

# South Dunedin Future Programme Journey

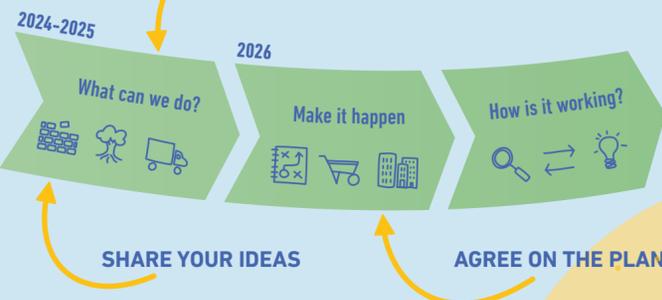
Reading about these hazards can be scary.

But it is important to know what our challenges are, so we can talk about how to respond and make the best plan.

If we do this together we can make South Dunedin a safer and better place to be.



HELP NARROW DOWN OPTIONS



## Get in touch



Head to our website to learn more. Sign up for regular updates or drop us a line.

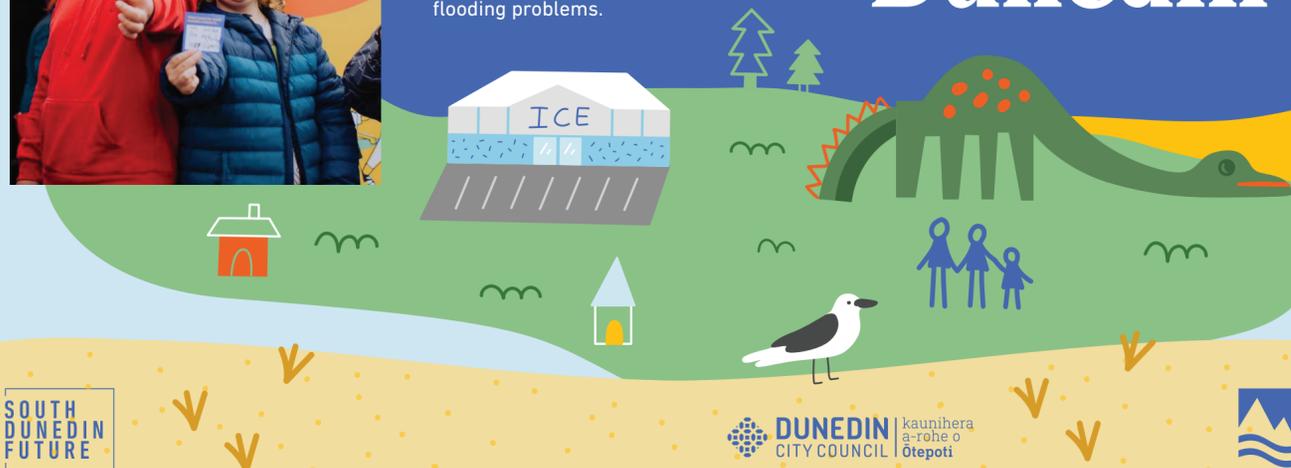
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**South Dunedin Future** is a joint programme between Dunedin City Council and Otago Regional Council to help the South Dunedin community adapt and prepare for a changing climate, and future flooding problems.

# South Dunedin Future

## The Science of South Dunedin



# South Dunedin Future

**We need to make a plan, and we need to do it together.**

We are studying how South Dunedin is being impacted by changes in weather, sea level, and groundwater level, and what we can expect over the coming decades.

We want to explain the science behind the natural hazards in South Dunedin, like flooding, and climate change.

This brochure is all about **what is happening**. It is your chance to learn more about the science of South Dunedin, and the challenges facing the area.

**Read more to get informed and get involved!**



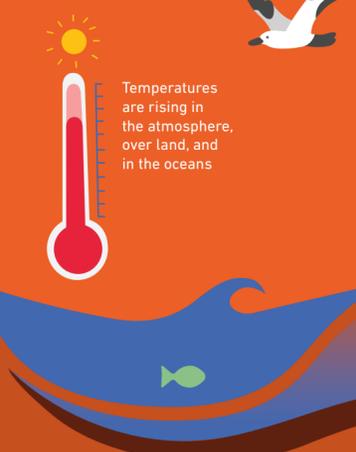
# Natural hazards in South Dunedin: Then and now

The South Dunedin community has a long history of resilience, but now faces its biggest challenge yet...

In South Dunedin, there's water coming down from the sky, up from the ground, and in from the sea. As the global climate continues to change, we are seeing increases in temperatures in our atmosphere, over land, and in the oceans. The risk of water ending up in places we don't want it is only going to increase, because climate change means more rainfall, more intense storms, rising seas, and higher groundwater.

To understand why, where, and how this water is coming in, we need to paint a picture of the South Dunedin landscape and the hazards that affect it.

South Dunedin is located on a low-lying plain of reclaimed coastal wetland – it used to be a mix of tidal flats and salt marsh, along with a lagoon and wetlands, that was filled in with sand and soft sediment in the 1870s.

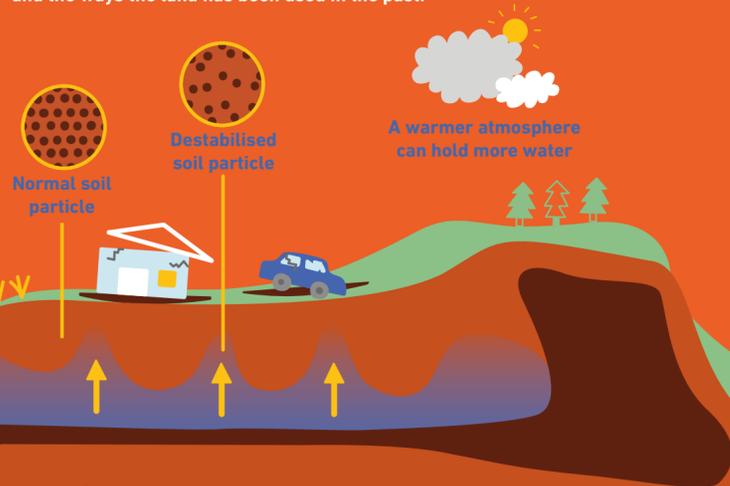


**This makes the area vulnerable to a range of natural hazards:**

- From earthquakes (seismic)
- From beneath the ground (groundwater)
- From the sea (coastal)
- From the sky (extreme weather events)

## The land and waters of Aotearoa New Zealand are alive and always changing.

Natural hazards are everywhere. The ones in South Dunedin exist because of its location, history, what the land is made of, and the ways the land has been used in the past.



## Why is there an earthquake hazard in South Dunedin?

When settlers began reclaiming the land in the 1870s, they filled in and topped up wet, low areas with materials that mainly came from the coastal dunes. This resulted in South Dunedin sitting on land that mostly consists of soft, sandy sediment.

Several geological faults in the Ōtepoti Dunedin area (e.g. the Akatore Fault, which runs south of the Taieri Plains, and offshore from Taieri Mouth) could cause large earthquakes. Sediment-filled basins such as the broader South Dunedin area can face greater earthquake shaking, and can cause liquefaction – where thick watery mud comes up through cracks to the surface, and land subsidence – where the land slowly or suddenly sinks.

## When South Dunedin was reclaimed and settled around 150 years ago, many houses were built below the high tide mark at the time.

Today, most of the area is no more than 50cm above high tide.

Sand dunes, like the ones in St Kilda and St Clair, help protect South Dunedin against water coming in from the sea. Unfortunately, these soft, sandy beaches are sensitive to changes in the natural environment and from human interference. On top of that, the St Kilda and St Clair dune systems are already showing signs of coastal erosion and movement inland.

## Why is there a coastal hazard in South Dunedin?

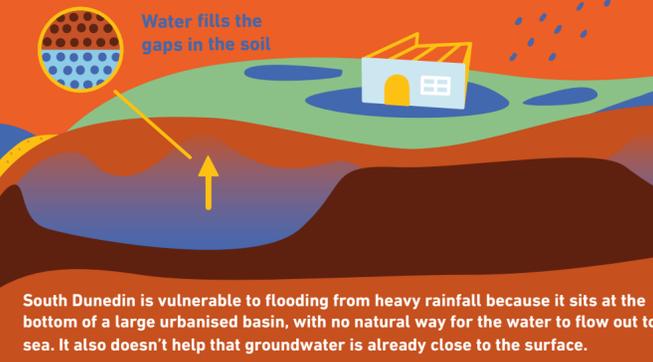
A large part of South Dunedin sits right next to the ocean, putting the community at risk of coastal hazards. These hazards can be gradual, for example sea-level rise and coastal erosion, or event-based, for example storm surges and tsunamis.



## Why is there a groundwater hazard in South Dunedin?

When it rains, water can soak into the ground and fill the cracks and spaces between the soil, sand, and rock. We call this groundwater. The upper limit of groundwater is called the water table, and its level changes with the seasons and rises when it rains. Close to rivers and the sea, the water table also changes along with the tides.

The original wetland had groundwater right to the surface. Reclamation since the 1870s has raised South Dunedin ground levels only a little above the water table. As a result, South Dunedin is at risk of flooding, ponding, and increasing, ongoing damp, due to a shallow water table that is likely to rise.



Long periods of moderate-to-heavy rainfall can cause significant surface runoff in South Dunedin. This has been made worse by more land being covered in concrete and buildings. Future sea-level rise is expected to worsen flooding.

## Why is there a rainfall hazard in South Dunedin?

Ōtepoti Dunedin occasionally experiences very heavy rain. South Dunedin had a major flood in June 2015, when 142mm of rain fell in 24 hours. This was the second-highest one-day rainfall at Musselburgh since records began in 1918.

The deluge from this event caused slips and knee-deep flood waters, left debris strewn across the suburbs, damaged hundreds of homes, and contaminated water.

# Natural hazards in South Dunedin: Looking ahead

The risk from natural hazards is expected to increase with time. To help the South Dunedin community adapt and prepare, we need to understand why these hazards exist and how they might affect us all.

## Rain and more rain

South Dunedin has no natural outlet, so pipes and pumps do all the work to drain water away. During heavy rainfall, underground storm and wastewater pipes fill up, and excess water will pool on the surface. By the end of the century, yearly rainfall is expected to increase by up to 6% due to climate change. Dunedin's pipes are getting old, making them less capable of dealing with this extra rain.

## Puddles and ponding

A shallow groundwater table can result in soggy soil and puddles in low-lying areas. Houses can become damp and sections waterlogged.

## Land ups and downs

The level of the ground can change up or down slowly due to gradual movement, or suddenly due to an earthquake. Preliminary satellite data suggests parts of South Dunedin are sinking very slowly, at about half a millimetre per year. More years of surveying should provide a clearer picture.



## Flooding

Groundwater (the water that is part of the earth underneath us) rises above the surface for a short period of time during heavy rainfall events. It can cause the type of ponding and flooding we saw in the 2015 floods.

## Water table

The groundwater table is shallow, as little as 30cm below the surface in some places. Rising sea levels will likely push the groundwater up even further, leaving less room in the ground for rain to soak in and resulting in more surface flooding.

## Coastal erosion

Beaches and dunes can be broken down and worn away by destructive waves, high winds, storm surges and sea level rise. This could also expose an old landfill under Kettle Park.

## Sea level rise

The sea level is expected to rise by 19 to 27cm by 2050. By the end of the century the sea level is expected to be 40 to 85cm higher than today's levels.

## Liquefaction

During earthquakes, underground layers of wet soil can act like a liquid, and ooze out of the surface, along with lots of water. The soil can't support the weight above, and this can buckle roads, crack pipes and badly damage buildings.

