Coastal Hazards Adaptation Planning

Coastal Flooding, Coastal Erosion and Rising Groundwater fact sheet

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Christchurch City Council

Climate change and the associated rise in sea level is likely to increase the risk of coastal hazards such as coastal flooding, coastal erosion and rising groundwater.

This is a challenge facing low-lying inland and coastal communities in Ōtautahi Christchurch, and all around the world.

Coastal Flooding

Coastal flooding (also referred to as coastal inundation) is a natural event that occurs when normally dry, low-lying land is flooded by the sea. Coastal flooding is primarily caused by severe weather events such as storms where low-pressure weather systems, large waves driven by strong winds, and heavy rain combine to raise water levels. However, rising sea levels can also lead to 'sunny day flooding' (where high tides cause flooding even without a storm). The worst flooding occurs when larger-than-normal high tides and storms occur at the same time.

As the level of the sea rises, land that currently floods during storms or extreme high tides may experience more frequent and deeper flooding. Slightly higher areas or low lying areas further inland may also begin to flood over time.

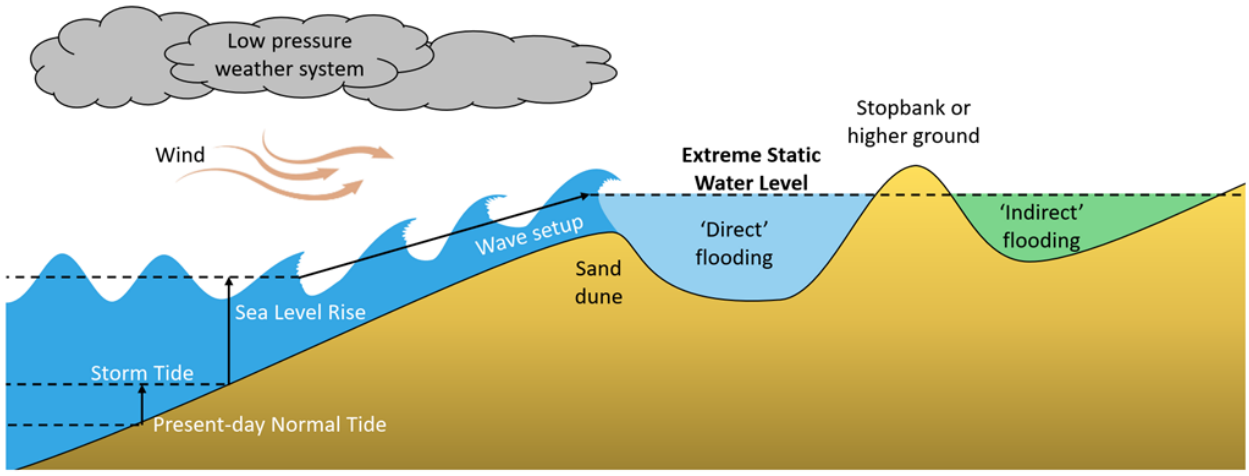

Figure 1: Conceptual model for calculating extreme static water levels for coastal flooding analysis.

Coastal Erosion

Coastal erosion is a natural and ongoing process that occurs when the sea wears away the land. The rate of erosion depends on:

- Ocean conditions such as waves, tides, storm surge and currents
- Climate variability such as predictable climate cycles and long-term climate change
- Sediment budget (the rate at which sediments come and go from the coast), and whether this is balanced
- Vertical land movement
- Sea level rise (SLR)

Over years and decades, depending on the balance of short-term erosion events and recovery periods, some coastlines grow out towards the sea (accrete), some stay in about the same place (equilibrium) and some retreat landward (erode).

As sea levels rise, erosion events will increase in severity and frequency as storms occur on higher water levels. It is also expected that recovery periods between erosion events will shorten. This means that eroding coastlines will erode faster or have larger individual erosion events, and accreting coastlines could grow seawards more slowly, stop accreting, or even become eroding coastlines. Even a shoreline that is accreting in the long-term can experience erosion events, which could cause damage to nearby property, infrastructure and activities.

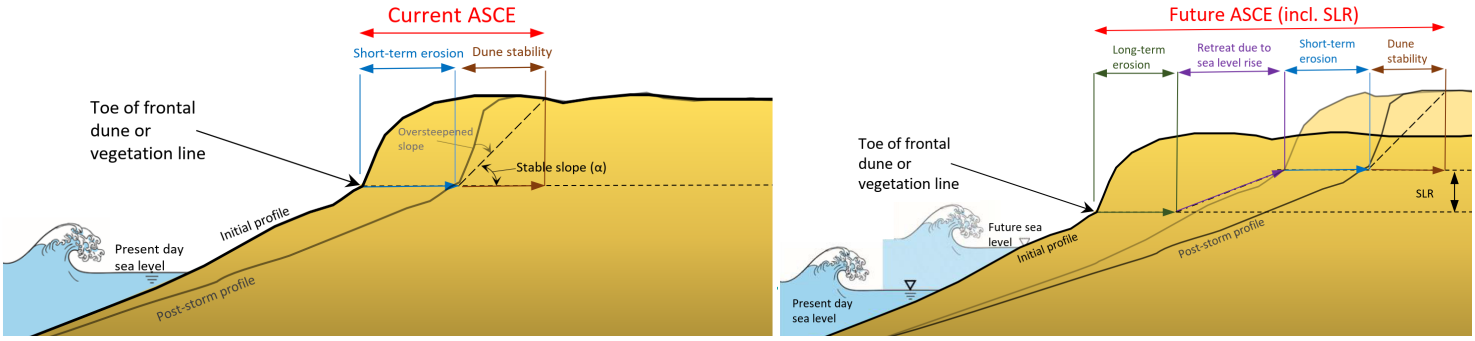

Figure 2: Conceptual model for Areas Susceptible to Coastal Erosion (ASCE) on a sand beach shoreline, showing the components contributing to erosion for the current-day (left figure) and in the future (right figure).

Rising Groundwater

Groundwater describes water that exists in saturated zones beneath the land surface. Near open water sources such as rivers, estuaries and the sea, groundwater connects to the surface water. This results in groundwater that is often much shallower in low lying areas near these open water sources.

Groundwater doesn't stay fixed at the same height all the time, it naturally fluctuates between days, weeks, seasons and years, alongside changes in surface water such as tidal cycles. Due to this connectivity, sea level rise as a result of climate change is expected to lead to rising groundwater in coastal areas causing wet ground or above-ground flooding in areas where the groundwater is already close to the surface. These effects may only last for a short time and then drop away again, but over time they may remain for longer. Changing weather patterns as a result of climate change may also result in less frequent but more intense heavy rainfall, which soaks into the ground, saturates it and temporarily brings the groundwater closer to the surface.

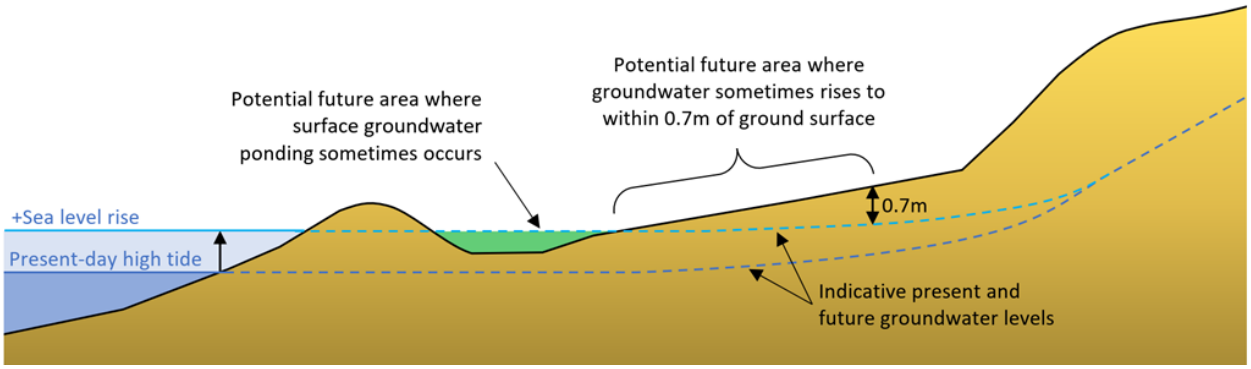

Figure 3: Conceptual model for identifying low-lying coastal areas which might be impacted by rising groundwater.