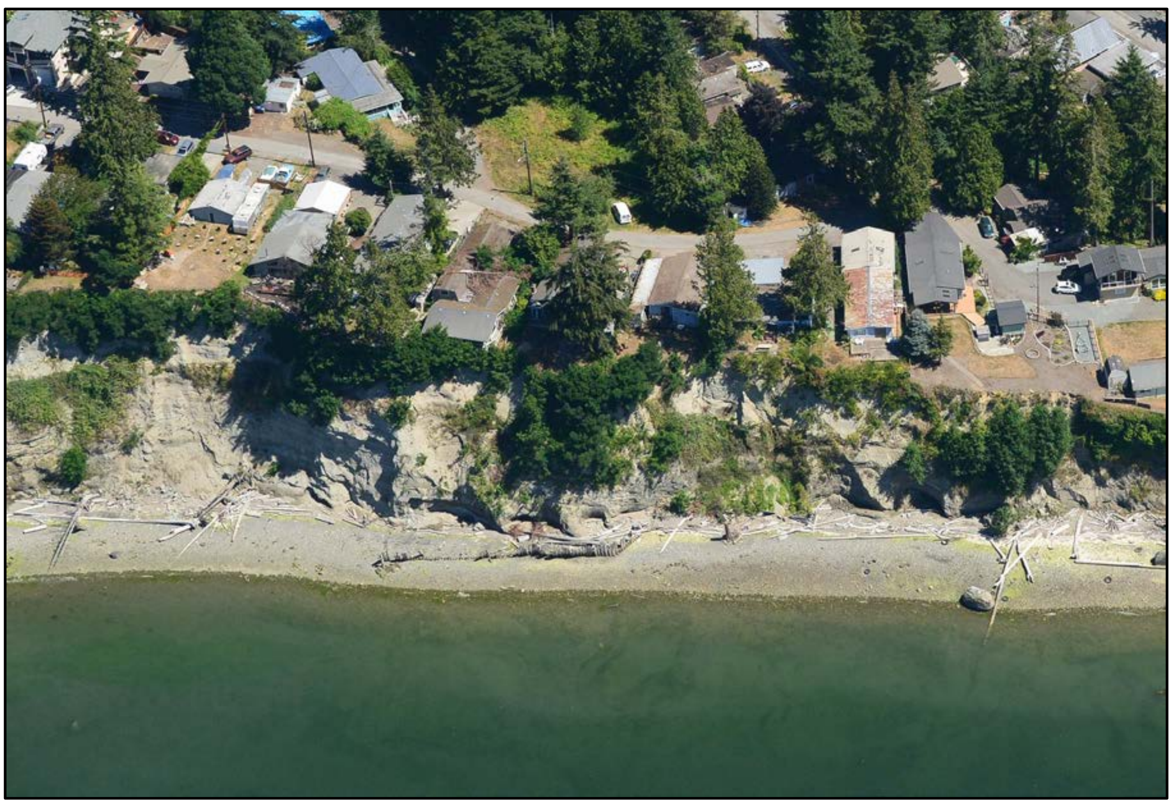

Figure 1. Hermosa Point is elevated land extending into the Port Susan forming the north point for Tulalip Bay. Fetch extends to Mukilteo nearly 8 miles away. The bluff to the north is rapidly eroding because of exposure to high energy waves, undercutting homes. This process will intensify with climate related storm intensification and sea level rise.

Figure 2. Priest Point is a "spit" formation created by the wind and wave induced movement of sand and gravel. The high elevation on the spit are naturally at the highest level of tides and storm surge. Houses built on the spit began as fishing shacks that were not of great concern. Fishing shacks upgraded to houses over time represent considerable investment that is at risk from sea level rise and intensified storms.

Tulalip Tribes' Adaptation Response

Tulalip Tribes have limited options available to respond to shoreline erosion. Effective technology for stopping erosion is limited to hardening the shoreline with seawalls or riprap. All around the Salish Sea where erosion has been stopped by the construction of seawalls habitat has been degraded. This response can be expected to reduce tribal subsistence resources such as clams in the intertidal zone. It will also degrade habitat for fish and crab that use the intertidal for rearing in a critical part of their life history. The alternative is to retreat from the immediate coast and restore natural processes. Methods called Soft Shore Stabilization are intended to, at least in part, restore natural processes so that they beach takes the energy of the waves instead of structures. However, these methods require adequate room for natural processes takes place. Seawalls protecting house on spits and beach often leave insufficient space. Without the seawall highest tides would reach the house. Retreat from the shoreline must be included to allow room for the beach to function in absorbing wave energy

The Tulalip Natural and Cultural Resources Department is working with the United States Geologic Survey and contracting with Coastal Geologic Services of Bellingham, Washington, to gather information that will allow us to better understand the rates of erosion on the Tulalip outer coast. These studies should be completed in early 2020. They will help us to determine an appropriate response to increased coastal storm activity and sea level rise