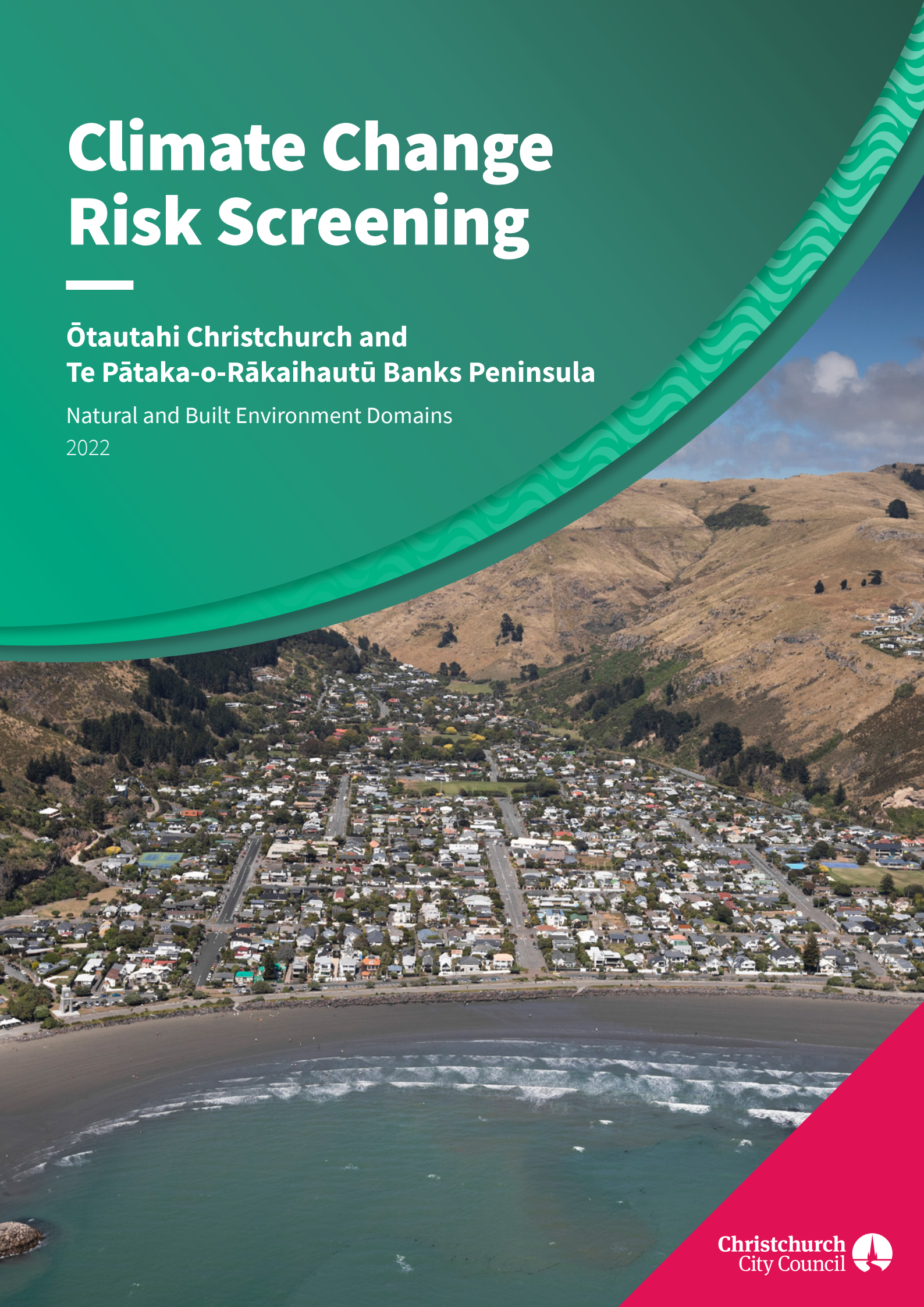
# Climate Change Risk Screening

## Ōtautahi Christchurch and Te Pātaka-o-Rākaihautū Banks Peninsula

Natural and Built Environment Domains

2022



Christchurch City Council

# Contents



## Karakia

| | |
|---|---|
| Whakataka te hau ki te uru | Get ready for the westerly |
| Whakataka te hau ki te tonga | and be prepared for the southerly. |
| Kia mākinakina ki uta | It will be icy cold inland, |
| Kia mātaratara ki tai | and icy cold on the shore. |
| E hī ake ana te atākura | May the dawn rise red-tipped on ice, |
| he tio, he huka, he hauhunga | on snow, on frost. |
| Haumi e! Hui e! Tāiki e! | Join! Gather! Intertwine! |

(Source: National Climate Change Risk Assessment, 2020)

This karakia (prayer) speaks to the great natural forces, which bind us together. It portrays a Māori worldview to help frame our thinking, and our approach to huringa āhuarangi (climate change) in Aotearoa New Zealand. It speaks to te hau ki te uru (the winds from the west) and te hau ki te tonga (the winds from the south). It acknowledges the growing challenges before us and the preparation needed to respond to them. It expresses the strengthening of our resilience and acknowledges that with unity we can overcome challenges and respond to ongoing changes in our environment.

In the context of huringa āhuarangi, this narrative emphasises our ties to and reliance on the natural world, and the connection of each generation to those before and after. This includes the connectedness of ecosystems and society, and of actions and consequences across domains.

# Executive summary

## Drivers for action

Our climate is changing. The latest Intergovernmental Panel on Climate Change (IPCC) reports confirm that, regardless of how quickly global emissions are reduced, climate change is locked in for decades to come.

> We must act now to reduce the risk to communities and the natural environment.

Local authorities are required to take informed and urgent action to mitigate greenhouse gas emissions and prepare communities for the inevitable impacts of climate change[1]. Through the Global Covenant of Mayors for Climate and Energy[2], the Christchurch City Council (the Council) has also committed to complete a district-wide risk assessment.

The Council has declared a Climate and Ecological Emergency and is working towards a strategic priority to "meet the challenge of climate change through every means available". The Council's Ōtautahi Christchurch Climate Resilience Strategy[3] makes a commitment to setting up programmes of work including "understanding the local effects of climate change", "proactive climate planning with communities" and "adapting and greening infrastructure". Through a coordinated and combined programme of mitigation and adaptation measures we will build climate resilience across the district.

## Climate Change Risk Screening

This Climate Change Risk Screening (Risk Screening) of the natural and built environments presents information drawn from a review of the available scientific and technical information for the district and a workshop of staff from across the Council, Ngāi Tahu, and a range of agencies. Ngāi Tahu has recently released its Te Kounga Paparangi | Climate Change Implementation Plan and has committed to undertaking its own climate risk screening work.

### Value domains included in the Risk Screening

| Value domain | Elements at risk |
|---|---|
| **Natural environment** | New Zealand's indigenous species, including he kura taiao – living treasures, terrestrial ecosystems, freshwater ecosystems, coastal, estuarine, and marine ecosystems, biosecurity. |
| **Built environment** | Built infrastructure across sectors including housing, public amenity, water, wastewater, stormwater, energy, transport, communications, waste and coastal defences. |

[1] *Climate Change Response Act, 2002. https://www.parliament.nz/resource/en-NZ/SCR_92789/7def17a414a95a1c769d8be6264ec2576e1aa90d*
[2] *www.globalcovenantofmayors.org*
[3] *Ōtautahi Christchurch Climate Resilience Strategy, 2021. https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/climate-change-strategy*

Following on from the recently completed national and Canterbury region risk assessments, this Risk Screening identifies significant risks across six sub-districts (Climate Risk Assessment Areas). It highlights priority areas that need a deeper assessment based on urgency and scale of consequence, and any "cascades" associated with the risk to inform our adaptive response.

Climate-related risk varies across the district according to what is exposed to which hazard in the short (roughly less than 30 years), medium (roughly 30-80 years), and long-term (roughly 80 years from now).

- Risks in Coastal Christchurch are dominated by hazards that exacerbate coastal and fluvial flooding: sea level rise, storm surge, tsunami, and rising groundwater. These present risks in the natural and built environments with coastal squeeze an issue for coastal habitats.
- In Inland Christchurch, the natural environment suffers with increasing temperatures and drought while the built environment suffers from flash flooding (caused by extreme rainfall events and river flooding).
- In the Port Hills, both the natural and built environments are vulnerable to wildfire and landslides.
- In Coastal Banks Peninsula, coastal and flood hazards mainly affect the natural environment but also threaten road access to isolated communities. Water supply is also affected by drought.
- Risks in Inland Banks Peninsula are dominated by drought, heat and wildfire affecting the natural environment and water supply security.
- Akaroa is affected by all the risks listed above.

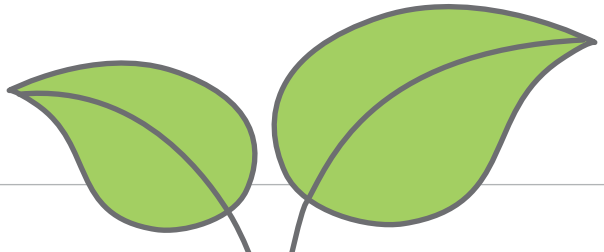
## Next steps

The Council will use this Risk Screening as a common operating picture regarding significant risks that our district faces due to climate change, with more detailed risk assessments expected to follow. Our Risk Screening assessment will be shared with Ngāi Tahu colleagues working on their Te Ao Tūroa and Whānau and Emergency Response teams, to foster collaborative approaches to adaptation planning.

The Risk Screening will help the Council identify, monitor and manage its risks, address knowledge gaps, and identify opportunities for collaboration to fill those gaps. It will be used to prioritise projects in Asset Management Plans and the Long Term Plan, ensuring climate resilience is appropriately included in planning and implementing our work.

The Risk Screening is the first step in *Programme 2: Understanding the local effects of climate change* of the Ōtautahi Christchurch Climate Resilience Strategy and will set the basis for further screening of the social, economic and governance domains. It will inform adaptation planning, spatial planning and the Council's other plans, strategies, and policies where climate resilience is relevant. The screening also provides information to assist mana whenua, stakeholders and residents to undertake their own adaptation planning.

Please note these are the risks to the best of our knowledge as of 2022. This document will be updated periodically to reflect the latest information on climate change risks.



# 1 Vision for a climate resilient district

**Our district must be climate ready. It must be resilient.**

This means reducing carbon emissions and adapting people, communities, and our natural environment to risks caused by climate change.

Our climate is changing. Regardless of how quickly global emissions are reduced, climate change is already locked in for decades to come. We must act now to reduce the risk to our communities and natural environment.

The Council's vision is of resilient communities living in the healthy environment of a liveable city and district with a prosperous economy. To help realise our vision for resilience, we have established a clear strategic priority to "meet the challenge of climate change through every means available". This requires us to plan now to prepare communities for future climate impacts and accelerate our transition to a net-zero emissions economy.

The Council plays a critical role in achieving climate resilience across our district by leading, enabling, and inspiring changes required to achieve this vision. Climate resilience is an outcome of coordinated efforts by all of us, to prepare to adapt to climate risks and to accelerate the transition towards net-zero emissions.

# 2 Why do we need a Climate Change Risk Screening?

As illustrated in Figure 1, the Climate Change Response Act 2002 requires that cycles of six-yearly National Climate Change Risk Assessments (NCCRA) are completed to inform cycles of six-yearly National Adaptation Plans. As part of this process, councils are required to report, if requested, on their exposure to climate change related risks. The Auditor General has also indicated that future audits of local government Long Term Plans will look carefully at how climate change is addressed, especially by councils that have declared a Climate Emergency. The Council also has responsibilities under the Local Government Act 2002, Resource Management Act 1991, Building Act 2004, and the Civil Defence and Emergency Management Act 2002 to support the wellbeing of communities, and the natural environment, provide reliable services such as roads, water supply and wastewater, and to manage natural hazards and their effects.

The Government completed the first NCCRA in August 2020 and Environment Canterbury (ECan) completed a regional risk assessment in November 2021. In 2021 the Ministry for the Environment (MfE) released *He kupu ārahi mō te aromatawai tūraru huringa āhuarangi ā-rohe / A guide to local climate change risk assessments.* This Risk Screening is aligned with MfE guidance and informed by the national and district assessments.

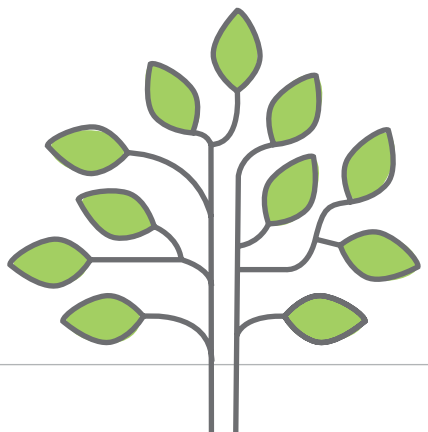
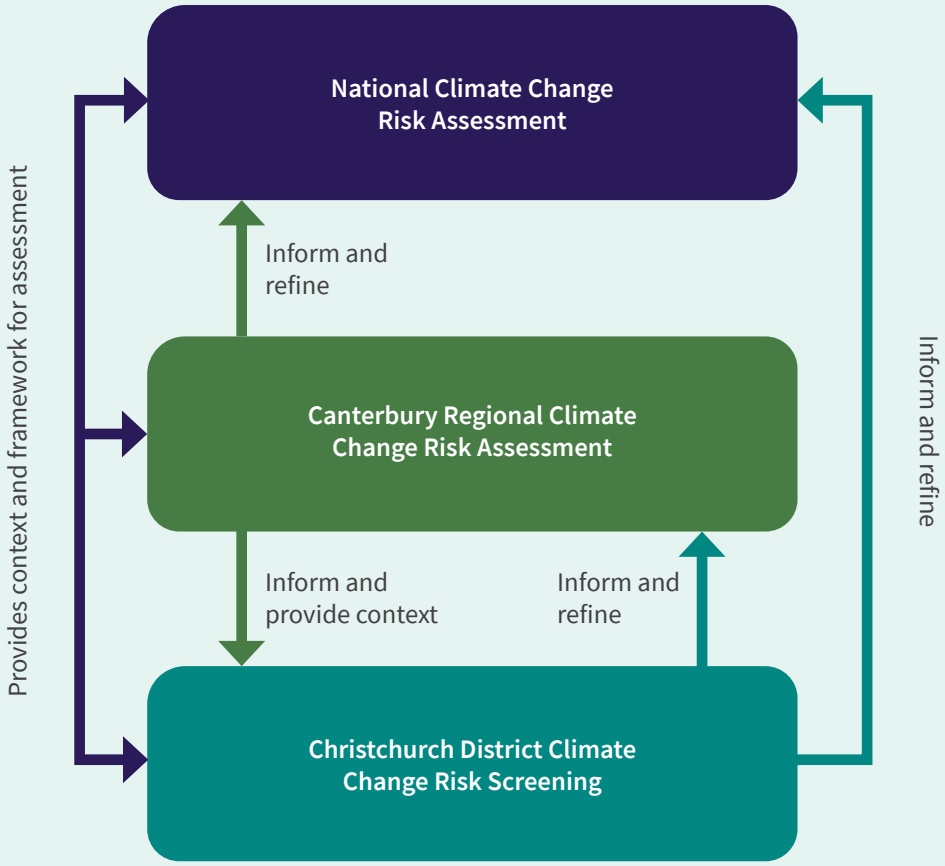


Figure 1: The hierarchy of climate risk assessment from national and regional to the local level.




| Executing agency | Scale and scope |
|---|---|
| Ministry for the Environment Manatū Mō Te Taiao | National 'high level' across all value domains to inform national policy and investment decisions. Low spatial resolution. |
| Environment Canterbury Regional Council | Whole of Canterbury across all value domains to inform regional and local planning. Resolution improved, but still lacks focus for district level response for Built and Natural Environment Value Domains. |
| Christchurch City Council | District-wide across built and natural environment value domains to inform district and city-level planning responses and investments. Spatial planning resolution across domains is appropriate. Findings will inform future revisions of the Regional and National assessments.<br><br>The built and natural domains set platform to engage stakeholders, including mana whenua, on risks to the human, economic and governance domain. |

The Council's 2019 strategic framework includes the community outcomes of resilient, safe and healthy communities, modern and robust infrastructure and a healthy environment contributing to developing a resilient, liveable city. It includes a strategic priority of "meeting the challenge of climate change through every means available". In response to these drivers, the Council declared a Climate and Ecological Emergency in May 2019 and adopted the Ōtautahi Christchurch Climate Resilience Strategy in June 2021. We need to understand climate change impacts in order to make robust decisions now and into the future.

As illustrated in Figure 2, the Ōtautahi Christchurch Climate Resilience Strategy commits to work programmes that address mitigation and adaptation. In order to support this work, the Risk Screening begins to assess our exposure and vulnerability to climate risks, and how these risks are projected to change over the next century. It will highlight the Council's understanding of the district's current and future climate-related risks by emphasising higher risk areas and areas that need a more detailed assessment.

## Programmes in the Ōtautahi Christchurch Climate Resilience Strategy

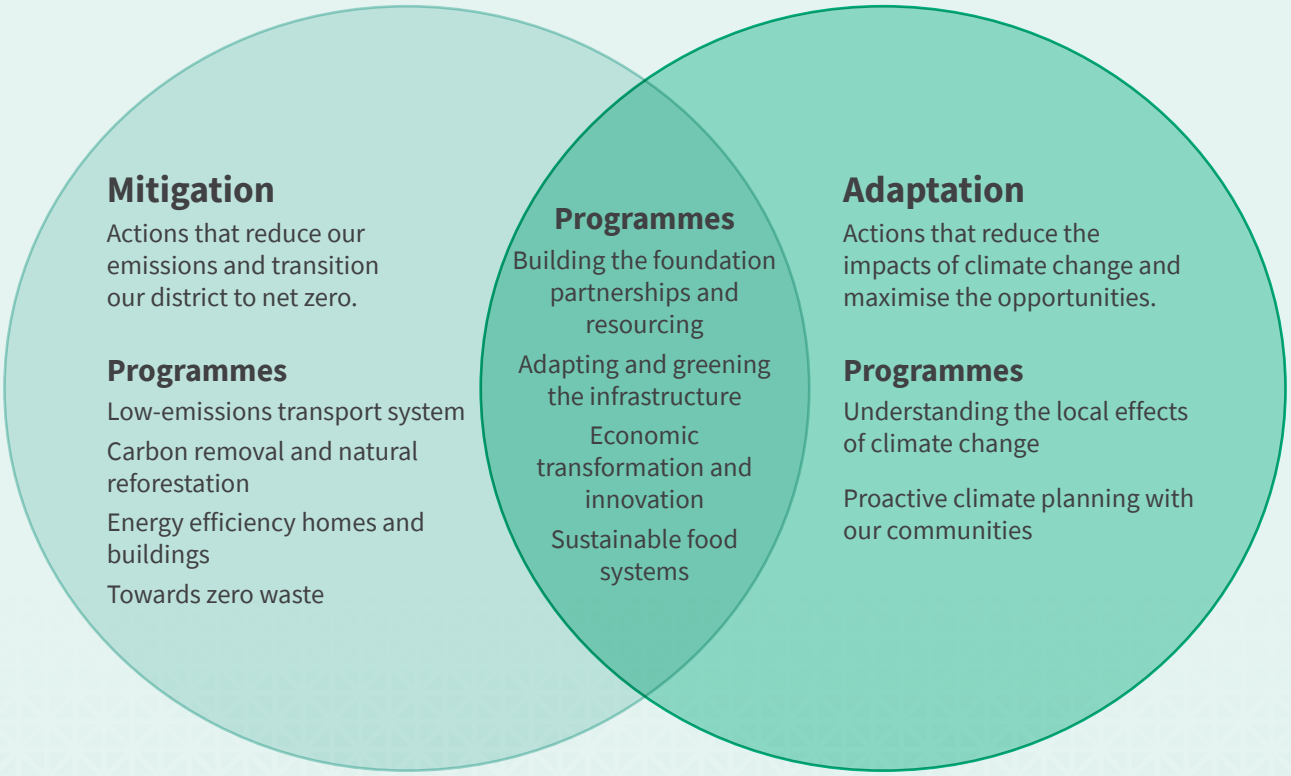



Figure 2: How programmes in the Ōtautahi Christchurch Climate Resilience Strategy support climate resilience.

# 3 Our changing climate and why it matters

As air temperatures rise, more energy is put into the atmosphere, and this increases the intensity of weather patterns. As well as higher temperatures, there will also be more intense, longer-lived droughts interspersed with more frequent and more extreme storms and rainfall events and stronger winds. Climate change projections for the Canterbury region suggest the following patterns (Macara et al, 2020)[4]:

- Average temperatures are projected to increase by 0.5-1.5°C by 2040, and up to 3.5°C hotter by 2090.
- During the baseline period, Christchurch recorded between 20-40 very hot days (greater than 25°C) per year, and this is projected to increase. Projections suggest up to 40 more per year by 2040 and up to an additional 60 by 2090.
- By 2040, there may be 10-30 fewer frost days per year and up to 50 fewer per year by 2090. Inland areas will be most severely affected by this. During the baseline period, Christchurch recorded between 10-25 frost days per year.
- Rainfall projections suggest that the average amount of rainfall per year will not change much, but the timing of when the rain falls will change. In general, we are expecting longer dry periods (more intense, more frequent drought) interspersed with more intense extreme rainfall events. Summer and autumn are projected to be generally wetter (up to 8% wetter by 2090) and winter will tend to be drier.
- Extreme daily winds are likely to increase by up to 10% by 2090, especially east of the Southern Alps.
- Rising snow lines, more frequent hot extremes and less frequent cold extremes, means that fire hazard is expected to increase in many parts of New Zealand.

Sea levels will also continue to rise. We have experienced approximately 20cm of sea level rise since 1995, and in Ōtautahi Christchurch we are anticipating a further 17 – 23cm of sea level rise by 2050, and between 52cm – 1m by 2100 (ranges taken between SSP2-4.5M (lower end) and SSP5-8.5H+ (upper end) from the 2022 Ministry for the Environment's Interim Guidance on the use of new sea level rise projections).

Areas in Banks Peninsula will experience increased landslides, gully erosion and sheet erosion, especially in un-vegetated areas due to increased intensity of extreme rainfall events as well as increased extreme winds over loess-mantled country. Shallow groundwater is also expected to rise and become saltier in coastal areas and near tidal reaches of rivers, in response to sea level rise.

Table 1 summarises the ways these changes in climate can impact people and the environment based on Pearce et al., 2017 and Macara et al., 2020.

*[4] Climate projections are presented as a 20-year average for two future periods: 2031-2050 (termed '2040') and 2081-2100 (termed '2090'). All maps show changes relative to the baseline climate of 1986-2005 (termed '1995').*

Table 1: General summary of impacts and implications of climate change for our district.

| Changes to climate | | Impact and implications |
|---|---|---|
| **Changing temperatures and seasonality** | **Average temperature will rise**<br>0.5°C to 1.5°C by 2040.<br>Up to 3°C hotter by 2090.<br><br>**More very hot days (greater than 25°C)**<br>10+ more 25°C+ per year by 2040.<br>20+ more hot days for Christchurch by 2090.<br>Up to 35 more very hot days in parts of Canterbury.<br><br>**Fewer frosts per year**<br>Up to 10 fewer frosts per year by 2040.<br>20 fewer frosts per year by 2090 for coastal areas.<br>Significantly fewer again for inland areas.<br><br>**Seasonal change in temperature**<br>Temperature will change - most in summer and autumn. Least change in spring. | • Heat stress will negatively affect the health of people, animals, and plants.<br>• Workplace productivity will be reduced for outdoor workers.<br>• Heating costs will decrease in winter, cooling costs will increase in summer. Many houses lack cooling systems, and installation will be more difficult for low income families, leading to equity issues.<br>• Summer leisure and tourism seasons will be extended, but ski season will be shorter and glaciers will be disappearing.<br>• Transport infrastructure will be damaged: road surfaces melted, rails buckled.<br>• Efficiency of wastewater treatment plants will be enhanced.<br>• Demand for drinking water will increase at times when water is likely to be scarcer.<br>• Water quality will deteriorate, made worse by increased water use for human activity.<br>• Current agriculture and horticulture will be at risk of new pests and diseases. Higher temperatures may allow for different crops to be grown.<br>• Timing of seasonal activities such as flowering, breeding and migration will change.<br>• Ecosystems will be under threat, with negative impacts on health and economy. Some species will become extinct.<br>• Loss of biodiversity will impact mahinga kai and other customary practices.<br>• Risk of wildfire will increase, especially in high winds and drought, when water is scarce for fire-fighting. The extreme fire-risk season will be longer. |
| **Changing rainfall patterns and intensity** | **Longer dry periods**<br>More intense, more frequent drought.<br><br>**Extreme rainfall events**<br>More frequent and more extreme rainfall events. | • Water availability for drinking, irrigation, agriculture, and horticulture will be reduced during drought, especially on Banks Peninsula. Average river flows may be 20% less by 2090.<br>• Rivers will flood more often, and more direct rainfall flash flooding of communities and businesses will affect people, the economy, and cultural values including mahinga kai.<br>• Stormwater infrastructure capacity will be exceeded more often, resulting in surface flooding.<br>• Flood water will damage bridges, roads and other infrastructure, wastewater will overflow more often.<br>• Insurance costs for homes and businesses will increase or become unavailable to those most at risk. This is already beginning to happen.<br>• Health risks from contamination of drinking water in flood events.<br>• Parks and recreation grounds will be affected by both drought and flooding.<br>• Drought and/or fire will reduce vegetation on hills, increasing landslides and erosion during intense rainfall and strong winds. There could be permanent loss of soils in Banks Peninsula, preventing revegetation.<br>• Increased erosion leads to more sediment in waterways, reducing water quality, and stream capacity and interfering with treatment of drinking water.<br>• Indigenous ecosystems, plants, and animals will be under threat, especially with drought.<br>• Drought will increase wildfire risk, especially when temperatures are high. |

| Changes to climate | | Impact and implications |
|---|---|---|
| Changes to sea level and coastal hazards | **Permanent sea level rise**<br>We expect to see a further 17–23cm of sea level rise by 2050, and between 52cm–1m by 2100. | • More frequent, more severe coastal flooding of coastal and low-lying inland communities, infrastructure and businesses will be the major issue, with knock-on consequences for health, wellbeing, and economy.<br>• Saltwater incursion into freshwater habitats where there is no room for inland migration.<br>• Terrestrial plant species that are intolerant to salt water in coastal areas will die.<br>• Shallow, salty groundwater in coastal areas will damage some buried pipes and foundations of roads and buildings. It can result in cold, damp homes and unhealthy living conditions.<br>• Groundwater moving closer to the surface can lead to long-term standing surface water, which may attract insects and exacerbate flooding issues.<br>• Ōtautahi Christchurch's coastline may switch from accretion (net sediment accumulation) to erosion (net sediment loss).<br>• Erosion and flooding may lead to loss of road access to isolated coastal communities.<br>• There will be changes in the cost and availability of insurance, as is beginning to happen already (Storey, 2017). Banks may stop providing mortgages in affected areas.<br>• Coastal and low-lying communities will need to adapt to sea level rise, or relocate.<br>• Our population could grow due to climate refugees from other countries.<br>• Wāhi tapu, wāhi taonga and cultural landscapes could be adversely affected, or lost. |
| | **Permanent groundwater rise**<br>Groundwater in coastal areas will be closer to the surface (shallower) in response to sea level rise. | |
| | **Storm surge**<br>Coastal flooding and coastal erosion will become more frequent and more intense due to temporary raising of sea level during storms. | |
| | **Saltwater intrusion**<br>Coastal groundwater will become salty and salt water will move further upstream in rivers. | |
| Oceanic changes | **Oceanic changes**<br>The ocean will become more acidic.<br>Sea water will become warmer.<br>There will be marine heatwaves. | • Altered marine ecosystems, particularly affecting hard-shelled species.<br>• Extinction of some species.<br>• Changes to the range of species, location and abundance of fish and sea birds around Aotearoa New Zealand.<br>• Impacts on aquaculture and fishing industries.<br>• Reduced recreational benefits. |
| Wind | **Wind speeds are likely to increase**<br>Annual average wind speeds are likely to increase by 0-5% but could be up to 10% faster by 2100. | • Trees, buildings and power lines will be damaged frequently, reducing resilience of essential services.<br>• Cycling will sometimes be more dangerous.<br>• Fire risk will increase during hot, dry periods and soil will dry more quickly, increasing demand on water supply.<br>• Wind-powered generation of electricity will be more viable. |

# 4 Our approach to screening climate-related risks

## 4.1 The process

Multi-disciplinary workshops were held involving Council staff and stakeholders to confirm hazard classes, identify critically exposed elements under the natural and built domains, and to populate the draft risk register and identify key risks across the district. The process that was followed is outlined at a high level below.

1. Build an understanding of how the climate is projected to change across three timeframes: the present, a medium-term scenario (round 2060), and a longer-term scenario towards the end of the century. The RCP 8.5 M climate projection was used (consistent with the NCCRA), and a range of climate conditions were applied including changing patterns of temperature, rainfall, storminess, wind, ocean acidification, wildfire susceptibility, landslides, sea level and groundwater level rise.
2. The district was divided into six Climate Risk Assessment Areas of similar geography to identify how risks vary across the district.
3. For each of the timeframes, there was an exploration of which elements in the natural environment (e.g. coastal ecosystems, terrestrial biodiversity) and the built environment (e.g. buildings, water infrastructure, roads) were exposed to different hazards in the different areas.
4. The vulnerability of exposed assets was explored to understand potential resilience or adaptive capacity of different elements.
5. Where elements were found to be exposed and vulnerable to a hazard, the scale of the consequences was assessed at a high level for the three timeframes. This was converted into a score on a 1-5 scale, with scores of 1 or 2 being identified as significant risks.
6. The overall scores were checked by subject matter experts to improve internal consistency.

This risk screening is based on the expert judgement of appropriate subject-matter experts, and is therefore inherently somewhat subjective.

## 4.2 Value domains and elements at risk

As summarised in Table 2, the NCCRA considers five "value domains" comprised of things that we value and are important for the health and wellbeing of our environment and communities. More detailed value domain descriptions and a Māori perspective on the definitions can be found in the NCCRA (environment.govt.nz/first-national-climate-change-risk-assessment-for-new-zealand).

Table 2: Value domains defined in the NCCRA

| Value domain | Elements at risk |
|---|---|
| **Natural environment** | All aspects of the non-human environment that support life and human activity, including: New Zealand's indigenous species / He Kura Taiao (living treasures), terrestrial ecosystems, freshwater ecosystems, coastal, estuarine, marine ecosystems and biosecurity. |
| **Built environment** | The set and configuration of physical infrastructure, including housing, public amenity, water, wastewater, stormwater, energy, transport, communications, waste, and coastal defences. |
| **Human** | Community wellbeing, social cohesion, and social welfare (urban, rural and coastal communities); health, education, sports, recreation, cultural heritage (archaeological sites, museums, arts, theatre), ahurea Māori, tikanga Māori – Māori culture, values and principles, cultural taonga. |
| **Economy** | Primary industries (forestry, agriculture, horticulture, arable land, viticulture, fisheries, aquaculture, marine farming); land use, tourism, technology, and business, whakatipu rawa – Māori enterprise, insurance, and banking. |
| **Governance** | Treaty partnerships, adaptive capacity, all governing and institutional systems, all population groups, including vulnerable groups. |

This Risk Screening considers the natural and built environment domains. This scope was decided because it is understood that most risks in the human, economic and governance domain cascade from risks in the natural and built environment domains, and assessing risks in these domains provides a strong basis for understanding the impacts of climate change. Many of the Council's direct functions also relate to management of these two domains. The specific elements at risk considered for each of these domains can be found in Appendix A.

Further work may be undertaken to address other domains once the findings of the Canterbury Climate Change Risk Assessment have been fully reviewed and assessed for relevance to our district. The risks in the human, economic and governance domains may also be more transferrable to all districts than those in the natural and built domains, which vary with location of assets and geographic setting.

## **4.3** Hazards considered

As seen in Table 3, 20 different hazards were considered but were grouped into five main 'hazard classes'.

Table 3: Hazards considered in the Risk Screening

| Hazard class | Specific hazard |
|---|---|
| **Sea level rise related** | Coastal flooding, tidal shifts and storm surge |
| | Sea level rise and sedimentation |
| | Sea level rise and rising groundwater |
| | Sea level rise and saltwater intrusion |
| | Tsunami flooding |
| | Coastal erosion |
| **Rainfall and floods** | Extreme rainfall events and flash flooding |
| | River flooding |
| | Seasonal rainfall changes |
| **Heat, drought and fire** | Higher air temperatures |
| | Seasonal temperature changes |
| | Higher water temperatures and marine heatwaves |
| | Reduced snow, frosts and ice |
| | Drought/lower average rainfall |
| | Fire |
| **Extreme weather** | Thunder and lightning |
| | High winds |
| | Hail |
| **Soil erosion and landslides** | Soil erosion (undermining structures and sedimentation) |
| | Landslides |

## **4.4** Climate Risk Assessment Areas

Six Climate Risk Assessment Areas of similar geophysical features and risk exposure were identified, as seen in Figure 3. These sub-district areas help us understand how risk varies across the district, which parts are most exposed to different hazards and where the risks are greatest.

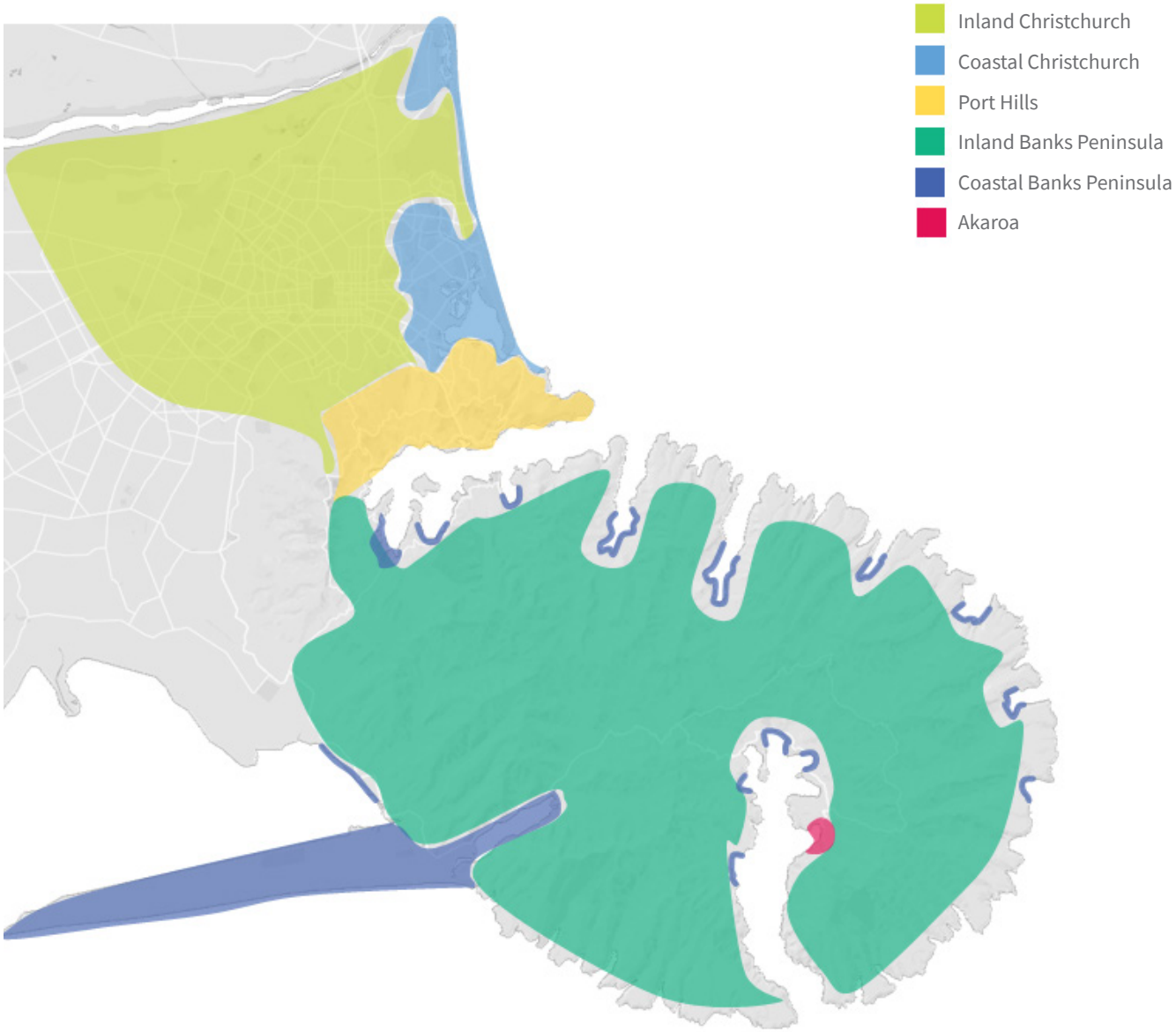



Figure 3: Six Climate Risk Assessment Areas across the Christchurch District.

# 5 District climate change risk profile

## 5.1 Highest priority risks for the district

Whilst the risk screening process has examined a wide range of hazards and exposed features, Table 4 gives a high-level overview of which hazards are of greatest concern for each Climate Risk Assessment Area. The risks within each area are described in more detail in the sections below.

Table 4: Summary of priority hazards and key exposed elements for each Climate Risk Assessment Area

| Climate Risk Assessment Area | Hazard | Exposed elements |
|---|---|---|
| **Inland Christchurch** | Drought, heat, intense rainfall, flash flooding | Parks, and inland reaches of the rivers.<br><br>Built urban areas with public and private property, business, industry, associated infrastructure. |
| **Coastal Christchurch** | Sea level rise, coastal erosion, coastal flooding, rising groundwater | Natural environment elements including parks, dunes, open coastal areas, the estuary, and the lower reaches of the rivers.<br><br>Built urban areas including public and private property, business, industry, and associated infrastructure. |
| **Port Hills** | Drought, wildfire, land stability with intense rainfall | Natural environment elements mixed with built urban areas with public and private property and associated infrastructure. |
| **Coastal Banks Peninsula** | Sea level rise, coastal erosion, coastal flooding, rising groundwater, drought | Largely undeveloped sections of coastline, farmland, natural environment.<br><br>Smaller, more defined communities with associated buildings and infrastructure. |
| **Inland Banks Peninsula** | Drought, wildfire, land stability issues with intense rainfall, erosion, and turbidity in waterways | Farmland, natural environment.<br><br>Smaller, rural communities with associated buildings and infrastructure. |
| **Akaroa** | Sea level rise, coastal erosion, coastal flooding, rising groundwater, drought, wildfire, land stability issues with intense rainfall | Coastal environment as well as terrestrial vegetation, particularly on hill slopes.<br><br>Built urban areas including public and private property, business, and associated infrastructure. |

More detailed work is needed to quantify the risks in a way that allows easy comparison of the severity of priority risks across elements and the Climate Risk Assessment Areas.

## **5.2** Visual comparison of Climate Risk Assessment Area risk profiles

Figure 4 displays simplified heat maps of climate risks for each Climate Risk Assessment Area to help visualise the variation of significant climate risk across the district. Risks are defined by considering the level of exposure and vulnerability of the element to each hazard over three different timeframes, and the scale of the consequences caused. A score from 1 to 5 was assigned, with scores of 1 or 2 being identified as significant risks, and scores of 3 being classified as moderate risk.

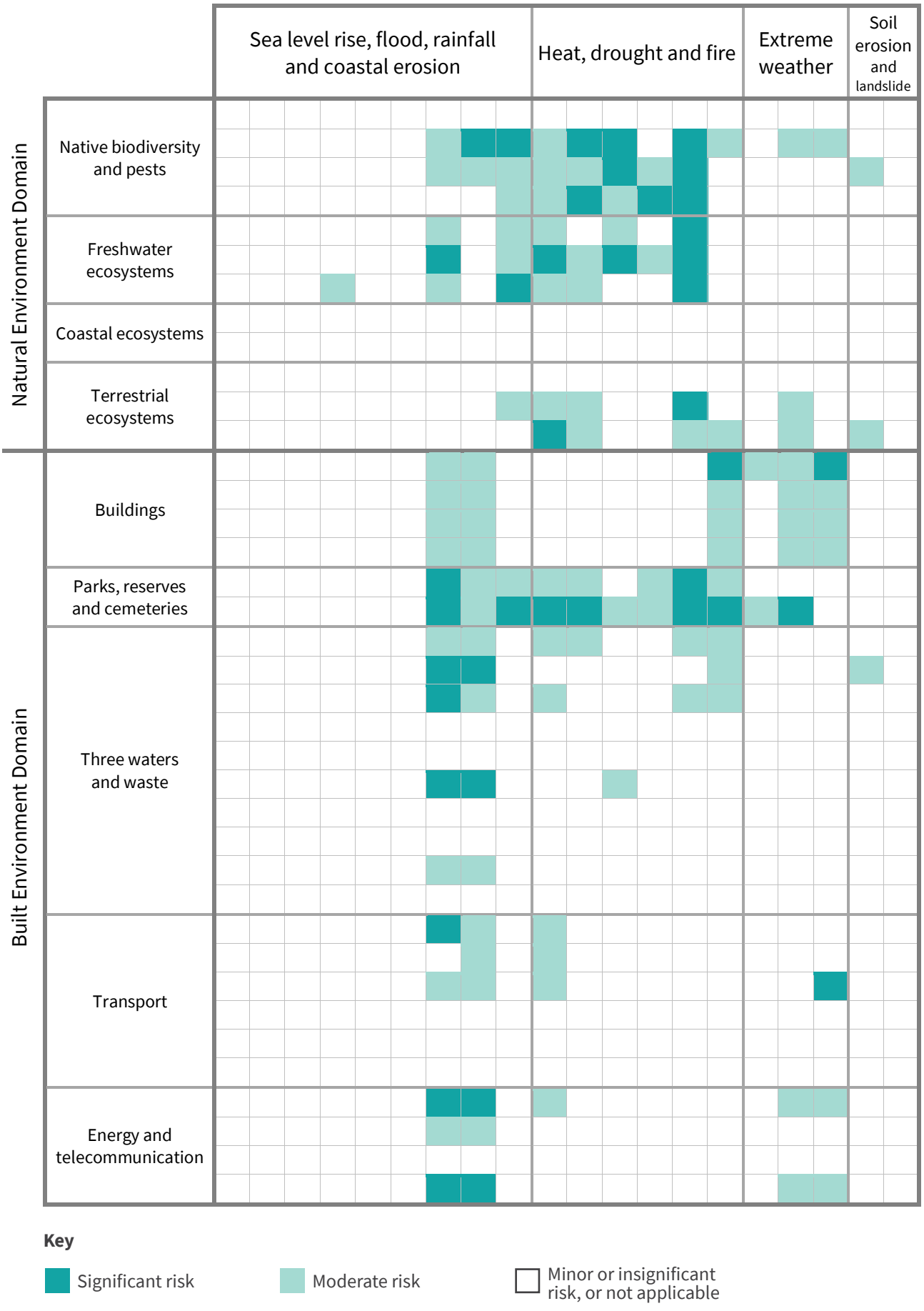
Figure 4 highlights several key differences and some similarities between Climate Risk Assessment Areas and domains including:

- In the natural environment domain, the clustering indicates that in all Climate Risk Assessment Areas, many natural elements are at risk from heat and drought. This is most significant in the Port Hills and Inland Banks Peninsula, which are both also at risk of fire.
- Also in the natural environment domain, the three coastal areas have clusters representing risks posed by sea level rise, flooding, rainfall and coastal erosion - though Akaroa has fewer exposed natural elements than Coastal Christchurch and Coastal Banks Peninsula.
- Similarly, in the built environment domain, the coastal areas Coastal Christchurch, Coastal Banks Peninsula and Akaroa show clustering on the left-hand side of the diagrams highlighting risk to infrastructure from the impacts of sea level rise, flooding, rainfall and coastal erosion.
- Also in the built environment domain, clustering on the right-hand side of the diagrams highlights the similarity between risks to infrastructure faced by the Port Hills, Akaroa and Inland Banks Peninsula to significant risks from fire, landslides, and high winds.

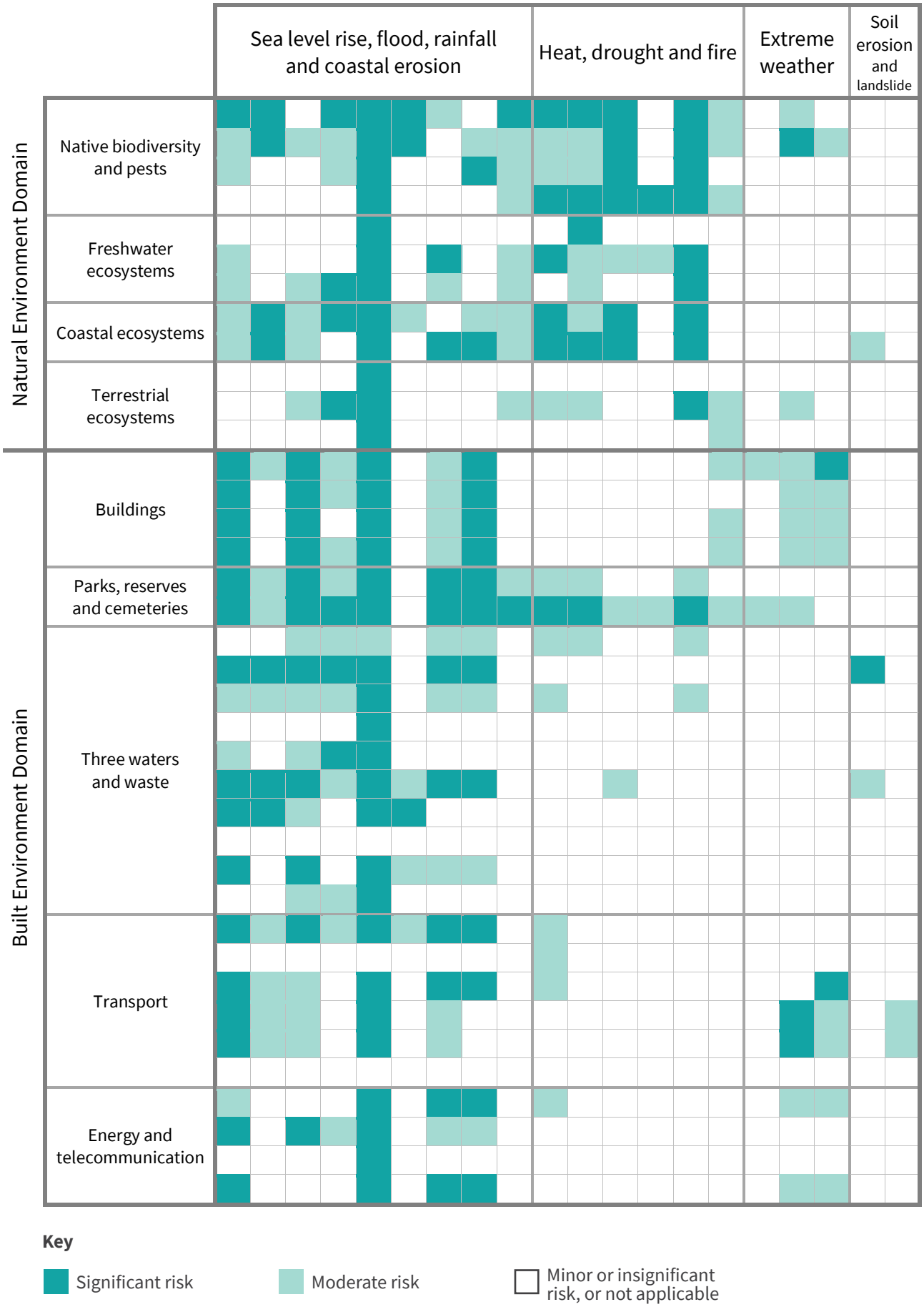
While scores of 1 and 2 are identified as significant risks and scores of 3 are moderate, scores of 4 are classified as minor risks and scores of 5 are classified as insignificant risks. Detailed risk matrices for each Climate Risk Assessment Area that show which specific hazard class and exposed element combinations constitute different risk scores can be found in Appendix B.

Figure 4: Simplified heat maps of climate risks for each Climate Risk Assessment Area.

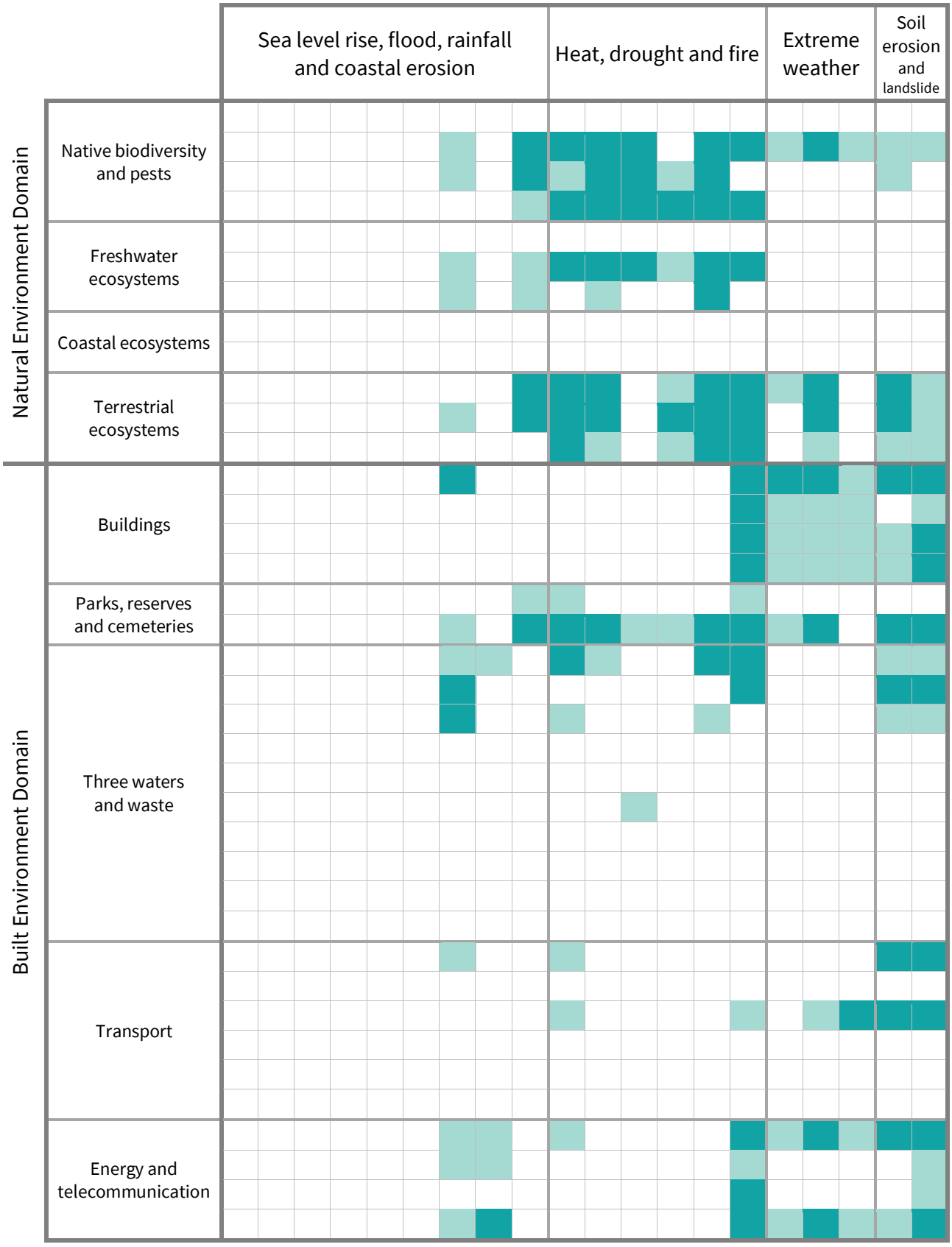
## Inland Christchurch



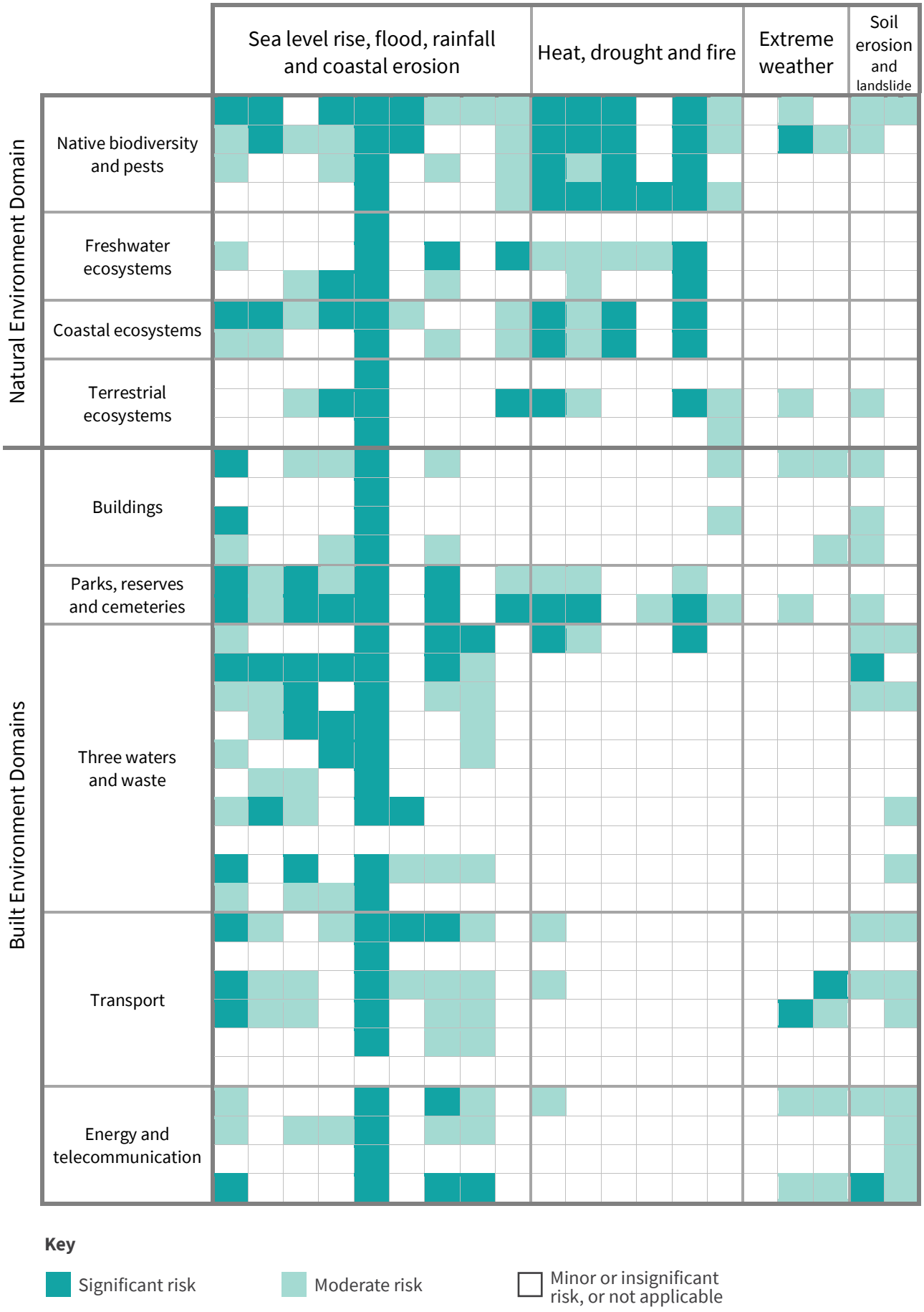
# Coastal Christchurch



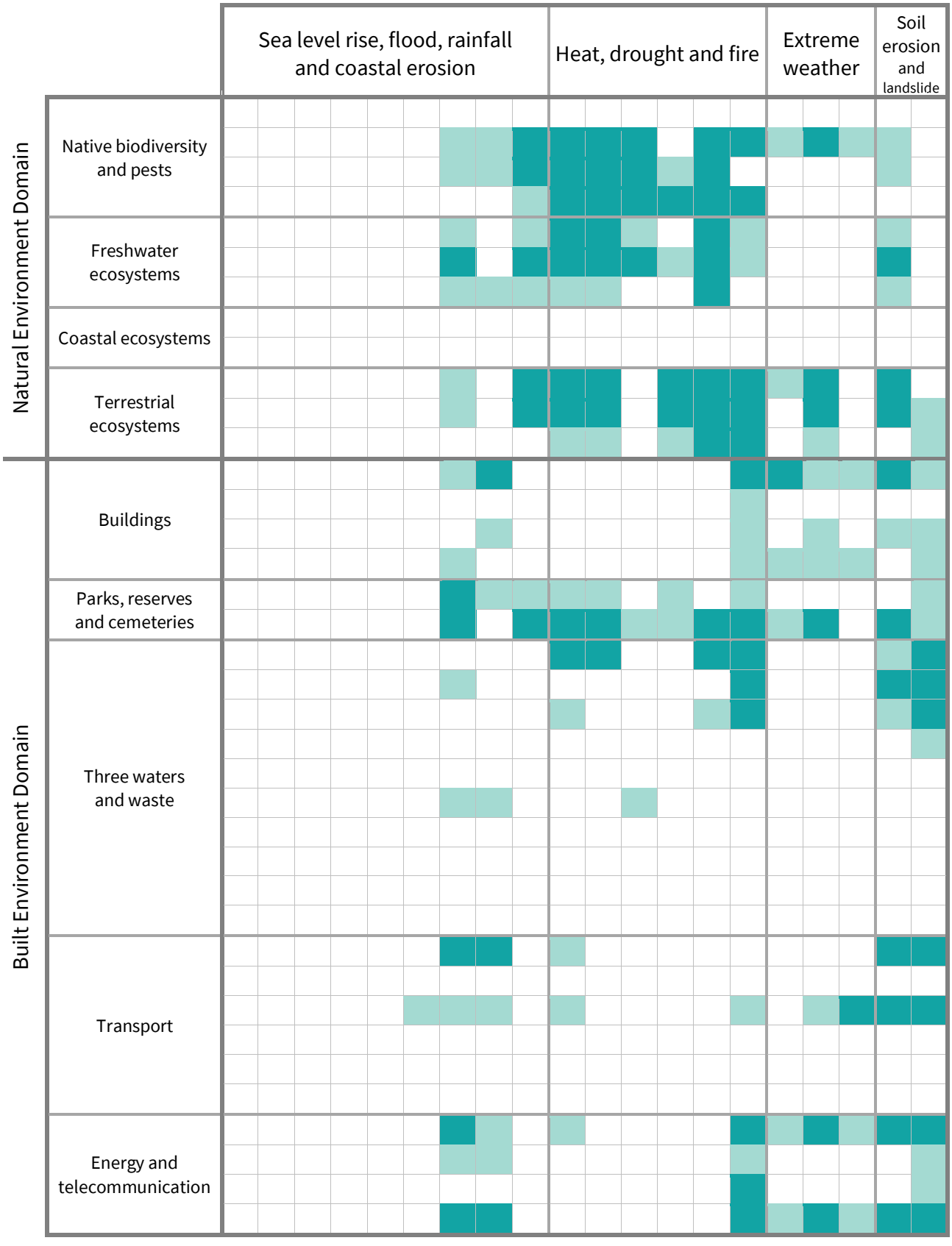
## Port Hills


Sea level rise, flood, rainfall and coastal erosion
Heat, drought and fire
Extreme weather
Soil erosion and landslide
Natural Environment Domain
Native biodiversity and pests
Freshwater ecosystems
Coastal ecosystems
Terrestrial ecosystems
Built Environment Domain
Buildings
Parks, reserves and cemeteries
Three waters and waste
Transport
Energy and telecommunication
Key
Significant risk
Moderate risk
Minor or insignificant risk, or not applicable

## Coastal Banks Peninsula



## Inland Banks Peninsula



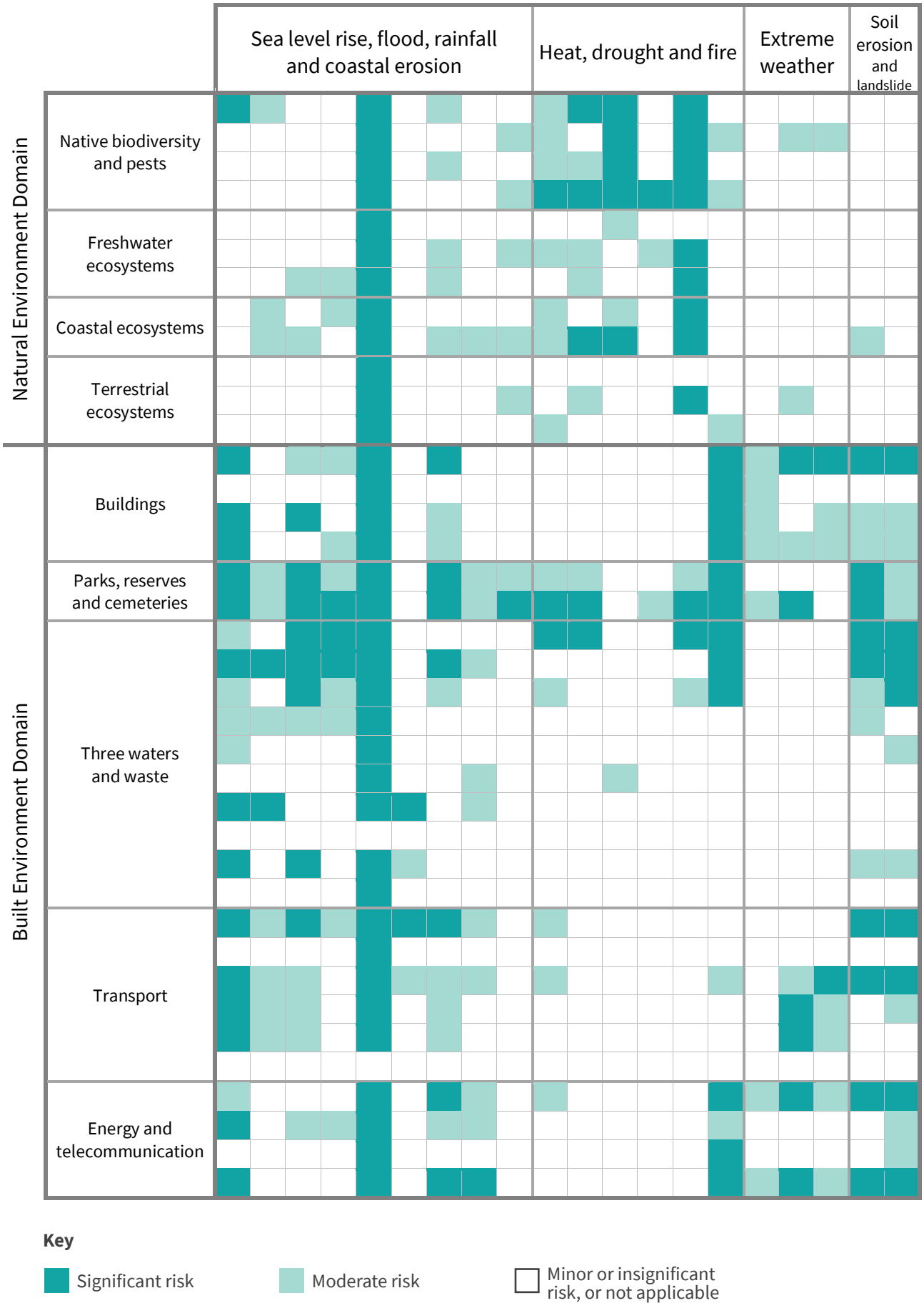

**Key**

Significant risk

Moderate risk

Minor or insignificant risk, or not applicable

## Akaroa


Sea level rise, flood, rainfall and coastal erosion
Heat, drought and fire
Extreme weather
Soil erosion and landslide
Natural Environment Domain
Native biodiversity and pests
Freshwater ecosystems
Coastal ecosystems
Terrestrial ecosystems
Built Environment Domain
Buildings
Parks, reserves and cemeteries
Three waters and waste
Transport
Energy and telecommunication
Key
Significant risk
Moderate risk
Minor or insignificant risk, or not applicable

## **5.3** Priority risks for Inland Christchurch


Priority risks facing Inland Christchurch are:

- Threats to terrestrial and aquatic ecosystems in the natural environment domain from temperature changes and extended dry spells.
- Increased rainfall intensity and extended dry spells impacting assets and services in the built environment domain.

Table 5 describes significant climate risks requiring more detailed assessment.

Table 5: Significant climate risks identified for Inland Christchurch

| Hazard | Impacts |
|---|---|
| **Natural Environment Domain: Inland Christchurch** | |
| Higher temperatures, lower average rainfall, drought, seasonal shifts in patterns of rainfall and temperature. | Causes stress to native terrestrial and wetland biodiversity. "Urban stream syndrome" in waterways due to changing water flows. |
| Seasonal temperature changes, higher temperatures, fewer frosts. | Allows pests to flourish at the expense of native fauna and flora. Increases in or changes to toxic algal bloom in freshwater ecosystems. |
| Extreme rainfall events leading to flash flooding, higher air temperatures, higher surface water temperatures, lower average rainfall, drought. | Surface water quality and quantity of rivers, streams, lakes, and wetlands impacted adversely due to increased sediment load and more frequent wastewater overflows. "Urban stream syndrome" in waterways due to changing water flows. |
| **Built Environment Domain: Inland Christchurch** | |
| River and rainfall flooding. Flooding expected further inland due to a combination of more water in the river at times with extreme rainfall events, and escape of water through gravity fed system inhibited by sea level rise. | Adverse impacts on engineered stormwater infrastructure; stop-banks and engineered flood management schemes will be at significant risk. |
| Extreme rainfall events leading to flash flooding. | Adverse impacts on lifelines and infrastructure: roads and bridges; electricity generation, transmission, and distribution infrastructure; telecoms, mobile towers, internet infrastructure. More frequent wastewater overflows. |
| Fire, high winds, hail. | Adverse impacts on residential buildings and communities. |
| High winds. | Adverse impacts on industrial, commercial and public buildings. |
| Extreme rainfall events leaving to flash flooding, drought (reserves also vulnerable to seasonal rainfall changes, high winds and fire). | Adverse impacts on parks, reserves and cemeteries. |

## **5.4** Priority risks for Coastal Christchurch


Priority risks facing Coastal Christchurch are:

- Coastal squeeze affecting species where they are unable to migrate inland as the sea rises.
- Sea level rise, coastal flooding, river flooding, rising ground water, and tsunami affecting the built environment domain.

Table 6 describes significant climate risks requiring more detailed assessment.

Table 6: Significant climate risks identified for Coastal Christchurch

| Hazard | Impacts |
|---|---|
| **Natural Environment Domain: Coastal Christchurch** | |
| Sea level rise. | Coastal squeeze on coastal habitats adjacent to built-up areas, as sea level rises but the coast is not allowed to migrate inland. This means less space is available for coastal/ estuarine species to live. |
| Higher water temperatures and marine heatwaves. | Adverse impact on coastal and marine biodiversity and food chain. |
| More frequent coastal flooding. | Adverse impact on saltwater sensitive species. |
| Rising groundwater. | Adverse impact on some species that do not tolerate saturated roots.<br>Long-term surface ponding can also impact on plants and can provide a breeding habitat for mosquitoes. |
| Saltwater incursion further upstream in rivers. | Adverse impact on river habitats. |
| Less frequent frosts, higher air temperatures. | Conditions allow weed species in lower reaches of rivers to thrive and clog up the rivers. Possibility of new/different terrestrial pests. Increases in or changes to toxic algal bloom in freshwater ecosystems. |
| Drought, high temperatures. | Adverse impact on surface water quality and quantity, freshwater and wetland biodiversity. Ecosystems affected by changes in flow. |
| Sea level rise, saltwater intrusion, lower average rainfall, drought. | Change of geophysical conditions of the land and the fertility of soils. |
| Increased tsunami risk. | Adverse impact on all elements of the natural environment. |
| **Built Environment Domain: Coastal Christchurch** | |
| Coastal flooding due to sea level rise, more frequent storm surges reaching further inland. | Adverse impacts on buildings - homes, commercial and industrial.<br>Parts of coastal suburbs that lie close to sea level will become subject to flooding in every spring tide, then, with time twice daily, and eventually will be constantly underwater. Higher parts of coastal suburbs will be subject to more frequent flooding when storm surge pushes sea water ashore.<br>The exact timing of this is uncertain, but we are expecting to see between 17–23cm of sea level rise by 2050, and 52cm to 1m by 2100. |

| | |
|---|---|
| Sea level rise. | Effectiveness of gravity fed stormwater system outflows inhibited, affecting the ability of water to escape the system, causing backing up and adversely affecting levels of service some distance inland. Potential for a similar effect on constructed wastewater overflows.<br>Sediment blocking outflows during storms also has the same effect and is already an issue in some suburbs. This will worsen as sea level rise increases. |
| Rising groundwater. | Close to the coast, higher groundwater levels will increase infiltration and reduce available capacity in wastewater and land drainage networks, adversely affecting levels of service. Higher groundwater can also degrade infrastructure (roads and some pipes), complicate repairs and increase risk of potable water contamination and potentially increasing wastewater overflows to water bodies.<br>More infiltration of groundwater into wastewater system will cause more wastewater overflows and possibly put capacity of treatment plant under stress.<br>Adverse impact on buildings close to the coast– possibly affecting foundations and leading to rising damp. |
| Rainfall and river flooding. | Adverse impact on buildings and infrastructure.<br>Increased rainfall throughout the city carried down the stormwater system and rivers to the coast will cause more frequent flooding, which is most common in lower reaches of the rivers. Sea level rise will inhibit fast dispersal of flood waters, so breaches of the flood protection system will be more frequent. Flooding can also increase inflow into the wastewater system resulting in overflows and capacity reductions.<br>Increase in river weed due to less frequent frosts and generally warmer temperatures may also exacerbate tendency to flood.<br>This will be all the more extreme when heavy rainfall coincides with coastal flooding due to storm surge. |
| Increased tsunami risk. | Adverse impacts on most elements of the built environment. |

## **5.5** Priority risks for Port Hills


Priority risks facing the Port Hills are:

- Seasonal shifts and higher temperatures resulting in drought impacting habitats and biodiversity.
- Landslides, gullying, and soil erosion also impacting several elements in the built and natural domains, with sedimentation impacting waterways.
- Wildfire impacting built and natural domains.

Table 7 describes significant climate risks requiring more detailed assessment.

Table 7: Significant climate risks identified for Port Hills

| Hazard | Impacts |
|---|---|
| **Natural Environment Domain: Port Hills** | |
| Drought, higher temperatures, seasonal shifts in temperature and rainfall patterns. | Causes stress to native and exotic freshwater and terrestrial species plants and animals, degrading biodiversity. |
| Increased wildfire risk. | Adverse effects on plants and animals, and air quality. |
| Wildfire and drought (followed by heavy rainfall triggering erosion and landslides). | Leads to de-vegetation, which results in more erosion and landslides, especially triggered by heavy rainfall. Soil loss inhibits revegetation. |
| Higher temperatures, drought, seasonal changes in rainfall and temperature patterns. | Change of geophysical conditions of the land and the fertility of soils. |
| Erosion, landslides (with heavy rainfall). | Increase in sediment/turbidity in waterways adversely affecting water quality. |
| Warmer temperatures, fewer frosts. | Pest species may flourish, dislodging native species, especially where ecosystems are already stressed. Increases in or changes to toxic algal bloom in freshwater ecosystems. |
| **Built Environment Domain: Port Hills** | |
| Increased wildfire risk. | Causes risk to homes, communities, parks and reserves, and infrastructure such as plastic water storage units: possible cascade to water security (moderate risk). Especially high risk during dry/ drought conditions with high winds and high temperatures, and during spells of drought where the amount of water available for firefighting is diminished. |
| Increased landslide and erosion risks due to land weathering and heavy rainfall/wind. | Adverse impact on stormwater systems and capacity.<br>Risk to homes and infrastructure, roads, power and telecoms infrastructure. |
| Extreme rainfall events/flash flooding. | Increasing risk of sewer overflows. |
| High temperatures, heatwaves, drought. | Water demand may exceed rate at which reservoirs can be filled leading to water shortages. |
| High winds. | Adverse impact on buildings and infrastructure. |
| Lightning. | Adverse impact on buildings, power poles and telecoms towers. |

## **5.6** Priority risks for Coastal Banks Peninsula


Priority risks facing Coastal Banks Peninsula are:

- Sea level rise, coastal flooding, river flooding, and rising groundwater.
- Flooding of the built and natural environment, leading to death of saltwater-intolerant species.
- Access issues for some communities as roads are affected by sea level rise, coastal flooding and erosion.
- Some communities affected by water supply issues.

Table 8 describes significant climate risks requiring more detailed assessment.

Table 8: Significant climate risks identified for Coastal Banks Peninsula

| Hazard | Impacts |
|---|---|
| **Natural Environment Domain: Coastal Banks Peninsula** | |
| Sea level rise and sedimentation. | Adverse impact on dunes, intertidal zone (including rocky shores), and coastal wetlands (from habitat squeeze). Complete loss of some habitat types. |
| Higher water temperatures and marine heatwaves. | Adverse impact on native coastal and marine biodiversity (seabird food chain). |
| Higher air and water temperatures and marine heatwaves, lower average rainfall, drought, seasonal temperature changes, high winds. | Adverse impacts on food chain especially for shorebirds. |
| Coastal flooding, tidal shifts, storm surge, sea level rise and sedimentation (habitat squeeze), saltwater intrusion, higher air and water temperatures, lower average rainfall, drought, coastal erosion. | Adverse impacts on native coastal and marine biodiversity, including habitat squeeze. |
| Coastal flooding, tidal shifts, storm surge, sea level rise and sedimentation (habitat squeeze), saltwater intrusion, rising groundwater. | Adverse impact on dunes, intertidal zone (including rocky shores), and coastal wetlands.<br>More frequent issues with flooding of septic tanks resulting in contamination of waterbodies/waterways. |
| Higher air and water temperatures, lower average rainfall, drought, seasonal temperature change, coastal erosion. | Adverse impacts especially on dune flora and fauna at Kaitorete Spit. |
| Sea level rise, coastal erosion and sedimentation. | Adverse impacts on native terrestrial biodiversity (habitat squeeze). |
| Higher air temperatures, higher water temperatures and marine heatwaves, lower average rainfall, drought. | Adverse impacts on native freshwater biodiversity, due in part to changes in stream flow.<br>Adverse impacts on marine, estuarine, and harbour water quality and health. |

| | |
|---|---|
| Higher air temperatures, seasonal temperature changes, higher water temperatures and marine heatwaves, reduced snow, frosts and ice, lower average rainfall, more frequent drought. | Increased adverse impacts of existing and new terrestrial, freshwater, coastal and marine pests and diseases on stressed ecosystems. Increases in or changes to toxic algal bloom in freshwater ecosystems. |
| Extreme rainfall events, flash flooding, seasonal rainfall changes, lower average rainfall, drought. | Adverse impacts on surface water quantity and quality (rivers, streams and lakes). |
| Lower average rainfall, drought, seasonal rainfall changes, sea level rise and saltwater intrusion. | Adverse impacts of change in geophysical conditions of the land and the fertility of soils |
| Increased tsunami risk. | Adverse impacts on all elements of the natural environment |
| **Built Environment Domain: Coastal Banks Peninsula** | |
| Coastal flooding, tidal shifts, storm surge, rising groundwater, river flooding. | Adverse impacts on buildings, and stormwater systems. (Stormwater system also affected by increased sediment from increased erosion and extreme rainfall events/ flooding). Significant risk to parks and reserves, some closed landfills, telecoms infrastructure. |
| Rising groundwater. | Adverse impacts on buildings, stormwater and wastewater infrastructure, roads and bridges. Possibly more overwhelming of septic tanks causing surface water contamination. |
| Lower average rainfall, drought, higher temperatures. | Adverse impacts on water security, water supply infrastructure and demand, including private water sources. Higher demand with higher temperatures. |
| Sea level rise, rising groundwater, river flooding, extreme rainfall events leading to flash flooding, seasonal rainfall changes, higher air temperatures, landslides. | Adverse impacts on water security, supply infrastructure, and demand. |
| Sea level rise, saltwater intrusion, extreme rainfall events leading to flash flooding, seasonal temperature changes, lower average rainfall, drought. | Adverse impacts on parks and reserves infrastructure and facilities. |
| Extreme rainfall events. | Adverse impacts on parks and reserves infrastructure and facilities, cemeteries, water security, supply infrastructure, and demand, roads and bridges, electricity transmission and distribution infrastructure. |
| Coastal erosion. | Adverse impacts on coastal barriers and sea walls, roads and bridges. Coastal barriers and seawalls may also be impacted by increasing sedimentation with sea level rise. |
| Coastal flooding, tidal shifts, storm surge, high winds. | Adverse impacts on marine facilities. |
| Sea level rise, saltwater intrusion, increased tsunami risk. | Adverse impacts on wastewater treatment. |
| Increased tsunami risk. | Adverse impacts on all elements of the built environment. |

## 5.7 Priority risks for Inland Banks Peninsula


Priority risks facing Inland Banks Peninsula are:

- Drought may make farming less sustainable over time.
- Heavy rainfall leading to land stability issues, especially if vegetation has already been killed by drought and high temperatures. This can lead to permanent soil loss, preventing revegetation and high sediment loads in waterways, degrading water quality, drinking water treatment becoming more difficult, and decreasing channel capacity.
- Issues with potable water availability where surface water is the main supply.

Table 9 describes significant climate risks requiring more detailed assessment.

Table 9: Significant climate risks identified for Inland Banks Peninsula

| Hazard | Impacts |
|---|---|
| **Natural Environment Domain: Inland Banks Peninsula** | |
| Increased wildfire risk. | Adverse impacts on air quality. |
| Seasonal changes in temperature and rainfall, higher air and water temperatures, drought, high winds. | Adverse impacts on terrestrial and freshwater biodiversity, due in part to changes in stream flow. |
| Higher temperatures, fewer frosts, seasonal changes in temperature, higher air and water temperatures, drought. | Risk of more and different pest species dislodging stressed native species. |
| Seasonal changes in temperature and rainfall, higher air and water temperatures, drought, increased sedimentation as a result of increased erosion. | Adverse impacts on surface water quality and quantity. |
| Increased frequency and intensity of lower average rainfall, drought. | Adverse impacts on groundwater quality and quantity. |
| Seasonal changes in temperature and rainfall, higher air temperatures, drought, fire risk, high winds, increased erosion. | Adverse impacts on geophysical conditions of the land and the fertility of soils, consequent impact on agriculture. |
| Increasing risk from high winds, lightning. | Adverse impacts on native and exotic terrestrial biodiversity. |
| **Built Environment Domain: Inland Banks Peninsula** | |
| Lower average rainfall, more frequent drought, higher temperatures, increased erosion/sedimentation. | Adverse impacts on water supply in areas with surface water supply. |
| Increased wildfire risk. | Adverse impacts on buildings, lifelines such as power transmission and other infrastructure. |
| Increasing risk from landslides and soil erosion. | Adverse impacts on buildings, roads, and other lifelines and infrastructure. |
| Increasing risk from high winds. | Adverse impacts on buildings, electricity transmission and telecommunications. |
| Increasing risk from lightning. | Adverse impacts on exposed buildings. |
| River flooding and extreme rainfall events (surface/flash flooding). | Adverse impacts on some properties, roads, bridges and infrastructure (especially Little River). |

## **5.8** Priority risks for Akaroa


Priority risks facing Akaroa are:

- Drought and high temperatures leading to water supply issues when there is high demand at times of low water availability. Land weathering, heavy rainfall and land stability may also increase sedimentation in waterways making it more difficult to treat for drinking.
- The low-lying commercial area becoming more prone to coastal flooding as the sea level rises.
- In areas where buildings are surrounded by trees, wildfire may become a greater risk.

Table 10 describes significant climate risks requiring more detailed assessment.

Table 10: Significant climate risks identified for Akaroa

| Hazard | Impacts |
|---|---|
| **Natural Environment Domain: Akaroa** | |
| Coastal flooding, tidal shifts, storm surge. | Adverse impacts on native coastal and marine biodiversity. |
| Drought, higher air temperatures, seasonal changes in rainfall and temperature patterns, fire, high winds. | Adverse impacts on native terrestrial biodiversity. |
| Higher water temperatures and marine heatwaves, drought/lower average rainfall and seasonal temperature changes. | Adverse impacts on native coastal and marine biodiversity, native freshwater biodiversity, surface water quantity and quality (rivers, streams, and lakes), marine, estuarine, and harbour water quality and health. |
| Increased sediment load with increased erosion. | Adverse impacts on surface water quantity and quality (rivers, streams, and lakes). |
| Drought. | Adverse impacts on dunes, intertidal zone (including rocky shores), coastal wetlands and groundwater.<br>Risk to groundwater - quantity and quality. |
| Warmer air and water temperatures, fewer frosts, changes to seasonal patterns in temperature and rainfall, more frequent and intense drought. | Pest species may flourish, dislodging native species on stressed ecosystems. Increases in or changes to toxic algal bloom in freshwater ecosystems. |
| Lower average rainfall, more frequent drought. | Change of geophysical conditions of the land and the fertility of soils. |
| Increased tsunami risk. | Adverse impacts on all elements of the natural environment. |

| Built Environment Domain: Akaroa | |
|---|---|
| Drought/lower average rainfall, higher temperatures, and increased erosion/ sedimentation. | Adverse impacts on water supply as Akaroa has surface water supply. Increased demand with high temperatures, likely to coincide with drought/low supply availability. Groundwater bores at major risk from higher temperatures, drought.<br><br>The exact timing of this is uncertain, but it is likely that this will be an issue experienced by 2045 at latest and worsening from then. |
| Wildfire hazard. | Adverse impacts on buildings, and communities, cemeteries, parks and reserves, and infrastructure such as three waters, telecoms, gas and power transmission: cascade to water security. Especially high risk during dry/drought conditions with high winds and high temperatures. |
| Coastal flooding due to sea level rise, more frequent storm surges reaching further inland. | Adverse impacts on buildings, especially the commercial area and some public and residential properties, petroleum infrastructure, parks and reserves and possibly closed landfills.<br><br>Also roads/access, coastal barriers and sea walls, stormwater and flood management infrastructure (including increased sediment in stormwater systems reducing capacity.<br><br>Parts of Akaroa that lie close to sea level will become subject to flooding in every spring tide, then, with time twice daily, and eventually will be constantly underwater. Higher parts of coastal suburbs will be subject to more frequent flooding when storm surge pushes sea water ashore. |
| Sea level rise and coastal hazards. | Adverse impacts on Akaroa port and other marine facilities. |
| High winds. | Adverse impacts on Akaroa port and other marine facilities.<br>Adverse impacts on buildings, parks and reserves, electricity transmission and telecoms. |
| Increased landslide and erosion (including tunnel gully erosion). | Adverse impacts on buildings, three waters infrastructure, roads, power and telecoms infrastructure, parks, reserves and cemeteries due to extreme rainfall events and high winds. Extra erosion also increases sediment in water supply, increasing turbidity and inhibiting treatment of potable water. |
| Hail. | Adverse impacts on buildings and vehicles. |
| Extreme rainfall events, pluvial (surface/ flash) flooding. | Adverse impacts on buildings and communities, parks and reserves, cemeteries, roads and bridges, stormwater infrastructure, power transmission. |
| Rising groundwater. | Adverse impacts on buildings, roads and bridges, parks, reserves and cemeteries, wastewater, stormwater, closed landfills. |
| Coastal erosion and/or sedimentation. | Adverse impacts on coastal barriers seawalls, roads and bridges, access, stormwater infrastructure. |
| Saltwater intrusion. | Adverse impacts on parks and reserves, in-ground infrastructure, stormwater management. |
| Higher temperatures and seasonal changes in temperature and rainfall patterns. | Adverse impacts on parks and reserves. |
| Increased tsunami risk. | All elements of the built environment. |

# 6 Commentary on the risk screening data

Climate change related risks vary across the Christchurch district as different hazards are an issue in different geographic situations, for example, depending on their proximity to the coast or how steep the land is. Risk also varies with what is exposed to the hazard: rural parts of the district have different elements exposed compared to urban areas. Solutions will need to be targeted to address specific risks in different areas.

- In Inland Christchurch, the built environment suffers from flash flooding (due to extreme rainfall events and river flooding) whilst the natural environment suffers with increasing temperatures and drought.
- Risks in Coastal Christchurch are dominated by hazards that exacerbate coastal and river flooding: sea level rise, storm surge, tsunami and rising groundwater. These present risks in both the built and natural environments. Coastal squeeze is an issue for coastal habitats.
- The Port Hills have both the built and natural environment vulnerable to wildfire and landslides.
- In Coastal Banks Peninsula the same coastal and flood-related hazards mainly affect the natural environment but also threaten road access to isolated communities. Water supply is also affected by drought.
- Risks in Inland Banks Peninsula are dominated by drought, heat and wildfire affecting the natural environment and water supply security.
- Akaroa is affected by all the risks listed above.

# 7 Next steps

Next steps are currently being scoped alongside implementation plans for all programmes in the Ōtautahi Christchurch Climate Resilience Strategy[5].

A more in-depth analysis of the risks identified in this screening is needed, alongside the identification of gaps wherever possible. This will lead to planning and implementation of adaptation measures that address the identified risks to our assets and services. These steps will involve communication and collaboration with other agencies where responsibility lies outside the Council, and it may include development of internal policy to direct how climate adaptation is included in our asset planning, design and management.

This risk screening provides a significant amount of new information that can be used to inform relevant decisions across the Council before these next steps have been progressed. Sign off by Council of this screening will enable a common understanding of the climate risks we face.

Where possible, climate adaptation measures will also seek to reduce embodied carbon and mitigate greenhouse gas emissions as well as bringing other benefits such as enhancing biodiversity and the health benefits of connecting people with nature. Thus a “climate resilience” approach will be implemented, resulting in multiple benefits to the work.

[5] *Ōtautahi Christchurch Climate Resilience Strategy, 2021. https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/climate-change-strategy*

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# **Appendix A:** Elements at risk considered for the natural and built environment domains

| Natural Environment | |
|---|---|
| **Sub-Domain** | **Elements considered** |
| Buildings | Residential and communities |
| | Industrial properties and facilities |
| | Commercial buildings and facilities |
| | Public buildings and community spaces (venues, halls, libraries, leisure facilities etc.) |
| Parks/reserves/cemeteries | Cemeteries |
| | Parks and reserves infrastructure and facilities |
| Three Waters: inground and at surface | Water security, supply infrastructure, and demand |
| | Engineered stormwater infrastructure |
| | Wastewater infrastructure |
| | Septic tanks |
| | Wastewater treatment plants |
| Flood management and irrigation schemes | Stopbanks and engineered flood management schemes |

| Built Environment | |
|---|---|
| **Sub-Domain** | **Elements considered** |
| Buildings | Residential and communities |
| | Industrial properties and facilities |
| | Commercial buildings and facilities |
| | Public buildings and community spaces (venues, halls, libraries, leisure facilities etc.) |
| Parks/reserves/cemeteries | Cemeteries |
| | Parks and reserves infrastructure and facilities |
| Three Waters: inground and at surface | Water security, supply infrastructure, and demand |
| | Engineered stormwater infrastructure |
| | Wastewater infrastructure |
| | Septic tanks |
| | Wastewater treatment plants |
| Flood management and irrigation schemes | Stopbanks and engineered flood management schemes |
| | Coastal barriers and sea walls |
| | Irrigation schemes |
| Solid waste management | Landfills and contaminated sites |
| | Refuse transfer stations and material recovery facilities |
| Transport | Roads and bridges |
| | Rail |
| | Public road transport systems (including buses) |
| | Marine facilities (excluding ports) |
| | Ports (Lyttelton and Akaroa) |
| | Christchurch Airport |
| Energy infrastructure | Electricity generation, transmission and distribution infrastructure |
| | Petroleum infrastructure |
| | Gas infrastructure |
| Communications infrastructure | Telecoms, mobile towers, internet infrastructure |

# **Appendix B:** Risk matrices for the natural and built environment domains

Risks are defined by considering the level of exposure and vulnerability of the element to each hazard over three different timeframes, and the scale of the consequences caused. Scores of 1 and 2 are identified as significant risks, scores of 3 are moderate risks, scores of 4 are minor risks and scores of 5 were identified as insignificant risks.

## Inland Christchurch

| | | Sea level rise related | | | | | | Rainfall and floods | | | Heat, drought and fire | | | | | | Extreme weather | | | Soil erosion and landslide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Element** | Coastal flooding, tidal shifts, & storm surge | Sea level rise & sedimentation | Sea level rise & rising groundwater | Sea level rise & saltwater intrusion | Tsunami inundation | Coastal erosion | Extreme rainfall & flash flooding | River flooding | Seasonal rainfall changes | Higher air temperatures | Seasonal temperature changes | Higher water temperatures & marine heatwaves | Reduced snow, frosts & ice | Drought / lower rainfall | Fire risk | Thunder & lightning | High winds | Hail | Soil erosion | Landslides |
| **NATURAL ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **NATIVE BIODIVERSITY AND PESTS** | Coastal and marine biodiversity | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Terrestrial biodiversity | 5 | 5 | 5 | 5 | 4 | N/A | 3 | 2 | 2 | 3 | 2 | 2 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 5 |
| | Freshwater biodiversity | 5 | 5 | 5 | 5 | 4 | N/A | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 4 | 5 | 5 | 4 | 3 | 5 |
| | Terrestrial, freshwater, coastal and marine pests and diseases | 5 | 5 | 5 | 5 | 4 | N/A | 4 | 4 | 3 | 3 | 2 | 3 | 2 | 2 | 4 | 5 | 5 | 5 | 5 | 5 |
| **FRESHWATER ECOSYSTEMS** | Lowland and non-coastal wetlands | 5 | 5 | 5 | 5 | 4 | N/A | 3 | 5 | 3 | 3 | 5 | 3 | 4 | 2 | 4 | 5 | 5 | 4 | 5 | 5 |
| | Surface water - Quantity and quality | 5 | 5 | 5 | 5 | 4 | N/A | 2 | 4 | 3 | 2 | 3 | 2 | 3 | 2 | 4 | 5 | 5 | 5 | 4 | 5 |
| | Groundwater - Quantity and quality | 5 | 5 | 5 | 3 | 4 | N/A | 3 | 4 | 2 | 3 | 3 | 4 | 4 | 2 | N/A | 5 | 5 | 5 | 5 | 5 |
| **COASTAL ECOSYSTEMS** | Dunes, intertidal zone and coastal wetlands | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Marine, estuarine, and harbour water quality & health | N/A | 5 | 5 | 5 | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| **TERRESTRIAL ECOSYSTEMS** | Hill country environments | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Change of geophysical conditions of the land and the fertility of soils | 5 | N/A | N/A | N/A | 4 | N/A | 4 | 5 | 3 | 3 | 3 | N/A | 4 | 2 | 4 | 5 | 3 | 5 | 4 | 5 |
| | Air quality | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | 2 | 3 | N/A | 4 | 3 | 3 | 5 | 3 | 5 | 3 | 5 |
| **BUILT ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **BUILDINGS** | Residential and communities | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 3 | 2 | 4 | 5 |
| | Industrial properties & facilities | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 3 | 4 | 5 |
| | Commercial buildings & facilities | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 3 | 4 | 5 |
| | Public buildings and community spaces | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 3 | 4 | 5 |
| **PARKS, RESERVES, CEMETERIES** | Cemeteries | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 3 | 3 | 3 | 3 | 5 | 3 | 2 | 3 | 4 | 5 | 4 | 4 | 5 |
| | Parks and reserves infrastructure & facilities | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 4 | 4 | 5 |
| **3 WATERS AND WASTE INFRASTRUCTURE** | Water security, supply infrastructure & demand | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 4 | 3 | 3 | 5 | 5 | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | Engineered stormwater infrastructure | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 4 | 3 | 5 |
| | Wastewater infrastructure | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 3 | 5 | 3 | 5 | 5 | 5 | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | Septic tanks | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Wastewater treatment plants | N/A | N/A | N/A | N/A | 4 | N/A | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 5 |
| | Stopbanks and engineered flood management schemes | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 1 | 5 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Coastal barriers and sea walls | N/A | N/A | N/A | N/A | 4 | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Irrigation schemes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Landfills and contaminated sites | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 5 | N/A |
| | Refuse transfer stations and material recovery facilities | N/A | N/A | N/A | N/A | 4 | N/A | 4 | 4 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 |
| **TRANSPORT INFRASTRUCTURE** | Roads and bridges | 5 | N/A | N/A | N/A | 4 | N/A | 2 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | Rail | N/A | N/A | N/A | N/A | 4 | N/A | 4 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 |
| | Public road transport systems | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 2 | 5 | 5 |
| | Marine facilities (excl. Ports) | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | 5 | 5 | N/A | 5 | 5 | N/A | 5 | N/A | N/A | N/A | N/A |
| | Ports | N/A | N/A | N/A | N/A | 4 | N/A | N/A | N/A | N/A | 5 | 5 | N/A | 5 | 5 | N/A | 5 | N/A | N/A | N/A | N/A |
| | Christchurch Airport | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 |
| **ENERGY AND TELECOMS** | Electricity generation, transmission and distribution infrastructure | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 2 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 4 | 3 | 3 | 5 | 5 |
| | Petroleum infrastructure | N/A | N/A | N/A | N/A | 4 | N/A | 3 | 3 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 |
| | Gas infrastructure | N/A | N/A | N/A | N/A | 4 | N/A | 4 | 4 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 |
| | Telecoms, mobile towers, internet infrastructure | N/A | N/A | N/A | N/A | 4 | N/A | 2 | 2 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 4 | 3 | 3 | 5 | 5 |

# Coastal Christchurch

| | | Sea level rise related | | | | | | Rainfall and floods | | | Heat, drought and fire | | | | | | Extreme weather | | | Soil erosion and landslide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Element | Coastal flooding, tidal shifts, & storm surge | Sea level rise & sedimentation | Sea level rise & rising groundwater | Sea level rise & saltwater intrusion | Tsunami inundation | Coastal erosion | Extreme rainfall & flash flooding | River flooding | Seasonal rainfall changes | Higher air temperatures | Seasonal temperature changes | Higher water temperatures & marine heatwaves | Reduced snow, frosts & ice | Drought / lower rainfall | Fire risk | Thunder & lightning | High winds | Hail | Soil erosion | Landslides |
| **NATURAL ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **NATIVE BIODIVERSITY AND THREAT OF PESTS** | Coastal and marine biodiversity | 2 | 2 | 4 | 2 | 2 | 2 | 3 | 4 | 2 | 2 | 2 | 1 | 4 | 2 | 3 | 5 | 3 | 4 | 5 | 5 |
| | Terrestrial biodiversity | 3 | 2 | 3 | 3 | 2 | 2 | 4 | 3 | 3 | 3 | 3 | 2 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 5 |
| | Freshwater biodiversity | 3 | 4 | 4 | 3 | 2 | 5 | 4 | 2 | 3 | 3 | 3 | 2 | 4 | 2 | 4 | 5 | 5 | 4 | 4 | 5 |
| | Terrestrial, freshwater, coastal and marine pests and diseases | 5 | 4 | 5 | 4 | 2 | 5 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| **FRESHWATER ECOSYSTEMS** | Lowland and non-coastal wetlands | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Surface water - Quantity and quality | 3 | 5 | 4 | 4 | 2 | 4 | 2 | 4 | 3 | 2 | 3 | 3 | 3 | 2 | 4 | 5 | 5 | 5 | 5 | 5 |
| | Groundwater - Quantity and quality | 3 | 5 | 3 | 2 | 2 | 5 | 3 | 4 | 3 | 4 | 3 | 4 | 4 | 2 | N/A | 5 | 5 | 5 | 5 | 5 |
| **COASTAL ECOSYSTEMS** | Dunes, intertidal zone and coastal wetlands | 3 | 2 | 3 | 2 | 2 | 3 | 4 | 3 | 3 | 2 | 3 | 2 | 4 | 2 | 5 | 5 | 4 | 5 | 4 | 5 |
| | Marine, estuarine, and harbour water quality & health | 3 | 2 | 3 | 5 | 2 | 4 | 2 | 2 | 3 | 2 | 2 | 2 | 4 | 2 | 4 | 5 | 4 | 5 | 3 | 5 |
| **TERRESTRIAL ECOSYSTEMS** | Hill country environments | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Change of geophysical conditions of the land and the fertility of soils | 4 | 5 | 3 | 2 | 2 | 5 | 4 | 5 | 3 | 3 | 3 | N/A | 4 | 2 | 3 | 5 | 3 | N/A | 4 | 5 |
| | Air quality | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | 4 | 4 | N/A | 4 | 4 | 3 | 5 | 4 | 5 | 5 | 5 |
| **BUILT ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **BUILDINGS** | Residential and communities | 1 | 3 | 1 | 3 | 2 | 5 | 3 | 1 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 2 | 4 | 5 |
| | Industrial properties & facilities | 2 | 4 | 2 | 3 | 2 | 5 | 3 | 2 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 3 | 3 | 4 | 5 |
| | Commercial buildings & facilities | 2 | 4 | 2 | 4 | 2 | 5 | 3 | 2 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 3 | 4 | 5 |
| | Public buildings and community spaces | 2 | 4 | 2 | 3 | 2 | 5 | 3 | 2 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 3 | 4 | 5 |
| **PARKS, RESERVES, CEMETERIES** | Cemeteries | 2 | 3 | 2 | 3 | 2 | 5 | 2 | 2 | 3 | 3 | 3 | 5 | 4 | 3 | 4 | 4 | 5 | 4 | 4 | 5 |
| | Parks and reserves infrastructure & facilities | 2 | 3 | 2 | 2 | 2 | 5 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 5 |
| **3 WATERS AND WASTE INFRASTRUCTURE** | Water security, supply infrastructure & demand | 3 | 4 | 2 | 1 | 2 | 4 | 3 | 3 | 5 | 3 | 3 | 5 | 5 | 3 | 4 | 4 | 5 | 4 | 5 | 5 |
| | Engineered stormwater infrastructure | 1 | 1 | 1 | 2 | 2 | 4 | 2 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 2 | 5 |
| | Wastewater infrastructure | 3 | 3 | 1 | 3 | 2 | 4 | 3 | 3 | 5 | 3 | 5 | 5 | 5 | 3 | 4 | 4 | 5 | 4 | 5 | 5 |
| | Septic tanks | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Wastewater treatment plants | 3 | 4 | 3 | 2 | 2 | N/A | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 5 |
| | Stopbanks and engineered flood management schemes | 2 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | 5 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 5 | 5 | 3 | 5 |
| | Coastal barriers and sea walls | 2 | 2 | 3 | 5 | 2 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Irrigation schemes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Landfills and contaminated sites | 2 | 4 | 2 | 4 | 2 | 3 | 3 | 3 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 |
| | Refuse transfer stations and material recovery facilities | 4 | 4 | 3 | 3 | 2 | 5 | 4 | 4 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 |
| **TRANSPORT INFRASTRUCTURE** | Roads and bridges | 2 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | Rail | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 |
| | Public road transport systems | 1 | 3 | 3 | 5 | 2 | 4 | 2 | 2 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 2 | 5 | 5 |
| | Marine facilities (excl. Ports) | 2 | 3 | 3 | 5 | 2 | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 3 | 5 | 3 |
| | Ports | 1 | 3 | 3 | 5 | 2 | 5 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 3 | 5 | 3 |
| | Christchurch Airport | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **ENERGY AND TELECOMS** | Electricity generation, transmission and distribution infrastructure | 3 | 5 | 5 | 5 | 2 | 5 | 2 | 2 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 4 | 3 | 3 | 5 | 5 |
| | Petroleum infrastructure | 2 | 4 | 2 | 3 | 2 | 5 | 3 | 3 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 |
| | Gas infrastructure | 5 | 5 | 5 | 5 | 2 | 5 | 4 | 4 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 |
| | Telecoms, mobile towers, internet infrastructure | 2 | 5 | 5 | 5 | 2 | 5 | 2 | 2 | 5 | 5 | 5 | N/A | 5 | 5 | 5 | 4 | 3 | 3 | 5 | 5 |

# Port Hills

| | | Sea level rise related | | | | | | Rainfall and floods | | | Heat, drought and fire | | | | | | Extreme weather | | | Soil erosion and landslide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Element | Coastal flooding, tidal shifts, & storm surge | Sea level rise & sedimentation | Sea level rise & rising groundwater | Sea level rise & saltwater intrusion | Tsunami inundation | Coastal erosion | Extreme rainfall & flash flooding | River flooding | Seasonal rainfall changes | Higher air temperatures | Seasonal temperature changes | Higher water temperatures & marine heatwaves | Reduced snow, frosts & ice | Drought / lower rainfall | Fire risk | Thunder & lightning | High winds | Hail | Soil erosion | Landslides |
| **NATURAL ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| NATIVE BIODIVERSITY AND THREAT OF PESTS | Coastal and marine biodiversity | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Terrestrial biodiversity | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 5 | 2 | 2 | 1 | 2 | 4 | 1 | 2 | 3 | 2 | 3 | 3 | 3 |
| | Freshwater biodiversity | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 4 | 2 | 3 | 2 | 2 | 3 | 2 | 4 | 5 | 5 | 4 | 3 | 5 |
| | Terrestrial, freshwater, coastal and marine pests and diseases | 5 | 5 | 5 | 5 | N/A | N/A | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 |
| FRESHWATER ECOSYSTEMS | Lowland and non-coastal wetlands | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Surface water - Quantity and quality | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 5 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 5 | 5 | 5 | 4 | 5 |
| | Groundwater - Quantity and quality | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 5 | 3 | 4 | 3 | 4 | 4 | 2 | N/A | 5 | 5 | 5 | 5 | 5 |
| COASTAL ECOSYSTEMS | Dunes, intertidal zone and coastal wetlands | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Marine, estuarine, and harbour water quality & health | N/A | 5 | 5 | 5 | N/A | N/A | N/A | 5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| TERRESTRIAL ECOSYSTEMS | Hill country environments | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 5 | 2 | 2 | 1 | N/A | 3 | 1 | 2 | 3 | 2 | 4 | 2 | 3 |
| | Change of geophysical conditions of the land and the fertility of soils | 5 | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 2 | 2 | 2 | N/A | 2 | 1 | 2 | 5 | 2 | N/A | 2 | 3 |
| | Air quality | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 3 | N/A | 3 | 2 | 1 | 5 | 3 | 5 | 3 | 3 |
| **BUILT ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| BUILDINGS | Residential and communities | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 1 | 2 | 2 | 3 | 2 | 2 |
| | Industrial properties & facilities | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 3 | 3 | 4 | 3 |
| | Commercial buildings & facilities | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 3 | 3 | 3 | 2 |
| | Public buildings and community spaces | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 3 | 3 | 3 | 2 |
| PARKS, RESERVES, CEMETERIES | Cemeteries | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 3 | 3 | 4 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 4 |
| | Parks and reserves infrastructure & facilities | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 4 | 2 | 2 |
| 3 WATERS AND WASTE INFRASTRUCTURE | Water security, supply infrastructure & demand | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 3 | 5 | 2 | 3 | 5 | 5 | 2 | 1 | 4 | 5 | 4 | 3 | 3 |
| | Engineered stormwater infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 4 | 5 | 4 | 1 | 2 |
| | Wastewater infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 3 | 5 | 5 | 5 | 3 | 2 | 4 | 5 | 4 | 3 | 3 |
| | Septic tanks | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| | Wastewater treatment plants | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | N/A | N/A |
| | Stopbanks and engineered flood management schemes | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | 5 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Coastal barriers and sea walls | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Irrigation schemes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Landfills and contaminated sites | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Refuse transfer stations and material recovery facilities | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| TRANSPORT INFRASTRUCTURE | Roads and bridges | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 5 | 3 | 5 | N/A | 5 | 5 | 4 | 5 | 4 | 5 | 2 | 2 |
| | Rail | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Public road transport systems | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 3 | 5 | N/A | 5 | 5 | 3 | 5 | 3 | 2 | 2 | 2 |
| | Marine facilities (excl. Ports) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | N/A | 5 | 5 | N/A | N/A | N/A | N/A | N/A | N/A |
| | Ports | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | N/A | 5 | 5 | N/A | N/A | N/A | N/A | N/A | N/A |
| | Christchurch Airport | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| ENERGY AND TELECOMS | Electricity generation, transmission and distribution infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 2 | 3 | 2 | 3 | 2 | 2 |
| | Petroleum infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 3 | 5 | 5 | 5 | N/A | 5 | 5 | 3 | 4 | 5 | 4 | 5 | 3 |
| | Gas infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 5 | 5 | N/A | 5 | 5 | 2 | 4 | 5 | 4 | 5 | 3 |
| | Telecoms, mobile towers, internet infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 2 | 5 | 5 | 5 | N/A | 5 | 5 | 2 | 3 | 2 | 3 | 3 | 2 |

# Coastal Banks Peninsula

| | | Sea level rise related | | | | | | Rainfall and floods | | | Heat, drought and fire | | | | | | Extreme weather | | | Soil erosion and landslide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Element | Coastal flooding, tidal shifts, & storm surge | Sea level rise & sedimentation | Sea level rise & rising groundwater | Sea level rise & saltwater intrusion | Tsunami inundation | Coastal erosion | Extreme rainfall & flash flooding | River flooding | Seasonal rainfall changes | Higher air temperatures | Seasonal temperature changes | Higher water temperatures & marine heatwaves | Reduced snow, frosts & ice | Drought / lower rainfall | Fire risk | Thunder & lightning | High winds | Hail | Soil erosion | Landslides |
| **NATURAL ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **NATIVE BIODIVERSITY AND THREAT OF PESTS** | Coastal and marine biodiversity | 2 | 2 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 4 | 2 | 3 | 5 | 3 | 4 | 3 | 3 |
| | Terrestrial biodiversity | 3 | 2 | 3 | 3 | 2 | 2 | 4 | 4 | 3 | 2 | 2 | 2 | 4 | 2 | 3 | 4 | 2 | 3 | 3 | 5 |
| | Freshwater biodiversity | 3 | 4 | 4 | 3 | 2 | 5 | 3 | 4 | 3 | 2 | 3 | 2 | 4 | 2 | 4 | 5 | 5 | 4 | 4 | 5 |
| | Terrestrial, freshwater, coastal and marine pests and diseases | 5 | 4 | 5 | 4 | 2 | 5 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| **FRESHWATER ECOSYSTEMS** | Lowland and non-coastal wetlands | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Surface water - Quantity and quality | 3 | 5 | 4 | 4 | 2 | 5 | 2 | 4 | 2 | 3 | 3 | 3 | 3 | 1 | 4 | 5 | 5 | 5 | 4 | 5 |
| | Groundwater - Quantity and quality | 4 | 5 | 3 | 2 | 2 | 5 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 2 | N/A | 5 | 5 | 5 | 5 | 5 |
| **COASTAL ECOSYSTEMS** | Dunes, intertidal zone and coastal wetlands | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 3 | 2 | 3 | 2 | 4 | 2 | 4 | 5 | 4 | 5 | 4 | 5 |
| | Marine, estuarine, and harbour water quality & health | 3 | 3 | 4 | 4 | 2 | 5 | 3 | 4 | 3 | 2 | 3 | 2 | 4 | 2 | 4 | 5 | 4 | 5 | 4 | 5 |
| **TERRESTRIAL ECOSYSTEMS** | Hill country environments | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Change of geophysical conditions of the land and the fertility of soils | 4 | 5 | 3 | 2 | 2 | 5 | 4 | 4 | 2 | 2 | 3 | N/A | 4 | 2 | 3 | 5 | 3 | N/A | 3 | 5 |
| | Air quality | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | 4 | 4 | N/A | 4 | 4 | 3 | 5 | 4 | 5 | 5 | 5 |
| **BUILT ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **BUILDINGS** | Residential and communities | 1 | 5 | 3 | 3 | 2 | 5 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 3 | 3 | 5 |
| | Industrial properties & facilities | 4 | 5 | 4 | 4 | 2 | 5 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 |
| | Commercial buildings & facilities | 2 | 4 | 4 | 4 | 2 | 5 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 3 | 5 |
| | Public buildings and community spaces | 3 | 4 | 4 | 3 | 2 | 5 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 | 3 | 5 |
| **PARKS, RESERVES, CEMETERIES** | Cemeteries | 2 | 3 | 2 | 3 | 2 | 5 | 2 | 4 | 3 | 3 | 3 | 5 | 4 | 3 | 4 | 4 | 5 | 4 | 4 | 4 |
| | Parks and reserves infrastructure & facilities | 2 | 3 | 2 | 2 | 2 | 5 | 2 | 4 | 2 | 2 | 2 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 3 | 4 |
| **3 WATERS AND WASTE INFRASTRUCTURE** | Water security, supply infrastructure & demand | 3 | 4 | 2 | 1 | 2 | 4 | 2 | 2 | 5 | 2 | 3 | 5 | 5 | 1 | 4 | 4 | 5 | 4 | 3 | 3 |
| | Engineered stormwater infrastructure | 2 | 2 | 1 | 2 | 2 | 5 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 2 | 4 |
| | Wastewater infrastructure | 3 | 3 | 1 | 3 | 2 | 4 | 3 | 3 | 5 | 3 | 5 | 5 | 5 | 3 | 4 | 4 | 5 | 4 | 3 | 3 |
| | Septic tanks | 4 | 3 | 2 | 2 | 2 | 4 | 4 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 4 |
| | Wastewater treatment plants | 3 | 4 | 4 | 2 | 2 | N/A | 4 | 3 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 4 |
| | Stopbanks and engineered flood management schemes | 4 | 3 | 3 | 4 | 2 | 4 | 5 | 4 | 5 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Coastal barriers and sea walls | 3 | 2 | 3 | 5 | 2 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 3 |
| | Irrigation schemes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Landfills and contaminated sites | 2 | 4 | 2 | 4 | 2 | 3 | 3 | 3 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 3 |
| | Refuse transfer stations and material recovery facilities | 3 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 |
| **TRANSPORT INFRASTRUCTURE** | Roads and bridges | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 3 |
| | Rail | N/A | N/a | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Public road transport systems | 1 | 3 | 3 | 5 | 2 | 3 | 3 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 5 | 5 | 5 | 2 | 3 | 3 |
| | Marine facilities (excl. Ports) | 2 | 3 | 3 | 5 | 2 | 4 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 3 | 5 | 3 |
| | Ports | N/A | N/A | N/A | N/A | 2 | 5 | 3 | 3 | N/A | 5 | 5 | 5 | 5 | 5 | N/A | N/A | N/A | N/A | N/A | N/A |
| | Christchurch Airport | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **ENERGY AND TELECOMS** | Electricity generation, transmission and distribution infrastructure | 3 | 5 | 5 | 5 | 2 | 5 | 2 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 |
| | Petroleum infrastructure | 3 | 5 | 3 | 3 | 2 | 5 | 3 | 3 | 5 | 5 | 5 | N/A | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 3 |
| | Gas infrastructure | 5 | 5 | 5 | 5 | 2 | 5 | 4 | 4 | 5 | 5 | 5 | N/A | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 3 |
| | Telecoms, mobile towers, internet infrastructure | 2 | 5 | 5 | 5 | 2 | 5 | 2 | 2 | 5 | 5 | 5 | N/A | 5 | 5 | 4 | 4 | 3 | 3 | 2 | 3 |

# Inland Banks Peninsula

| | | Sea level rise related | | | | | | Rainfall and floods | | | Heat, drought and fire | | | | | | Extreme weather | | | Soil erosion and landslide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Element | Coastal flooding, tidal shifts, & storm surge | Sea level rise & sedimentation | Sea level rise & rising groundwater | Sea level rise & saltwater intrusion | Tsunami inundation | Coastal erosion | Extreme rainfall & flash flooding | River flooding | Seasonal rainfall changes | Higher air temperatures | Seasonal temperature changes | Higher water temperatures & marine heatwaves | Reduced snow, frosts & ice | Drought / lower rainfall | Fire risk | Thunder & lightning | High winds | Hail | Soil erosion | Landslides |
| **NATURAL ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **NATIVE BIODIVERSITY AND THREAT OF PESTS** | Coastal and marine biodiversity | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Terrestrial biodiversity | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 3 | 2 | 2 | 1 | 2 | 4 | 1 | 2 | 3 | 2 | 3 | 3 | 4 |
| | Freshwater biodiversity | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 4 | 5 | 5 | 4 | 3 | 5 |
| | Terrestrial, freshwater, coastal and marine pests and diseases | 5 | 5 | 5 | 5 | N/A | N/A | 4 | 4 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 5 | 5 | 5 | 5 | 5 |
| **FRESHWATER ECOSYSTEMS** | Lowland and non-coastal wetlands | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 4 | 3 | 2 | 2 | 3 | 4 | 2 | 3 | 5 | 5 | 4 | 3 | 5 |
| | Surface water - Quantity and quality | 5 | 5 | 5 | 5 | N/A | N/A | 2 | 4 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 5 | 5 | 5 | 2 | 5 |
| | Groundwater - Quantity and quality | 5 | 5 | 5 | 5 | N/A | N/A | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | N/A | 5 | 5 | 5 | 3 | 5 |
| **COASTAL ECOSYSTEMS** | Dunes, intertidal zone and coastal wetlands | N/A | 5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Marine, estuarine, and harbour water quality & health | N/A | 5 | 5 | 5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| **TERRESTRIAL ECOSYSTEMS** | Hill country environments | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 2 | 1 | 1 | N/A | 2 | 1 | 2 | 3 | 2 | 4 | 2 | 4 |
| | Change of geophysical conditions of the land and the fertility of soils | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 2 | 2 | 2 | N/A | 2 | 1 | 2 | 5 | 2 | N/A | 2 | 3 |
| | Air quality | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 3 | N/A | 3 | 2 | 1 | 5 | 3 | 5 | 4 | 3 |
| **BUILT ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **BUILDINGS** | Residential and communities | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 2 | 5 | 4 | 5 | 5 | 5 | 5 | 1 | 2 | 3 | 3 | 2 | 3 |
| | Industrial properties & facilities | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 4 | 4 |
| | Commercial buildings & facilities | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 4 | 3 | 3 |
| | Public buildings and community spaces | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 3 |
| **PARKS, RESERVES, CEMETERIES** | Cemeteries | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 3 | 3 | 3 | 3 | 5 | 3 | 4 | 3 | 5 | 5 | 4 | 4 | 3 |
| | Parks and reserves infrastructure & facilities | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 4 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 4 | 2 | 3 |
| **3 WATERS AND WASTE INFRASTRUCTURE** | Water security, supply infrastructure & demand | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 2 | 2 | 5 | 5 | 1 | 1 | 4 | 5 | 4 | 3 | 2 |
| | Engineered stormwater infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 4 | 5 | 4 | 2 | 2 |
| | Wastewater infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 3 | 5 | 5 | 5 | 3 | 2 | 4 | 5 | 4 | 3 | 2 |
| | Septic tanks | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 3 |
| | Wastewater treatment plants | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 4 |
| | Stopbanks and engineered flood management schemes | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 3 | 5 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 5 |
| | Coastal barriers and sea walls | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| | Irrigation schemes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Landfills and contaminated sites | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Refuse transfer stations and material recovery facilities | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **TRANSPORT INFRASTRUCTURE** | Roads and bridges | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 2 | 5 | 3 | 5 | N/A | 5 | 5 | 4 | 5 | 4 | 5 | 2 | 2 |
| | Rail | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Public road transport systems | N/A | N/A | N/A | N/A | N/A | 3 | 3 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 3 | 5 | 3 | 2 | 2 | 2 |
| | Marine facilities (excl. Ports) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | N/A | 5 | 5 | N/A | N/A | N/A | N/A | N/A | N/A |
| | Ports | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 | 5 | N/A | 5 | 5 | N/A | N/A | N/A | N/A | N/A | N/A |
| | Christchurch Airport | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **ENERGY AND TELECOMS** | Electricity generation, transmission and distribution infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 2 | 3 | 2 | 3 | 2 | 2 |
| | Petroleum infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 3 | 3 | 5 | 5 | 5 | N/A | 5 | 5 | 3 | 4 | 5 | 4 | 5 | 3 |
| | Gas infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 4 | 4 | 5 | 5 | 5 | N/A | 5 | 5 | 2 | 4 | 5 | 4 | 5 | 3 |
| | Telecoms, mobile towers, internet infrastructure | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 2 | 5 | 5 | 5 | N/A | 5 | 5 | 2 | 3 | 2 | 3 | 2 | 2 |

# Akaroa

| | | Sea level rise related | | | | | | Rainfall and floods | | | Heat, drought and fire | | | | | | Extreme weather | | | Soil erosion and landslide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Element | Coastal flooding, tidal shifts, & storm surge | Sea level rise & sedimentation | Sea level rise & rising groundwater | Sea level rise & saltwater intrusion | Tsunami inundation | Coastal erosion | Extreme rainfall & flash flooding | River flooding | Seasonal rainfall changes | Higher air temperatures | Seasonal temperature changes | Higher water temperatures & marine heatwaves | Reduced snow, frosts & ice | Drought / lower rainfall | Fire risk | Thunder & lightning | High winds | Hail | Soil erosion | Landslides |
| **NATURAL ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **NATIVE BIODIVERSITY AND THREAT OF PESTS** | Coastal and marine biodiversity | 2 | 3 | 4 | 4 | 2 | 5 | 3 | 4 | 5 | 3 | 2 | 2 | 4 | 2 | 4 | 5 | 4 | 4 | 5 | 5 |
| | Terrestrial biodiversity | 4 | 5 | 5 | 5 | 2 | 5 | 4 | 5 | 3 | 3 | 4 | 2 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 5 |
| | Freshwater biodiversity | 5 | 5 | 5 | 4 | 2 | 5 | 3 | 5 | 4 | 3 | 3 | 2 | 4 | 2 | 4 | 5 | 5 | 4 | 4 | 5 |
| | Terrestrial, freshwater, coastal and marine pests and diseases | 5 | 4 | 5 | 5 | 2 | 5 | 4 | 5 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| **FRESHWATER ECOSYSTEMS** | Lowland and non-coastal wetlands | 5 | 5 | 5 | 5 | 2 | N/A | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 5 |
| | Surface water - Quantity and quality | 5 | 5 | 5 | 5 | 2 | 5 | 3 | 5 | 3 | 3 | 3 | 4 | 3 | 2 | 4 | 5 | 5 | 5 | 4 | 5 |
| | Groundwater - Quantity and quality | 5 | 5 | 3 | 3 | 2 | 5 | 3 | 5 | 4 | 4 | 3 | 4 | 4 | 2 | N/A | 5 | 5 | 5 | 5 | 5 |
| **COASTAL ECOSYSTEMS** | Dunes, intertidal zone and coastal wetlands | 4 | 3 | 4 | 3 | 2 | 5 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 2 | 4 | 5 | 5 | 5 | 4 | 5 |
| | Marine, estuarine, and harbour water quality & health | 5 | 3 | 3 | 5 | 2 | 5 | 3 | 3 | 3 | 3 | 2 | 2 | 4 | 2 | 4 | 5 | 4 | 5 | 3 | 5 |
| **TERRESTRIAL ECOSYSTEMS** | Hill country environments | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 5 |
| | Change of geophysical conditions of the land and the fertility of soils | N/A | 5 | 5 | 4 | 2 | 5 | 5 | 5 | 3 | 4 | 3 | N/A | 4 | 2 | 4 | 5 | 3 | N/A | 4 | 5 |
| | Air quality | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | 3 | 4 | N/A | 4 | 4 | 3 | 5 | 4 | 5 | 5 | 5 |
| **BUILT ENVIRONMENT DOMAIN** | | | | | | | | | | | | | | | | | | | | | |
| **BUILDINGS** | Residential and communities | 2 | 5 | 3 | 3 | 2 | 5 | 2 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 1 | 3 | 2 | 2 | 2 | 2 |
| | Industrial properties & facilities | 5 | 5 | 4 | 4 | 2 | 5 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 4 | 4 | 4 | 4 |
| | Commercial buildings & facilities | 1 | 4 | 2 | 4 | 2 | 5 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 4 | 3 | 3 | 3 |
| | Public buildings and community spaces | 2 | 4 | 4 | 3 | 2 | 5 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 3 | 3 | 3 | 3 | 3 |
| **PARKS, RESERVES, CEMETERIES** | Cemeteries | 2 | 3 | 2 | 3 | 2 | 5 | 2 | 3 | 3 | 3 | 3 | 5 | 4 | 3 | 2 | 4 | 5 | 4 | 2 | 3 |
| | Parks and reserves infrastructure & facilities | 2 | 3 | 2 | 2 | 2 | 5 | 2 | 3 | 2 | 2 | 2 | 4 | 3 | 2 | 2 | 3 | 2 | 4 | 2 | 3 |
| **3 WATERS AND WASTE INFRASTRUCTURE** | Water security, supply infrastructure & demand | 3 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 5 | 2 | 2 | 5 | 5 | 1 | 1 | 4 | 5 | 4 | 2 | 2 |
| | Engineered stormwater infrastructure | 1 | 2 | 2 | 2 | 2 | 4 | 2 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 4 | 5 | 4 | 1 | 2 |
| | Wastewater infrastructure | 3 | 4 | 2 | 3 | 2 | 4 | 4 | 4 | 5 | 3 | 5 | 5 | 5 | 3 | 2 | 4 | 5 | 4 | 3 | 2 |
| | Septic tanks | 3 | 3 | 3 | 3 | 2 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 3 | 4 |
| | Wastewater treatment plants | 3 | 5 | 5 | 4 | 2 | N/A | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 3 |
| | Stopbanks and engineered flood management schemes | 5 | 4 | 4 | 4 | 2 | 5 | 5 | 3 | 5 | 5 | 5 | 3 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 4 |
| | Coastal barriers and sea walls | 2 | 2 | 4 | 5 | 2 | 2 | 4 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 4 |
| | Irrigation schemes | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Landfills and contaminated sites | 2 | 4 | 2 | 4 | 2 | 3 | 4 | 4 | 5 | 4 | 5 | N/A | 5 | 5 | 4 | 5 | 5 | 5 | 3 | 3 |
| | Refuse transfer stations and material recovery facilities | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **TRANSPORT INFRASTRUCTURE** | Roads and bridges | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 4 | 5 | 4 | 5 | 2 | 2 |
| | Rail | N/A | N/A | N/A | N/A | 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Public road transport systems | 2 | 3 | 3 | 5 | 2 | 3 | 3 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 3 | 5 | 3 | 2 | 2 | 2 |
| | Marine facilities (excl. Ports) | 2 | 3 | 3 | 5 | 2 | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 3 | 5 | 3 |
| | Ports | 1 | 3 | 3 | 5 | 2 | 5 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 3 | 5 | 4 |
| | Christchurch Airport | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **ENERGY AND TELECOMS** | Electricity generation, transmission and distribution infrastructure | 3 | 5 | 5 | 5 | 2 | 5 | 2 | 3 | 5 | 3 | 5 | N/A | 5 | 5 | 2 | 3 | 2 | 3 | 2 | 2 |
| | Petroleum infrastructure | 2 | 4 | 3 | 3 | 2 | 5 | 3 | 3 | 5 | 5 | 5 | N/A | 5 | 5 | 3 | 4 | 5 | 4 | 5 | 3 |
| | Gas infrastructure | 5 | 5 | 5 | 5 | 2 | 5 | 4 | 4 | 5 | 5 | 5 | N/A | 5 | 5 | 2 | 4 | 5 | 4 | 5 | 3 |
| | Telecoms, mobile towers, internet infrastructure | 2 | 5 | 5 | 5 | 2 | 5 | 2 | 2 | 5 | 5 | 5 | N/A | 5 | 5 | 2 | 3 | 2 | 3 | 2 | 2 |