He Pou a Rangi
Climate Change Commission

National insights relevant for adaptation planning

Metrics on exposure and vulnerability to climate-related hazards

August 2026

Haere mai – welcome

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Disclosure statement: As anticipated by the appointment criteria, the Climate Change Commissioners come from varying fields such as adaptation, agriculture, economics, te ao Māori and the Māori–Crown relationship. While a number of board members continue to hold roles within these fields, our advice is independent and evidence based. The Commission operates under its Interests Policy, which is derived from the Crown Entities Act 2004. You can read more about our board members on the Climate Change Commission website. The Commission regularly updates and publishes on its website a register of relevant board interests.

Contents

About He Pou a Rangi Climate Change Commission

He Pou a Rangi Climate Change Commission (the Commission) is an independent Crown entity established by the Climate Change Response Act 2002 (the Act) to:

a. provide independent, evidence-based advice to successive governments on mitigating climate change (including through reducing emissions of greenhouse gases) and adapting to the effects of climate change

b. monitor and review progress towards emissions reduction and adaptation.

In carrying out these roles, the Act requires the Commission to draw from the best available evidence and analysis, and to consider the impacts of climate change and the implications for Aotearoa New Zealand over time. The Act also directs us to consider the Crown–Māori relationship, te ao Māori and specific effects on iwi/Māori in our work.

The Commission's independent and impartial advice focuses on the outcomes that can result from government action and policy, and the choices that decision-makers have. The aim is to support the Government to fulfil its role under the Act, including achieving emissions budgets and the 2050 target, and allowing the people of Aotearoa New Zealand to prepare for, and adapt to, the effects of climate change.

The scope and timeframes for the Commission's advice and monitoring reports are set out in the Act. More information about the Commission's work programme can be found on our website, climatecommission.govt.nz.

Part A: Overview

Chapter 1: Overview

This report provides a high-level view of exposure and vulnerability to selected climate-related hazards across Aotearoa New Zealand.

It contains insights about exposure to flooding, landslides and extreme heat, isolation due to coastal flooding, social vulnerability of communities affected by climate-related hazards, and affordability and availability of insurance.

The high-level information in this report can support decision-making about Aotearoa New Zealand's adaptation needs, but does not recommend specific actions to address climate-related hazards. It complements, and is published alongside, the Commission's second assessment of adaptation progress – *Progress report: National adaptation plan*.[i] That progress report includes recommendations for action and considerations the Government should include in future adaptation planning and implementation.

This report also complements and builds on our work for the second national climate change risk assessment, which considered how Aotearoa New Zealand's economy, society, environment and ecology might be affected by climate-related risks. Together, this work provides insights to assist decision-makers to understand, prioritise, plan and implement adaptation actions.

Box 1.1: The metrics in this report

For this report we have drawn insights from seven metrics across four categories:

- **Exposure to climate-related hazards**
  - People, buildings and infrastructure exposed to climate-related hazards
  - Measure of extreme heat
- **Isolation due to climate-related hazards**
  - Isolation due to coastal flooding: population and marae
  - Isolation due to coastal flooding: businesses
- **Social vulnerability to climate-related hazards**
  - Dimensions of social vulnerability
  - Social vulnerability of populations exposed to or isolated by coastal flooding
- **Affordability and availability of services**
  - Insurance availability

[i] Under section 5ZU of the Climate Change Response Act 2002, we are required to provide periodic progress assessments evaluating the national adaptation plan's implementation and effectiveness.

The information in this report describes exposure and vulnerability at a national level, focusing on current conditions and projected directions of change. Projections are not predictions, but it is useful for communities and decision-makers to consider a range of plausible future scenarios when making decisions about how to adapt to climate change.

While these metrics do not directly measure adaptation, they can provide useful insight to support national-level adaptation planning. For community-level adaptation planning, understanding national trends is useful but more specific local data will also be needed.

We developed an initial set of national metrics for our first assessment of the national adaptation plan, which was published in 2024. In this report we update and expand on those initial metrics to provide a broad picture of national-level exposure and vulnerability.

There is no globally accepted standard for measuring climate change adaptation, but international best practice has focused on approaches that combine quantitative metrics with qualitative analysis. This is the approach we have taken for this report. Measuring exposure and vulnerability can provide some insight into adaptation needs and progress, and can form one part of a broader picture of Aotearoa New Zealand's progress adapting to climate change.

We will continue to refine and develop the suite of national metrics in the future.

Chapter 2: About the national metrics provides more detail on the metrics and their relevance for adaptation planning.

Overall insights

Aotearoa New Zealand is already experiencing significant exposure and vulnerability to climate-related hazards. At 1°C of global warming, a threshold that has already passed, 254,000 homes are exposed to inland flooding (based on a flooding event that has a 1% probability of occurring in any given year: see **Box 1.2**). At the same level of warming, about 77,800 people and 44,300 homes are exposed to rainfall-induced landslides.

Even for those people who are not directly affected, many tens of thousands could become isolated by climate-related hazards. For example, flooding can cut off access routes to properties that are not themselves flooded. The harm arising from climate-related hazards will vary from one community to the next, and from person to person, depending on factors such as age, health, financial security, social connections, and so on.

The number of people exposed to climate-related hazards is projected to grow as global temperatures increase and sea levels rise. This is true for inland and coastal flooding and for other hazards. For example, extreme heat is projected to increase significantly in coming decades.

Understanding who is exposed to climate-related hazards, how they might be affected and how this is changing over time is one step towards supporting effective adaptation. Together with other evidence, measures of exposure and vulnerability can inform decisions about where adaptation action is needed, and provide some insight into the effectiveness of those actions.

Both for planning and for monitoring, more detailed local-level information will also be needed, together with other evidence that more directly addresses the effectiveness of adaptation efforts.

Exposure to climate-related hazards varies between districts and will change over time

There is considerable variance across Aotearoa New Zealand in terms of exposure and vulnerability to climate-related hazards, and in terms of potential changes over time. In particular:

- **Current exposure and changes across time:** Some districts have significant numbers of people, buildings and infrastructure already exposed to climate-related hazards. For others, exposure is projected to increase rapidly as temperatures and sea levels rise.
- Multiple hazards: Some districts are already exposed to multiple different climate-related hazards, while others are likely to be exposed to multiple hazards in future.
- Indirect and cascading risks: In some districts, people, communities and businesses could become isolated due to coastal flooding even if they are not directly affected, as vital transport routes are cut off affecting access to essential services.

- Social vulnerability: Some districts have high levels of exposure to climate-related hazards, combined with significant numbers of people who may be likely to experience harm – for example because of age, health conditions, economic insecurity or other factors. This points to hot spots where climate-related hazards may cause disproportionate harm, and where populations may have limited capacity to adapt.
- Absolute and relative exposure: In some districts a large proportion of people, businesses, infrastructure or marae are exposed to climate-related hazards, but the total numbers exposed are relatively small. In larger cities the proportion of people exposed to climate-related hazards can be relatively modest, but the absolute numbers exposed are large. When developing adaptation policy, it is important for decision-makers to be aware both of overall directions and patterns of change, and of the specific characteristics and needs of communities.

Adaptation responses will need to be tailored to each district's unique circumstances and informed by specific local data together with qualitative evidence about local needs. Some examples of variation across districts, and of the interactions between exposure and vulnerability, include:

- Of all districts, Auckland has the largest total population and amount of infrastructure exposed to inland flooding and landslides, even though the proportions exposed are lower than for many other districts. Auckland also has the largest total population exposed to inland flooding while also living in areas of high socioeconomic deprivation.
- Christchurch has the highest total number of people currently exposed to coastal flooding and the second largest population exposed to inland flooding. Some Christchurch suburbs (CBD and Woolston) show signs of insurance becoming less available.
- Whangārei ranks second highest nationally in terms of population exposed to landslides, both in absolute terms and as a proportion of the population. Whangārei also ranks highly in terms of infrastructure exposed to landslides. The number of extreme hot days in Whangārei is also projected to increase substantially in the future. Just over one in five Whangārei residents is aged over 65 years, and a high proportion of those live alone. Age, together with other factors such as underlying health conditions and mobility, can make people more likely to experience harm from hazards such as flooding.
- A high proportion of Napier's population and infrastructure is exposed to inland flooding and coastal flooding. A high proportion of Napier's businesses could become isolated by coastal flooding. A large proportion of Napier's population also experiences high levels of social vulnerability.
- Thames–Coromandel and Buller districts rank consistently high across exposure and social vulnerability metrics.

Box 1.2: Key terms

Degrees of warming

In this report exposure to inland flooding and landslides is assessed at three levels of global warming: 1°C, 2°C and 3°C above pre-industrial levels (pre-industrial being the period from 1850–1900). Today's climate is already 1.4°C above pre-industrial levels.[1]

We use 1°C of warming as the baseline for our assessment, reflecting actual measurements from the period between 1985 and 2014. When we say locations are 'already' exposed to inland flooding or rainfall induced landslides, we mean they were exposed at 1°C of warming. The 2°C and 3°C degree thresholds could be passed in future. Exactly when depends on a range of factors including global action to reduce emissions.

Exposure to and isolation due to climate-related hazards

This report analyses exposure to and isolation resulting from climate-related hazards such as coastal flooding, inland flooding and rainfall-induced landslides. In this report when we say a district is 'exposed to' or 'could become isolated by' a hazard, we mean it is exposed during a 1% 'annual exceedance probability' event (that is, an event with a 1% or greater probability of occurring in any given year).

Sea-level rise

In this report we define sea-level rise by comparing to a 1995–2024 baseline (with a midpoint of 2005).[ii] When we refer to 'current' sea levels we mean sea levels in 2005. When we refer to sea-level rise of 0.2 m, 0.5 m or 1.0 m, we are referring to increases relative to 2005. When we refer to 'increments' of sea-level rise, we mean increases of 0.2 m and 0.5 m against that 2005 baseline.

Extreme heat

Throughout this report, an 'extreme hot day' is one that exceeds the hottest 2% of days for that location and day during the period 1985 to 2014. While most of our metrics describe exposure at different levels of warming above pre-industrial levels, this metric projects increases in extreme heat under different climate impact scenarios (low, medium and high impact).[iii]

[ii] The 2005 baseline is relative sea-level rise that includes vertical land movement data from the NZ SeaRise: Te Tai Pari O Aotearoa programme (available at https://searise.nz/resources/nz-searise-projections/).

[iii] For more information on the Intergovernmental Panel on Climate Change's climate scenarios, see its Sixth Assessment Report (available at https://www.ipcc.ch/assessment-report/ar6/) or Chapter 2 of *Priorities for action: National Climate Change Risk Assessment for Aotearoa New Zealand* (2026), which is available on our website.

Insights by metric

Exposure to climate-related hazards

People, buildings and infrastructure exposed to climate-related hazards

This metric quantifies the exposure of people, buildings and infrastructure to three climate-related hazards: coastal flooding, inland flooding and rainfall-induced landslides. We provide this information for both current and projected future climates. The types of buildings and infrastructure considered have been selected because of their importance for supporting well-functioning communities.

Significant insights include:

- Nationally, about 754,000 people (15.1%) and 252,000 homes (15.5%) are already exposed to inland flooding at 1°C of warming above pre-industrial levels (a threshold that has already passed: see **Box 1.2**).
- Nationally, about 78,000 people (1.6%) and 44,000 homes (2.7%) are already exposed to landslides at 1°C of warming above pre-industrial levels. This increases steadily as warming levels increase.
- Some districts have a high proportion of the population and/or infrastructure exposed to multiple hazards. For example, the Buller and Kaipara districts are among the top five in terms of proportion of population exposed to both inland and coastal flooding. Ōpōtiki is in the top five for proportion of population exposed to both inland flooding and landslides.
- In Auckland and Christchurch, the proportion of population and infrastructure exposed to climate hazards is relatively modest compared with smaller districts, but the absolute numbers are high. Auckland has the largest total number of people exposed to inland flooding and landslides, while Christchurch has the second largest total number of people exposed to inland and coastal flooding.
- Some communities are exposed to climate-related hazards and also face high levels of socioeconomic deprivation.[iv] For example, at 1°C of warming:
  - in Auckland, about 183,000 people are already exposed to inland flooding and 54,000 (29.7%) of those live in areas of high socioeconomic deprivation
  - in Wairoa, 62.6% of the population (5,520 people) is exposed to inland flooding (the highest of any district) and 81% (4,500) of those live in areas of high socioeconomic deprivation
  - in Kawerau, 57% of the population (4,170) is exposed to inland flooding and 90% (3,760 people) of those live in areas of high socioeconomic deprivation.

[iv] 'High socioeconomic deprivation' refers to areas in deciles 9 and 10 of the New Zealand index of socioeconomic deprivation.

Measure of extreme heat

This metric identifies the number of 'extreme hot days' that are projected to occur in different parts of the country in future.

Even though Aotearoa New Zealand has a temperate climate, many effects of extreme heat are associated with relative rather than absolute temperatures.[2] This means that people and sectors can experience negative effects even with modest increases in seasonal temperature relative to what they are used to.

For this reason, we define an 'extreme hot day' by comparing to past temperatures – specifically the period from 1985 to 2014. For any location and day, an 'extreme hot day' is one that exceeds the hottest 2% of days recorded during that same time of year.

Extreme heat can affect people's health and wellbeing, especially for those who are already vulnerable, for example due to age or underlying health conditions.[2]

Extreme heat can also cause harm to ecosystems, infrastructure and economic activity.[3]

The number of extreme hot days is expected to increase significantly in future for all climate impact scenarios (low, medium and high). More specifically:

- over the 2020–2040 period, extreme hot days are projected to occur on 4–6% of days across most of the North Island and 3–5% of days for most of the South Island
- over the 2040–2060 period, extreme hot days are projected to occur on 6–11% of days for much of the North Island and up to 14% in some parts. In the South Island extreme hot days are projected for 4–9% of days.

Isolation

Isolation due to coastal flooding: populations and marae

This metric looks at the number of people, homes and marae who could become isolated by coastal flooding (that is, during a 1% annual exceedance probability coastal flooding event: see **Box 1.2**). Becoming isolated refers to being cut off from emergency services, supermarkets, education, work and marae if transport networks are damaged. We consider the possibility of becoming isolated under current conditions, and at different increments of sea-level rise.

Isolation can be highly disruptive to communities. It can have significant impacts on health and wellbeing (for example, by affecting access to medical services). It can also disrupt education and economic activity, and cause significant distress.

Significant results include:

- Under current conditions, about 142,000 people (2.9%) nationally could become isolated by coastal flooding. With 0.2 m of sea-level rise this increases to 183,000 (3.7%) and with 0.5 m of sea-level rise to 238,000 people (4.8%).
- Under current conditions, 100 marae (9%) could become isolated by coastal flooding. That rises to 116 marae (10.9%) at 0.2 m of sea-level rise, and 142 marae (13.4%) at 0.5 m of sea-level rise.
- The possibility of becoming isolated varies significantly between districts. Half of people in Thames–Coromandel district could become isolated by coastal flooding with current sea levels. This rises to 65.4% with 0.2 m of sea-level rise and to 77.8% with 0.5 m of sea-level rise.

Isolation due to coastal flooding: businesses

Under this metric we consider the number of businesses that could become isolated due to coastal flooding. Isolation caused by coastal flooding has the potential to partially or fully disrupt business activity, with flow-on economic consequences at local and national levels.

Business isolation and the resulting economic disruption could have cascading impacts for communities – for example, by affecting incomes, access to goods and services, and longer-term business viability in some locations.

In some parts of the country, inland businesses rely on coastal transport networks and could become isolated even if they are not directly affected by floods. In some places, businesses could become isolated years or decades before they are directly exposed. This can have significant impacts on production and supply chains; for example, if suppliers cannot get produce and goods to plants and markets. Fruit growers, for example, rely on timely harvesting, processing and distribution to market, all of which can be disrupted if roads are flooded.

Significant results for this metric include:

- Many more businesses are likely to be isolated than directly exposed to coastal flooding.
- Currently, more than 15,500 businesses (3.2% of all businesses in Aotearoa New Zealand) could become isolated by coastal flooding. This number increases to 22,500 businesses (4.6%) with 0.2 m of sea-level rise, and 28,900 (5.9%) at 0.5 m.
- The number of coastal businesses that could become isolated varies from district to district. There are 13 districts that rate consistently highly across all sea-level rise increments. For example:
  - for the Hauraki and Thames–Coromandel districts, more than 30% of businesses could become isolated at just 0.2 m of sea-level rise
  - in Hauraki district, 39.9% of businesses classified as agricultural, forestry and fishing could become isolated at 0.2 m of sea-level rise. A significant proportion of Hauraki businesses are in the dairy farming sector, which is particularly sensitive to being isolated.

Social vulnerability

Dimensions of social vulnerability

The impacts of climate-related hazards are not likely to fall evenly. Some people or groups may be less able to cope physically with an extreme weather event, for reasons such as age, health or physical disability. Others may be less able to recover from flooding or other events because of limited economic resources.

This metric considers various dimensions relevant to the harm that people or groups might experience from climate-related hazards, and to how they perceive and respond to risk. These are referred to as dimensions of social vulnerability. As well as age, health and disability, and financial security, they include social connectedness, skills and knowledge, housing safety and security, access to food and water, and occupation.

Understanding which groups and populations may be more likely to experience harm from climate-related hazards is an important complement to understanding exposure. While no single dimension of social vulnerability will provide a picture of whether a person will be harmed by climate-hazards, those with multiple dimensions will be more likely to experience harm. This understanding can inform adaptation planning and action, and can also support emergency planning and response.

Significant results include:

- Between 2018 to 2023, there have been increases across some dimensions of social vulnerability nationally. This includes increases in the older adult population, and the number of older adults living alone. There has also been an increase in household crowding, number of people with poor mental health, and children experiencing food insecurity.

Social vulnerability of populations exposed to or isolated by coastal flooding

This metric brings together data about exposure to coastal flooding, and dimensions of social vulnerability of the people and communities that are exposed. An index has been created to inform this analysis – the specific hazard vulnerability index (the index).

This index helps to identify districts where exposure and vulnerability combine to create hot spots where climate risks may cause disproportionate or inequitable impacts. This type of information is useful to highlight areas where climate-related risk might be particularly high, and where carefully targeted responses may be needed.

Districts with a high proportion of their population in the top 20% of the index (quintile five) are defined as having high levels of social vulnerability.

Significant results include:

- Nationally, nearly 29,000 people (0.6%) are currently directly exposed to coastal flooding. Approximately 7,600 of those exposed (26.3%) are defined as having high levels of social vulnerability.
- Approximately 53,000 people (1.1%) are directly exposed to coastal flooding at 0.2 m of sea-level rise. Around 13,000 of those exposed (24.8%) are defined as having high levels of social vulnerability.
- Napier and Buller districts have the highest proportion of their populations that are both exposed to coastal flooding and defined as having high levels of social vulnerability.

Availability of services

Insurance availability

This metric considers households in areas exposed to inland flooding, and their access to home insurance. Access to home insurance considers both availability and affordability.

Availability of home insurance was assessed based on whether households in the affected suburbs can obtain competitive quotes for insurance (that is, two or more online quotes).

Significant results include:

- Approximately 4% of properties within flood zones are currently unable to obtain home insurance quotes from two or more insurance underwriters.

If exposure or vulnerability to climate-related hazards is not reduced, and costs of damages from these hazards start to increase, insurance companies will respond by either increasing premiums in the most at-risk locations or by withdrawing insurance coverage altogether. Information about changes in insurance availability can help to inform policy responses; for example, by showing where action is needed to reduce physical exposure and vulnerability.

Part B:
Detailed results

Chapter 2: About the national metrics

This report presents insights about Aotearoa New Zealand communities' exposure and vulnerability to selected climate-related hazards.

This report builds on earlier work carried out for our 2024 progress assessment on climate change adaptation, and is intended to complement our 2026 assessment.

For this report we have updated the 2024 metrics and broadened them to include a wider range of climate hazards. We have also added new metrics focusing on business isolation and insurance affordability (see **Table 2.1**).

The focus of this work continues to be on high-level metrics relating to aspects of climate-related risk. It is important to understand how risk and the main components of risk (hazard, exposure and vulnerability) are changing over time. Doing so is an important step towards building a more quantitative picture of risk that can inform the measurement of adaptation progress.

This work also complements and builds on the second national climate change risk assessment for Aotearoa New Zealand (2026), which considered how Aotearoa New Zealand's economy, society, environment and ecology might be affected by climate-related risks. The metrics in this report provide a cross-system perspective touching on multiple risks identified in the 2026 risk assessment.

Our analysis in this report focuses on current conditions and projected changes which are relevant for national-level monitoring of adaptation progress. For example, some of the metrics in this report show exposure at 0.2 m and 0.5 m of sea-level rise, without specific timeframes for when those are likely to occur. Projections are not predictions, but it is useful for communities and decision-makers to consider a range of plausible future scenarios when making decisions about how to adapt to climate change. Changes in climate are not the only thing that will lead to changes in exposure and vulnerability. Social and demographic changes, along with actions taken to adapt (such as land-use and planning decisions) will also affect exposure and vulnerability in different places over time.

While national metrics are useful for highlighting overall directions and patterns of change, more specific local data will be needed to inform community-level adaptation planning.

This report does not recommend any particular actions to address climate-related hazards but aims to provide insights that assist decision-makers to understand, prioritise, plan and implement adaptation actions. More specific recommendations for central government adaptation planning and implementation are contained in the Commission's second adaptation progress assessment, which is published alongside this report.

Table 2.1: The metrics in this report

Category	Metric
Exposure to climate-related hazards	People, buildings and infrastructure exposed to climate-related hazards (Chapter 3)
	Measure of extreme heat (Chapter 4)
Isolation from climate-related hazards	Isolation due to coastal flooding: population and marae (Chapter 5)
	Isolation due to coastal flooding: businesses (Chapter 6)
Social vulnerability to climate-related hazards	Dimensions of social vulnerability (Chapter 7)
	Social vulnerability of populations exposed to or isolated by coastal flooding (Chapter 8)
Affordability and availability of services	Insurance availability (Chapter 9)

Criteria for selecting national metrics

The Commission developed five criteria to serve as guiding principles for selecting national-level metrics for our 2024 progress assessment. Under those criteria, the metrics should:

- **focus on significant climate risks for Aotearoa New Zealand:** offer insights into high-priority climate risks that Aotearoa New Zealand is facing. Collectively, the suite of metrics should assess across the dimensions of risk – exposure, sensitivity and adaptive capacity
- **provide a cross-system perspective:** collectively provide a broad cross-system perspective, touching on multiple outcome areas or sectors
- **be based on reliable, robust and relevant data**
- **provide a measurable picture of progress over time:** be easy to understand, comparable, and applicable across different timeframes and scales – including national, regional and local levels. They should be based on data that can be updated over time
- **provide a holistic assessment of progress:** collectively draw on diverse data, including both quantitative and qualitative information.

These criteria continue to be useful to guide the selection and development of national metrics. This report includes updates to metrics we used in our 2024 progress assessment as well as some new metrics. However, because of differences explained throughout this report we are unable to highlight any trend information.

How we commissioned the metrics

We commissioned external providers to gather data for each metric, including reports from Earth Sciences New Zealand, Urban Intelligence, and Dr Luke Harrington and Dr Hamish Lewis. We also used publicly available information from the Treasury and from Massey University's Environmental Health Intelligence New Zealand research group.

Further detail on the metrics can be found in the relevant chapters of this report and in the separate commissioned reports, which are available on our website.

Challenges associated with developing climate adaptation metrics

Globally, there is no commonly accepted framework for measuring climate change adaptation – it is recognised that measuring adaptation is complex. Recent international best practice has focused on integrated monitoring approaches that use both quantitative metrics and qualitative analysis to assess what is changing, and also why and how.

Measuring adaptation progress is challenging for several reasons:

- It is difficult to attribute risk reduction to adaptation, because a range of other factors (such as broader social, demographic and economic changes) also affect risk.
- Aotearoa New Zealand does not have clear targets for adaptation.
- Establishing meaningful baselines is complex due to the changing nature of climate risks.
- Adaptation actions can take a long time to deliver visible results. For example, changes to legislation or institutional arrangements can take many years to develop and implement.
- Adaptation needs vary depending on context – one community's needs will differ from another's, and the same adaptation response can have different impacts in different places.

These challenges are compounded by the ever-changing nature of climate risks and impacts.

This report is a step towards measurement of progress on adaptation

While the metrics in this report are not directly measuring adaptation, they do provide useful insights into some areas relevant for adaptation planning and action nationally. Monitoring quantitative trends supports qualitative analysis of adaptation progress and the effectiveness of adaptation actions.

Given the complexities of measuring adaptation, any single indicator can provide only limited insight on adaptation progress. Measuring adaptation will require complementary metrics that can be linked to adaptation objectives and outcomes, and account for the impacts of adaptation actions across different locations and timeframes.

We will continue to develop our approaches to assessing adaptation progress.

The following chapters provide detailed findings for each of our seven metrics. In each chapter we set out:

- what is being measured (including definitions and methodology)
- detailed results and insights, and
- gaps and potential improvements in each metric.

Box 2.1: Climate-related risk and climate adaptation

Climate-related risk

The main components of climate-related risk are hazard, exposure and vulnerability. The combination of these factors creates the potential for adverse consequences.

Climate-related hazards include coastal and inland flooding, rising sea levels, storms and droughts, and temperature extremes.

Climate-related risks depend on a combination of exposure to hazards (for example, who or what can be affected) and on vulnerability (characteristics that make people, places or things more or less likely to be harmed, and that affect their ability to adapt). They are also affected by actions taken to address risk and whether they work as planned or not.

Impacts from climate hazards can differ from place to place. They can be direct (such as physical damage from flooding) or indirect (such as downstream economic impacts from that flooding). They can also change across time. Potential harm can include (among other things) threats to life and health; damage to property, buildings and infrastructure; harm to ecosystems; economic harm; and harm to communities and social cohesion.

Climate adaptation

Climate adaptation refers to the process of adjusting to the actual or expected changes brought about by climate change. This includes steps that government and other sectors can take to prevent or reduce harm from climate risk (for example, changes to laws, policies, practices and processes, as well as to physical structures and the built environment).

Effective adaptation requires an understanding of relevant climate-related risks, including complexities such as how those risks might vary from place to place, change over time, or be subject to indirect or cascading impacts.

Effective adaptation also requires clarity on the actions that can most effectively reduce harm, and on how those actions should be prioritised in terms of urgency and resourcing. Prioritisation might depend, among other things, on the scale of potential harm, the timeframe in which the risk or opportunity is emerging, and the extent to which practical options are available in response.

Adaptation needs will also vary from place to place, and from one community to the next, depending on the specific mix of exposure and vulnerability they face.

Chapter 3: People, buildings and infrastructure exposed to climate-related hazards

This metric quantifies the extent of exposure of people, buildings and infrastructure to three climate-related hazards:

- coastal flooding
- inland flooding
- landslides.

Exposure to these hazards is assessed for both current and possible future climates.

By providing a national-level picture of the extent to which people, buildings and infrastructure are exposed to climate-related hazards, this metric:

- helps to identify where there might be potential hotspots of exposure
- provides a basis for the development of adaptation policy responses, and
- supports decisions about the prioritisation of adaptation efforts.

As sea levels rise, and as the country experiences more frequent and extreme weather events, more homes and infrastructure will be exposed to climate-related hazards. This means that the potential for damage and disruption will also increase in future.

Damage to homes will have major impacts on the wellbeing of people and families. Damage to infrastructure can also have significant impacts, for example by disrupting transport, cutting off electricity and water supplies, and causing failure in wastewater networks.

Box 3.1 Key results

- Nationally, at 1°C of warming above pre-industrial levels:
  - about 754,000 people (15.1%) and 252,000 homes (15.5%) are already exposed to inland flooding
  - about 78,000 people (1.6%) and 44,000 homes (2.7%) are already exposed to landslides.
- About 0.6% of the national population (32,000 people) is currently exposed to coastal flooding.
- Some districts have a high proportion of the population and/or infrastructure exposed to multiple hazards.
- Exposure increases as global temperatures rise.

What this measures

This metric draws on analysis carried out by Earth Sciences New Zealand, through their *National Climate Hazard Exposure Census,* which we commissioned as part of our climate change adaptation work programme.[4] The Census looks at the exposure of people, assets and infrastructure networks to different climate-related hazards. We have analysed this information by local authority district.

The metric focuses on a selection of the information from the Earth Sciences New Zealand dataset. In particular, we selected climate hazards and elements relevant to the impacts communities might face. **Table 3.1** shows the elements, and **Table 3.2** shows the climate hazards selected to inform this metric.

For more detail, see the *National Climate Hazard Exposure Census* report, which is available on our website.

Table 3.1: Selected elements from Earth Sciences New Zealand's National Climate Hazard Exposure Census

Element	Description
Infrastructure	
Roads	State highways and local roads
Electricity transmission	High voltage transmission pylons (the national grid)
Rail	The national rail network, including metropolitan lines and freight corridors
Water supply	Pipes used to supply potable/drinking water
Stormwater and wastewater networks	Pipes used to drain stormwater and carry wastewater
People, homes and community buildings	
Population	Estimated population, based on 2023 Census data and modelling allocating people to residential addresses
Exposed and in high socioeconomic deprivation	Within each district, the proportion of the population that is exposed to a hazard, and living in an area of high socioeconomic deprivation (decile 9 and 10 of the New Zealand index of socioeconomic deprivation[v])
Residential	Homes and residences, including mixed-use buildings[vi]
Community buildings	Building classified as community halls, libraries and other multi-use community spaces, including wharekai
Aged care	Buildings classified as retirement villages and aged care facilities

[v] https://www.stats.govt.nz/information-releases/new-zealand-index-of-socioeconomic-deprivation-2023-census/

[vi] Building categories are as defined in Appendix F.3 of the Ratings Valuation Rules 2010 https://www.linz.govt.nz/sites/default/files/30300-Rating%2520Valuations%2520Rules%25202008-%2520version%2520date%25201%2520October%25202010%2520-%2520LINZS30300_0.pdf

Table 3.2: Climate hazards used for Exposure Census assessment

Hazard	Description
Inland flooding	1% annual exceedance probability (AEP) inland flood for pre-industrial temperatures 1°C to 3°C.[vii] A 1% AEP flood means a 1% probability that an event will occur in any given year.
Coastal flooding	1% AEP coastal flooding under different sea-level rise increments of 0.0 m (2020), 0.5 m, and 1.0 m[viii]
Rainfall-induced landslides	Landslides in response to a 1% AEP rainfall event for pre-industrial temperatures 1°C to 3°C[1]

Source: Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

For this analysis we have assessed exposure spatially by determining whether an element or asset is located within a hazard-prone area, based on the estimated hazard extent area.

Buildings are considered exposed if there is more than 5 cm of water around 50% of the perimeter. For other linear infrastructure, such as roads and pipelines, any part that overlaps with the hazard and is within 5 cm of water is considered exposed. For landslides, any part of an element that overlaps with the hazard is considered exposed.

This assessment only focuses on exposure and does not assess potential for an asset to be damaged. For example, an asset might be exposed but sufficiently robust to withstand that level of exposure.

The results presented in this chapter for 2°C and 3°C of warming are based on the average projected increase in climate hazards across five individual climate models (the 'multi-model mean'). Averaging across models provides a central picture that highlights overall directions and patterns of change. Individual climate models can give a wider range of results. Detailed risk assessment and adaptation planning should consider a broad range of outcomes from modelling results to make informed decisions. For example, the results of extreme rainfall projections given by individual models may be significantly higher or lower than the average. Not considering the range of results can lead to planning decisions that under or overestimate rainfall-driven climate hazards.

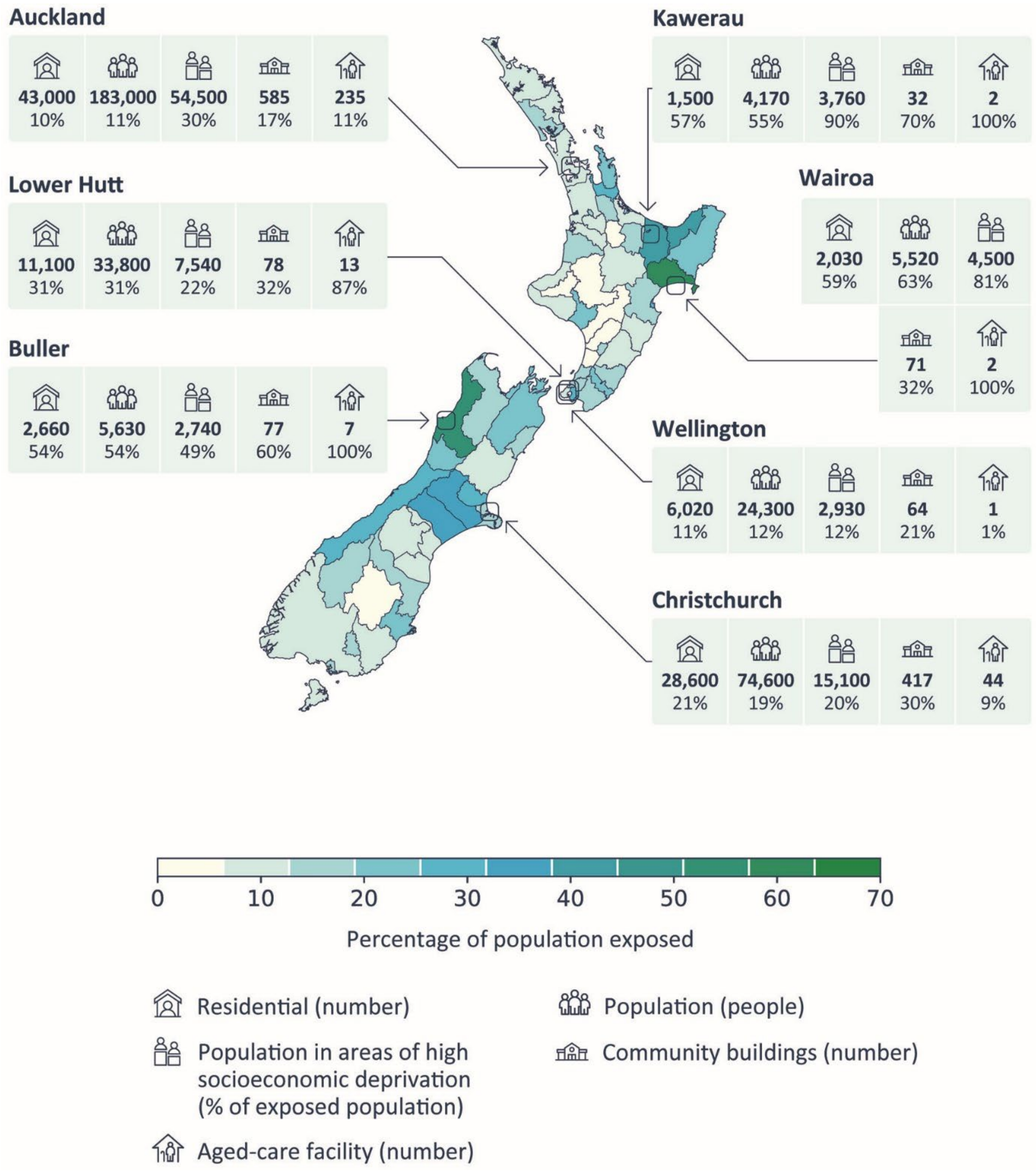
[vii] For both inland flooding and rainfall-induced landslides, the baseline period is 1986–2005, centred on 1995. This baseline period is already approximately 1°C warmer than pre-industrial (1850–1900) conditions. Therefore, the 1°C threshold has already passed. Today's climate is already 1.4°C above pre-industrial levels. For clarity and consistency with international norms, we have chosen to express the baseline centred on 1995 as 1°C pre-industrial.

[viii] Note that sea-level rise has already occurred, and the use of a 0.0 m 2005 baseline obscures approximately 0.2 m of sea-level rise that has already happened. However, because of the differences in the rate of observed sea-level rise occurring across different parts of New Zealand, it is not possible to use a pre-industrial or equivalent baseline for sea-level rise. (https://www.stats.govt.nz/indicators/coastal-sea-level-rise/)
s

Results: inland flooding

Exposure to inland flooding: people, homes and buildings

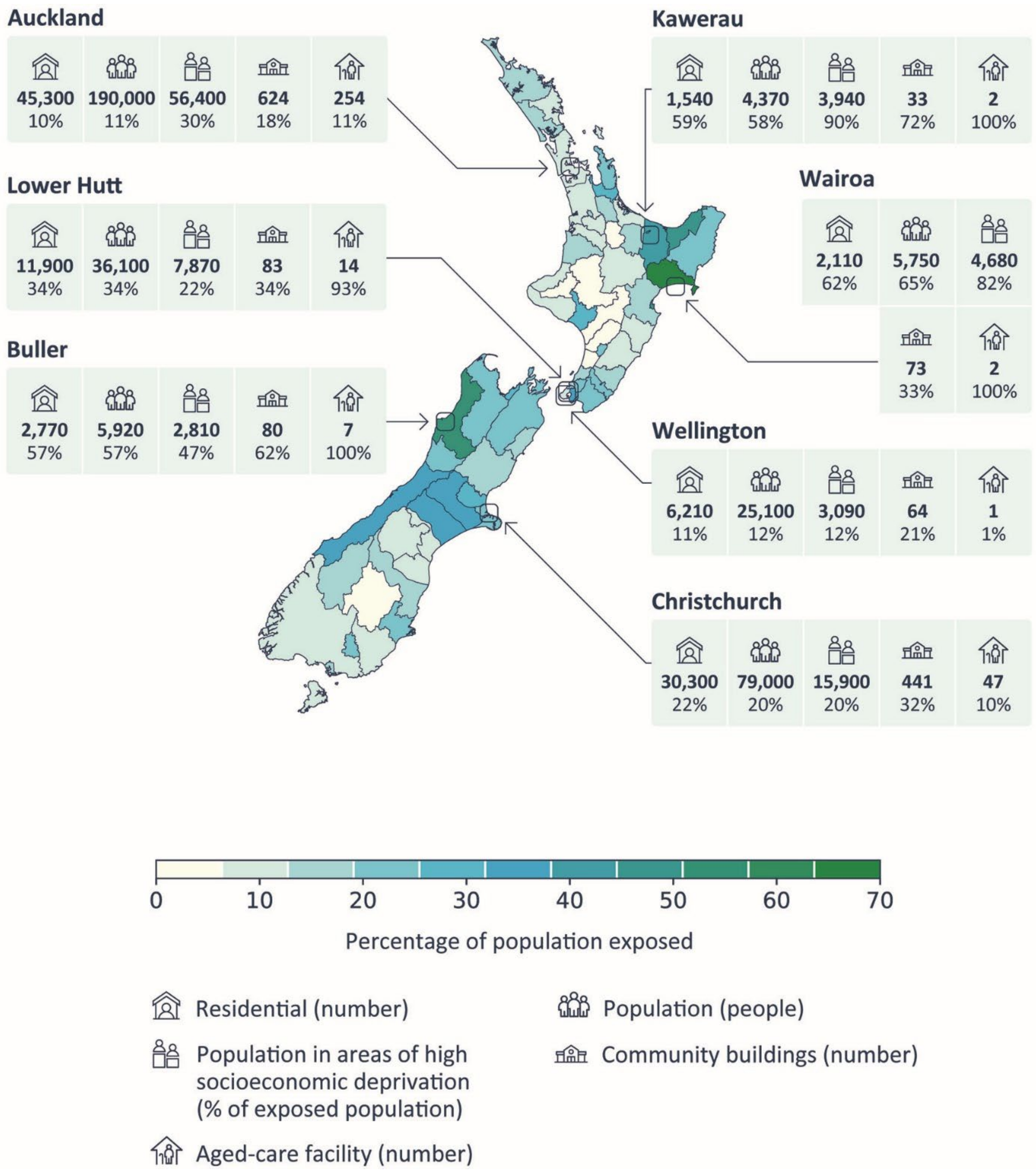
Figure 3.1: People, homes and community buildings exposed to inland flooding with a 1% annual exceedance probability at 1°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms.

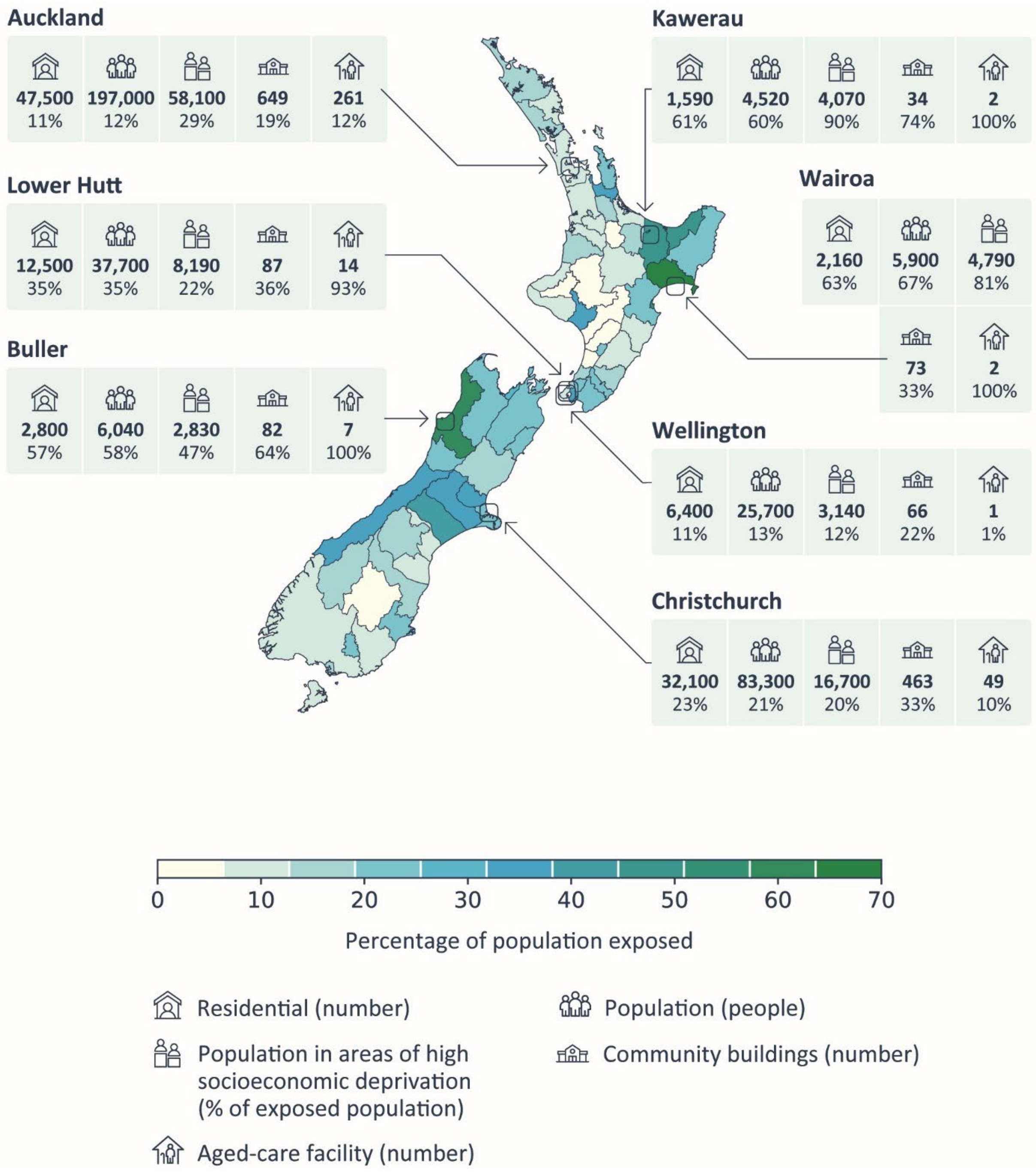
Figure 3.2: People, homes and community buildings exposed to inland flooding with a 1% annual exceedance probability at 2°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms.

Figure 3.3: People, homes and community buildings exposed to inland flooding with a 1% annual exceedance probability at 3°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms.

More people, homes and buildings are exposed to inland flooding than to other climate hazards. Nationally:

- 15.1% of the population (754,000 people) is already exposed to inland flooding at 1°C of warming. This increases to 16.2% of the population (810,000 people) at 2°C of warming and 17.2% (857,000 people) at 3°C of warming.
- 15.5% of residential buildings (252,000 buildings) are exposed to inland flooding at 1°C of warming. This increases to 16.8% of residential buildings (272,000 buildings) at 2°C and to 17.9% (290,000 buildings) at 3°C of warming.
- People living in areas with the highest levels of socioeconomic deprivation (top two deciles of the New Zealand index of socioeconomic deprivation) are disproportionately exposed to inland flooding. Of people already exposed to inland flooding at 1°C of warming, 27% (201,000 people) live in areas of high socioeconomic deprivation.

Wairoa, Kawerau and Buller districts have the highest proportions of population exposed to inland flooding at all increments of warming (**Figures 3.1–3.3, Table 3.3**). Wairoa and Kawerau are also the two areas with the highest proportions of exposed population living in areas of high socioeconomic deprivation. In Wairoa, 81.5% (4,500 people) already exposed to inland flooding also live in areas of high socioeconomic deprivation. In Kawerau, the figure is 90% (3,760). At 1°C of warming, all aged-care facilities in Wairoa, Kawerau, Buller and Ōpōtiki are already exposed to inland flooding.

While urban districts like Auckland, Christchurch and Lower Hutt have lower proportions of people exposed to inland flooding than smaller districts, absolute numbers of people exposed to inland flooding are much higher. About 183,000 people (11.1%) are already exposed to inland flooding in Auckland. Of those, 54,500 people (29.7% of those exposed) live in areas of high socioeconomic deprivation.

Table 3.3: Districts with the highest proportions of population exposed to inland flooding

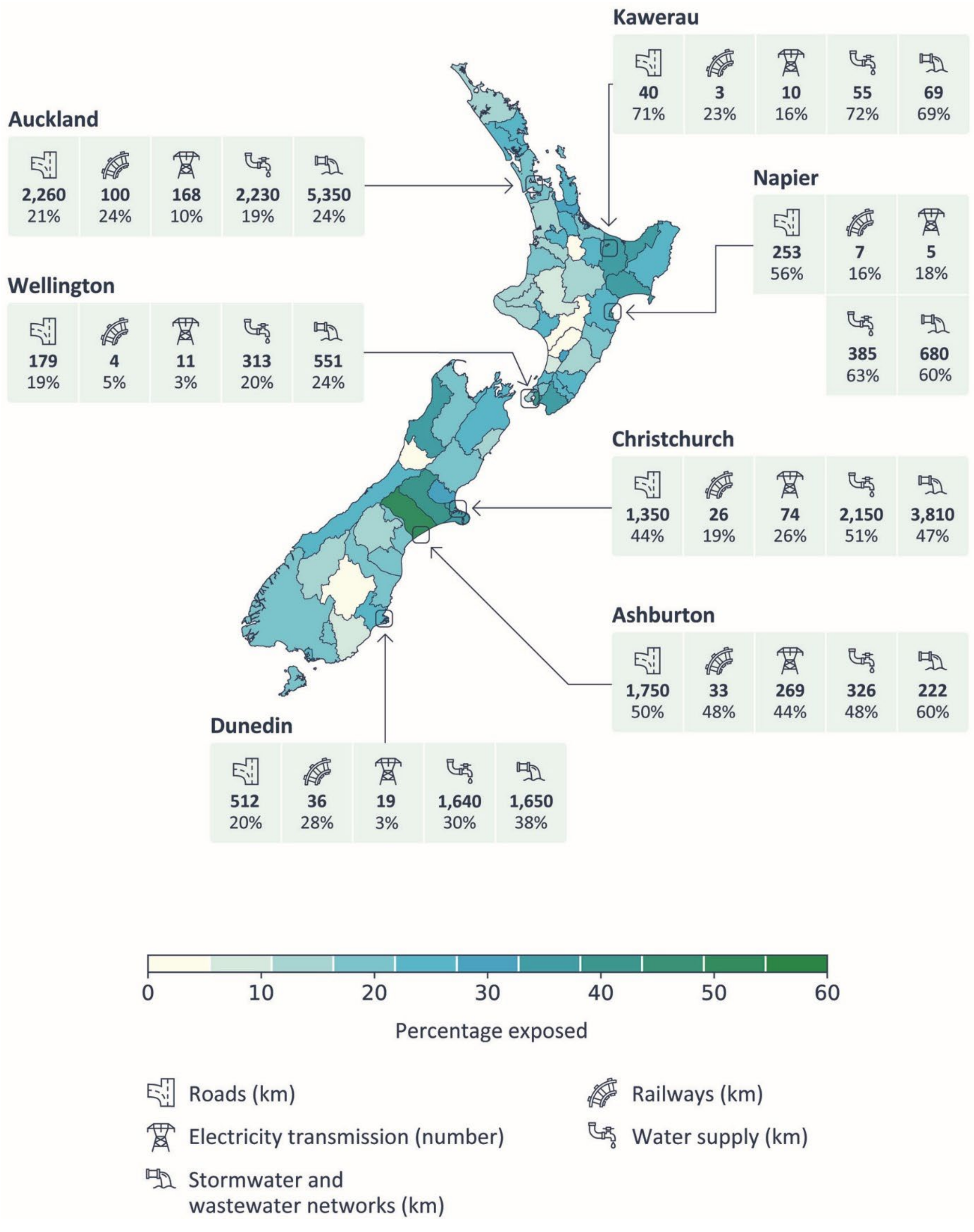
Rank	At 1°C of warming	At 2°C of warming	At 3°C of warming
1	Wairoa (62.6%)	Wairoa (65.1%) ▶	Wairoa (66.9%) ▶
2	Kawerau (55.4%)	Kawerau (58.0%) ▶	Kawerau (59.9%) ▶
3	Buller (53.9%)	Buller (56.6%) ▶	Buller (57.8%) ▶

Arrows (▲/▼) indicate change in ranking. Right arrow (▶) indicates unchanged ranking

Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Exposure to inland flooding: infrastructure

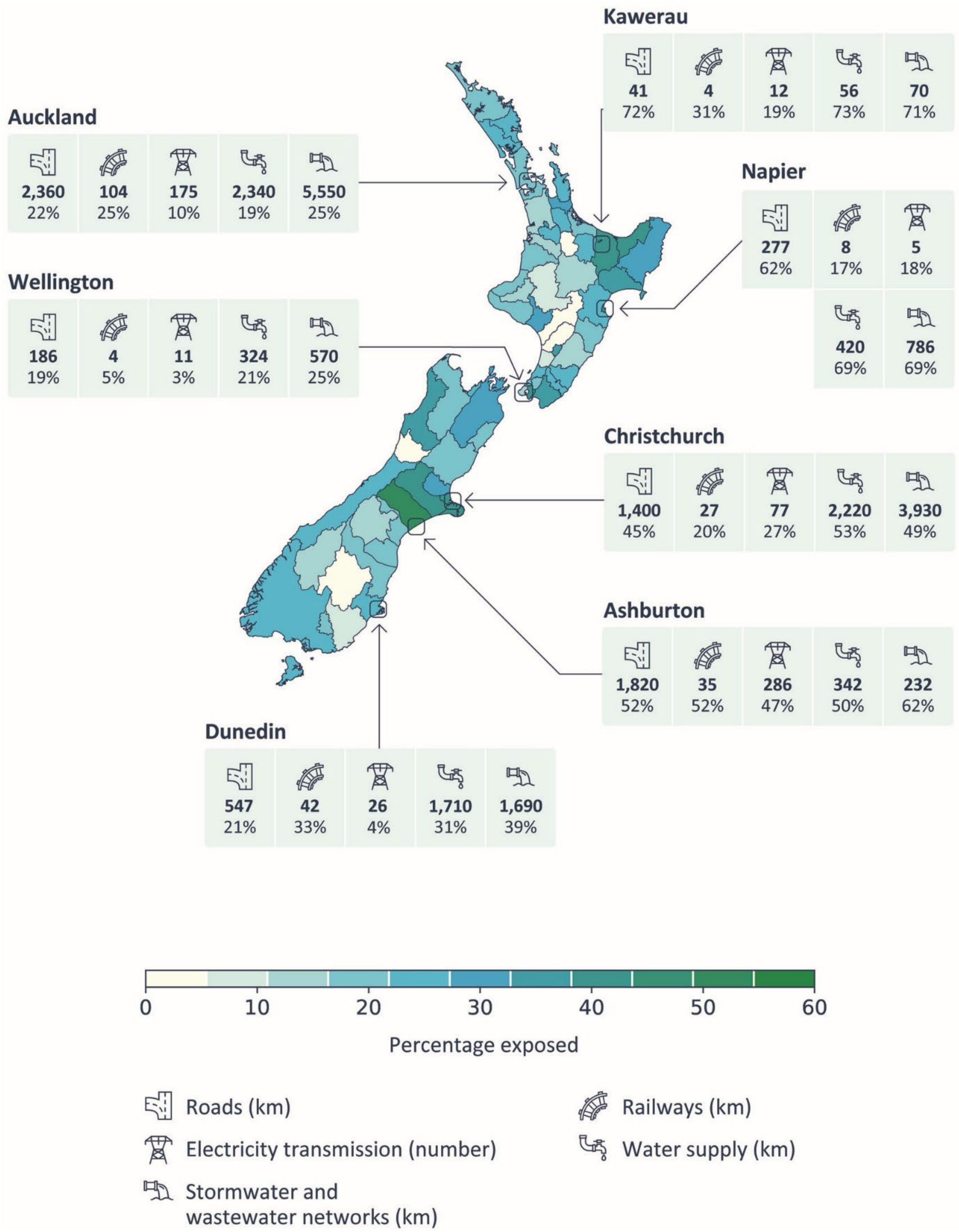
Figure 3.4: Infrastructure exposed to inland flooding with a 1% annual exceedance probability at 1°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

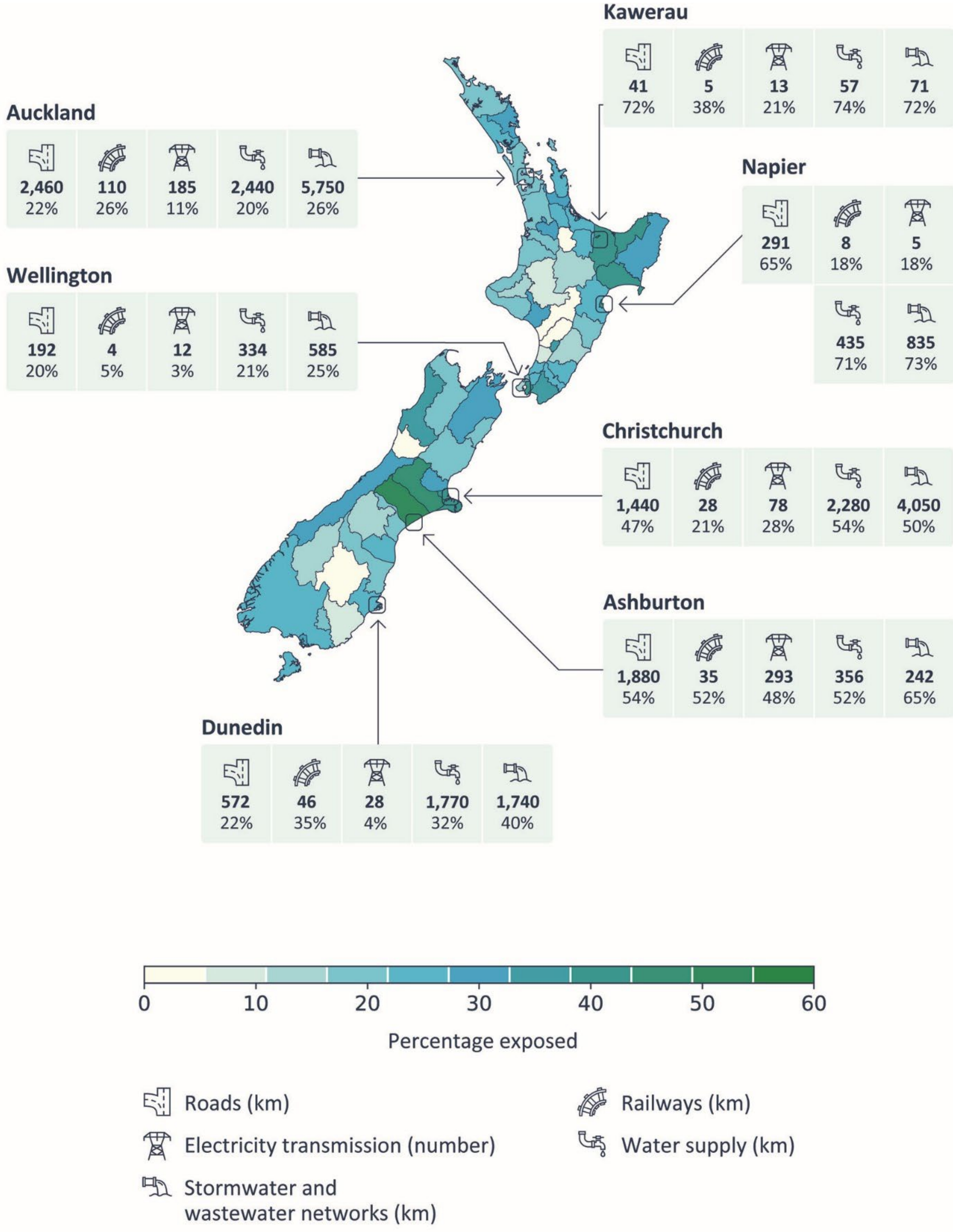
Figure 3.5: Infrastructure exposed to inland flooding with a 1% annual exceedance probability at 2°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

Figure 3.6: Infrastructure exposed to inland flooding with a 1% annual exceedance probability at 3°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

Infrastructure such as roads and water networks shows high levels of exposure to inland flooding. Nationally:

- 35.2% of wastewater and stormwater pipelines (28,100 km) are already exposed to inland flooding at 1°C of warming. This increases to 36.6% (29,200 km) at 2°C and to 37.8% (30,200 km) at 3°C of warming.
- 27.7% (18,000 km) of water supply pipelines are exposed to inland flooding at 1°C of warming. This increases to 28.9% (18,700 km) at 2°C and 30.0% (19,500 km) at 3°C of warming.
- 18.8% (26,800 km) of roads are exposed to inland flooding at 1°C of warming. This increases to 19.8% (28,200 km) at 2°C and 20.7% (29,500 km) at 3°C of warming.

Kawerau, Napier and Ashburton have high proportions of infrastructure exposed to inland flooding (**Figures 3.4–3.6**). At 1°C of warming, more than 70% of Kawerau district roads and potable water pipes are exposed, and in Napier, 56.1% (253 km) of roads and 59.8% (680 km) of waste and stormwater pipes are exposed.

Auckland and Christchurch also have the highest total amounts of critical infrastructure exposed. For example, in Auckland, 2,260 km (20.6%) of roads are already exposed to inland flooding at 1°C of warming, along with 5,350 km (23.9%) of the wastewater and stormwater networks. In Christchurch, 3,810 km (47.1%) of the wastewater and stormwater networks are exposed.

Results: coastal flooding

Exposure to coastal flooding: people, homes and buildings

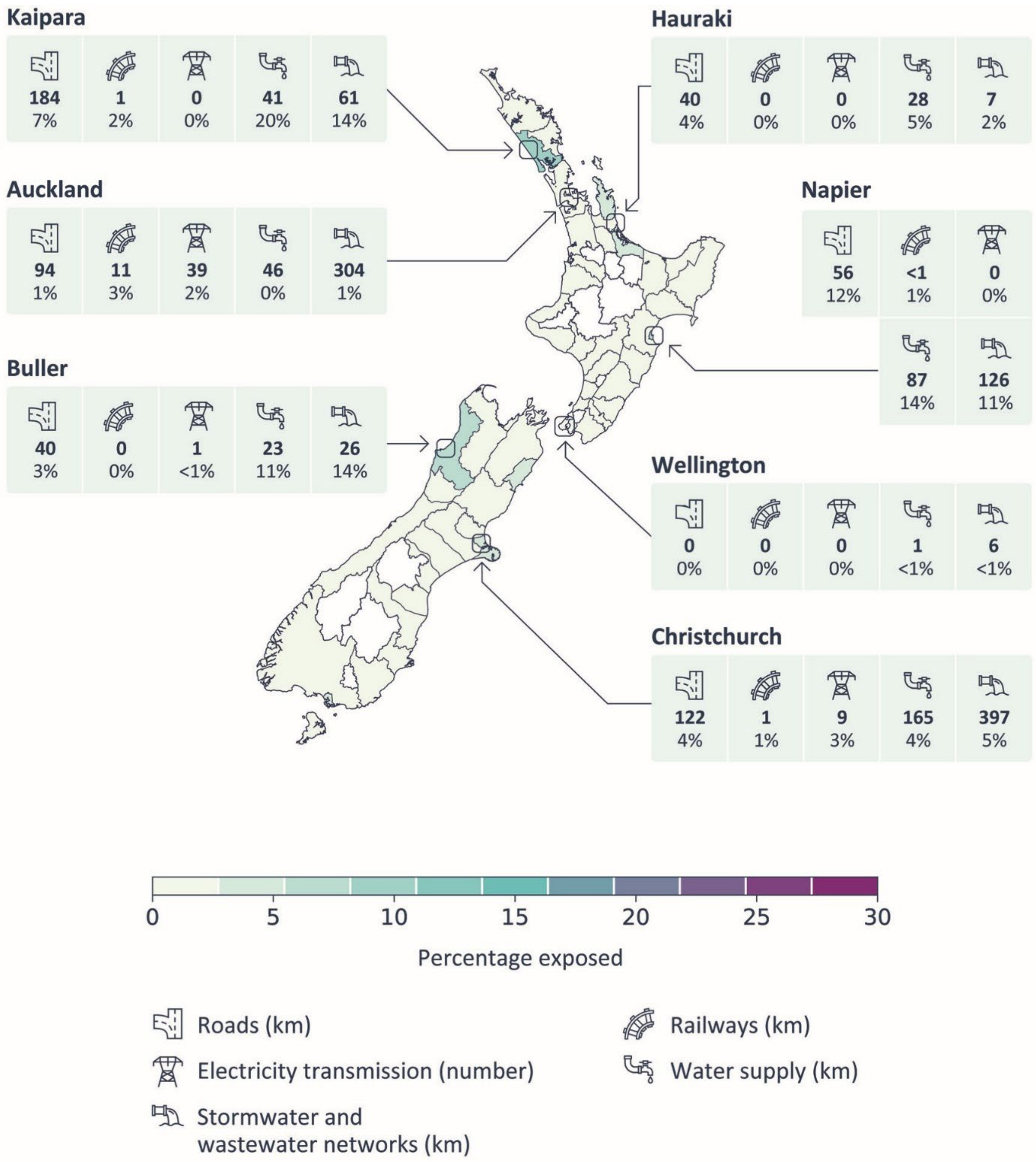
Nationally:

- 0.6% of the population (32,000 people) are currently exposed to coastal flooding. This increases to 1.8% of the population (87,000 people) at 0.5 m of sea-level rise and to 3.3% (163,000 people) at 1.0 m of sea-level rise.
- 0.7% of residential buildings (11,800 buildings) are currently exposed to coastal flooding. This increases to 2.0% of residential buildings (33,000, buildings) at 0.5 m of sea-level rise and to 3.7% (80,000 buildings) at 1.0 m of sea-level rise.
- 26.7% of people currently exposed to coastal flooding live in areas of high socioeconomic deprivation. This rises to 27.5% at 0.5 m of sea-level rise.
- 3.0% of community buildings (666 buildings) and 0.5% of aged-care facilities (37 buildings) are currently exposed to coastal flooding. This increases to 5.6% of community buildings (1,260 buildings) and 0.7% of aged-care facilities (55 buildings) at 0.5 m of sea-level rise, and to 8.4% of community buildings (2,390 buildings) and 2.0% of aged-care facilities (145 buildings) with 1.0 m of sea-level rise.

We explore population exposure and social vulnerability by district in *Chapter 8: Social vulnerability of populations exposed to or isolated by coastal flooding*.

Exposure to coastal flooding: infrastructure

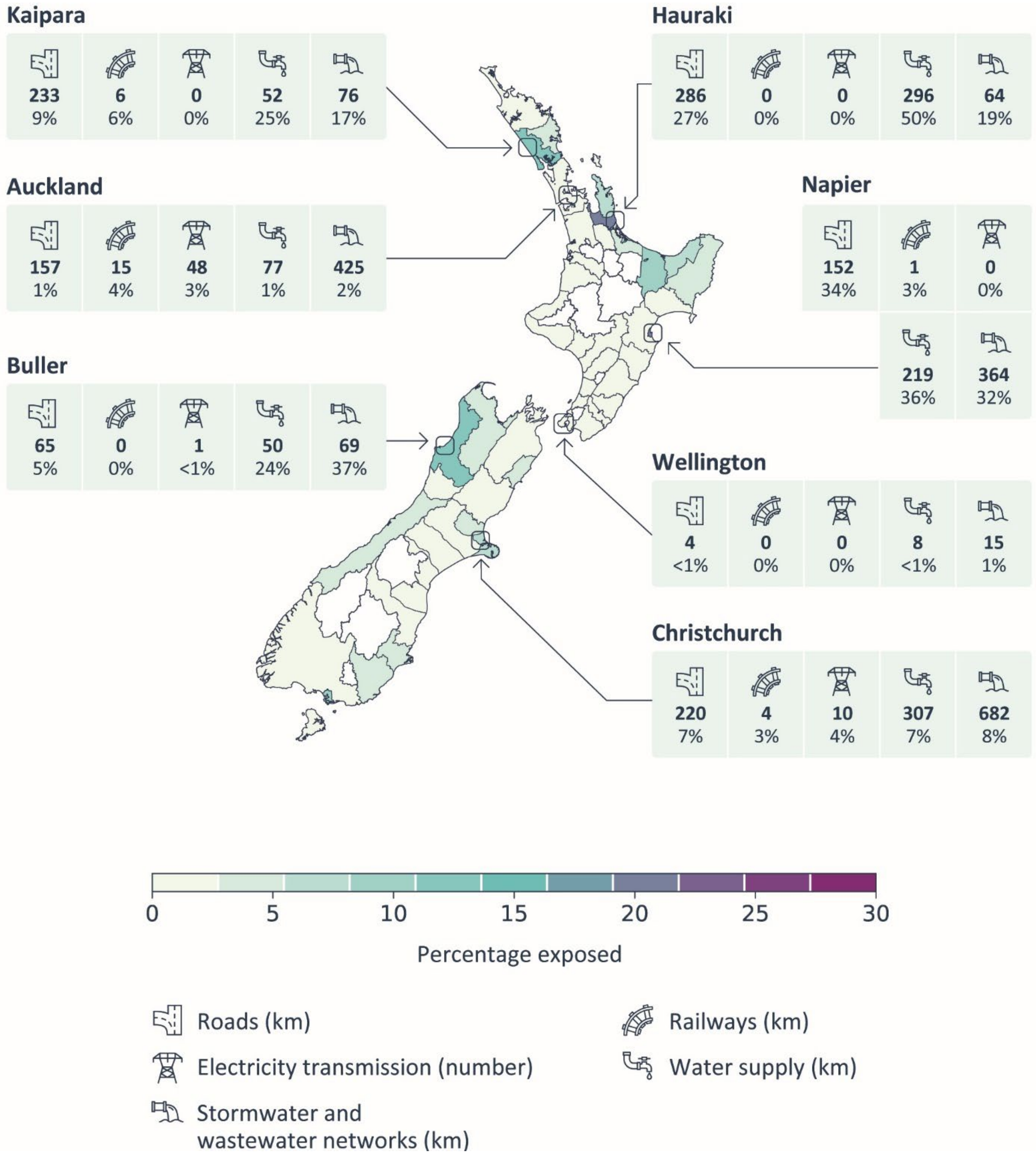
Figure 3.7: Infrastructure exposed to coastal flooding with a 1% annual exceedance probability at current sea level



Source: Commission analysis of Earth Sciences New Zealand. National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the items of critical infrastructure.

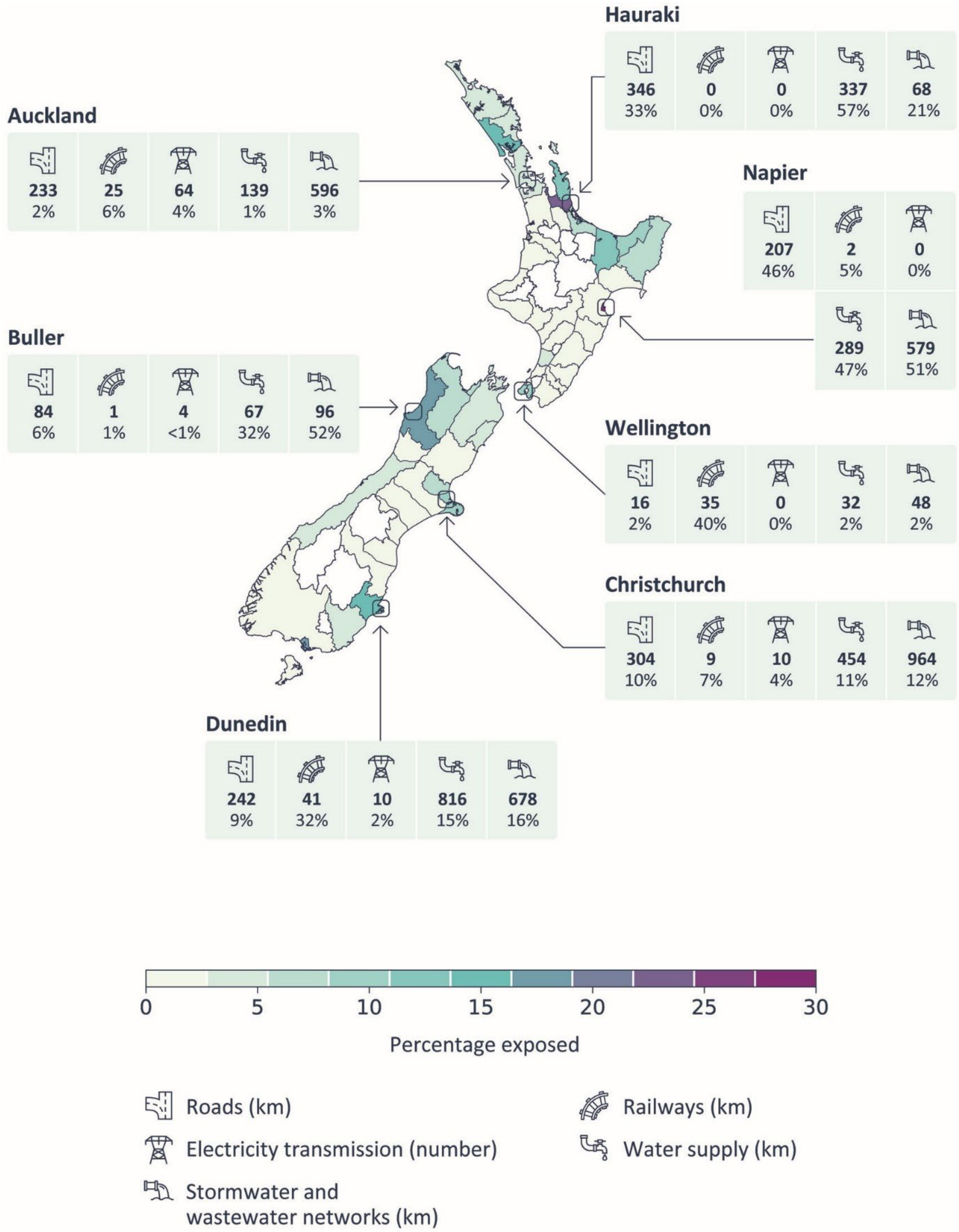
Figure 3.8: Infrastructure exposed to coastal flooding with a 1% annual exceedance probability at 0.5 m of sea-level rise



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

Figure 3.9: Infrastructure exposed to coastal flooding with a 1% annual exceedance probability at 1.0 m of sea-level rise



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

Infrastructure such as roads and water networks shows significant levels of exposure to coastal flooding. Nationally:

- Approximately 1% (1,290 km) of roads are currently exposed to coastal flooding. This increases to 1.9% (2,640 km) with 0.5 m of sea-level rise and 2.6% (3,740 km) with 1.0 m of sea-level rise.
- Some 0.2% (68 pylons) of electricity transmission structures are currently exposed to coastal flooding. This increases to 0.3% (127 pylons) with 0.5 m of sea-level rise and to 0.5% (214 pylons) with 1.0 m of sea-level rise.
- Approximately 2.0% (1,560 km) of wastewater and stormwater pipes are currently exposed to coastal flooding. This increases to 4.1% (3,270 km) with 0.5 m of sea-level rise. And to 6.8% (5,380 km) with 1.0 m of sea-level rise.
- Approximately 1.2% (796 km) of potable water pipelines are currently exposed to coastal flooding. This increases to 3.3% (2,140 km) with 0.5 m of sea-level rise and to 5.3% (3,400 km) with 1.0 m of sea-level rise.

Napier, Hauraki and Thames–Coromandel have high proportions of infrastructure exposed to coastal flooding across all increments of sea-level rise. In these districts, exposure increases significantly between the current and 0.5 m sea-level rise increments.

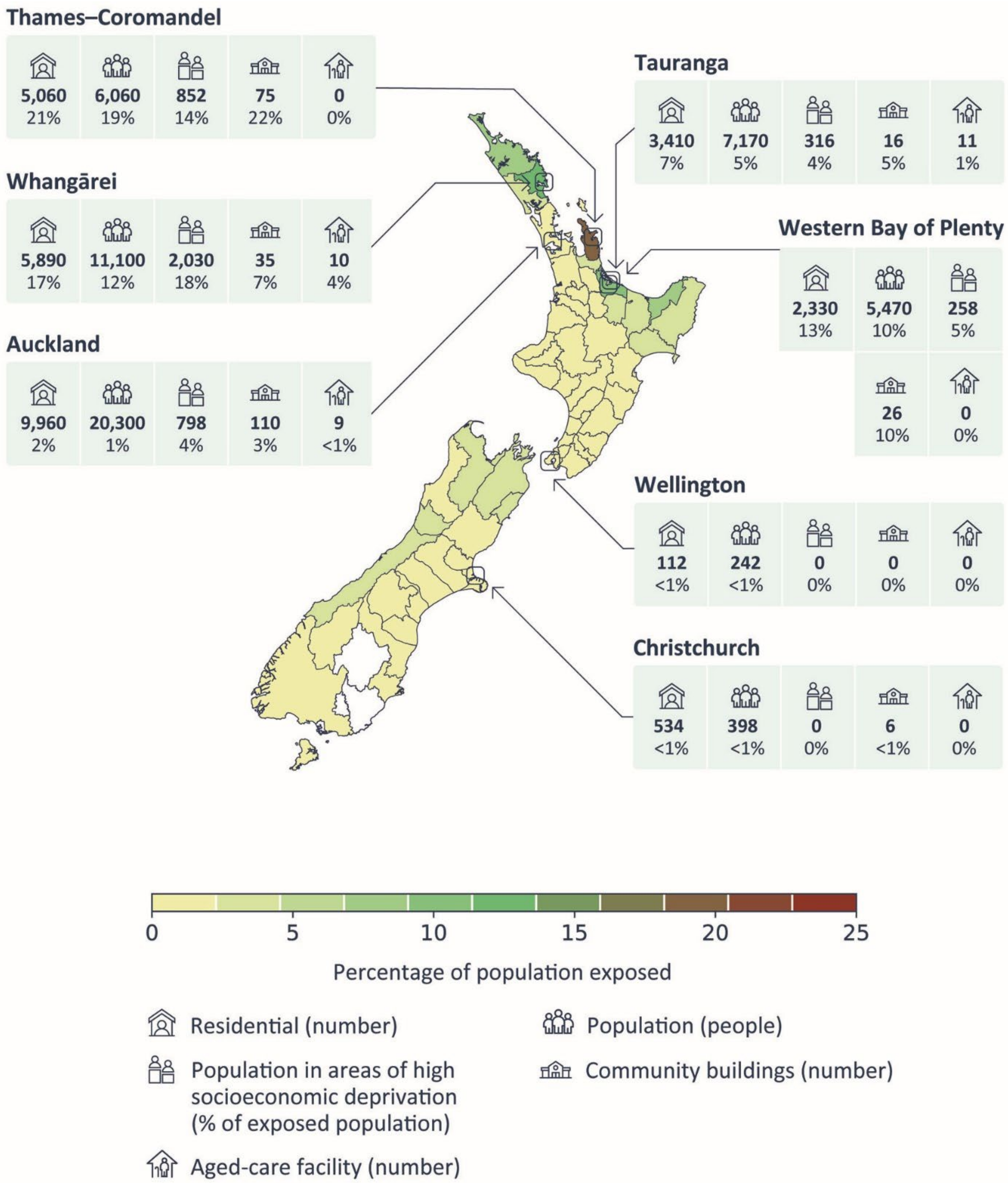
In Napier, 12.4% (56 km) of roads are already exposed to coastal flooding. This increases to 33.9% (152 km) with 0.5 m of sea-level rise and 46.0% (207 km) with 1.0 m of sea-level rise. In Hauraki district, 3.7% (40 km) of roads are currently exposed. This increases to 26.9% (286 km) with 0.5 m of sea-level rise and to 32.6% (346 km) with 1.0 m of sea-level rise.

For waste and stormwater pipelines, in Napier 11.1% (126 km) are currently exposed. This rises to 32.0% (364 km) with 0.5 m of sea-level rise and to 50.9% (579 km) with 1.0 m of sea-level rise. For water supply pipes, 14.3% (87 km) in Napier are currently exposed. This increases to 35.9% (219 km) with 0.5 m of sea-level rise and to 47.4% (289 km) with 1.0 m of sea-level rise. In Hauraki district, 4.7% (28 km) of water-supply pipes are currently exposed. This increases to 49.7% (296 km) with 0.5 m of sea-level rise and to 56.5% (337 km) with 1.0 m of sea-level rise.

Results: Rainfall-induced landslides

Exposure to rainfall-induced landslides: people, homes and buildings

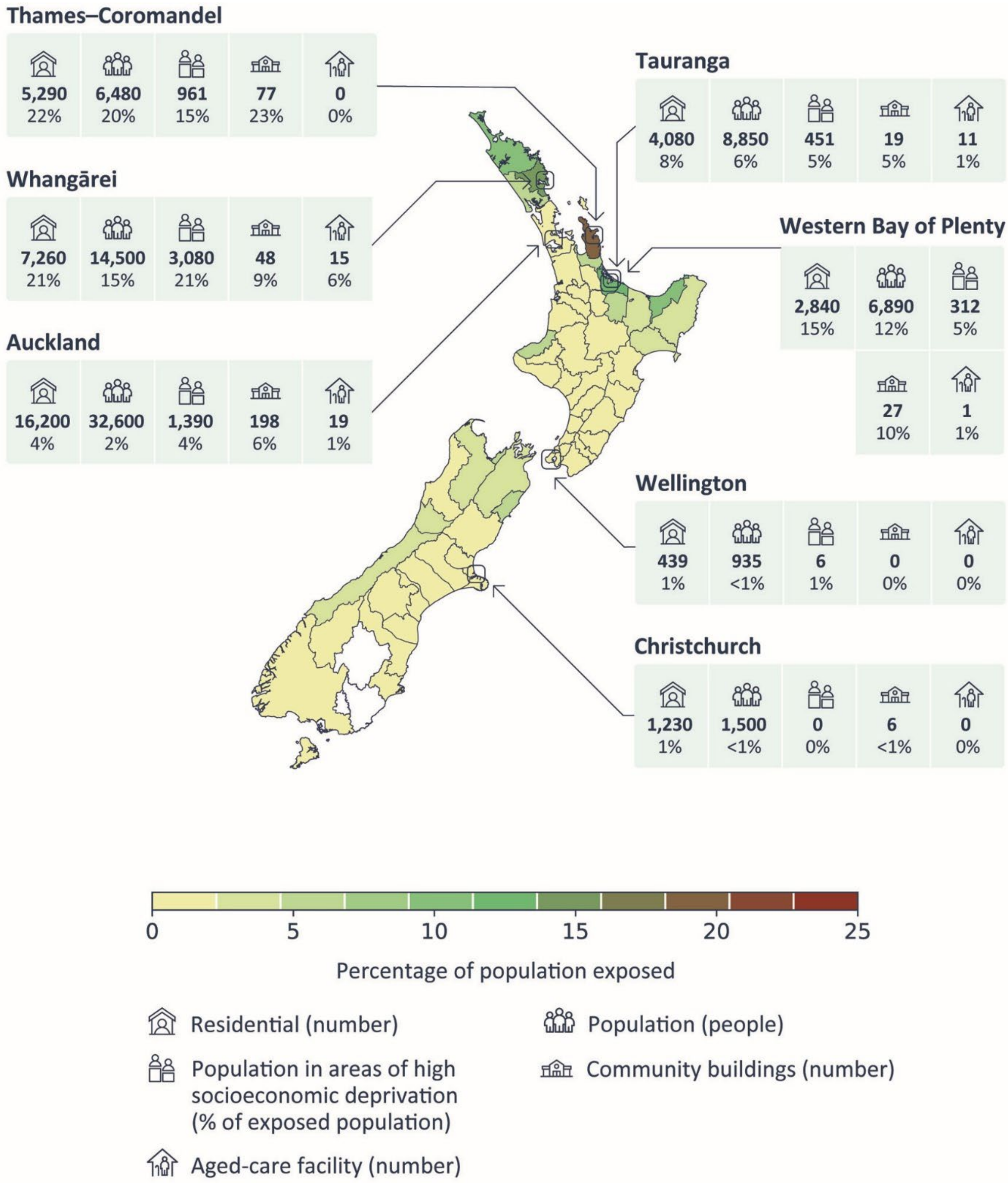
Figure 3.10: People, homes and community buildings exposed to rainfall-induced landslides at 1°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms.

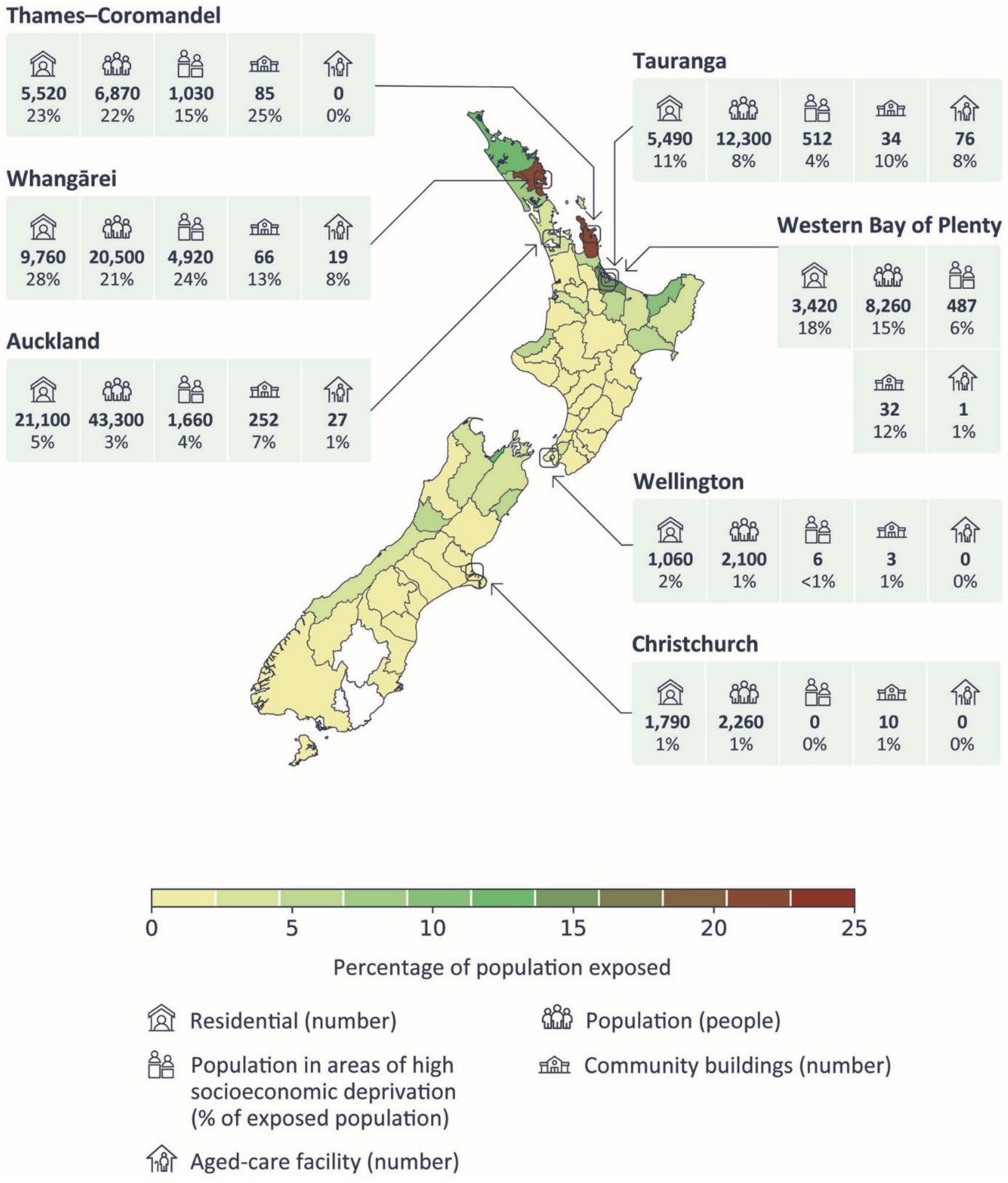
Figure 3.11: People, homes and community buildings exposed to rainfall-induced landslides with 2°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms.

Figure 3.12: People, homes and community buildings exposed to rainfall-induced landslides with 3°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms.

Exposure to rainfall-induced landslides is projected to increase significantly this century due to temperature-driven changes in rainfall patterns. Nationally:

- 2.7% of residential buildings (44,300 buildings) are already exposed at 1°C of warming. This increases to 3.7% of residential buildings (59,700 buildings) at 2°C of warming and to 4.8% (77,700 buildings) with 3°C of warming.
- 1.6% of the population (77,800 people) are exposed to rainfall-induced landslides at 1°C of warming. This increases to 2.2% of the population (109,000 people) at 2°C of warming and to 3.0% (147,000 people) at 3°C of warming.
- 3.4% of community buildings (772 buildings) and 0.5% of aged-care facilities (33 buildings) are already exposed to landslides at 1°C of warming. This rises to 4.3% (976 buildings) for community buildings and 0.7% (55 buildings) for aged-care facilities at 2°C of warming and to 5.5% (1,230 buildings) for community buildings and to 2.0% (148 buildings) for aged-care facilities with 3°C of warming.
- 13% of the national population who are exposed to rainfall-induced landslides live in areas of high socioeconomic deprivation. This is not projected to grow in a warming climate.

Thames–Coromandel, Whangārei and Western Bay of Plenty have the highest proportions of population exposed to rainfall-induced landslides at 1°C of warming (**Table 3.4**). In Thames–Coromandel, 20.2% (6,480 people) of the population is exposed to rainfall-induced landslides at 2°C of warming. None of these districts show disproportionate representation in the number of exposed people living in areas of high socioeconomic deprivation at 1°C. However, at higher increments in Whangārei the share of those exposed and living in areas of high socioeconomic deprivation is greater than 20%, reaching 24% at 3°C of warming.

Auckland, Whangārei and Tauranga have the highest absolute numbers of people exposed to rainfall-induced landslides currently and at 2°C and 3°C of warming (**Table 3.5**).

Table 3.4: Districts with the highest proportion of population exposed to rainfall-induced landslides

Rank	At 1°C of warming	At 2°C of warming	At 3°C of warming
1	Thames–Coromandel (18.9%)	Thames–Coromandel (20.2%) ▶	Thames–Coromandel (21.5%) ▶
2	Whangārei (11.5%)	Whangārei (15.0%) ▶	Whangārei (21.2%) ▶
3	Western Bay of Plenty (9.7%)	Western Bay of Plenty (12.3%) ▶	Western Bay of Plenty (14.7%) ▶

Source: Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Arrows (▲/▼) indicate change in ranking. Right arrow (▶) indicates unchanged ranking.

Table 3.5: Districts with the largest number of people exposed to rainfall-induced landslides

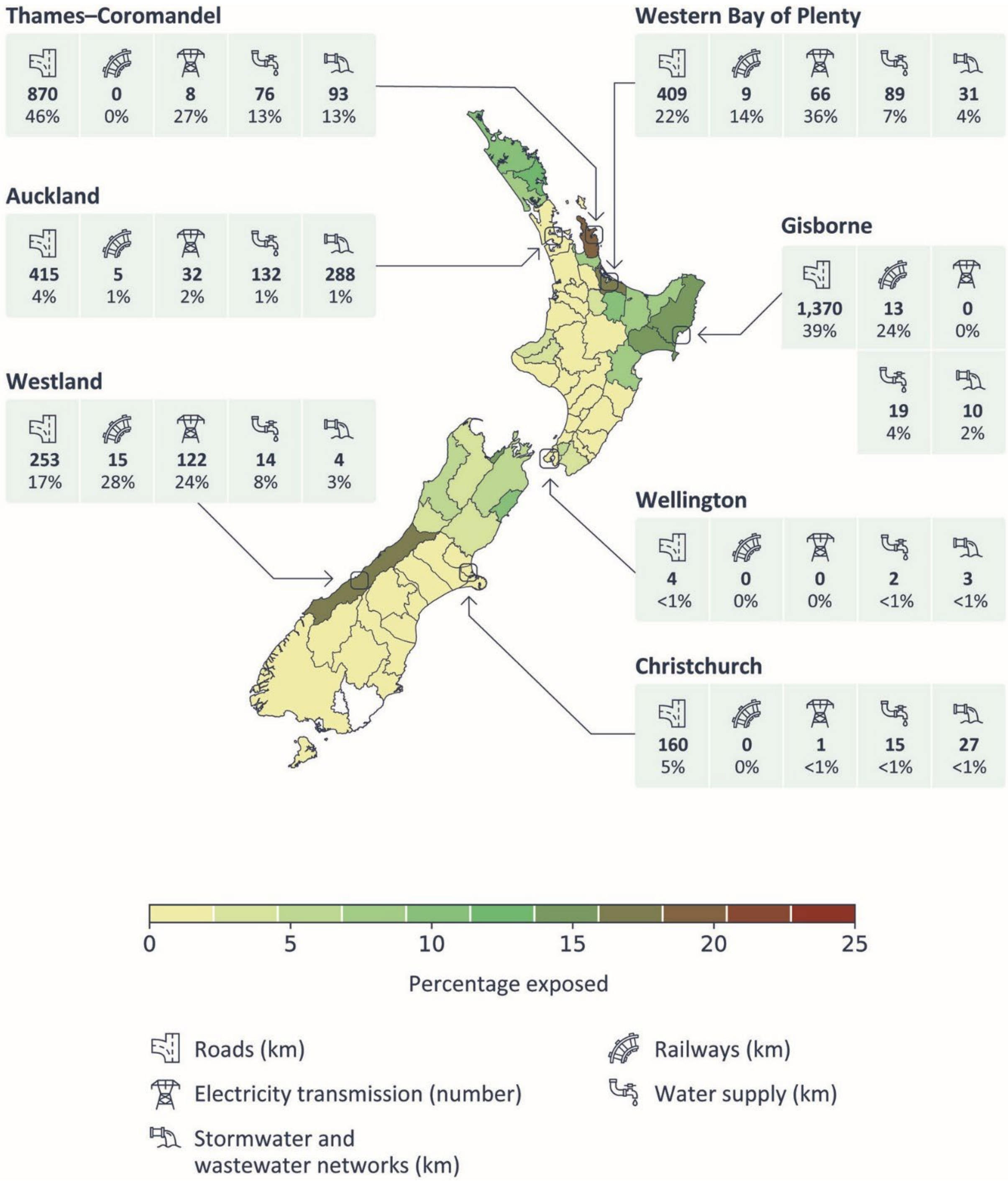
Rank	At 1°C of warming	At 2°C of warming	At 3°C of warming
1	Auckland (20,300)	Auckland (32,600) ▶	Auckland (43,300) ▶
2	Whangārei (11,100)	Whangārei (14,500) ▶	Whangārei (20,500) ▶
3	Tauranga (7,170)	Tauranga (8,850) ▶	Tauranga (12,300) ▶

Source: Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Arrows (▲/▼) indicate change in ranking. Right arrow (▶) indicates unchanged ranking.

Exposure to rainfall-induced landslides: infrastructure

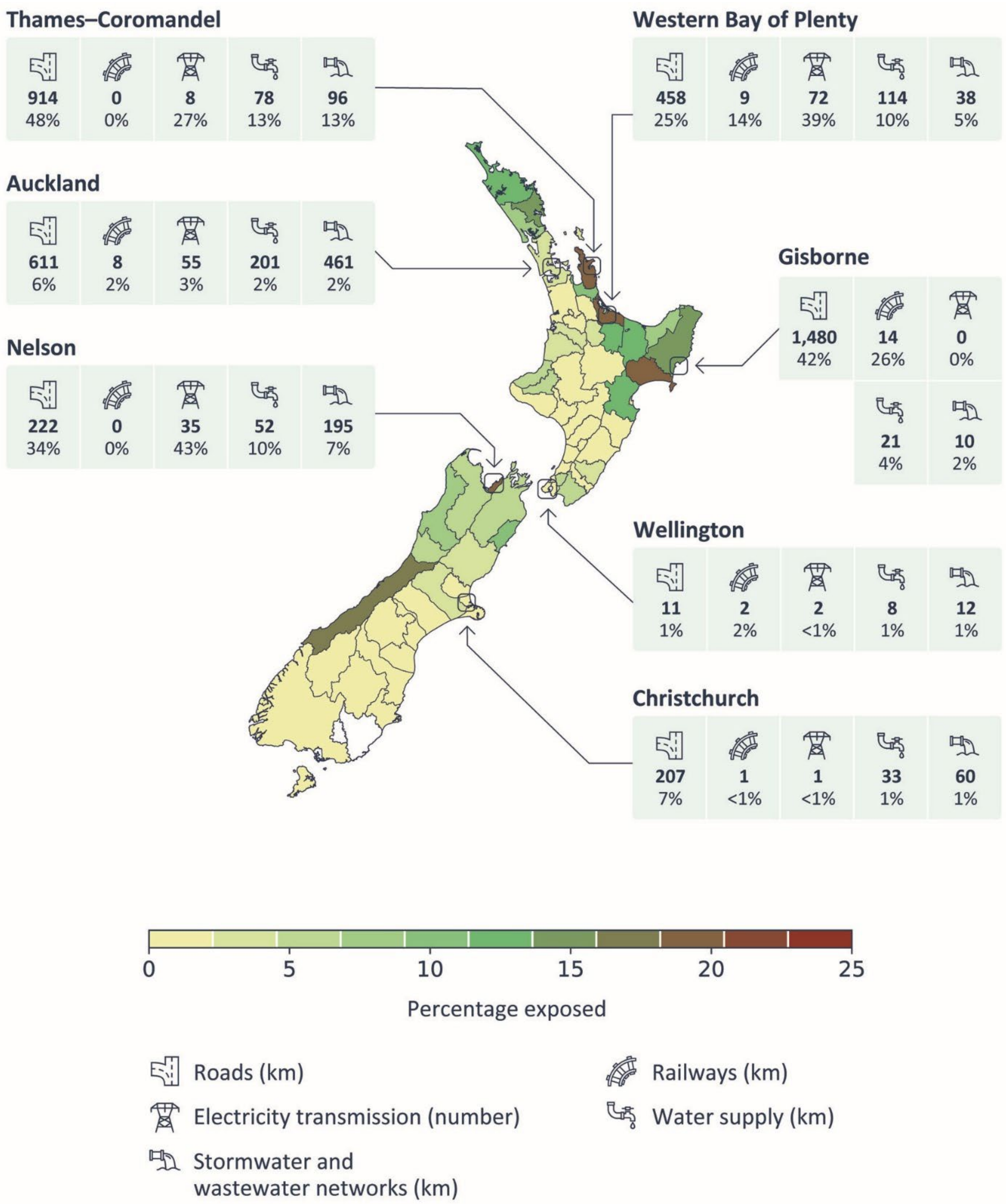
Figure 3.13: Infrastructure exposed to rainfall-induced landslides at 1°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

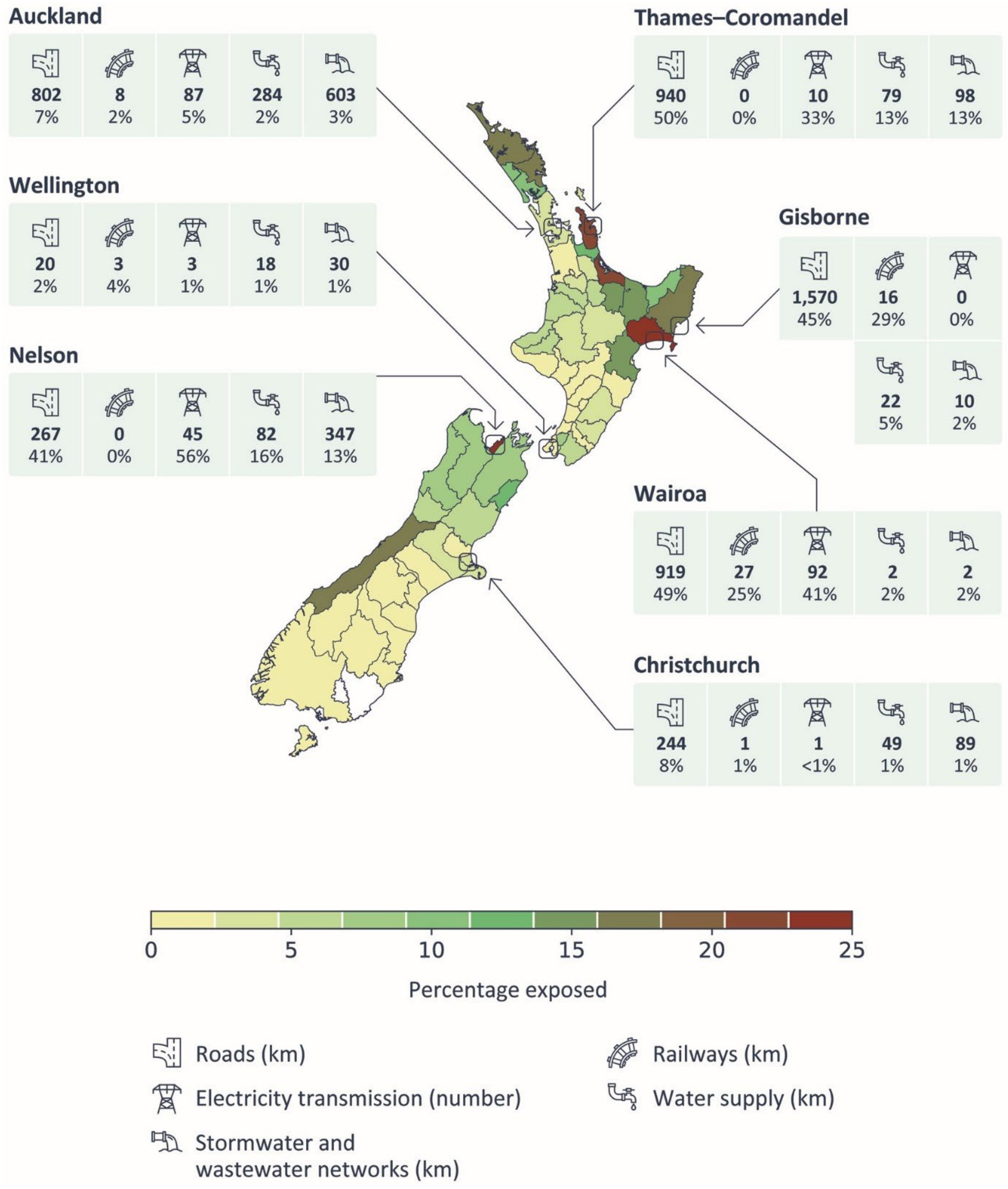
Figure 3.14: Infrastructure exposed to rainfall-induced landslides at 2°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

Figure 3.15: Infrastructure exposed to rainfall-induced landslides at 3°C of warming



Source: Commission analysis of Earth Sciences New Zealand, National Climate Hazard Exposure Census (2026)

Note: The map shows exposure in Auckland, Wellington, Christchurch and the most exposed districts in absolute and percentage terms. Infrastructure exposure is based on average exposure across all of the infrastructure elements shown.

Nelson, Whangārei, Thames–Coromandel and Westland have high shares of infrastructure exposed to landslides. Thames–Coromandel has a high proportion of roads (46%, 869 km) already exposed at 1°C of warming.

In Whangārei, 8.5% (90 km) of water-supply pipeline are exposed to landslides at 1°C of warming, rising to 14.5% (153 km) at 3°C of warming. For electricity pylons, 12.8% (41 pylons) are exposed to landslides across all warming increments.

Some districts are exposed to multiple hazards

Some districts have high exposure across multiple hazards. As Aotearoa New Zealand's largest urban district, Auckland has the largest number of people exposed to both inland flooding and landslides, and the third largest number of people exposed to coastal flooding. Tauranga has the third largest number of people exposed to landslides, the sixth largest number of people exposed to coastal flooding and the eighth largest number of people exposed to inland flooding. Christchurch has the largest number of people exposed to coastal flooding and the second largest population exposed to inland flooding.

Proportionally, Thames–Coromandel district is most exposed to rainfall-induced landslides and the fourth most exposed to coastal flooding. For inland flooding it ranks 17th. Ōpōtiki district is the fourth most exposed to both inland flooding and landslides and ranks 16th for exposure to coastal flooding. For landslides and coastal flooding, 70% of the exposed population in Ōpōtiki live in areas of high socioeconomic deprivation.

There are similar patterns of exposure for infrastructure. For example, the extent of the infrastructure exposed in Auckland is consistently high across infrastructure types. Auckland has the most roads exposed to inland flooding, the third most roads exposed to coastal flooding and the 10th most roads exposed to landslides.

Updates and improvements since our 2024 progress assessment

The exposure metric in the Commission's 2024 progress assessment focused on the exposure of people, infrastructure and assets to coastal flooding and landslides.

This metric adds to that analysis by:

- assessing exposure to inland flooding
- assessing exposure to landslides, by accounting for rainfall-driven changes
- incorporating new infrastructure elements, including water networks (potable, storm and waste).

There are some methodological differences which mean exposure for some elements is not comparable across the two analyses. The key difference is that the new Earth Sciences New Zealand analysis assesses exposure at the building level, whereas the 2024 analysis (carried out by Urban Intelligence[5]) assessed it at the property level.

Gaps and limitations

- The exposure information we have highlighted in this section is high level and highlights some of the most exposed areas which need urgent interventions.
- While this analysis quantifies exposure to climate-related hazards, it does not assess vulnerability (that is, the potential damage to people, buildings or infrastructure) of what is exposed. For example, a building may be exposed to flooding but built in a way that is likely to sustain little damage from a flood. The metric therefore doesn't give a full picture of risk and how the exposed elements are likely to withstand climate hazards.
- The extent of people, homes and infrastructure assessed for exposure is based on current population, number of buildings and amount of infrastructure. We have not considered future changes to these elements in this analysis.
- The use of different baseline periods for each climate-related hazard creates inconsistencies when comparing exposure:
  - For inland flooding and rainfall-induced landslides, the baseline period is 1986–2005, centred on 1995. This baseline period is already approximately 1°C warmer than pre-industrial conditions. For clarity and consistency with international norms, we have chosen to express the baseline centred on 1995 as 1°C pre-industrial.
- Where exposure is driven by heavy rainfall (such as for inland flooding and landslides), results are shown using the multi-model mean. Individual climate models project different levels of increase in heavy rainfall. Averaging across models provides a central picture that highlights overall directions and patterns of change; individual climate models can give a wider range of results. Detailed risk assessment and adaptation planning should consider a broad range of outcomes from modelling results to make informed decisions.
- Due to the methodological differences described above we were not able to repeat our 2024 analysis in a consistent way. This means it is difficult to compare the changes in exposure from 2024 to now. We were also not able to include exposure of hospitals, schools and fire stations, which we hope to include in future.

Chapter 4: Measure of extreme heat

In this metric we consider how frequently Aotearoa New Zealand will experience extreme hot days under different climate scenarios.

Exposure to extreme heat can affect the health and wellbeing of people, communities and ecosystems. Extreme heat can also create risks to key infrastructure, industries and sectors of the economy. For example, extreme heat can cause buildings to overheat or railway tracks to buckle.

This is a new measure, in which we compare the number of extreme hot days that are projected to occur at a location and day under different climate scenarios. People and ecosystems can experience negative effects even with modest increases in temperature relative to what they are used to.[6,7] For that reason, this metric defines extreme heat by comparing with past temperatures for a given location and time of year.

Measuring the number of extreme hot days can provide insight into the climate-related risks and adaptation requirements for any particular location. It also allows comparisons between locations and across time, to aid understanding of the speed at which change is occurring.

Exposure to extreme heat is likely to substantially increase in Aotearoa New Zealand this century, irrespective of the climate impact scenario we follow.

Box 4.1: Key results

- The number of extreme hot days is expected to increase significantly in future for all climate impact scenarios (low, medium and high). More specifically:
  - during the 2020–2040 period, extreme hot days are projected to occur on 4–6% of days across most of the North Island and 3–5% of days for most of the South Island
  - during the 2040–2060 period, extreme hot days are projected to occur on 6–11% of days for much of the North Island and up to 14% in some parts. In the South Island extreme hot days are projected for 4–9% of days.

What this measures

This metric was developed for the Commission by Dr Luke Harrington and Dr Hamish Lewis. It is a percentile-based metric of extreme heat, focused on expected percentage of days that exceed the current 98th temperature percentile. A day that exceeds this percentile (that is, it is among the hottest 2% of days) for a particular location is considered an ‘extreme hot day’.

The 98th percentile is quantified using a 15-day rolling window centred on a ‘day of interest’.

Once this threshold is established for each calendar day of interest, the number of days exceeding that baseline threshold of extreme heat are counted. The total number of days that exceed the threshold is referred to (in units of % of days) as TX98p. This 98th percentile value is a day-, location- and season-specific threshold.

Model simulations spanning 1985–2014 established a historical baseline period. Projected changes are examined across a 2015–2099 future period under three climate scenarios – SSP1–2.6 (low climate impact scenario), SSP2–4.5 (mid-range climate impact scenario) and SSP3–7.0 (high climate impact scenario).[ix] While other metrics in this report refer to exposure at different levels of global warming (1°C, 2°C and 3°C above pre-industrial levels) the downscaled projections for this metric were not available for temperature increments.

For this metric, our analysis presents results for three periods: 2020–2040, 2040–2060 and 2080–2100. The midpoints of these periods are 2030, 2050 and 2090.

Understanding changes in extreme heat using the 98th percentile threshold allows us to focus on the types of extreme heat that have the biggest impact. The biggest impacts are associated with temperatures that occur less often in a particular location.

Our projections are based on a multi-model mean

The projections for this metric are based on an average of six different climate models (known as a multi-model mean). Averaging across models provides a central picture that highlights overall directions and patterns of change.

Using the multi-model mean masks the full range of outcomes shown by individual models. Future work could explore and contextualise the different modelled outcomes. Detailed risk assessment and adaptation planning should consider a broad range of outcomes from modelling results to make informed decisions. However, for simplicity of communication, the results here are only for the multi-model mean.

The definition of extreme heat we are using, which is based on the 98th percentile, is specific to each model's reference period. This percentile-based methodology will typically lead to less difference between models than if an absolute threshold is used, such as days above 25°C.

More information about this metric

For more information about this metric and the methodology used, see *Future projections of extreme heat across Aotearoa New Zealand,* published separately on our website.[8]

[ix] For more information on the Intergovernmental Panel on Climate Change's climate scenarios, see its Sixth Assessment Report (available at https://www.ipcc.ch/assessment-report/ar6/) or Chapter 2 of *Priorities for action: National Climate Change Risk Assessment for Aotearoa New Zealand* (2026), which is available on our website.

Results

The extent of exposure to extreme heat depends on how the climate changes in the future. The findings below discuss how extreme heat may change under a range of future climate scenarios.

Even over the near term (2020–2040 time period) and under a low climate impact scenario, our analysis indicates there will be a significant increase in the number of extreme hot days.

Table 4.1 shows examples of the thresholds for extreme heat across the country, and how 'extreme' heat differs from place to place depending on historical daily temperatures.

Table 4.1: Examples of threshold temperatures for different seasons and selected locations [x]

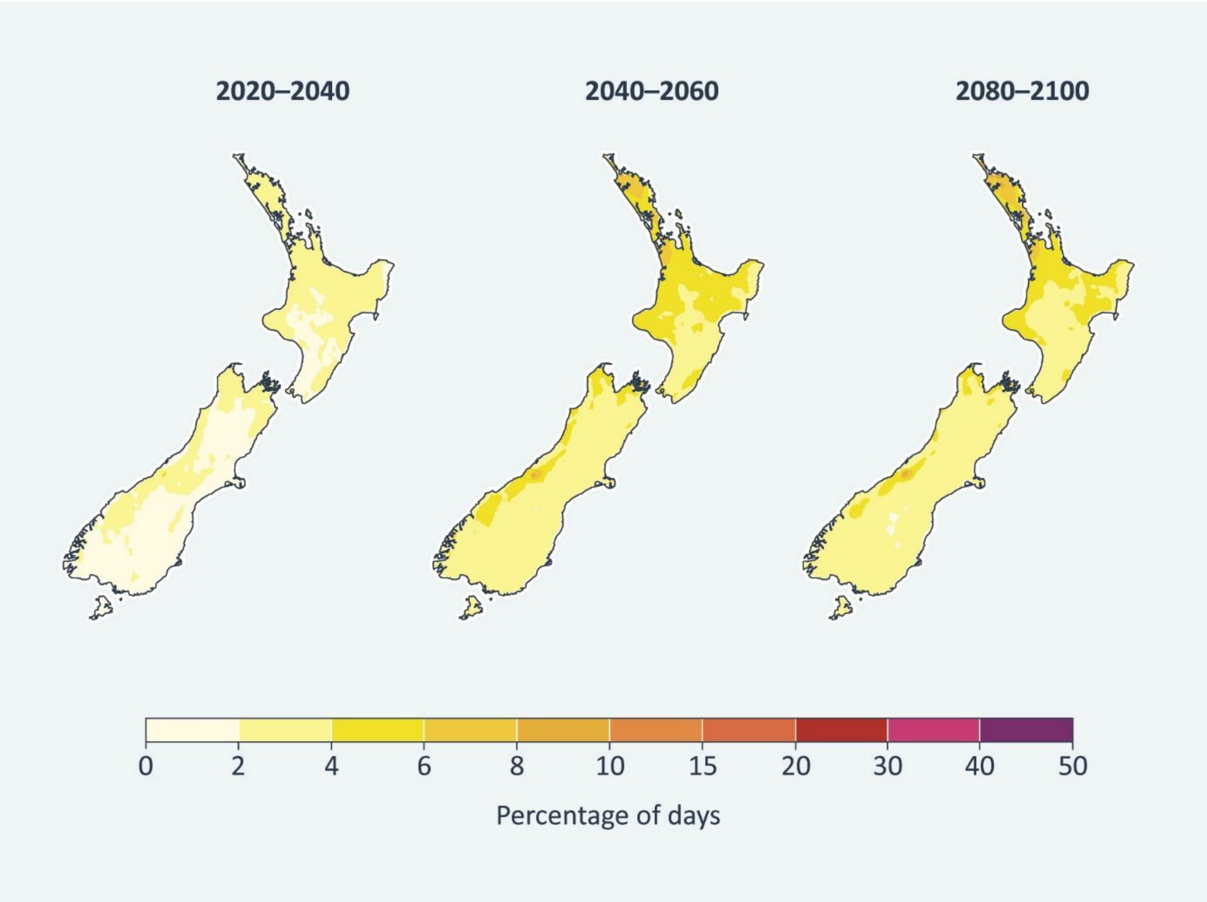
	Summer (January 15)	Autumn (April 15)	Winter (July 15)	Spring (October 15)
Whangārei	27.5°C	23.1°C	17.7°C	22.2°C
Hamilton	28.9°C	23.9°C	17.4°C	22.2°C
Gisborne	31.4°C	25.1°C	18.5°C	25.3°C
Christchurch	32.8°C	25.0°C	17.1°C	24.8°C
Gore	27.4°C	21.3°C	13.7°C	21.1°C

Source: Harrington and Lewis, *Future projections of extreme heat in New Zealand* (2026)

[x] The thresholds presented in this table are the multi-model mean. Each model will establish its own threshold based on the distribution of temperatures within its reference period. These are for illustration purposes only.

Results: low climate impact scenario

Figure 4.1: Annual percentage of extreme hot days in a low climate impact scenario across three time periods



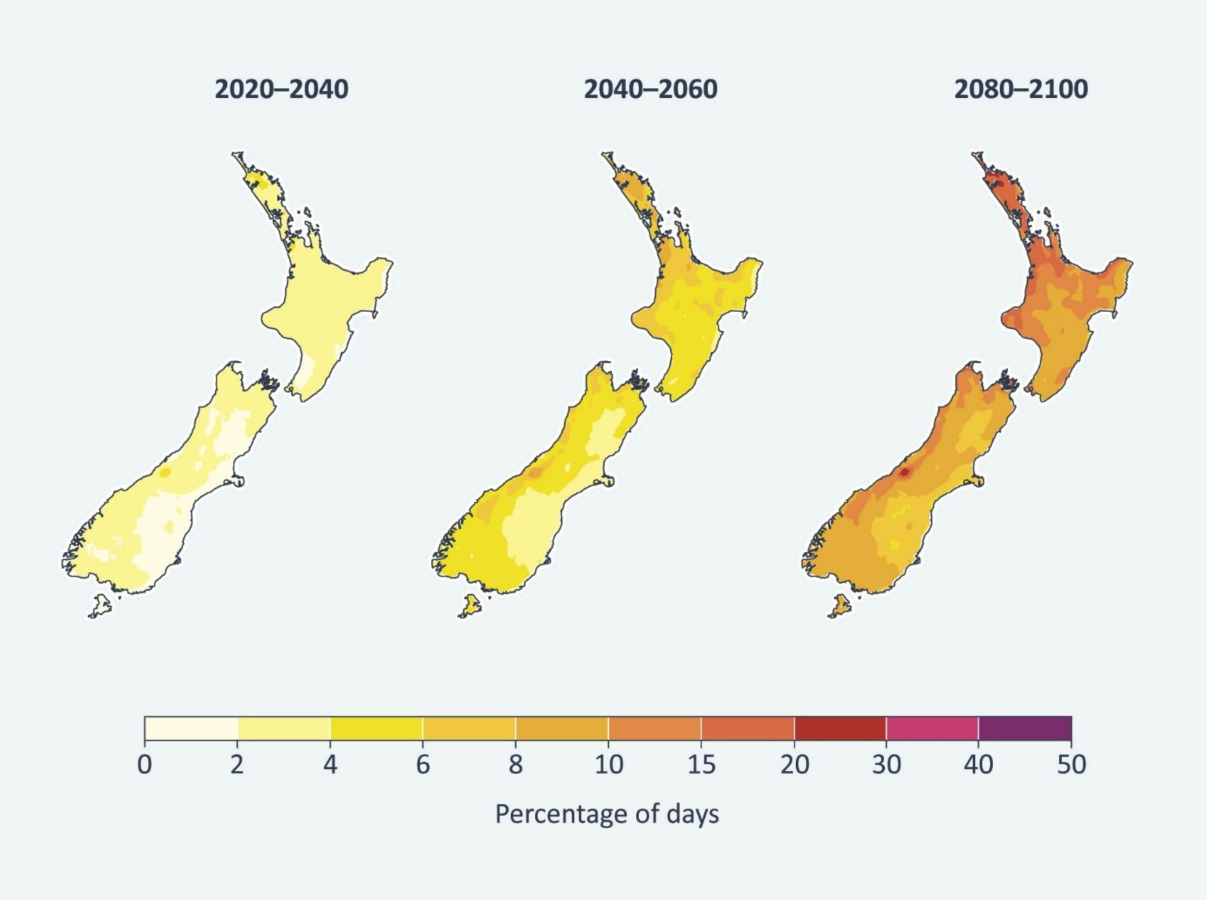
Source: Harrington and Lewis, *Future projections of extreme heat in New Zealand* (2026)

For most of the North Island, temperatures that occurred on 2% of days during 1985–2014 are expected to occur on 4–5% of days in the 2030 period. For most of the South Island, temperatures that occurred on 2% of days in 1985–2014 are projected to occur on 3–4% of days in the 2020–2040 period, and on 4–5% of days in some northern South Island districts.

The risk of extreme temperatures rises over the 2040–2060 time period. In the north of the North Island, extreme hot days are expected to occur on 6–10% of days. For the rest of the country extreme hot days are expected to occur on 4–6% of days, more frequently in some northern and western districts.

Results: mid-range climate impact scenario

Figure 4.2: Annual percentage of extreme hot days in a mid-range climate impact scenario across three time periods



Source: Harrington and Lewis, *Future projections of extreme heat in New Zealand* (2026)

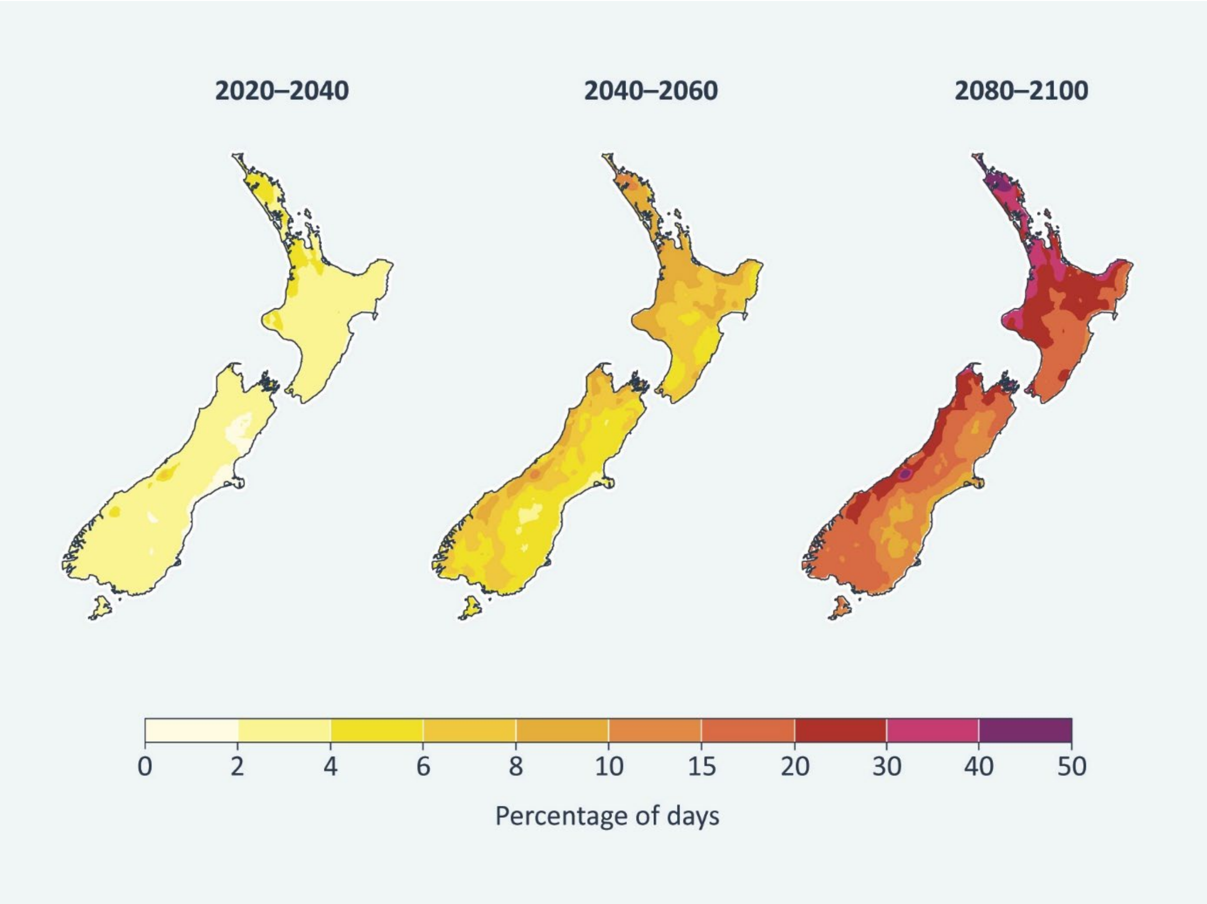
Given the faster and continuous rate of warming that occurs under the SSP2–4.5 scenario, by the 2040–2060 period the risk of extreme hot days exceeds all of those reached under the SSP1–2.6 scenario.

By the 2060–2080 period, extreme heat is projected to occur on 15–20% of days across the upper North Island and 10–16% of days for the lower North Island and western parts of the South Island. For the rest of the South Island, extreme hot days are projected to occur on 7–11% of days.

By the end of century (2080–2100 time period), extreme hot days are projected to occur on over 24% of days in the upper North Island. For the rest of the North Island, extreme hot days are projected to occur on 15–24% of days.

Results: high climate impact scenario

Figure 4.3: Annual percentage of extreme hot days in a high climate impact scenario across three time periods



Source: Harrington and Lewis, *Future projections of extreme heat in New Zealand* (2026)

By the 2060–2080 period under a high climate impact scenario, extreme heat is projected for 20–30% of days across the upper North Island, and nearly 30% of days in the Far North.

This increases to 40–60% of days in the upper North Island in the 2080–2100 time period and 24–40% of days for the rest of the North Island and western South Island.

Gaps and limitations

- This metric is one measure of extreme heat. Further work is needed to develop sector-specific measures of extreme heat – for example, a metric looking at the physiological effects of heat stress for pastoral agriculture.
- Use of the multi-model mean provides a central picture that highlights overall directions and patterns of change; individual climate models can give a wider range of results. Our analysis could be further refined by looking at these extreme heat projections for individual models or groups of models.
- This metric only considers temperature. High humidity can intensify the effects of extreme heat. However, there is no agreed upon method for measuring heat stress – which includes humidity – in Aotearoa New Zealand.
- This metric only considers extreme heat hazards. Further work is needed to understand population exposure to extreme heat, as well as heat-specific vulnerability.

Chapter 5: Isolation due to coastal flooding: population and marae

In this metric we consider the number of people who may become isolated due to coastal flooding. We also consider isolation of marae.

'Isolation' refers to being cut off from important services like emergency services, supermarkets, education, work, and cultural sites of significance (such as marae) if transport networks are damaged. Isolation can be highly disruptive to communities, and place significant burdens on affected people and households.

Isolation of people

In some parts of Aotearoa New Zealand, people who live inland rely on coastal transport networks. In those places, transport networks are more exposed to coastal flooding events than the communities they serve, and people could become isolated years or decades before their home themselves are exposed.

Understanding where, when and to what extent people and their homes might lose access to essential services can help highlight critical vulnerabilities in the transport network. It can also be a useful indication of potential for disruption to other infrastructure which is often co-located with roadways – such as electricity, water and internet.

Isolation of marae

Understanding the extent to which marae could become isolated during a flood is also important because damage to access roads can prevent people from coming together for cultural and other events. It is also an indication of potential damage to surrounding sites of significance, such as urupā and mahinga kai. Marae play critical roles as emergency hubs and in providing support to local communities during extreme events.

Box 5.1: Key results

- Under current conditions, about 142,000 people (2.9%) nationally could become isolated by coastal flooding. With 0.2 m of sea-level rise this increases to 183,000 (3.7%) and with 0.5 m of sea-level rise to 238,000 people (4.8%).
- Under current conditions, 100 marae (9.4%) could become isolated by coastal flooding. That rises to 116 marae (10.9%) at 0.2 m of sea-level rise and 142 marae (13.4%) at 0.5 m of sea-level rise.
- Risk of isolation varies significantly between districts. Half of people in Thames–Coromandel district could become isolated by coastal flooding with current sea-levels. This rises to 65.4% with 0.2 m of sea-level rise and to 77.8% with 0.5 m of sea-level rise.

What this measures

This metric estimates the number of people (based on where they live) and marae that could become isolated due to a 1% annual exceedance probability coastal flood under current conditions and for future increments of sea-level rise.

People are considered isolated if – because of coastal flooding – they have no accessible driving route from their homes to essential destinations like schools, hospitals and fire stations. These facilities serve as proxies for broader access to essential services. Loss of access to these destinations also gives an indication that they are likely cut off from other services such as supermarkets and doctors.

Similarly, marae are considered isolated if flooding cuts off road access between them and other essential destinations. This loss of access not only means they are cut off from services, it also means they are likely to be inaccessible to the communities they serve.

This metric captures accessibility impacts beyond direct inundation.

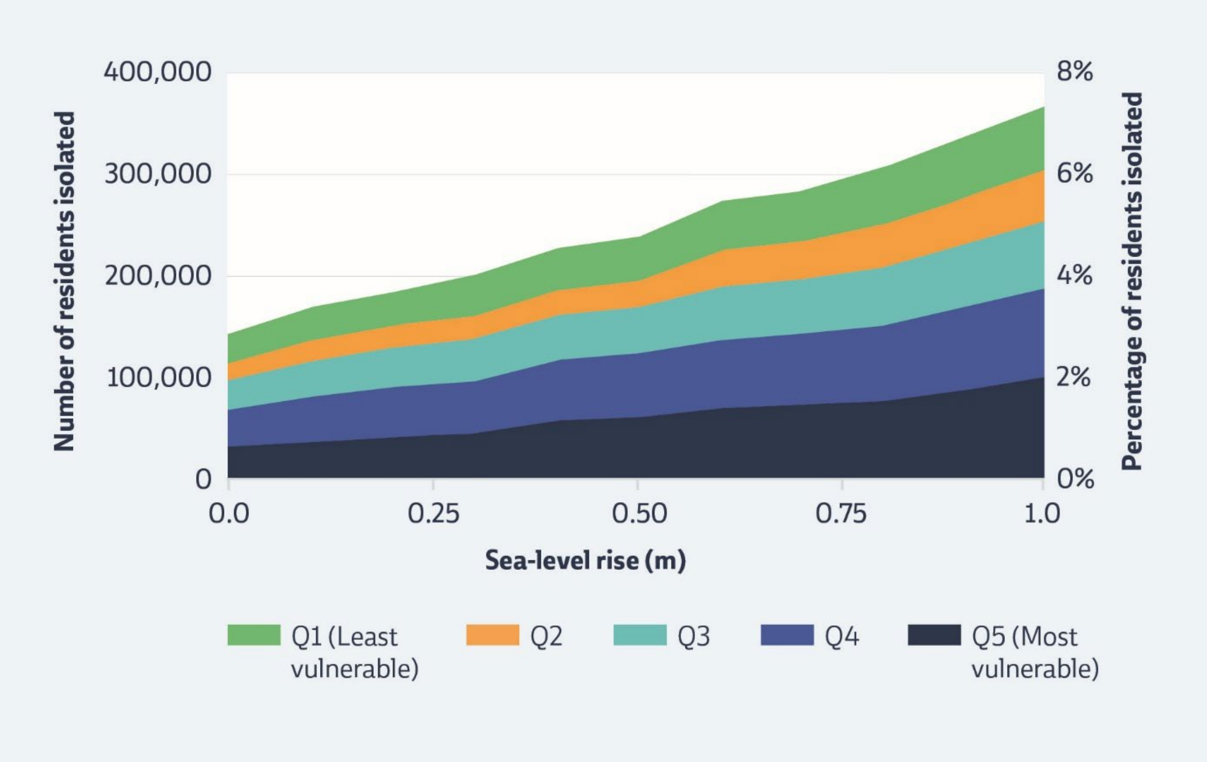
Information for this metric was drawn from two sources. To measure exposure to and isolation of population arising from coastal flooding, we used information from Urban Intelligence's *Social Vulnerability Assessment* (2026),[9] and *National Infrastructure Exposure and Property Isolation Assessment* (2024).[5]

Results

Population who could become isolated

Currently, at 0.0 m of sea-level rise, more than 142,200 New Zealanders (approximately 2.9% of the population) could become isolated by a 1% annual exceedance probability coastal flooding event. This number increases with sea-level rise. More than 183,000 (3.7% of the population) could become isolated at 0.2 m of sea-level rise, increasing to 238,000 (4.8%) at 0.5 m and 368,000 (7.4%) at 1.0 m of sea-level rise. As **Figure 5.1** shows, the number of people who could become isolated is significantly greater than the number directly exposed. This is because some inland communities rely on coastal roads.

Figure 5.1: Population exposed to or potentially isolated by coastal flooding



Source: Urban Intelligence, *Social Vulnerability Assessment* (2026)

Thames–Coromandel is the most affected district across all increments of sea-level rise. Just under half (49.0%) of the district's population could become isolated by coastal flooding (15,600 people) under current conditions. This rises to 65.4% (20,900 people) with 0.2 m of sea-level rise and to 77.9% (24,800) at 0.5 m of sea-level rise. Kaipara district has the next highest percentage, with 25.5% (6,600 people) who could become isolated under current conditions, followed by Buller district with 18.3% (1,900 people) and Napier City 19.1% (12,200 people). At future increments of sea-level rise, these same districts continue to have the highest shares of population who could become isolated (**Table 5.1**).

Table 5.1: Districts with the highest proportion of population who could become isolated by coastal flooding

Rank	0.0 m sea-level rise	0.2 m sea-level rise	0.5 m sea-level rise
1	Thames–Coromandel (49.0%)	Thames–Coromandel (65.4%)	Thames–Coromandel (77.9%)
2	Kaipara (25.5%)	Kaipara (25.7%)	Napier (41.1%)
3	Napier (19.1%)	Buller (25.0%)	Buller (34.5%)

Source: Urban Intelligence, *Social Vulnerability Assessment* (2026)

Thames–Coromandel and Napier are still among the highest ranked districts for total population who could become isolated by coastal flooding. However, Auckland and Christchurch are the top two with the greatest absolute number of people who could become isolated (**Table 5.2**).

Table 5.2: Districts with the highest total populations who could become isolated by coastal flooding

Rank	0.0 m sea-level rise	0.2 m sea-level rise	0.5 m sea-level rise
1	Auckland (27,600)	Auckland (29,400)	Auckland (40,600)
2	Christchurch (20,300)	Christchurch (23,800)	Christchurch (34,000)
3	Thames–Coromandel (15,600)	Thames–Coromandel (20,900)	Napier (26,400)

Source: Urban Intelligence, *Social Vulnerability Assessment* (2026)

Marae that could become isolated

We have used analysis undertaken for our 2024 progress assessment to show marae which could become isolated by coastal flooding. This is due to limited updates and improvements to the data used to undertake this recent analysis.

Nationwide, 116 marae (11% of all marae) could become isolated by a 1% annual exceedance probability coastal flooding event with 0.2 m of sea-level rise. The total number of marae that could become isolated increases to 142 marae (13%) with 0.5 m of sea-level rise and 170 marae (16%) with 1.0 m of sea-level rise.

The Far North district has the greatest number of marae (31, or 22%) that could become isolated under current conditions. With 0.2 m of sea-level rise this increases to 34 marae

(24%). At 1.0 m of sea-level rise it increases to 45 marae (31%). Western Bay of Plenty has the highest percentage of marae (35%, or nine marae) that could become isolated under present conditions. This increases to 42% (11 marae) with 1.0 m of sea-level rise.

Updates and improvements since our 2024 progress assessment

Isolation of people

Methodological improvements from our 2024 progress assessment mean that the updated analysis presents a more accurate picture of population distribution. The updated approach identifies and excludes non-residential properties. However, the updates also mean that the population numbers are not comparable to our 2024 progress assessment.

Thames–Coromandel remains the most affected district across all increments of sea-level rise. Half of its usually resident population could become isolated at current sea levels. This rises to 65% with 0.2 m of sea-level rise. Compared with our 2024 progress assessment, this is a significant increase in the estimated population who could become isolated, but the difference is driven by methodological improvements.

Isolation of marae

With respect to isolation of marae, between our 2024 progress assessment and this report there have been no improvements to the method for identifying marae that could become isolated by coastal flooding. Likewise, there have been no changes to the coastal flooding data that would change the results we presented in our 2024 progress assessment. For these reasons we have used the 2024 results for this report.

Gaps and limitations

- Due to time and resource constraints, this analysis of isolation is limited to coastal flooding. It would be valuable to extend this analysis to also cover other climate-related hazards, including inland flooding and rainfall-induced landslides.
- This metric is based on current population and numbers of marae, and does not consider future changes in population growth or distribution.
- This analysis does not reflect information about vulnerability for roading infrastructure including bridges. For example, roads or bridges might be exposed, but may be sufficiently robust to withstand that level of exposure. Getting that information would improve understanding of isolation risk.
- This metric considers access to hospitals, schools and fire stations, but doesn't consider how practical that access is. In some places, even when road access is available via alternative routes, hazards could effectively cut off services because increased travel times and fuel costs become untenable.

Chapter 6: Isolation due to coastal flooding: businesses

In this metric we consider the locations and numbers of businesses that may become isolated during coastal flooding events.

In this metric we count the number of businesses in each district that could become isolated due to coastal flooding, both in current conditions and for future increments of sea-level rise. We also consider which business sectors are affected.

This is a new metric, in which we seek to extend our understanding of isolation risks from coastal flooding.

Isolation can partially or fully disrupt business activity, and cause flow-on effects for communities and the country as a whole. These can include loss of income, reduced access to goods and services, and disruptions to longer-term business viability.

At a national level, this analysis contributes to the evidence base on the economic dimensions of coastal flooding hazards. The analysis also provides a basis for more specific local or sector-led risk assessments to inform adaptation planning.

Box 6.1: Key results

- Currently, more than 15,500 businesses (3.2% of all businesses in Aotearoa New Zealand) could become isolated by coastal flooding. This number increases to 22,500 businesses (4.6%) with 0.2 m of sea-level rise and 28,900 (5.9%) at 0.5 m.
- The number of coastal businesses that could become isolated varies from district to district. There are 13 districts that rate consistently highly across all sea-level rise increments. For example:
  - For the Hauraki and Thames–Coromandel districts, more than 30% of businesses could become isolated at just 0.2 m of sea-level rise.
  - In Hauraki district, 39% of businesses classified as agricultural, forestry and fishing could become isolated at 0.2 m of sea-level rise. A significant proportion of Hauraki businesses are in the dairy farming sector, which is particularly sensitive to being isolated.

What this measures

This metric focuses on the extent of business isolation caused by a 1% annual exceedance probability coastal flooding event, specifically tracking the number and proportion of businesses that lose road connectivity to essential services.

This analysis is carried out over four steps:

1. Coastal flood hazard extents are defined for current conditions and under three increments of future sea-level rise (0.2 m, 0.5 m and 1.0 m).
2. Businesses and their associated industry classifications (Australian and New Zealand Standard Industrial Classification[xi]) are attributed to individual properties.
3. The road network is modified to reflect flood-induced disruptions.
4. Routing analysis is used to determine whether businesses would remain connected to essential services.

The results are presented at national and district levels, and are further broken down by industry sector. This analysis does not include the rental hiring and real estate services sector because it includes large numbers of individual landlords with residential addresses. For this group, only some of the sector are likely to be places of business, while the remainder may be rented homes where isolation from essential services is more likely to affect homes rather than disrupting other business activity.

This is an initial screening-level analysis which begins to build an evidence base for understanding the potential risk of isolation for businesses, and potential impacts for businesses and the wider economy. For example, if a business loses road connections that will likely result in productivity losses and supply chain disruptions, this disruption to business activity could have significant flow-on effects to local and national economic activity.

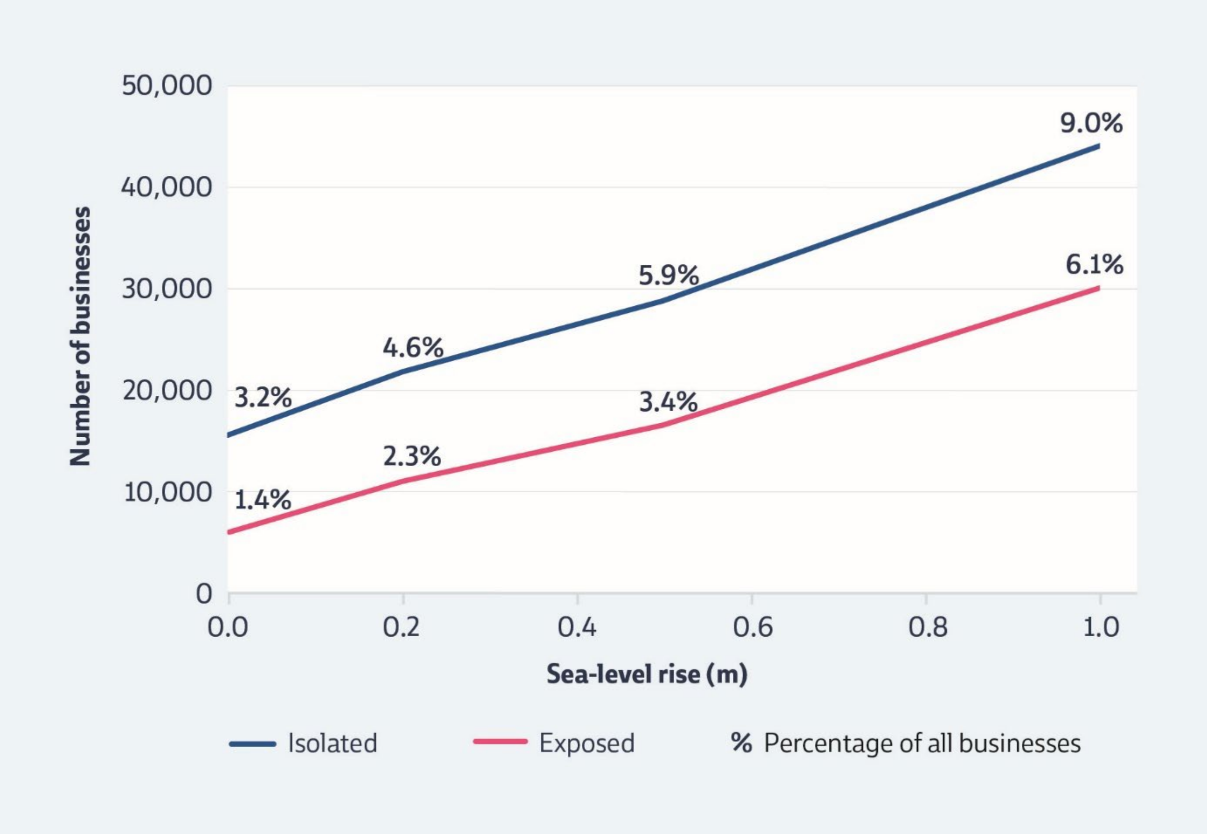
The information for this metric was taken from Urban Intelligence's *Business Isolation Report* (2026), which is published separately on our website.[10] This was an extension to Urban Intelligence's work on assessing the risk of isolation from coastal flooding, but looked specifically at coastal businesses.

[xi] Industry classifications are assigned by Australian and New Zealand Standard Industrial Classification 2006 division available at https://www.abs.gov.au/statistics/classifications/australian-and-new-zealand-standard-industrialclassification-anzsic/2006-revision-2-0/numbering-system-and-titles

Results

National business exposure and isolation

Figure 6.1: Businesses exposed to or potentially isolated by coastal flooding



Source: Urban Intelligence, *Business Isolation Report* (2026)

Under current conditions, more than 15,500 businesses (3.2% of all New Zealand businesses) could become isolated by coastal flooding. This rises to 22,500 businesses (4.6%) at 0.2 m of sea-level rise, 28,900 (5.9%) at 0.5 m of sea-level rise and to 44,400 (9.0%) at 1.0 m of sea-level rise.

National business isolation by sector

Table 6.1 shows the number of businesses that could become isolated for the top four industry sectors under current conditions through to 1.0 m of sea-level rise.

The agricultural, forestry and fishing sector is the sector most likely to become isolated due to coastal flooding, with 2,278 premises affected under current conditions, rising to 4,319 premises at 1.0 m of sea-level rise. This sector includes businesses such as horticulture and fruit growing, livestock and grain farming, forestry and logging, aquaculture and fishing.

Table 6.1: Number of businesses in each Australian and New Zealand Standard Industrial Classification category isolated by coastal flooding

	Sea-level rise			
Sector	**Current**	**0.2 m**	**0.5 m**	**1.0 m**
Agriculture, forestry and fishing	2,280	3,090	3,460	4,320
Construction	1,670	2,440	3,010	4,460
Professional, scientific and technical services	1,580	2,200	2,870	4,790
Financial and insurance services	1,140	1,600	2,270	3,780

Source: Urban Intelligence, *Business Isolation Report* (2026)

In the construction sector, 1,670 businesses could become isolated by coastal flooding under current conditions. At 1.0 m of sea-level rise this increases to 4,460 businesses. The construction sector includes businesses such as owner-operated residential builders, building construction firms, and the heavy and civil engineering construction sector.

The professional, scientific and technical services sector has 1,580 business which could become isolated by coastal flooding under current conditions. This increases to 4,790 businesses at 1.0 m of sea-level rise. This sector includes businesses in the scientific research, architectural and engineering, legal and accounting, advertising, market research, management, and veterinary sectors.

The financial services and insurance sector has 1,140 businesses which could become isolated by coastal flooding under current conditions. This increases to 3,780 businesses at 1.0 m of sea-level rise. This sector includes businesses in the banking, financial and investment services, and insurance sectors.

Business isolation at the district level

Table 6.2: Districts with the highest proportion of businesses isolated by coastal flooding at different sea-level rise increments

Rank	Sea-level rise			
	Current	**0.2 m**	**0.5 m**	**1.0 m**
1	Kaipara (26.9%)	Thames–Coromandel (31.2%) ▲	Thames–Coromandel (37.0%) ▶	Thames–Coromandel (52.1%) ▶
2	Thames–Coromandel (20.9%)	Hauraki (30.3%) ▲	Hauraki (31.6%) ▶	Ōpōtiki (41.1%) ▲
3	Ōpōtiki (17.5%)	Kaipara (28.3%) ▼	Kaipara (31.0%) ▶	Napier (37.1%) ▲
4	Nelson (15.4%)	Nelson (22.9%) ▶	Ōpōtiki (29.5%) ▲	Buller (37.0%) ▲
5	Buller (14.6%)	Buller (21.7%) ▶	Buller (27.5%) ▶	Hauraki (35.2%) ▼

Source: Urban Intelligence, *Business Isolation Report* (2026)

Arrows (▲/▼) indicate change in ranking. Right arrow (▶) indicates unchanged ranking.

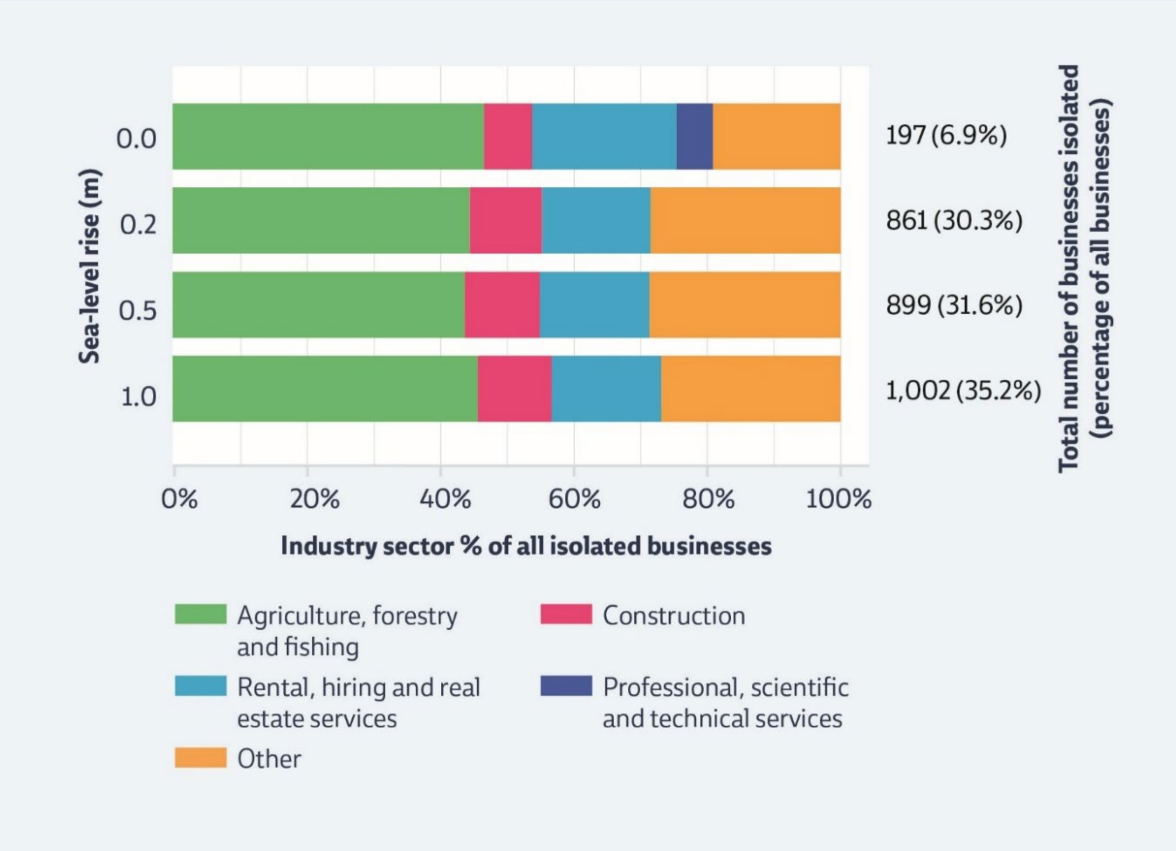
The number and proportion of businesses that could become isolated varies between districts – some are more at risk of localised economic disruption. Across different increments of sea-level rise, Thames–Coromandel is consistently in the top two districts in terms of proportion of businesses affected. Buller is consistently in the top five. In Thames–Coromandel, the number of businesses that could become isolated increases significantly at different increments of sea-level rise.

Box 6.2: Business isolation in the Hauraki district

Figure 6.2 shows the proportion (by industry sector) of Hauraki businesses that could become isolated by coastal flooding, both under current conditions and at future increments of sea-level rise.

Under current conditions, 92 businesses in the agricultural, forestry and fishing sector could become isolated by coastal flooding. This represents about 10% of the sector's 960 businesses in the district. With 0.2 m of sea-level rise, this number rapidly increases to 30% of all businesses, including 39% of businesses (378 businesses) in the agricultural, forestry and fishing sector.

Figure 6.2: Hauraki district business isolation by industry sector at different increments of sea-level rise



Source: Urban Intelligence, *Business Isolation Report* (2026)

Note: Segments may not sum to 100 due to rounding

In 2025, businesses in the district generated $1.5 billion in GDP. Agricultural, forestry and fishing was the second-largest sector, contributing 17% of the district's GDP ($254 million). The majority (76%) of this came from dairy farming.[11] Dairy businesses are particularly vulnerable to isolation, as they depend on the daily collection of milk.

With 383 agricultural, forestry and fishing businesses (39%) affected at 0.2 m of sea-level rise, a significant share of the region's business activity could be at risk. This risk would increase with further sea-level rise, with 0.5 m affecting 394 (41%) businesses.

This illustrates the potential for isolation from coastal flooding to significantly affect Hauraki's businesses, which provide employment and generate economic activity, with the agricultural, forestry and fishing sector particularly at risk.

Gaps and limitations

- The gaps discussed in *Chapter 5: Isolation from coastal flooding – population and marae* are also relevant for this metric. In particular, this metric applies only to coastal flooding, not to other hazards such as inland flooding or landslides.
- Isolation from schools, fire stations and hospitals may not be as critical for some businesses as it is for populations. A more detailed analysis of business supply chains by sector would be useful.
- This metric focuses only on coastal businesses, and only on coastal flooding – other hazards such as inland flooding could also lead to business isolation but are not covered in this metric.
- This metric is based on the current number of businesses, and does not consider future changes in the distribution of economic activity. This metric considers broad categories of businesses based on their industrial sector. Further work could look in more depth at specific sub-categories of businesses where isolation might have the most impact on the businesses themselves, the communities they support, or the economy.

Chapter 7: Dimensions of social vulnerability

In this metric we consider the social vulnerability of people and communities who are exposed to climate-related hazards.

This metric brings together existing national data about social dimensions affecting how likely people and groups are to experience harm from climate-related hazards.

Information about social vulnerability can inform adaptation planning and event responses, ensuring that the specific needs of people and communities are addressed. Understanding those needs will be particularly important for local adaptation planning, to ensure responses are targeted at people and groups with most need. Spatial analysis of social vulnerability can identify locations with both high vulnerability and high levels of exposure to climate hazards.

The impacts of climate change will not be felt evenly by all people, households and communities. Underlying characteristics and personal circumstances can affect the harm they experience. There is no single measure that can tell us how a person or community will be affected. However, specific characteristics can make a difference. For example, age and mobility can affect a person's ability to respond to a flood or other climate-related event, and economic resources can affect a person's or household's capacity to recover.

Understanding social vulnerability can therefore give some insight into the levels of harm people and groups might experience, and their capacity to cope with and recover from that harm.

Box 7.1: Key results

- Between 2018 and 2023, there have been increases across some dimensions nationally. This includes increases in the older adult population, and the number of older adults living alone. There have also been increases in household crowding, the number of people with poor mental health, and children experiencing food insecurity.

What this measures

The metric uses social vulnerability indicators to identify population groups and geographic areas that are more likely to experience harm from climate hazards such as flooding, and/or are less able to prepare for, cope with, recover from, or adapt to the impacts of those hazards.

We have used indicators prepared by Environmental Health Intelligence New Zealand for our 2024 progress assessment. Environmental Health Intelligence New Zealand has assessed those indicators as working well for a range of natural hazards, including climate-related hazards (particularly sudden-onset hazards).[12] Since 2024 Environmental Health Intelligence New Zealand has updated the indicators using data from the 2023 Census.

The indicators cover important dimensions that affect social vulnerability, specifically:

- population
- children and young people
- older adults
- health and disability status
- having enough money to cope with crises and losses
- social connectedness
- awareness, skills and knowledge to cope with hazards
- safe, secure and healthy housing
- having enough food and water to cope with shortage
- decision-making and leadership
- occupational exposure/vulnerability
- other individual-level factors of social vulnerability.

Results

Overall changes at the national level from the 2018 Census to the 2023 Census show:

- there have been increases in some indicators nationally, including older adult population, older adults living alone, household crowding, people with poor mental health, and children experiencing household food insecurity
- there has been a decrease in the number of households with no motor vehicle, internet or mobile phone; and in damp mouldy dwellings. There has also been a decline in rates of voting participation.

Some geographic areas continue to have high levels of vulnerability for certain indicators (**Table 7.1**).

Table 7.1: Dimensions of social vulnerability by district – based on 2018 and 2023 Census data

2018 Census	2023 Census
Napier	
One in five people (20%) in Napier were aged 65+ years, while 15% of households comprised an older adult (65+ years) living alone. The proportion of the population living in areas of high socioeconomic deprivation was 24%, while 34% of households lived in rented dwellings.	There has been an increase in people in Napier aged 65+ years (31%), while around the same percentage of households have an older adult (65+ years) living alone (16%). The proportion of the population living in areas of high socioeconomic deprivation is 23%, while there has been a slight decrease in households in rented dwellings (to 31%).
Thames–Coromandel	
The proportion of the population living in areas of high socioeconomic deprivation was about 19%, almost one third of the population (31%) were aged 65+ years, and 18% of households had an older person living alone. About 27% of households lived in rented dwellings. About 7% of those were employed in the primary sector, and 18% of the population of the district were Māori.	The proportion of population living in areas of high socioeconomic deprivation stays about the same with 20%. There has been a slight increase in population over 65 years (34%), with 19% of over 65 years living alone. There has been a decrease in the amount of people living in rented accommodation to 23%. The Māori population is around 19% and people working in the primary sector 6%.
Buller	
Around 42% of the population in Buller were living in areas of high socioeconomic deprivation. Almost one in four people (23%) were aged 65+ years, 16% of households had an older adult living alone, and more than 32% of households lived in rented dwellings. Buller also had one of the highest proportions in the country of one person households (36%), and of households without access to safe running water, at 12%.	Around 41% of the population are living in areas of high socioeconomic deprivation. There has been a slight increase in older adults to 34%, while older adults living alone is at 19%. There has been a decrease in population living in rented housing, down to 19%. The proportion of people without access to safe running water stays at 12%. People living alone remains the highest in the country with 37%. Buller is also the district that has the most people without internet at 20%.

2018 Census	2023 Census
Hauraki	
Hauraki had about 40% of the population living in areas of high socioeconomic deprivation, about 24% of the population was aged 65+ years, almost 16% of households had an older adult living alone, and 31% of households lived in rented dwellings. In addition, a relatively high proportion of people employed worked in primary industries (17%), while 39% of adults were not in the labour force.	There has been a slight decrease in population living in areas with high socioeconomic deprivation in Hauraki. There was a small increase in population over 65 years to 26%, while the same amount of older adults are living alone (16%). In line with national trends there has been a decrease in population living in rented accommodation to 28%. There has been a decrease in population working in primary industries to 14%. 40% of adults are not in the labour force.
Wairoa	
The proportion of the population living in areas of high socioeconomic deprivation was about 77%, one of the highest in the country. Wairoa also had some of the highest rates in the country of people living in crowded households (17%). Around one in four people (24%) were under 15 years, 14% of households had an older person living alone, 39% of households lived in rented dwellings, and about 24% of those employed worked in the primary sector. The district also had among the highest representation of Māori in the country, at 66% of the population (compared to about 17% nationally).	People living in areas or high socioeconomic deprivation drops in slightly in Wairoa to 75%, which is the second highest in the country. There has been an increase in people living in crowded housing to 24%. The number of households with a child under 14 is 23%, while 15% of households are older people living alone. There has been a decrease in those living in rented dwellings to 35%. People working in primary industries has decreased to 19%. Wairoa district remains one of the districts with the highest Māori population, a slight increase to 69%.

2018 Census	2023 Census
Nelson	
About 14% of the population lived in areas of high socioeconomic deprivation, with 31% of households living in rented dwellings. Around 12% of those employed worked as healthcare and social assistance workers. Just over 19% of the population was aged 65+ years, with 14% of households having an older adult living alone.	In Nelson, the population living in areas of high socioeconomic deprivation has dropped slightly to 11%, along with those living in rented accommodation to 29%. About 12% of the population is still employed in healthcare and social assistance. The number of people over 65 years has increased to 22% of the population, with 15% of households being an older person living alone.
Waitomo/Ruapehu	
In Ruapehu, 46% of the population was living in areas of high socioeconomic deprivation. For Waitomo, the figure was 48%. Both districts had 40% of households living in rented dwellings, and about 12% of households with an older person living alone. The proportion of those employed working in the primary sector was 26% in Waitomo and 23% in Ruapehu.	The population living in areas of high socioeconomic deprivation has increased in both Ruapehu (49%) and Waitomo (56%). Those living in rental housing has decreased in Ruapehu to 38% and also Waitomo, to 36%. The population employed in the primary sector has decreased in Waitomo and stayed the same in Ruapehu, with both at 23%.

We did not report on the following districts in 2024, so cannot make comparisons across time. However, we include them here because of their relevance for assessing overlaps between social vulnerability and exposure to climate hazards.

In Whangārei, around 21% of residents are aged 65 years, while households with an older adult living alone increased to about 14%. The proportion of the population living in areas of high socioeconomic deprivation is around 30%, while households living in rental accommodation is approximately 30%. Māori made up around 30.1% of the population, and approximately 8% of workers are employed in primary industries.

In Gisborne, 17% of residents are aged 65 years and over, with approximately 13% of households containing an older adult living alone. The proportion of the population living in areas of high socioeconomic deprivation is 48%, while around 37% of households live in rental accommodation. Māori comprise more than half of the district's population at 54.8%, and primary industries remain an important source of employment, with 16% of those employed working in the sector.

In Gore 21% of residents are aged 65 years and over, while approximately 17% of households have an older adult living alone. The proportion of the population living in areas of high socioeconomic deprivation is about 19%, while 25% of households live in rental accommodation. Primary industries are a significant source of employment in the district at 17.7%.

Updates and improvements since our 2024 progress assessment

We commissioned Environmental Health Intelligence New Zealand to gather this data for our 2024 National Adaptation Plan Progress Assessment. Environmental Health Intelligence New Zealand has since updated this with data from the 2023 Census. [13]

To advance the work that was started for the 2024 progress assessment, the Commission asked Urban Intelligence to undertake a more detailed analysis on how social vulnerability interacts with hazard exposure.

As this more advanced analysis is complex, it was only possible to complete it for coastal flooding hazards (see *Chapter 8: Social vulnerability of populations exposed to or isolated by coastal flooding*).

Gaps and limitations

Personal circumstances, pre-existing conditions and/or socio-demographic characteristics can all make a person more likely to experience harm, or can affect how they will respond to risk. However, the indicators have primarily been selected to show individual-level and household-level resilience, and may not reflect all aspects of community-level resilience. For example, some communities and neighbourhoods might have strong support networks that support resilience, but which are difficult to capture nationally and at a local level.

Some aspects of social vulnerability are also not fully captured in the indicators. For example, Environmental Health Intelligence New Zealand notes that physical and mental health status, and disability, play an important role in people's vulnerability and susceptibility to the impacts of climate change, but these are difficult to measure at a local level.

This analysis uses 2023 Census information. The Government has announced changes to the five-yearly census from 2030. It is not yet clear how this analysis will be updated in the future.

Chapter 8: Social vulnerability of populations exposed to or isolated by coastal flooding

This metric brings data about coastal flooding exposure and isolation together with data about social vulnerability.

Combining this information creates a more detailed picture of which people and communities might be more likely to experience harm from coastal flooding, and which dimensions of social vulnerability contribute to this.

Exploring dimensions of social vulnerability can improve understanding of the likelihood that people or communities will experience harm from climate-related hazards. The impacts of climate change will not be felt evenly across society, as underlying circumstances can affect how people prepare for and respond to coastal flooding events. Bringing spatial analysis of climate hazards together with demographic data highlights where physical risk and social vulnerability can compound to create hotspots of disproportionate and inequitable impact.

Box 8.1: Key results

- Nationally, nearly 29,000 people (0.6%) are currently directly exposed to coastal flooding. Approximately 7,600 of those exposed (26.3%) are classed as having high levels of social vulnerability.
- Approximately 53,000 people (1.1%) are directly exposed to coastal flooding at 0.2 m of sea-level rise. Around 13,000 of those exposed (24.8%) are classed as having high levels of social vulnerability.
- Napier and Buller districts have the highest proportion of their populations both exposed to coastal flooding and classed as having high levels of social vulnerability.

What this measures

This metric relies on work carried out for the Commission by Urban Intelligence. The metric focuses on areas where physical risk and social vulnerability combine, and considers the particular dimensions of social vulnerability affecting each district.

This analysis underlying this metric requires several steps:

Step 1: Exposure

Exposure was assessed by first considering residential properties that were either directly exposed to a 1% annual exceedance probability coastal flooding event, or that could become isolated due to such an event. We gathered this data for different increments of sea-level rise (current conditions, 0.2 m, 0.5 m and 1.0 m).

Step 2: Social vulnerability

The social vulnerability of populations exposed to or isolated due to coastal flooding was assessed.

Urban Intelligence did this by creating a specific hazard vulnerability index (the index). This index bundles together social vulnerability indicators (using census data) under four categories: (i) physical health; (ii) mental health, identity, autonomy, and sense of wellbeing and belonging; (iii) equity; and (iv) social cohesion (**Table 8.1**). These indicators are relevant to the likelihood that people will experience disproportionate harm from coastal flooding events.

Districts with a high proportion of a population in the top 20% of the index (quintile five) are defined as having high levels of social vulnerability.

Step 3: Calculating a risk score

The exposure and vulnerability results were then combined to create a 'risk score', which expresses the proportion of a district's total population that has both high levels of social vulnerability *and* is directly exposed to coastal flooding. The risk score can give insight into which communities are likely to experience greater harm arising from coastal flooding across different increments of sea-level rise.

Further information about this metric is available in Urban Intelligence's report *Social Vulnerability Assessment*, published separately on our website.

Table 8.1: Social vulnerability category bundles

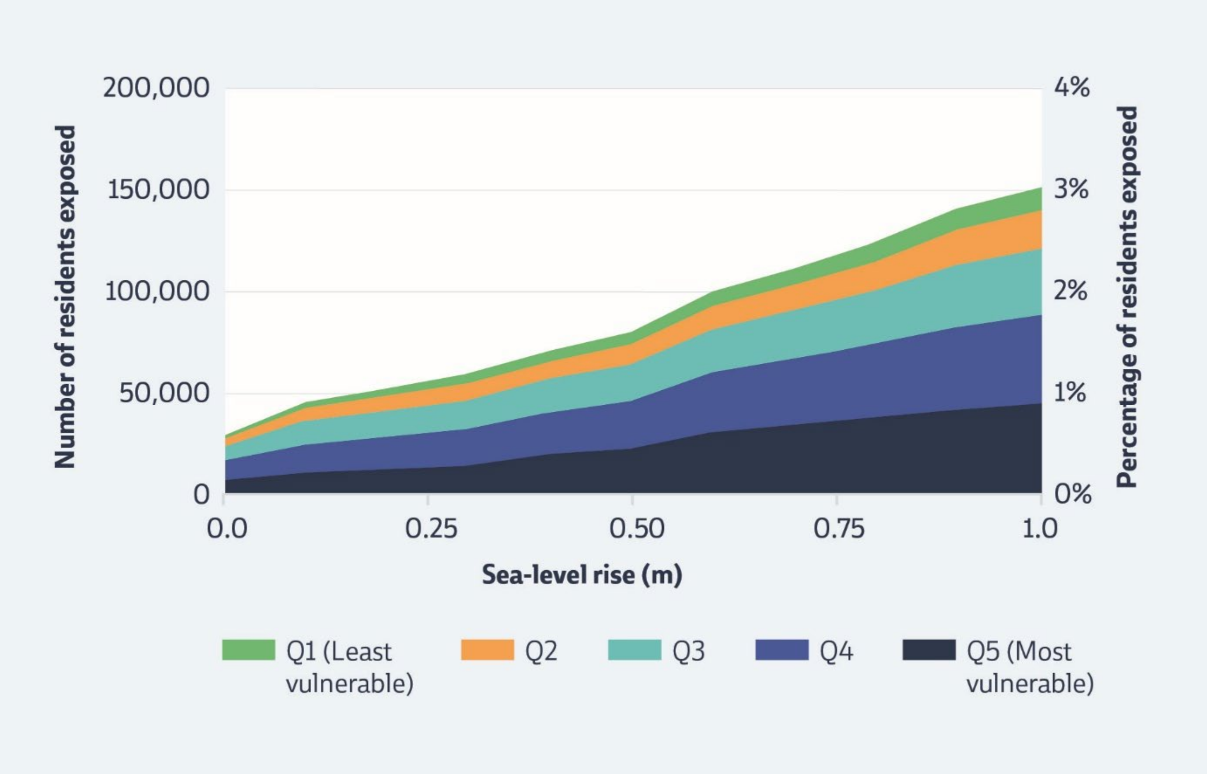
Social vulnerability category bundles			
Physical health	**Mental health, identity, autonomy, and sense of wellbeing and belonging**	**Equity**	**Social cohesion**
• Occupational exposure • Mobility • Physiological • Awareness of hazards and local knowledge • Housing status • Having enough food and water	• Occupational exposure • Social connection • Awareness of hazards and local knowledge • Financial wellbeing • Housing status • Having enough food and water	• System inequities • Housing status • Financial wellbeing	• System inequities • Social connection • Cultural wellbeing • Displacement

Results

Social vulnerability and exposure to coastal flooding

Nationally, of people who are currently potentially exposed to coastal flooding, about 7,600 people (26.3%) are defined in the index as having high levels of social vulnerability. This increases to about 13,000 people (24.8%) at 0.2 m of sea-level rise, 23,200 people (29%) at 0.5 m of sea-level rise, and about 44,500 people (29.5%) at 1.0 m of sea-level rise (**Figure 8.1**).

Figure 8.1: Percentage of residents exposed to a 1% annual exceedance probability coastal flood, by quintile of social vulnerability



Source: Urban Intelligence, *Social Vulnerability Assessment* (2025)

There is an uneven distribution of people across Aotearoa New Zealand who are both exposed to coastal flooding and defined as having high levels of social vulnerability. Some districts have greater numbers of potentially affected residents, and a high percentage of those residents more likely to experience harm from such an event.

Across all increments of sea-level rise, Buller and Napier consistently have the highest proportion of their population exposed to coastal flooding (**Tables 8.2–8.4**). These districts also consistently have the highest proportion of their total population that are exposed and defined as having high levels of social vulnerability.

Thames–Coromandel, Whakatāne, Kaipara and Ōpōtiki also have relatively high proportions of their total population exposed and defined as having high levels of social vulnerability.

Table 8.2: Districts with greatest direct exposure to coastal flooding at 0.0 m of sea-level rise

District	Risk score[1]	Total population exposed	% of total population exposed	% of exposed population that is vulnerable[2]
Buller	7.11	854	8.17	87.0
Kaipara	4.12	1390	5.34	77.10
Napier	4.04	8190	12.80	31.60
Thames–Coromandel	2.11	1790	5.61	37.50
Westland	0.50	81	0.92	54.50

[1] 'Risk score' is the percentage of the total population that is both exposed to the hazard and in the highest social vulnerability quintile (Q5).

[2] 'Vulnerable' is the percent of exposed population with highest social vulnerability (Q5).

Table 8.3: Districts with greatest direct exposure to coastal flooding at 0.2 m of sea-level rise

District	Risk score[1]	Total population exposed	% of total population exposed	% of exposed population that is vulnerable[2]
Buller	11.10	1,390	13.30	83.0
Napier	5.59	12,500	19.50	28.70
Kaipara	4.37	1,480	5.71	76.50
Whakatāne	4.02	2,530	6.87	58.40
Thames–Coromandel	2.54	2,470	7.76	32.80

[1] 'Risk score' is the percentage of the total population that is both exposed to the hazard and in the highest social vulnerability quintile (Q5).

[2] 'Vulnerable' is the percent of exposed population with highest social vulnerability (Q5).

Table 8.4: Districts with greatest direct exposure to coastal flooding at 0.5 m of sea-level rise

District	Risk score[1]	Total population exposed	% of total population exposed	% of exposed population that is vulnerable[2]
Buller	17.4	2,360	22.1	77.1
Napier	13.6	20,200	31.5	43.1
Kaipara	4.8	1,620	6.2	76.4
Whakatāne	4.5	3,250	8.8	51.5
Ōpōtiki	3.4	356	3.7	94.8

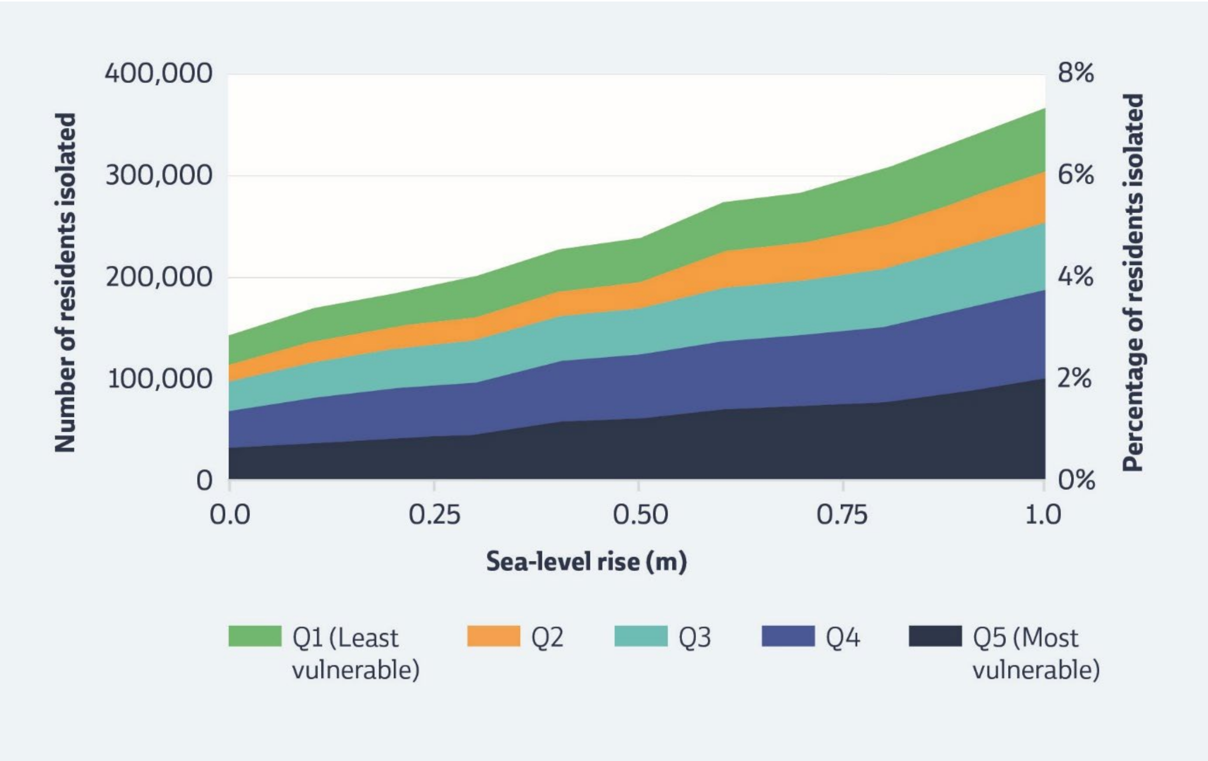
1 'Risk score' is the percentage of the total population that is both exposed to the hazard and in the highest social vulnerability quintile (Q5).

2 'Vulnerable' is the percent of exposed population with highest social vulnerability (Q5).

Social vulnerability and risk of isolation

Nationally, of the 142,000 people (2.9%) who currently could become isolated due to coastal flooding, 21.6% are defined in the index as having high levels of social vulnerability (approximately 31,000 people). This increases to 21.8% (40,000 people) with 0.2 m of sea-level rise, 25.0% (60,000 people) at 0.5 m of sea-level rise, and 27.4% (100,000 people) at 1.0 m of sea-level rise (**Figure 8.2**).

Figure 8.2: Percentage of residents potentially isolated by a 1% annual exceedance probability coastal flood, by quintile of social vulnerability



Source: Urban Intelligence, *Social Vulnerability Assessment* (2025)

There is an uneven distribution of people across Aotearoa New Zealand who could become isolated due to coastal flooding and who are defined as having high levels of social vulnerability (**Tables 8.5–8.7**). Some districts have more residents that will be potentially affected, and a higher percentage of those residents may be more likely to experience negative impacts as a result of isolation.

Table 8.5: Districts with greatest risk of isolation due to coastal flooding at 0.0 m of sea-level rise

District	Risk score [1]	Number of people who could become isolated	% of population who could become isolated	% of exposed population that is vulnerable [2]
Buller	15.9	1,910	18.3	86.7
Thames–Coromandel	11.40	15,600	49.0	23.2
Kaipara	7.8	6,630	25.6	30.6
Napier	7.5	12,200	19.1	39.2
Far North	7.1	11,400	15.9	44.4

1 'Risk score' is the percentage of the total population that is both exposed to the hazard and in the highest social vulnerability quintile (Q5).

2 'Vulnerable' is the percent of exposed population with highest social vulnerability (Q5).

Table 8.6: Districts with greatest risk of isolation due to coastal flooding at 0.2 m of sea-level rise

District	Risk score[1]	Number of people who could become isolated	% of population who could become isolated	% of exposed population that is vulnerable[2]
Buller	20.1	2,610	25.0	82.7
Thames–Coromandel	12.1	20,900	65.4	18.5
Napier	8.5	16,000	24.9	34.1
Kaipara	7.9	6,690	25.8	30.8
Far North	7.5	11,700	16.5	45.6

1 'Risk score' is the percentage of the total population that is both exposed to the hazard and in the highest social vulnerability quintile (Q5).

2 'Vulnerable' is the percent of exposed population with highest social vulnerability (Q5).

Table 8.7: Districts with greatest risk of isolation due to coastal flooding at 0.5 m of sea-level rise

District	Risk score [1]	Number of people who could become isolated	% of population who could become isolated	% of exposed population that is vulnerable [2]
Buller	28.1	3,610	34.5	81.4
Napier	20.1	26,300	41.1	48.8
Thames–Coromandel	18.6	24,800	77.9	23.9
Ōpōtiki	14.4	1,780	17.7	81.3
Kaipara	8.1	6,780	26.1	31.1

1 'Risk score' is the percentage of the total population that is both exposed to the hazard and in the highest social vulnerability quintile (Q5).

2 'Vulnerable' is the percent of exposed population with highest social vulnerability (Q5).

Buller and Thames–Coromandel are the districts that consistently have the highest risk scores across all increments of sea-level rise (**Tables 8.5–8.7**). Buller's higher risk score is driven by a large proportion of the population who could become isolated by coastal flooding and are also vulnerable, whereas Thames–Coromandel has a higher proportion who could become isolated but a lower proportion who are vulnerable.

Thames–Coromandel consistently has highest percentage of population who could become isolated across all increments of sea-level rise and the percentage increases rapidly over the increments (from 49.0% under current conditions to 77.9% with 0.5 m of sea-level rise).

Kaipara has the second highest percentage of people who could become isolated under current conditions, but this stays relatively constant across the different increments (from 25.6% under current conditions to 26.1% at 0.5 m of sea-level rise). Buller and Napier both record steady increases in the number of people who could become isolated across increments of sea-level rise.

Updates and improvements since our 2024 progress assessment

This work builds on our separate analysis presented in *Chapter 5: Isolation due to coastal flooding – population and marae* and *Chapter 7: Dimensions of social vulnerability.*

Gaps and limitations

For this analysis, we wanted to understand where heightened social vulnerability to coastal flooding was across the country and some of the underlying reasons. While an approach to this was developed and analysis was carried out, we were not able to draw definitive findings. However, we did find that factors that contribute to communities having heightened social vulnerability are diverse and not limited to physical health impacts. Across exposed communities none of the categories that were explored for social vulnerability clearly dominated. This shows that broad range of adaptation responses will be needed to address the different dimensions of social vulnerability, rather than just a focus on physical health and/or mental health.

This metric is based on current populations and measures of social vulnerability. The analysis does not consider projected changes to population growth or distribution, or to factors that can affect social vulnerability.

This analysis is complex and evolving. It expands on other analysis we have carried out to give an understanding of how communities might be impacted by coastal flooding. Aotearoa New Zealand also faces risks from other climate hazards. Also, factors that make up social vulnerability are dynamic, influenced by shifting capabilities and characteristics, and by the wider context in which people live. There is a need for ongoing research, refinement of vulnerability measures, engagement with communities, and continued monitoring. The findings presented here should therefore be understood as part of an iterative process of risk assessment and adaptation planning, rather than a final statement.

Chapter 9: Insurance availability

This metric provides information about the availability of household insurance at a national level.

This metric can provide an indication of the financial vulnerability of households that are exposed to inland flooding. Measuring insurance availability can give an indication of household financial sensitivity. Insurance transfers risk from households to insurers, enabling households to reduce their financial sensitivity by minimising costs associated with damage from climate events such as flooding.

Changes to this metric over time can be an indication of how household financial sensitivity is changing. As insurers move towards risk-based pricing for floods, affordability pressures are likely become most intense inside flood zones.

What this measures

This metric considers the availability of home insurance in areas exposed to 1% annual exceedance probability inland flooding, using data on the availability of online insurance quotes. The analysis focuses on 'high risk' properties in suburbs "known to be affected by inland flooding".[xii] We define availability as 'limited' for any area where it is not possible to obtain competitive quotes (i.e. quotes from two or more insurance underwriters).

This metric was developed using public information published by the Treasury, who contracted actuarial firm Finity to gather information about price and availability of residential insurance.[14]

Our findings

Approximately 4% of properties located within flood zones are unable to obtain online quotes from two or more insurance underwriters. These properties are not evenly distributed across regions.

There are multiple locations where households exposed to flooding are already facing difficulty obtaining competitive quotes. Suburbs with signs of limited insurance availability include: Kaeo (Far North), Avondale and Milford (Auckland), Thames (Thames–Coromandel) Paraparaumu (Kapiti), Island Bay (Wellington), Westport (Buller), Kaiapoi (Waimakariri), Woolston and Christchurch CBD (Christchurch).

[xii] A list of the suburbs included in the analysis is available in the Finity report available at https://www.treasury.govt.nz/publications/information-release/residential-insurance-data-collection-reports-information-release

Gaps and limitations

The analysis by Finity that has informed this metric uses a small sample size, which could understate or overstate levels of availability within the suburbs analysed.

The other part of monitoring changes to insurance is to track changes in the affordability of insurance premiums. We attempted to include analysis that looked at insurance premium prices compared to median household income growth. However, due to limitations in the data we were unable to complete a sufficiently robust analysis.

We did find that there is variability in the affordability of insurance premiums across regions with Gisborne, Hawke's Bay, Manawatū–Whanganui, West Coast and Marlborough potentially showing signs of unaffordability. What the analysis did show was the expected losses from flood hazard are being shared across all policy holders (as opposed to those most exposed to flooding). As exposure to flooding increases under climate change, it would be reasonable to expect an increase in insurance premium prices. We did find variation in insurance affordability across regions.

Technical glossary

adaptation	The process of adjusting to the actual or expected changes brought about by climate change. For people, and the systems people create, this means making changes to try to avoid or minimise the harm or damage from climate change and its effects – or to benefit from opportunities climate change might provide. These could be changes, for example, to laws, policies, practices and processes, as well as to physical structures and the built environment. In nature, and within natural systems, adaptation can happen by itself through ecological and evolutionary processes, or through human assistance, by helping those systems adjust to climate change and its effects.
adaptive capacity	The ability of systems, institutions, humans and other organisms to adjust to potential damage, or to take advantage of opportunities or to respond to consequences from climate impacts.
annual exceedance probability (AEP)	The probability that a hazard event of a specific size will occur or be exceeded within a single year – for example, a 1% AEP coastal flood event has a 1% chance of occurring in any one year based on the current climate. This does not mean a 1% AEP event will only occur once in 100 years.
cascading impacts	These occur when a climate-related risk or hazard generates a sequence of secondary events in natural and human systems that results in physical, natural, social or economic disruption – the resulting impact is often significantly larger than the initial impact.
climate mitigation	Human actions to reduce emissions by sources or enhance removals by sinks of greenhouse gases. Examples of reducing emissions by sources include walking instead of driving or replacing a coal boiler with a renewable electric-powered one. Examples of enhancing removals by sinks include growing new trees to absorb carbon, or industrial carbon capture and storage activities.
climate-related	Climate hazards can be progressive and ongoing changes

hazard	(such as sea-level rise, warming temperatures and changing seasonal weather patterns) or extreme events (such as cyclones, droughts and wildfires). While climate change does not necessarily cause extreme events, it makes them more frequent and severe.
climate-related risk	The potential for adverse consequences, for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Adverse consequences may affect human lives, livelihoods, health and wellbeing; economic, social and cultural assets and investments; infrastructure; services (including ecosystem services); and ecosystems and species.
climate resilience	The ability to prepare for, respond to and cope with the impacts of changing climate (without losing essential functioning and identity); the changes in climate include those progressive and ongoing changes that can be anticipated and those that occur as extreme events.
effective adaptation	Effective adaptation reduces climate risk, anticipates and accounts for complexities, anticipates and accounts for the uncertain nature of climate change risks and impacts, and aims to avoid maladaptation.
emissions	These are greenhouse gases released into the atmosphere. The Climate Change Response Act 2002 covers the following greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
exposure	Assessment of exposure considers how much of value is present in the face of a particular hazard – the people; livelihoods; species or ecosystems; environmental functions, services and resources; infrastructure; or economic, social or cultural assets in places and settings that could be adversely affected.
extreme weather event	An event that is rare at a particular place and time of year. Definitions of ‘rare’ vary, but an extreme weather event would normally be as rare as, or rarer than, one that falls in

	the highest or lowest 5–10% of recorded weather data. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense.
impacts	The consequences of realised risks on natural and human systems, which result from the interactions of climate-related hazards (including extreme weather events), exposure and vulnerability. They are generally effects on human lives, livelihoods, health and wellbeing; ecosystems and species; economic, social and cultural assets; services (including ecosystem services); and infrastructure. They can be harmful or beneficial. Also known as consequences or outcomes. See also 'cascading impacts'.
isolation	Isolation occurs when communities, households or people are cut off from essential services like emergency services, supermarkets, education, work and cultural sites of significance (such as marae) if transport networks are damaged or inaccessible.
projections	Estimated value of a future quantity (such as emissions levels, temperature increases, or sea-level rise increments) based on a prescribed set of assumptions.
risk assessment	The scientific estimation of risks, which may be either quantitative or qualitative.
sea-level rise	These are increases in the height of sea levels over time, which may occur globally or locally.
sensitivity	The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change.
socioeconomic deprivation	A state of observable and demonstrable disadvantage for an individual, family or group. It is generally expressed relative to the local community, or to the wider society or nation to which they belong (i.e. low or high socioeconomic deprivation).
vulnerability	The conditions that determine how climate change impacts may affect an area, system or community – it includes sensitivity to harm, and the ability to cope and adapt (see 'adaptive capacity').

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He Pou a Rangi
Climate Change Commission

Level 21, 1 Willis Street
Wellington 6011
PO Box 24448
Wellington 6142

www.climatecommission.govt.nz

New Zealand Government
Te Kāwanatanga o Aotearoa