Ministry for the Environment
Manatū Mō Te Taiao

National Climate Change Risk Assessment for New Zealand

Arotakenga Tūraru mō te Huringa Āhuarangi o Āotearoa

Snapshot
Whakarāpopotonga

New Zealand Government

Karakia

Whakataka te hau ki te uru,

Whakataka te hau ki te tonga.

Kia mākinakina ki uta,

Kia mātaratara ki tai.

E hī ake ana te atākura he tio,

he huka, he hauhunga.

Haumi e! Hui e! Tāiki e!

Get ready for the westerly

and be prepared for the southerly.

It will be icy cold inland,

and icy cold on the shore.

May the dawn rise red-tipped on ice,

on snow, on frost.

Join! Gather! Intertwine!

This karakia (incantation) speaks to the interdependencies between the environment and people. In the context of climate change, this is a call to all New Zealanders to work together to build a more resilient future that is inclusive of all, across all domains.

This report summarises the findings of New Zealand's first National Climate Change Risk Assessment.

Our climate is changing

The climate is changing. All governments accept that further changes will result from increasing amounts of **greenhouse gases** in the atmosphere. In New Zealand, we are already experiencing the effects.

Over the past century, temperatures have increased, glaciers have melted and sea levels have risen. Such changes will continue, and their impacts increase.

These future changes will have far-reaching consequences for people and the environment – in cities, towns and communities, across all levels of government, and from the coastline to lakes, rivers and forests.

Why we need to assess the risks from climate change

Climate change will affect all of us. We need to plan how we will respond and adapt, hand-in-hand with reducing our emissions.

Central government plays an important part in this planning, including:

- creating the legislative framework
- enabling local government, businesses and communities to adapt effectively
- preparing for major natural **hazards** such as floods, drought, storms and wildfire.

A national framework for assessing risk[1]

The Climate Change Response (Zero Carbon) Amendment Act 2019 sets a framework for effective adaptation[2] across New Zealand, consisting of:

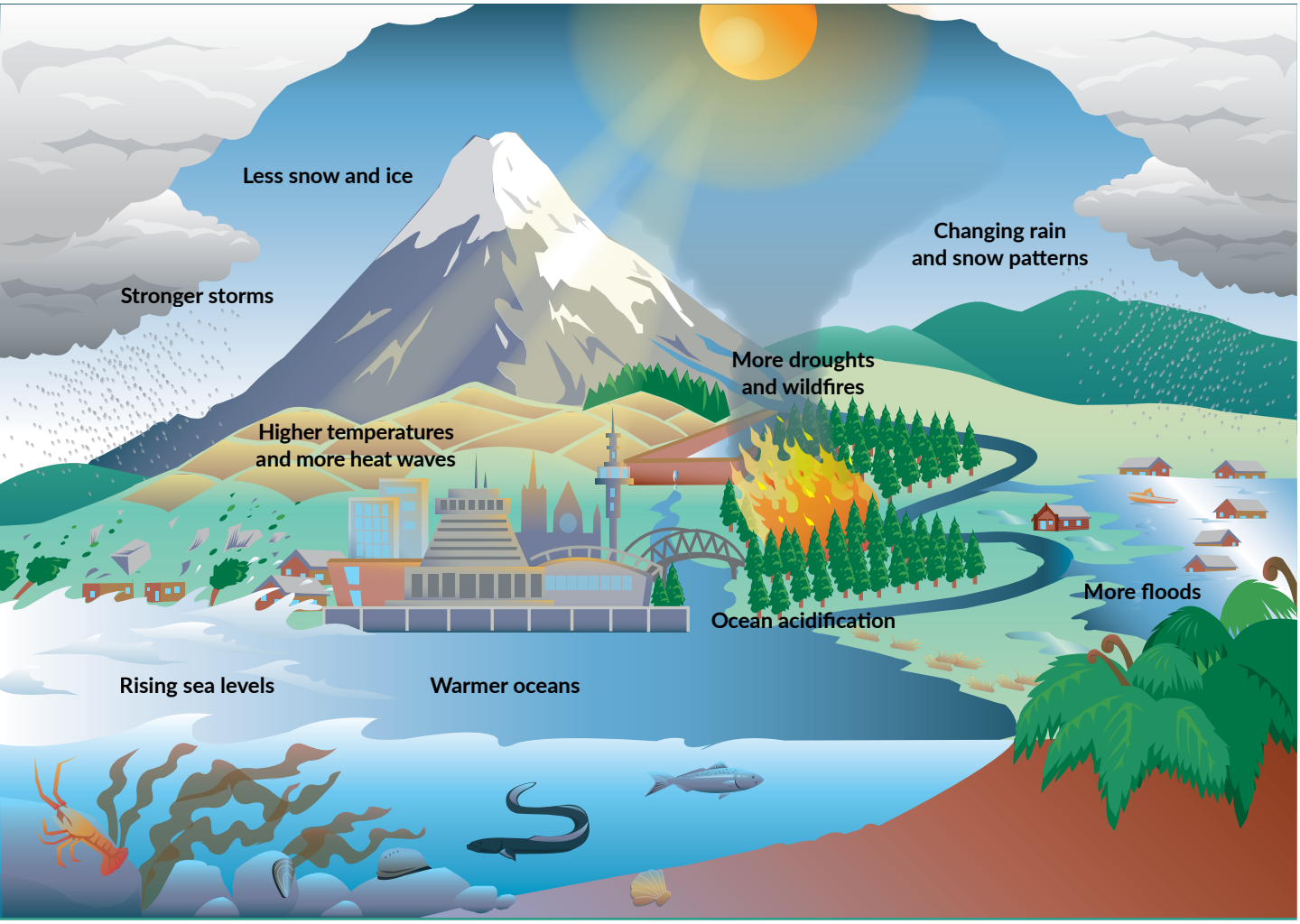
- a National Climate Change Risk Assessment, every six years
- a national adaptation plan, produced two years after each risk assessment
- monitoring implementation of the national adaptation plan, to ensure accountability.

The national adaptation plan will build on the actions New Zealand is already taking to respond to the impacts of climate change. With input from iwi/hapū/Māori, local government, key stakeholders and the general public, the plan will:

- define the Government's objectives for adapting to climate change, and how it will meet these
- respond to the most significant risks identified in the risk assessment.

Figure 1: How climate change is projected to impact New Zealand

(See page 3 for more information on climate change impacts)



1 The potential, when the outcome is uncertain, for adverse consequences on lives, livelihoods, health, ecosystems and species, economic, social and cultural assets, services (including environmental) and infrastructure. Risk results from the interaction of vulnerability, exposure and hazard.

2 Adaptation is an adjustment to actual or expected climate change and its effects.

What is the National Climate Change Risk Assessment?

The risk assessment is a national overview of how New Zealand may be affected by climate change-related hazards.[3] It:

- identifies the main risks and opportunities
- highlights any information gaps
- helps identify where the Government needs to focus its action.

Read the National Climate Change Risk Assessment Report on our website.

The risk assessment was based on *Arotakenga Huringa Āhuarangi: A Framework for the National Climate Change Risk Assessment for Aotearoa New Zealand* (the framework). A diverse team of academics and consultants prepared the report over nine months. It combines feedback from Māori/iwi and stakeholder engagement with scientific, technical and expert analysis.

How will the findings be used?

The risk assessment will be used to develop a national adaptation plan over the next two years. The plan will outline what we need to do to prepare for the risks.

Climate change in New Zealand

Our climate is warming, sea levels are rising, and extreme weather is becoming more frequent and severe.

The National Institute of Water and Atmospheric Research (NIWA) developed the projections used for the risk assessment. The trends (see figure 1) include:

- In the last 100 years, our climate has warmed by 1°C. If global emissions remain high, temperatures will increase by a further 1°C by 2040 and 3°C by 2090, with the greatest warming likely to be in the northeast.
- In the last 60 years, sea levels have risen by 2.44 mm per year. If global emissions remain high, sea levels will increase by a further 0.21 m by 2040 and 0.67 m by 2090.
- Extreme weather events such as storms, heatwaves and heavy rainfall are likely to be more frequent and intense. Large increases in extreme rainfall are expected everywhere in the country.
- The number of frost and snow days are projected to decrease.
- Drought is predicted to increase in frequency and severity, particularly along the eastern side of the Southern Alps.
- Wildfire risk is predicted to increase.

Although these projections have a degree of uncertainty, they present plausible futures resulting from climate change. More information is available in the *Climate Change Projections for New Zealand Snapshot*.

Findings of the risk assessment

The 43 priority risks across five domains

The risk assessment grouped risks according to five value domains: human domain, natural environment domain, economy domain, built environment domain and governance domain.

These underpin our wellbeing and provide the structure for the assessment. The main report sets out the consequence and urgency ratings for all 43 risks. These are also shown in table 2 on page 8.

The 10 most significant risks

To find the most significant risks, we identified the two most urgent risks in each of the five domains (see table 1).

3 Hazard is the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Table 1: New Zealand's 10 most significant climate change risks, based on consequence and urgency

DOMAIN	RISK	RATING	
		Consequence	Urgency (44–94)
Natural environment	Risks to coastal ecosystems, including the intertidal zone, estuaries, dunes, coastal lakes and wetlands, due to ongoing sea-level rise and extreme weather events.	Major	78
	Risks to indigenous ecosystems and species from the enhanced spread, survival and establishment of invasive species due to climate change.	Major	73
Human	Risks to social cohesion and community wellbeing from displacement of individuals, families and communities due to climate change impacts.	Extreme	88
	Risks of exacerbating existing inequities and creating new and additional inequities due to differential distribution of climate change impacts.	Extreme	85
Economy	Risks to governments from economic costs associated with lost productivity, disaster relief expenditure and unfunded contingent liabilities due to extreme events and ongoing, gradual changes.	Extreme	90
	Risks to the financial system from instability due to extreme weather events and ongoing, gradual changes.	Major	83
Built environment	Risk to potable water supplies (availability and quality) due to changes in rainfall, temperature, drought, extreme weather events and ongoing sea-level rise.	Extreme	93
	Risks to buildings due to extreme weather events, drought, increased fire weather and ongoing sea-level rise.	Extreme	90
Governance	Risk of maladaptation[1] across all domains due to practices, processes and tools that do not account for uncertainty and change over long timeframes.	Extreme	83
	Risk that climate change impacts across all domains will be exacerbated because current institutional arrangements are not fit for adaptation. Institutional arrangements include legislative and decision-making frameworks, coordination within and across levels of government, and funding mechanisms.	Extreme	80

1 Maladaptation refers to actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased vulnerability[4] to climate change, or diminished welfare, now or in the future. Maladaptation is usually an unintended consequence.

4 Vulnerability is the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm, and lack of capacity to cope and adapt.

There are connections across risks and domains

The main report explores some connections between domains and risks, including a case study in section 6 on page 102. However, the framework did not provide a way to include the interactions between the risks in this first risk assessment.

To be effective, the responses to the priority risks will need to recognise these interconnections. Māori who were consulted emphasised that this was fundamental to exploring climate risks.

Opportunities

We identified only a few opportunities. All require research to ensure responses do not worsen climate change impacts unintentionally. The opportunities are:

- higher productivity in some primary sectors due to warmer temperatures
- businesses to provide adaptation-related goods and services
- lower cold weather-related mortality
- lower winter heating demand.

Knowledge gaps

Gaps in the knowledge about climate change include:

- biological data on ecosystems and species
- the relationship between vulnerable social groups, cultural heritage and climate change, along with impacts on Māori social, cultural, spiritual and economic wellbeing
- the effect on banking and insurance, and the flow-on effect on the financial system
- consistent hazard information for assessing the exposure of the built environment at a national scale
- the interdependencies and shared risks between infrastructure sectors
- a coordinated research platform to inform effective adaptation
- the current and future barriers to adaptation
- the full range of opportunities, and better understanding of those already identified.

Māori perspectives

The priority risks will disproportionately affect certain Māori groups and interests, values, practices and wellbeing. Mātauranga Māori[5] will be critical for a greater understanding of the risks, and for future planning. Some iwi support a parallel risk assessment for Māori, by Māori.

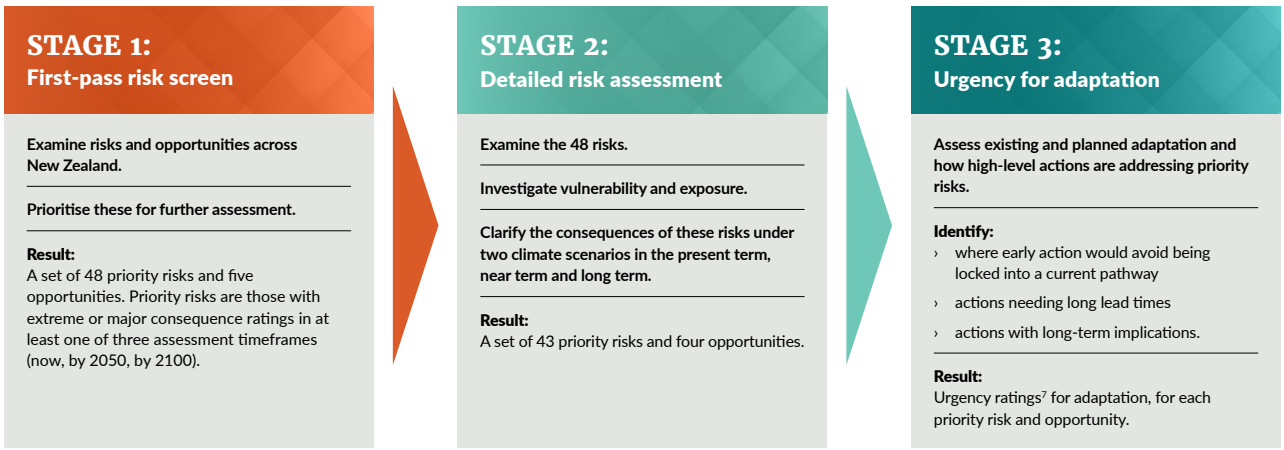
Risks of particular significance to Māori include:

- risks to social, cultural, spiritual and economic wellbeing from loss and degradation of lands and waters; and from loss of species and biodiversity (risks H5 and H6, see table 2)
- risks to social cohesion and community wellbeing from displacement of individuals, families and communities (risk H1)
- risks of exacerbating and creating inequities due to unequal impacts of climate change (risk H2).

Many iwi and hapū are already developing their own climate change plans.

Assessing risk: a three-stage process

Below is the process used for the risk assessment.



5 Mātauranga Māori or Māori knowledge has many definitions that cover belief systems, epistemologies, values, and knowledge both in a traditional and contemporary sense. Mātauranga Māori incorporates knowledge, comprehension and understanding of everything visible and invisible existing in the universe.

6 Urgency is defined as "a measure of the degree to which further action is needed in the next five years to reduce a risk or realise an opportunity from climate change" (Committee on Climate Change, 2019, p.5). The framework adopted the urgency categories from the *2017 UK Climate Change Risk Assessment* (Committee on Climate Change, 2017).

Rating risks by consequence and urgency

Table 2 sets out the consequence and urgency ratings for the priority risks.

Consequence ratings

Consequence ratings reflect the degree to which the assets in each domain are exposed and vulnerable to climate hazards. The ratings are insignificant, minor, moderate, major and extreme.

Urgency ratings

The risk assessment assessed the urgency of taking action to address each risk (the 'adaptation urgency'). This determined the degree to which further action is recommended in the next six years.

The urgency ratings range from 44 to 94, and are based on a number of factors, particularly whether an adequate response is under way or planned.

What the risk assessment does not include

Some issues were beyond the scope of the first risk assessment.

Socio-economic projections

Socio-economic factors for risk assessment include population, technological change and economic growth. New Zealand's socio-economic fabric will be very different in 2050 and in 2100. For example, cultural diversity will continue to grow.

For the first risk assessment, the framework excluded socio-economic projections such as future changes in population, gross domestic product and other economic, land-use or employment variables.

The main report explores these issues at a high level through a case study in section 6 on page 102.

Transition risks

Risks may emerge from the move to a lower-carbon, global economy. These include higher pricing of greenhouse gas emissions, and the costs of moving to new technology.[7]

The framework excluded transition risks from this first assessment. The Government is currently addressing these risks, for example through the Climate Change Response (Zero Carbon) Amendment Act 2019. It is also proposing to require financial firms and listed companies to report on the climate change impacts of their business in a consistent way.

Regional and local assessments

The risk assessment is a national-scale assessment, designed to feed into the national adaptation plan. It considers climate impacts on different parts of the country, using seven sub-national zones and two marine zones.

We aggregated the risks to the national scale, showing where risks may be higher in one or two zones. The method can apply to a regional, catchment, district and city scale. Regional and district assessments would focus more on informing governance and planning by regional, district and city councils.[8]

International and transboundary issues

Climate change will affect people and economies around the world, which will have flow-on effects for New Zealand. Future assessments may explore these issues more broadly.

Next steps

The risk assessment gives decision-makers the best available evidence and assessment for a planned approach to climate change risks and opportunities.

National adaptation plan

The risk assessment enables the Government to prioritise action, including through the national adaptation plan.

The national adaptation plan is required to be published within two years of the release of the risk assessment. The Climate Change Commission will monitor its implementation, and report to the Minister every two years on its effectiveness.

The next risk assessment within six years

The Climate Change Response (Zero Carbon) Amendment Act 2019 requires a risk assessment at least every six years. The Climate Change Commission will carry out future risk assessments.

This current assessment lays the groundwork for the next by documenting the method (see the National Climate Change Risk Assessment Method report), and providing the Government with tools (spreadsheets and engagement materials), raw data and records of engagement.

The Government and the Climate Change Commission have the option of building on this information and consultation. The research priorities and gaps will need to be addressed promptly if they are to inform the next assessment in 2024.

More information

Learn more about New Zealand's pathway to climate resilience.

7 Task Force on Climate-related Financial Disclosures (TCFD), 2017.

8 Ministry for the Environment, 2019.

Table 2: The most significant risks and other priority risks, by domain and consequence and urgency ratings

Natural environment				Human					
10 MOST SIGNIFICANT RISKS									
Risk	**Ratings**			**Risk**	**Ratings**			**Risk**	
N1 Risks to coastal ecosystems, including the intertidal zone, estuaries, dunes, coastal lakes and wetlands, due to ongoing sea-level rise and extreme weather events.	**Urgency**		78	H1 Risks to social cohesion and community wellbeing from displacement of individuals, families and communities due to climate change impacts.	**Urgency**		88	E1 Risks to governments from economic costs associated with lost productivity, disaster relief expenditure and unfunded contingent liabilities due to extreme events and ongoing, gradual changes.
	Consequence	**Now**	Min		**Consequence**	**Now**	Min		
		2050	Mod			**2050**	Ext		
		2100	Major			**2100**	Ext		
N2 Risks to indigenous ecosystems and species from the enhanced spread, survival and establishment of invasive species due to climate change.	**Urgency**		73	H2 Risks of exacerbating existing inequities and creating new and additional inequities due to differential distribution of climate change impacts.	**Urgency**		85	E2 Risks to the financial system from instability due to extreme weather events and ongoing, gradual changes.
	Consequence	**Now**	Mod		**Consequence**	**Now**	Major		
		2050	Mod			**2050**	Ext		
		2100	Major			**2100**	Ext		
OTHER PRIORITY RISKS									
Risk	**Ratings**			**Risk**	**Ratings**			**Risk**	
N3 Risks to riverine ecosystems and species from alterations in the volume and variability of water flow, increased water temperatures, and more dynamic morphology (erosion and deposition), due to changes in rainfall and temperature.	**Urgency**		68	H3 Risks to physical health from exposure to storm events, heatwaves, vector-borne and zoonotic diseases, water availability and resource quality and accessibility, due to changes in temperature, rainfall and extreme weather events.	**Urgency**		83	E3 Risks to land-based primary sector productivity and output due to changes in mean rainfall and temperature, seasonality, weather extremes and changes in the distribution of invasive species.
	Consequence	**Now**	Mod		**Consequence**	**Now**	Min		
		2050	Mod			**2050**	Mod		
		2100	Major			**2100**	Major		
N4 Risks to wetland ecosystems and species, particularly in eastern and northern parts of New Zealand, from reduced moisture status due to reduced rainfall.	**Urgency**		68	H4 Risks of conflict, disruption and loss of trust in government, from changing patterns in the value of assets and competition for access to scarce resources, primarily due to extreme weather events and ongoing sea-level rise.	**Urgency**		83	E4 Risks to tourism from changes to landscapes and ecosystems and impacts on lifeline infrastructure, due to extreme weather events and ongoing, gradual changes.
	Consequence	**Now**	Min		**Consequence**	**Now**	Mod		
		2050	Mod			**2050**	Major		
		2100	Major			**2100**	Major		
N5 Risks to migratory and/or coastal and river-bed nesting birds due to reduced ocean productivity, ongoing sea-level rise and altered river flows.	**Urgency**		65	H5 Risks to Māori social, cultural, spiritual and economic wellbeing from loss and degradation of lands and waters, as well as cultural assets such as marae, due to ongoing sea-level rise, changes in rainfall and drought.	**Urgency**		80	E5 Risks to fisheries from changes in the characteristics, productivity, and spatial distribution of fish stocks, due to changes in ocean temperature and acidification.
	Consequence	**Now**	Min		**Consequence**	**Now**	Major		
		2050	Mod			**2050**	Ext		
		2100	Major			**2100**	Ext		
N6 Risks to lake ecosystems due to changes in temperature, lake-water residence time, and thermal stratification and mixing.	**Urgency**		65	H6 Risks to Māori social, cultural, spiritual and economic wellbeing from loss of species and biodiversity, due to greater climate variability and ongoing sea-level rise.	**Urgency**		80	E6 Risks to the insurability of assets, due to ongoing sea-level rise and extreme weather events.
	Consequence	**Now**	Min		**Consequence**	**Now**	Major		
		2050	Mod			**2050**	Ext		
		2100	Major			**2100**	Ext		

CONSEQUENCE RATING KEY:

Insig	Insignificant	**Mod**	Moderate	**Ext**	Extreme
Min	Minor	**Major**	Major		

Economy			Built environment			Governance		
Ratings			**Risk**	**Ratings**		**Risk**	**Ratings**	
Urgency		90	B1 Risk to potable water supplies (availability and quality) due to changes in rainfall, temperature, drought, extreme weather events and ongoing sea-level rise.	**Urgency**	93	G1 Risk of maladaptation across all domains due to the application of practices, processes and tools that do not account for uncertainty and change over long timeframes.	**Urgency**	83
Consequence	**Now**	Min		**Consequence**	**Now**		**Consequence**	**Now**
	2050	Major			**2050**			**2050**
	2100	Ext			**2100**			**2100**
Urgency		83	B2 Risks to buildings due to extreme weather events, drought, increased fire weather and ongoing sea-level rise.	**Urgency**	90	G2 Risk that climate change impacts across all domains will be exacerbated because current institutional arrangements are not fit for climate change adaptation. Institutional arrangements include legislative and decision-making frameworks, coordination within and across levels of government, and funding mechanisms.	**Urgency**	80
Consequence	**Now**	Min		**Consequence**	**Now**		**Consequence**	**Now**
	2050	Mod			**2050**			**2050**
	2100	Major			**2100**			**2100**
Ratings			**Risk**	**Ratings**		**Risk**	**Ratings**	
Urgency		81	B3 Risks to landfills and contaminated sites due to extreme weather events and ongoing sea-level rise.	**Urgency**	85	G3 Risks to governments and businesses from climate change-related litigation, due to inadequate or mistimed climate change adaptation.	**Urgency**	78
Consequence	**Now**	Min		**Consequence**	**Now**		**Consequence**	**Now**
	2050	Mod			**2050**			**2050**
	2100	Major			**2100**			**2100**
Urgency		80	B4 Risk to wastewater and stormwater systems (and levels of service) due to extreme weather events and ongoing sea-level rise.	**Urgency**	85	G4 Risk of a breach of Treaty obligations from a failure to engage adequately with and protect current and future generations of Māori from the impacts of climate change.	**Urgency**	75
Consequence	**Now**	Min		**Consequence**	**Now**		**Consequence**	**Now**
	2050	Mod			**2050**			**2050**
	2100	Major			**2100**			**2100**
Urgency		80	B5 Risks to ports and associated infrastructure, due to extreme weather events and ongoing sea-level rise.	**Urgency**	70	G5 Risks of delayed adaptation and maladaptation, due to knowledge gaps resulting from under-investment in climate adaptation research and capacity building.	**Urgency**	75
Consequence	**Now**	Min		**Consequence**	**Now**		**Consequence**	**Now**
	2050	Mod			**2050**			**2050**
	2100	Major			**2100**			**2100**
Urgency		75	B6 Risks to linear transport networks, due to changes in temperature, extreme weather events and ongoing sea-level rise.	**Urgency**	60	G6 Risks to the ability of the emergency management system to respond to an increasing frequency and scale of compounding and cascading climate change impacts in New Zealand and the Pacific region.	**Urgency**	70
Consequence	**Now**	Insig		**Consequence**	**Now**		**Consequence**	**Now**
	2050	Mod			**2050**			**2050**
	2100	Major			**2100**			**2100**

Natural environment				Human					
Risk	**Ratings**			**Risk**	**Ratings**			**Risk**	
N7 Risks to terrestrial, freshwater and marine ecosystems, due to increased extreme weather events, drought, and fire weather.	**Urgency**		60	H7 Risks to mental health, identity, autonomy and sense of belonging and wellbeing from trauma, due to ongoing sea-level rise, extreme weather events and drought.	**Urgency**		80	E7 Risks to businesses and public organisations from supply chain and distribution network disruptions, due to extreme weather events and ongoing, gradual changes.
	Consequence	**Now**	Min		**Consequence**	**Now**	Major		
		2050	Mod			**2050**	Major		
		2100	Major			**2100**	Major		
N8 Risks to oceanic ecosystem productivity and functioning, due to changes in sea-surface temperature, ocean mixing, nutrient availability, chemical composition and vertical particle flux.	**Urgency**		55	H8 Risks to Māori and European cultural heritage sites, due to ongoing sea-level rise, extreme weather events and increasing fire weather.	**Urgency**		75		
	Consequence	**Now**	Min		**Consequence**	**Now**	Major		
		2050	Mod			**2050**	Major		
		2100	Major			**2100**	Major		
N9 Risks to sub-alpine ecosystems, due to changes in temperature and a reduction in snow cover.	**Urgency**		55						
	Consequence	**Now**	Min						
		2050	Mod						
		2100	Major						
N10 Risks to carbonate-based, hard-shelled species from ocean acidification, due to increased atmospheric concentrations of CO_2.	**Urgency**		55						
	Consequence	**Now**	Min						
		2050	Mod						
		2100	Major						
N11 Risks to the long-term composition and stability of indigenous forest ecosystems due to changes in temperature, rainfall, wind and drought.	**Urgency**		53						
	Consequence	**Now**	Insig						
		2050	Min						
		2100	Major						
N12 Risks to the diverse range of threatened and endangered species that are dependent on New Zealand's offshore islands for their continued survival due to ongoing sea-level rise, changes in terrestrial climates, and changes in ocean chemistry and productivity.	**Urgency**		45						
	Consequence	**Now**	Min						
		2050	Mod						
		2100	Major						

Economy			Built environment			Governance		
Ratings			Risk	Ratings		Risk	Ratings	
Urgency		68	B7 Risk to airports, due to changes in temperature, wind, extreme weather events and ongoing sea-level rise.	Urgency	55	G7 Risk that effective climate change adaptation policy will not be implemented and sustained, due to a failure to secure sufficient parliamentary agreement.	Urgency	68
Consequence	Now	Insig		Consequence	Now	Major	Consequence	Now	Mod
	2050	Mod			2050	Major		2050	Ext
	2100	Major			2100	Ext		2100	Ext
			B8 Risks to electricity infrastructure, due to changes in temperature, rainfall, snow, extreme weather events, wind and increased fire weather.	Urgency	55	G8 Risk to the ability of democratic institutions to follow due democratic decision-making processes under pressure from an increasing frequency and scale of compounding and cascading climate change impacts.	Urgency	53
				Consequence	Now	Mod	Consequence	Now	Mod
					2050	Mod		2050	Major
					2100	Major		2100	Major

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