SKAGIT CLIMATE SCIENCE CONSORTIUM

SEA LEVEL RISE

THE CHALLENGE

As air temperatures warm, the base sea level is projected to increase. While sea levels are not currently measured in Skagit Bay, we do know that the waters adjacent to Seattle have risen about 9 inches since 1900. The average sea level in Puget Sound is currently projected to rise about 24 inches (+/– 12 inches) by 2100, though other studies suggest it could rise much higher. While there is broad consensus about the upward trajectory of sea level, scientists are still learning how fast, or slow, change will occur. Regardless, as the base sea level increases, many challenges and risks currently experienced in the Skagit area will likely become more frequent and more severe.

Understanding sea level is complex as the sea level varies a lot, naturally, without any climate change related influence. Indeed, annual average sea level can vary up to 18 inches just based on factors such as El Niño and average annual wind dynamics. Even within Puget Sound, water levels can vary substantially and can be more extreme in the presence of storms. However, we do know that even given large natural variation, small changes in the average annual sea level can have a large impact on storm surge and ultimately on coastal flooding. In fact:

A 12 inch increase in sea level turns a 100-year coastal storm event into a
10-year coastal storm event

A 24 inch increase in sea level turns a 100-year coastal storm event into an
annual coastal storm event

Sea level rise increases coastal flooding and erodes bluffs and dikes; raises groundwater levels; decreases farmland drainage; and affects ecosystems and habitats.

COASTAL FLOODING AND EROSION

Increases in coastal flooding and erosion are the result of more frequent extreme high tides, higher storm surge, and the greater chance of a high tide coinciding with a flooding river. Sea level and storm surge can cause floodwaters to "back up" into the lower Skagit River potentially increasing river flooding. Already seawater backs up from the bay to about Mt. Vernon during high tides.

Rising sea levels can cause storm waves to become larger and more likely to overtop dikes and erode coastal bluffs and bulkheads. Flooding and erosion are expected to increase in the coming decades resulting in more frequent disruptions to major transportation corridors, bluff erosion and wave-induced landslides, and damage to property.

RISING GROUNDWATER LEVELS

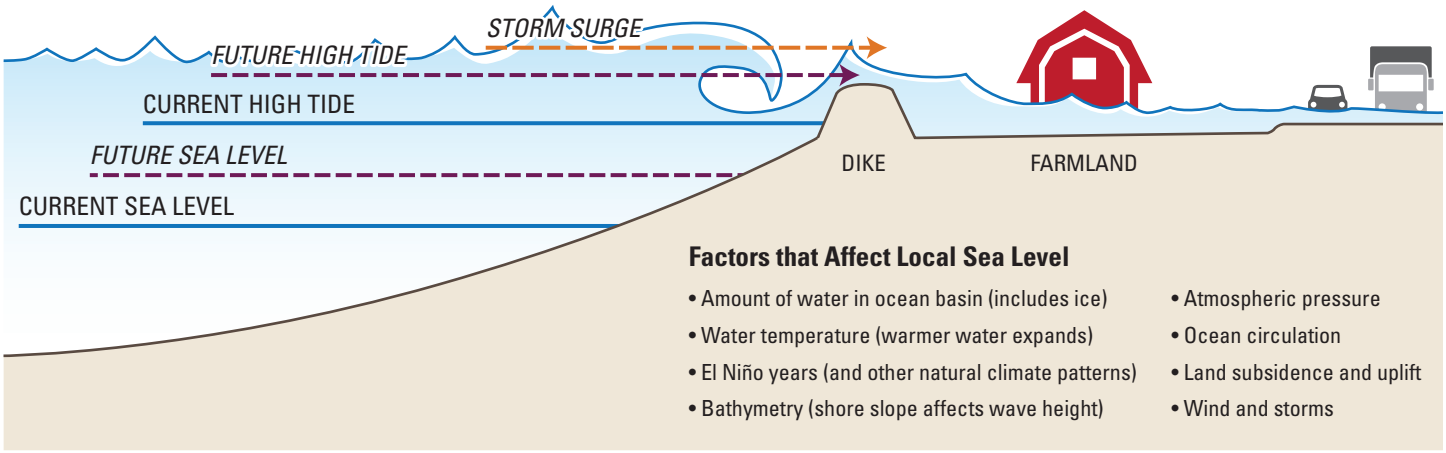
A rising sea also raises the level of groundwater underlying low coastal lands, affecting farmland and coastal septic systems. The lowest farmland on the delta has already subsided below the level of the nearby tidal marsh, located on the bay side of existing dikes and levees (see photo). Farm drainage on the delta is also affected, as rising seas result in a greater need for mechanical pumps to drain ditches and keep farm fields from flooding.

CHANGING HABITATS

Coastal habitats will be affected by sea level rise too. Eelgrass meadows, which support a variety of fish, birds, and crabs, may benefit if deepening coastal waters increase the area suitable for eelgrass growth. Some tidal marshes on the other hand may drown, especially where dikes, seawalls, or natural topography prevent inland "migration" or movement of these habitats. In addition, higher winter storm waves may also increase the rate of erosion for both marshes and eelgrass meadows and lead to habitat loss.

Samish Bay at high tide

Rising Sea Levels & Storm Surge



Factors that Affect Local Sea Level

- Amount of water in ocean basin (includes ice)
- Water temperature (warmer water expands)
- El Niño years (and other natural climate patterns)
- Bathymetry (shore slope affects wave height)
- Atmospheric pressure
- Ocean circulation
- Land subsidence and uplift
- Wind and storms

NOTE: Sea, tide, and storm surge levels are for illustrative purposes only and do not depict actual or projected levels.

SC^2 AS A PROVEN RESOURCE

Predicting changes in sea level and the potential associated impacts is very challenging. SC^2 scientists are integrating information related to sea level rise, storm surge, sediment transport and deposition, groundwater levels, and wave energy specific to the Skagit Bay and delta. Farmers, drainage district managers, restoration practitioners, local governments, and residents need this critical understanding to inform sea dike, tide gate and levee maintenance and strategies to reduce long-term costs, plan for future drainage, ensure restoration projects will deliver their intended benefits, and protect their homes and infrastructure. Scientists are currently working with partners to: monitor groundwater wells; improve accuracy of levee height data and inundation models; validate model projections of changes in groundwater; inform restoration planning; and, help identify and prioritize information needs and future actions.

PHOTO: DAN CODD

LOOKING FORWARD TO MORE SOLUTIONS, MORE ACTION

SC^2 has the knowledge and ability to provide flood managers, delta residents, and farmers with inundation maps and associated vulnerability assessments that show the potential combined effects of sea level rise and increasing flood risk. We can respond to concerns about farmland drainage by implementing high priority research regarding sea level rise scenarios combined with sediment deposition and flooding in the delta. To understand ecosystem impacts and marsh sustainability, SC^2 seeks to simulate the effects of sea level rise and changes in river flow using estuary marsh accretion and empirical vegetation prediction models.

SC2 SKAGIT CLIMATE SCIENCE CONSORTIUM

The Skagit Climate Science Consortium (SC^2)

SC^2 is a nonprofit 501c(3) organization consisting of scientists working with local people to assess, plan, and adapt to climate related impacts. Composed of research scientists from universities and federal, municipal, and tribal governments and agencies working in the Skagit basin, SC^2 members seek to understand how the landscape, plants, animals and people may be affected by changes in the patterns of rain, snow, temperature, storms and tides.

www.skagitclimatescience.org

Visit our website to learn more about who we are, what we do, and the various resources we can provide.

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