

Adapting to Climate Change in New Zealand



**Recommendations from the Climate Change
Adaptation Technical Working Group**

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Foreword

In the time it has taken the Climate Change Adaptation Technical Working Group to prepare this report, New Zealand has continued to experience extreme weather events and our climate has continued to change. 2018 has started out to be a year of climate extremes. The 2017/2018 summer was the hottest year on record, with droughts declared. At the same time we experienced the devastating impacts from Ex-tropical Cyclones Fehi and Gita¹ with evacuations of homes, stranded tourists, power cuts, landslips, impassable roads, and wastewater overflows.



We present this report to the Minister for Climate Change at a time when New Zealand is waking up to the reality that climate change affects what we do, how we do it, and where we live. The recommendations in this report challenge the *status quo* of reacting to climate events as they occur. This will not meet our needs going forward.

Our land and water, our cities and rural land uses, our housing and the infrastructure that supports our daily lives, and our natural environment, are all affected by climate change. Impacts in one of these areas affects the others and will compound and cascade along the way. This brings new challenges for New Zealand and the need to fundamentally change the way we do things. This means raising the priority of climate change adaptation and developing new approaches.

We must start now to assess the risks and plan proactively in the knowledge there will be inevitable damages and losses. These can be reduced if the recommendations in this report are adopted. This report provides a comprehensive and integrated set of recommendations that will enable New Zealand to reduce its exposure and vulnerability to the ongoing risks from climate change and to navigate the changes required with confidence. All New Zealanders will need to take action for us to achieve effective adaptation.

We expect a timely response and timetable for implementing the recommendations in this final report, which builds on the momentum that has begun from our stocktake released in December 2017.

My thanks go to Co-chair Penny Nelson and the Technical Working Group, the Secretariat, and to those with whom we had discussions during the preparation of this report.

A handwritten signature in black ink, appearing to read 'Judy Lawrence'.

Judy Lawrence
Co-chair of the Climate Change Adaptation Technical Working Group

¹ NIWA. 2018. *Seasonal Climate Summary: New Zealand Climate Summary: Summer 2017-18*. Issued 5 March 2018.

Executive summary

The climate is changing – we need to act now

The global climate has already changed as a result of greenhouse gas emissions from human activities, and it will continue to do so.

New Zealand will experience increases in the frequency and intensity of extreme events such as higher temperatures, flooding, droughts, and wildfires. There will also be slowly emerging changes to our climate such as ongoing sea-level rise, and warmer and more acidic oceans. We are already seeing evidence of this. These changes threaten our coastal communities, cities, infrastructure, human health, biodiversity, oceans, and our natural resource-based economy.

There will be losses and damages. Opportunities will also arise for new and innovative ways to adapt. We need to act now to address the ongoing changes to our climate.

New Zealand is starting to adapt – but it's not enough

New Zealand is only in the early stages of planning to adapt to the impacts of climate change. We have a lot of information, but it's not necessarily the most appropriate information nor is it easily accessible to support the hard decisions we have to make.

We need to do more, earlier, and take action to reduce risks and build resilience to our changing climate.

Principles we recommend to guide action

We have developed a number of principles to guide, support and help sustain effective climate change adaptation. We recommend New Zealand must:

- anticipate change and focus on preventing future risks from climate change rather than responding as the changes occur
- take a long-term perspective when acting
- take actions which maximise co-benefits, and minimise actions which hinder adaptation
- act together in partnership, *ara whakamua*, and do this in a way that is based on the principles contained in the Treaty of Waitangi
- prioritise action to the most vulnerable communities and sectors
- integrate climate change adaptation into decision-making
- make decisions based on the best available evidence, including science, data, knowledge, and *Mātauranga Māori*
- approach adaptation action with flexibility and enable local circumstances to be reflected.

Actions we recommend

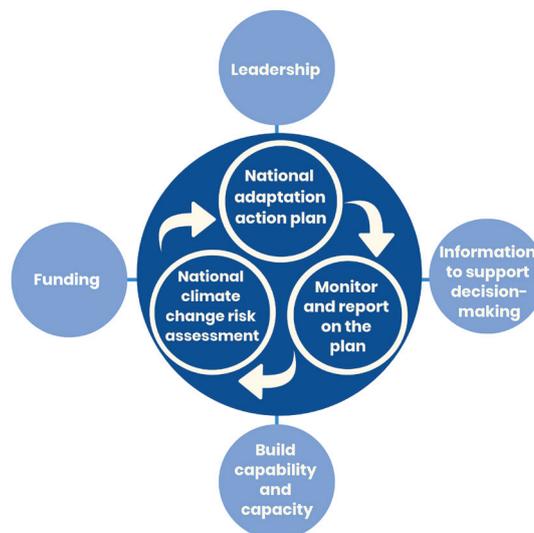
We recommend, for adaptation to be effective, New Zealand needs:

1. **Foundational actions:** these are building blocks that are essential for effective adaptation across all levels of society, the environment, and the economy. Some of these actions need to start now and some will depend on other actions being delivered first. These include:
 - a. core actions of a:
 - regularly updated national adaptation action plan
 - regularly updated national climate change risk assessment to prioritise actions
 - monitoring and reporting function for assessing the progress of implementing the national adaptation action plan and its effectiveness in addressing changing risks and priorities
 - b. supporting functions including:
 - strong leadership to direct New Zealand’s adaptation action
 - robust and accessible information for decision-making on climate risks and how to adapt
 - building capacity and capability to adapt
 - funding mechanisms to support action.

Figure 1 shows these core actions and supporting functions.

2. **Immediate actions:** these are discrete actions that can start now, be achieved relatively quickly, and address a specific opportunity to act. These actions are not intended to replace foundational actions.

Figure 1: Foundational actions we recommend for effective adaptation in New Zealand include core actions and supporting functions



Foundational actions

RECOMMENDATION	ACTION	WHY THIS IS IMPORTANT
1. Take a planned approach to adaptation	<p>Action 1: Develop and regularly update a national adaptation action plan</p> <p>Action 2: Monitor and report on national adaptation action plan implementation</p>	<p>These actions are fundamental because the plan will set out New Zealand’s adaptation actions providing leadership for tackling the climate impacts over long timeframes. They will define what needs to be done first, who does what, and will be informed by the national climate change risk assessment (Action 4). The plan will be regularly monitored for its effectiveness in reducing risk and building resilience.</p>
2. Understand risks, vulnerabilities and opportunities	<p>Action 3: Develop a national methodology and framework for assessing climate change risks and vulnerabilities and develop nationally-consistent datasets</p> <p>Action 4: Develop and regularly update a national climate change risk assessment</p>	<p>The assessment of climate risk needs to be done in a consistent way across the country for efficient adaptation to take place. Taking these actions will help us understand where we need to focus our efforts to reduce New Zealanders’ exposure and vulnerability to climate change impacts. This will enable the national adaptation action plan to prioritise areas and communities which are the most exposed and vulnerable to the impacts of climate change.</p>
3. Provide leadership for adaptation action	<p>Action 5: Establish governance arrangements that support long-term adaptation action</p> <p>Action 6: Incentivise and guide ongoing progress in adaptation action including avoiding, accommodating, retreating and defending</p> <p>Action 7: Review existing legislation and policy to integrate and align climate change adaptation considerations</p> <p>Action 8: Include the impacts of climate change in central and local government procurement processes</p> <p>Action 9: Update and regularly review organisational planning, risk management, and disclosure requirements</p>	<p>Strong leadership and clear responsibilities are needed so everyone who needs to can work together effectively to implement the plan and adapt to climate change over long timeframes. This involves how adaptation action is managed by central and local government, iwi/hapū, the private sector and communities, and how adaptation is supported by law.</p>

RECOMMENDATION	ACTION	WHY THIS IS IMPORTANT
4. Use information to support decision-making	<p>Action 10: Strategic and coordinated investment in science and technology for supporting climate change adaptation</p> <p>Action 11: Commission Mātauranga Māori-led measures that reflect cultural impacts of climate change and are developed and managed by iwi/hapū</p> <p>Action 12: Communicate nationally what New Zealand can do to adapt through a climate change information portal and other channels</p>	Investment in the science and information of adaptation and its dissemination is needed for making decisions on how to adapt to climate change and for monitoring the plan. Investing in strategic science and technology is fundamental for effective adaptation. This includes datasets that are consistent across the country and investment in their stewardship over time. We also recommend communicating nationally about what New Zealand can do to adapt to climate change, through a climate change information platform.
5. Build adaptive capacity and capability	<p>Action 13: Establish a centralised service to provide expert advice to local government for risk-based decision-making</p> <p>Action 14: Build capability and capacity in climate change adaptation across central government agencies</p> <p>Action 15: Build capability in climate change adaptation in key professional bodies and industry groups by developing and implementing training and development programmes</p>	It is important to upskill those who are mandated to take action and those who need to act. This includes central and local government, key professional bodies, and industry groups.
6. Determine how to fund adaptation	<p>Action 16: Define funding arrangements for climate change adaptation</p> <p>Action 17: Investigate how future costs of climate change adaptation could be reflected in investment and planning decisions</p>	It is imperative funding mechanisms for adaptation are in place that fit the nature of the problem, do not create moral hazard, and can be sustained over long timeframes. We also recommend new tools are used to reflect future costs in investment and planning decisions. These are essential for taking effective adaptation action early and as climate changes evolve.

Immediate actions

ACTION	WHY THIS IS IMPORTANT
Action 18: Central government to continually reinforce publicly that climate change adaptation is a priority for New Zealand and that the Government recognises the need to link adaptation action with climate change mitigation	Adaptation must be recognised as an essential part of the climate change agenda now, while legislative attention is being given to climate change. This is essential because all of New Zealand will be impacted by the changing climate.
Action 19: Implement Actions 1, 2, 3, 4 and 5 using the proposed Zero Carbon Bill to give a consistent and clear legislative mandate for climate change adaptation	The Zero Carbon Bill provides an opportunity to implement our recommended core actions for long-term and sustained adaptation action.
Action 20: Include adaptation funding in the Government's commitment to hold a public inquiry into the drivers of local government costs and its revenue base	Taking this action will highlight the significant level of investment that needs to occur to reduce risk and the level of damages New Zealand can expect as the climate continues to change.
Action 21: When implementing the National Policy Statement for Freshwater Management, councils have particular regard to adapting to the effects of climate change	It is important for councils to consider the adaptation needed to achieve water quality and quantity limits under a changing climate.

What happens next?

We are a technical working group representing a broad range of interests and have been tasked to give our expert advice to the Government on what actions can be taken to adapt to the impacts of climate change. Our recommendations comprise a package of actions that together address what it will take to reduce climate risks and build resilience to the effects of climate change. This is our final report to the Minister for Climate Change and it builds on the stocktake released in December 2017.

We would like to see a timely government response to the recommendations we have presented here that defines how and when these actions will be implemented and monitored. A timetable of actions will enable New Zealand to have a credible adaptation plan that is informed, organised and proactively reduces our exposure and vulnerability to the social, cultural, environmental and economic consequences of climate change.

1 Effective adaptation for New Zealand

1.1 The climate is changing and New Zealand needs to adapt

Global climate has already changed as a result of greenhouse gas emissions from human activities and it will continue to do so. While we are uncertain about the speed and scale of further change, we know that planning for the future means planning for ongoing climate change.

New Zealand will experience increased frequency and intensity of extreme events such as higher temperatures, flooding, droughts and wildfires, and slowly emerging changes such as ongoing sea-level rise, warmer and more acidic oceans, and new pests threatening our natural environment. We are already seeing evidence of this. These changes threaten our coastal communities, cities, infrastructure, human health, biodiversity, oceans and our natural resource-based economy (Intergovernmental Panel on Climate Change, 2014).

There will be losses and damages. Opportunities will also arise for new and innovative ways to adapt. We need to act now to address the ongoing changes to our climate.

1.2 What New Zealand is doing to adapt

Our stocktake², published in December 2017, summarised the expected impacts of climate change on New Zealand over the medium and long term, took stock of existing work on adaptation, and identified gaps in New Zealand's current approach. In our stocktake we also defined what 'effective adaptation' means to us.

What is effective adaptation?

To be effective, adaptation action must enable New Zealand's communities to reduce the risks from climate change impacts today, and over the medium and long term by:

- reducing the exposure and vulnerability of our social and cultural systems, natural and built environment (including physical assets), and economy
- maintaining and improving the capacity of our social, cultural, environmental, physical and economic systems to adapt.

² Climate Change Adaptation Technical Working Group. 2017. *Adapting to climate change in New Zealand: Stocktake Report from the Climate Change Adaptation Technical Working Group.*

We identified three characteristics that need to be in place for effective adaptation to be implemented in New Zealand and used them to review the adaptation work being undertaken in New Zealand. They are:

1. being **informed** about how the climate is changing and what this means for New Zealanders
2. being **organised**, with a common goal, a planned approach, appropriate tools, and clear roles and responsibilities
3. taking **dynamic action** to proactively reduce exposure and vulnerability to the social, cultural, environmental and economic consequences of climate change.

We concluded that every New Zealander has a role to play in adapting to climate change. We believe it is essential that a whole of New Zealand approach be taken where:

- central government makes policy decisions on national issues, provides the policy framework, supporting information and the statutory means for implementing policy, as well as some of the operational delivery
- local government integrates the effects of climate change into its decisions such as, land-use planning, water resource management, service delivery for the three waters³, flood risk management, biodiversity and biosecurity responsibilities, roading, and emergency management
- iwi/Māori, through the Treaty partnership with government, are able to make informed choices about how they will respond to climate change; and have a platform for expressing values and preferences for the options available
- the private sector takes action to adapt and drives investment in behaviours and activities which can develop resilience and support adaptation action
- the community is able to make informed choices about how they will respond to climate change and have a platform for expressing values and preferences for how adaptation is implemented.

New Zealand's progress towards effective adaptation

Our stocktake report concluded New Zealand is in the early stages of planning for adaptation to the impacts of climate change.

Using the three characteristics for effective adaptation, New Zealand's progress to date can be best described as:

- **Informed:** A significant amount of information has been developed on what is happening to New Zealand's climate and the impacts of a changing climate. However, not all of this information is accessible to communities or in a form that can support decision-making.

³ Three waters includes drinking water, stormwater and wastewater.

Collective knowledge gaps also exist and include:

- understanding social vulnerability in New Zealand and how to assess it
 - potential new threats to biosecurity and biodiversity
 - impacts to human health and health services including human tolerance limits
 - how the hydrological cycle in New Zealand may respond to changes in climate, in particular, potential effects on the frequency and intensity of rainfall-induced flooding
 - how natural systems may respond to increased climate variability and intensity of extreme events. This includes the tolerance limits of the natural environment and cultural indicators of these changes
 - how land and water (terrestrial and marine) uses may be impacted by the compounding effects of climate change
 - the costs of inaction over the medium and long term.
- **Organised:** Unlike many other countries (developed and developing), New Zealand does not have a coordinated plan for how to adapt to climate change, the institutional arrangements for monitoring and implementing a plan, nor the tools and resources to adapt in a consistent way. Competing objectives and inconsistencies in timeframes across legislation and policies related to climate change adaptation (eg, resilience and disaster risk reduction) means roles can be confused. As a result, investment in resources to deliver adaptive action is challenging. Without investment in building capability, capacity to adapt is limited.
 - **Dynamic action:** Examples of proactive adaptation action where there is high exposure and potentially large costs are limited. In most cases, actions are reactive and part of a response after extreme events, rather than being proactive and using fit-for-purpose preventative measures and planning tools that consider wider impacts and a longer-term view.

Overall, we concluded that, while some specific actions are being undertaken, planning for and taking action to adapt to climate change is not occurring early enough, nor at the scale we consider necessary.

We also recognised it is important to build upon the actions being taken now. This includes:

- strategic funding and coordination of adaptation research
- investing in research to understand the ongoing changes in climate that New Zealand can expect, the implications of those changes, and to develop tools to help address the changes.

Some New Zealand communities facing significant impacts are more informed than others about the further changes they can expect and yet all communities will be affected, in some way, by climate change.

Our stocktake report also identified barriers constraining action. These include insufficiencies in:

- access to information to understand the risks
- resources to take action

- leadership to guide action
- alignment of legislation
- fit-for-purpose decision-making tools and processes (evaluation and engagement) to deliver action
- how costs of action can be shared and funded.

In this report we provide recommendations to address these challenges.

1.3 Developing the options New Zealand has to adapt effectively

In this, our final report, we have identified recommendations for the actions New Zealand needs to take to build resilience to the effects of climate change while growing the economy sustainably.

We recommend a series of actions that, if taken together, will enable New Zealand to adapt to climate change effectively.

In developing our recommendations, we used the collective experience of the science, business, local government, and adaptation and risk management experts within our group, alongside New Zealand and international literature on climate change adaptation. We also tested our draft actions through targeted discussions with other experts in their fields.

In developing our recommendations we have considered:

- the actions already underway and how to build on these (what we found in our stocktake report)
- New Zealand's social, cultural and economic context, from the perspective of the Treaty of Waitangi
- how an economy-wide approach could enable effective adaptation
- approaches and research other countries are undertaking to adapt to climate change.

The details of the latter three aspects are included in [Appendix 1](#) of this report.

2 Principles to guide effective adaptation

We have developed a set of principles to frame our recommendations. We propose these be used to guide effective adaptation in New Zealand.

2.1 Principles to guide the action New Zealand takes

- **Adaptation anticipates change and focuses on proactive action rather than response**
Anticipating the ongoing risks of climate change and taking timely action to reduce and prevent future damage is fundamental to effective adaptation. This can be achieved using:
 - predictive methods (where uncertainty is low)
 - scenarios (where uncertainties are high)
 - adaptive planning, including monitoring whether actions achieve the desired outcome and reporting how successful the implementation plan is in reducing the risk, exposure and vulnerability of communities to climate change.

Shifting from a reactive approach, where we respond to climate events after they have occurred, to more proactive actions will enhance resilience and reduce the financial and social exposure to climate change impacts across New Zealand.

- **Action to adapt takes a long-term perspective**
Adaptation action must be ongoing and consistent. This requires a long-term commitment to continuing action that spans political, planning and financial cycles. It is also important that decisions made now on how to adapt do not restrict New Zealand's ability to make future decisions about how to act.

Certainty in New Zealand's approach to climate change action will give decision-makers confidence to make long-term investment decisions; for example, where to live, what infrastructure to invest in, or what crops to grow.

- **Adaptation action maximises co-benefits and minimises maladaptation**
Climate change impacts will create losses and damages in New Zealand. Taking action needs to:
 - reduce losses and damages
 - create benefits and maximise co-benefits
 - avoid maladaptation, such as locking in unsustainable practices and reducing the ability to respond to future changes.

As an example, actions to adapt to climate change can also be linked with actions to mitigate climate change by reducing emissions. For example, planting trees on marginal land to increase resilience to erosion (and improve water quality) will also have mitigation co-benefits through increased carbon sequestration (increased removal and storage of emissions). However, increased exposure to pests, wildfire and water stress as a result of planting may also cause maladaptation.

2.2 Principles for how actions are implemented

- **We adapt together, in partnership – ara whakamua**
Based on the principles derived from the Treaty of Waitangi, partnership with iwi/hapū on New Zealand’s adaptation response is an essential foundation. This includes principles of reciprocity, autonomy, active protection, mutual benefit, equity, equal treatment, and redress. Our aim has been to ensure the principles are reflected in all our recommendations.
- **All action prioritises the most vulnerable sectors and communities**
Understanding which sectors and communities are most vulnerable to climate change impacts is essential for prioritising and building local adaptive capacity and capability. For example, some communities may be less able to adapt due to socio-economic circumstances; and older infrastructure may be unable to cope with future climate conditions.
- **Climate change adaptation is integrated into decision-making**
Integrating the risks and opportunities from climate change into decisions and actions will be a critical element of New Zealand’s adaptation response.⁴ To achieve effective adaptation, short-, medium-, and long-term decision-making needs to consider current and ongoing climate risks and their scale.

Factoring in climate risk means decisions will be informed by an understanding of the current and future costs and benefits, as well as consideration of equity within and between generations.⁵ This applies to both policy and long-term investment decisions across all levels of government, the economy, and society.
- **Decision-making uses the best available evidence, including science, data, local knowledge, and Mātauranga Māori**
Adaptation decisions will be evidence-based and make full use of the latest research, data and practical experience relevant to climate change adaptation. The knowledge and experience of iwi/hapū and local communities are of significant value and need to be central to decision-making. Continued investment in research and innovation, as well as the accessible communication of the resulting information, will help us manage climate risks and explore opportunities.

⁴ Article 7(9) of the Paris Agreement.

⁵ Commonwealth of Australia 2015. *National Climate Resilience and Adaptation Strategy*. Retrieved from www.environment.gov.au/climate-change/adaptation/strategy (13 December 2107).

- **Adaptation action is flexible to climate changes and reflects local circumstances including values and culture**

While change itself is certain, some uncertainty will always exist (eg, in the speed and scale of changes to the climate that New Zealand can expect over the longer term).

Adaptation decisions need to be flexible and readily adjusted so they can respond to evolving information and knowledge.

Different regions of New Zealand are likely to have different adaptation priorities based on their local circumstances and unique risk profiles and as such, different adaptation options need to be considered and modified accordingly over time.

3 Recommendations for effective adaptation

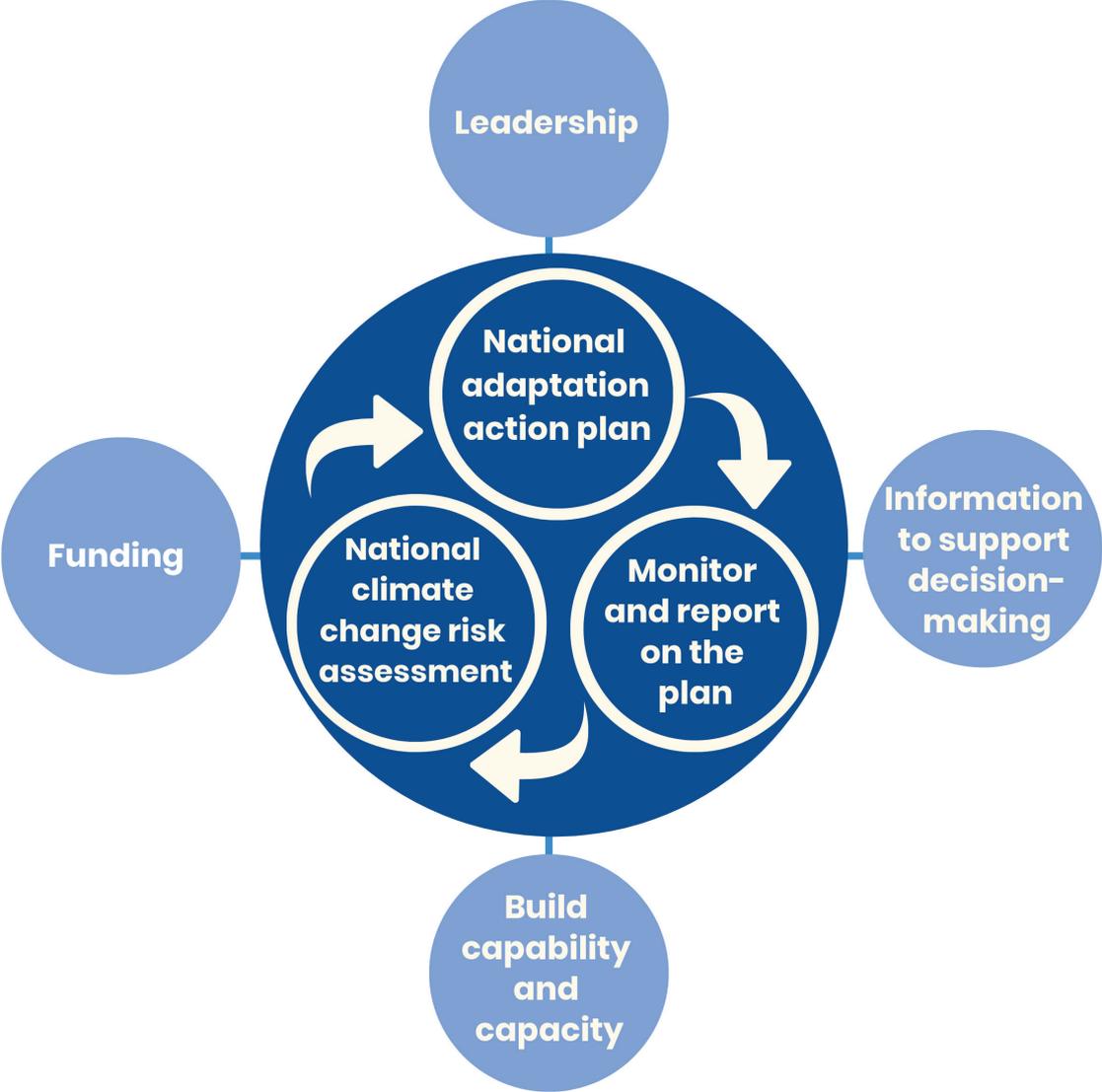
We recommend, for adaptation to be effective, New Zealand needs the following.

- Core actions of a:
 - regularly updated national adaptation action plan
 - regularly updated national climate change risk assessment to prioritise actions
 - monitoring and reporting function for assessing the progress of implementing the national adaptation action plan and its effectiveness in addressing changing risks and priorities.
- Supporting functions including:
 - strong leadership to direct New Zealand’s adaptation action
 - robust and accessible information for decision-making on climate risks and how to adapt
 - building capacity and capability to adapt
 - funding mechanisms to support action.

Figure 1 shows these core actions and supporting functions.

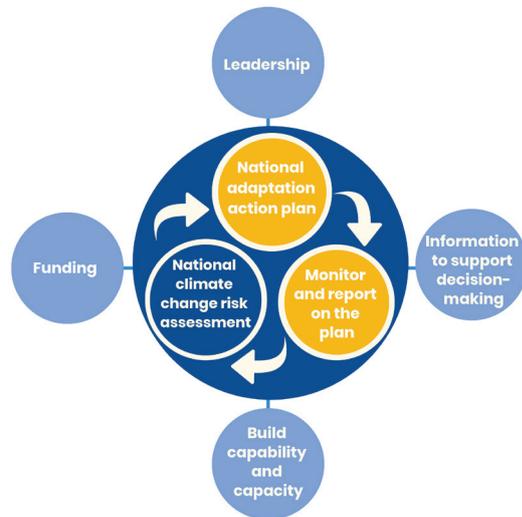
We consider all of these recommendations to be **foundational actions**. These building blocks are essential for adaptation to be effective across all levels of society and the economy. Some of these actions need to start now and some will depend on other actions being delivered first. For example, a national climate change risk assessment will inform the national adaptation action plan. These include Actions 1 to 17 and are discussed in section 3.1 to 3.6.

Figure 1: Foundational actions we recommend for effective adaptation in New Zealand include core actions and supporting functions



3.1 A planned approach to adaptation

*Having a planned approach will mean New Zealand is more **organised** to deliver effective adaptation*



These recommendations are about having a clear, planned approach to action on climate change adaptation.

Our stocktake identified that New Zealand currently has no coordinated adaptation plan to adapt to climate change.

We recommend a **planned approach**, because it will:

- ensure New Zealand is taking considered and sustained steps to reduce risk by adapting to the impacts of climate change
- provide clarity to all levels of government, iwi/hapū, the private sector, and communities on priorities and the role they can take to adapt to climate change
- enable the risks from climate change to be reduced because plans can be regularly updated to address ongoing changes to the climate and focus investment in adaptation actions
- ensure New Zealand’s adaptation plan can be monitored, with progress on implementation reported on and updated, making it comparable with plans of other countries (both developed and developing)⁶
- enable New Zealand to meet our commitment under the Paris Agreement to plan for and take action on climate change adaptation. This will also contribute to our responsibilities under the Sendai Framework for Disaster Risk Reduction and the United Nations Sustainable Development Goals.

⁶ This method of producing a plan, and reporting on it has been used in the United Kingdom, for example, where it has addressed some of the highest priority risks relating to flooding, water security, food production, environment, and biodiversity.

Action 1: Develop and regularly update a national adaptation action plan

We recommend a national adaptation action plan (the plan) to:

- enhance certainty about New Zealand’s commitment to plan for and take action on climate change adaptation
- define a common set of outcomes, goals and priorities for climate change adaptation
- clarify roles and responsibilities between central and local government, iwi/hapū, the private sector and communities, and encourage collaboration
- improve transparency and drive accountability for progress, priorities and outcomes
- provide a focus for investment
- establish the basis for incorporating climate change adaptation into decision-making by central and local governments, iwi/hapū, the private sector, and communities
- increase consistency between strategies, policies and national guidance, because the plan will provide a common basis for the alignment of actions by all.

To achieve this, we recommend the plan:

- focuses in the first instance on advancing the actions identified in this document based on the principles for effective adaptation (section 2)
- is informed by and updated over time in response to the national risk assessments (Action 4)
- uses a 100-year planning timeframe so decisions have a long-term perspective and action is taken now
- clarifies adaptation objectives over the defined planning period, including success factors
- provides robust information based on strong scientific evidence, building on the information base that already exists and new information as it becomes available
- is informed by experts working in a multidisciplinary way – in climate science, impacts and implications, adaptation, social behavioural science, engineering, health, environmental science, Te Ao Māori including Mātauranga Māori, finance, economics, and legal and public policy
- identifies priority sectors, including assisting and prioritising vulnerable people and regions – based on their exposure, vulnerability and adaptive capacity through the assessment of risks
- takes advantage of opportunities for adaptation, including the transition of communities and businesses to a more climate resilient future
- is developed through a process of public engagement and is publicly available
- allocates actions for central government, local government, iwi/hapū, the private sector, and communities

- can be used to inform future local government, iwi/hapū, the private sector, and community plans
- is required in legislation to ensure it is enduring across political, planning and financial cycles
- is updated regularly to capture evolving climate risks and its effectiveness in delivering adaptation, and is informed by the monitoring and reporting undertaken under Action 2. We recommend updates take place at least every five years (sooner if climate change or societal signals indicate a change in action or pathway is required).

We recommend the plan be a single document, developed by central government in collaboration with local government, iwi/hapū, the private sector, and the New Zealand public. Although we recommend this be undertaken at a national, economy-wide level, it does not preclude the development of supporting plans for regions, communities, or by the private sector.

Action 2: Monitor and report on national adaptation action plan implementation

We recommend regular monitoring and reporting to understand progress with implementing the plan and its effectiveness in addressing changing risks and priorities. The outcome of this process will be to update and reprioritise actions in the plan. This will ensure the plan is dynamic and actions remain relevant and effective in reducing risks and enhancing resilience. In the countries that already have national adaptation action plans and national climate change risk assessments this process has helped inform continual improvement in the effectiveness of their plans.

We recommend the monitoring and reporting of the plan:

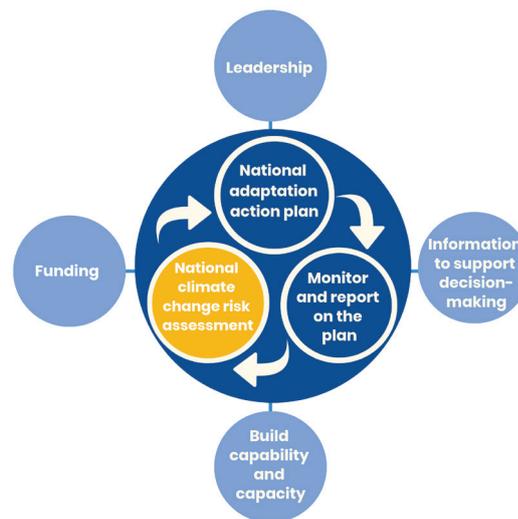
- uses indicators, derived in a transparent way through co-design between physical and social science experts, iwi/hapū, and adaptation practitioners; and which are informed by international best practice
- assesses the effectiveness of the plan – how outcomes achieved are contributing to the goal
- defines how actions have contributed to reducing risks and the level of exposure and vulnerability of communities, based on subsequent national climate change risk assessments
- reviews the priorities of the plan based on the most recent national climate change risk assessment
- identifies and recommends further actions needed to address:
 - the barriers to implementation where progress is not occurring
 - any emerging dependencies and future risks
- describes the timeliness and cost of actions
- is publicly available

- is required in legislation to ensure it is enduring across political, planning and financial cycles⁷
- is formally responded to by government, and the requirement for this is legislated.

We recommend the plan be monitored and reported on every two years. It is essential this be done consistently and independently from the preparation of the plan.

3.2 Understanding risks, vulnerabilities and opportunities

*Understanding risks, vulnerabilities and opportunities will mean New Zealand is more **informed** to deliver effective adaptation*



These recommendations are about identifying the risks, vulnerabilities and opportunities at a national level to identify and prioritise action within the national adaptation action plan.

Our stocktake identified New Zealand has neither a nationwide climate change risk assessment nor national guidance to support local government and other sectors to deliver their own risk assessments.

Without a consistent approach to climate change risk assessments at a national and local level, there can be no certainty resources are being directed to the most effective actions or the most critical needs.

Identifying climate change risks at a national level will help **reduce risks, enhance resilience, and identify opportunities**. Taking this approach will determine:

- how **exposed** people, culture, the natural and built environments (including physical assets) and the economy are to the changes

⁷ Without mandatory monitoring and reporting, economy-wide buy-in to adaptation will be elusive as was found in the United Kingdom where there is no mandatory process for the Government to respond to reports on adaptation progress in the United Kingdom's Climate Change Act (2008).

- how **vulnerable** people, culture, the natural and built environments (including physical assets) and the economy are; that is, their ability to cope with and adapt to the changes.

Action 3: Develop a national methodology and framework for assessing climate change risks and vulnerabilities and develop nationally-consistent datasets

A national methodology and framework for assessing climate change risks and vulnerabilities is needed as a priority, as are the nationally-consistent datasets to inform these assessments. A standardised approach to these assessments will:

- ensure consistency of all risk assessments across New Zealand
- enable comparison and calibration of risks from multiple environments (social, cultural, natural, physical and economic), including the scale of the impacts and changes in risks and vulnerabilities over time
- ensure credibility of the national climate change risk assessment (*Action 4: Develop and regularly update a national climate change risk assessment*).

We recommend a national methodology and framework which:

- defines the agreed climate and socio-economic scenarios for use in determining future risk and vulnerability
- sets out how risks and vulnerabilities will be assessed using agreed future climate scenarios to address uncertainties and change
- allows risks and vulnerabilities to be prioritised so the most vulnerable communities, exposed areas, and areas that present opportunities can be identified
- considers risk and vulnerability of:
 - society
 - culture
 - the economy
 - the natural and built environments (including physical assets)
 - values and lifecycles of assets
 - international dimensions (such as trade, conflict, and migration as a result of climate change)
- includes a standardised approach to communicating the characteristics of future climate changes including extreme events and slowly emerging impacts
- is sensitive to New Zealand’s particular cultural, environmental, social and economic circumstances

- provides for regional differences including allowance for unique circumstances to be highlighted for specific focus
- deals with compounding and cascading risks across areas of interest as well as tangible and intangible losses
- provides for the quantification of potential losses in financial terms, including social and cultural cost, to support investment business cases
- provides for qualitative narratives for instances when quantification is not possible
- is publicly available and accessible to all and can be used by central and local government, iwi/hapū, the private sector, and communities
- is supported by tools, templates and guidance documents
- considers existing risk methodologies used by central and local government, and relevant international approaches (eg, the United Kingdom and the Netherlands) that can be applied in conditions of uncertainty and change over long timeframes
- is updated as best practice and vulnerability assessment methodology evolves, and users are made aware of the updates.

We also recommend, as part of developing the national methodology and framework, that nationally-consistent datasets are developed.

Local government, researchers and the private sector have called for nationally-consistent land elevation data to support planning; for example, for ongoing sea-level rise assessments. The Parliamentary Commissioner for the Environment has also recommended the inclusion of protocols for the procurement of nationally-consistent elevation data and to create a national repository for such data. This repository will include, for example:

- nationally-standardised projections and scenarios that are informed by the impacts of climate change and changes to society over long timeframes
- nationally-consistent land elevation (LIDAR)⁸ or similar information produced by other rapidly developing technologies
- data required for local scale hazards and risks assessment
- data from increased and improved monitoring of vertical land movement by extending and upgrading the current sensor network
- social vulnerability assessment methodologies for applying in vulnerability assessments and for deciding on adaptation actions.

We recommend a national methodology, framework and datasets is developed by experts in risk and vulnerability assessments in collaboration with those who will implement a climate change risk assessment. This includes subject matter experts from central and local government, iwi/hapū, the private sector, and the New Zealand public.

⁸ LIDAR stands for Light Detection And Ranging.

Action 4: Develop and regularly update a national climate change risk assessment

We recommend a national climate change risk assessment is undertaken and regularly updated to:

- improve New Zealand's understanding of the extent and severity of the impacts and changes in risks and vulnerabilities over time by defining risks, vulnerabilities and opportunities using agreed climate scenarios
- inform Action 1: *Develop and regularly update a national adaptation action plan*, including the prioritisation of actions
- create an efficient approach to adaptation as it will direct the allocation of resources (including funding); for example, for vulnerable communities.

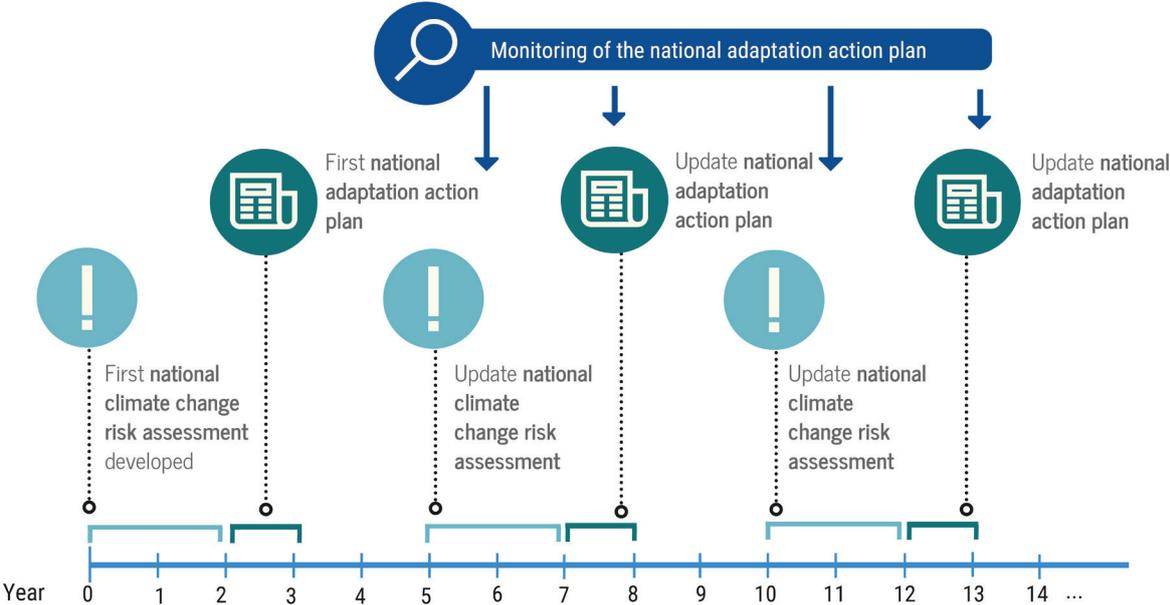
To achieve this we recommend each climate change national risk assessment:

- is based on the methodology defined in Action 3: *Develop a national methodology and framework for assessing climate change risks and vulnerabilities and develop nationally-consistent datasets*
- is repeated and updated at regular intervals to determine how risks are changing in response to actions being taken and where new risks may arise. We recommend updates take place at least every five years (sooner if climate change signals indicate additional adaptive action is required), in between updates to the national adaptation action plan
- is developed using credible and consistent information from trusted sources
- is independently peer reviewed by risk assessment experts to ensure it implements the national methodology and adheres to best practice
- identifies, from the experience undertaking the climate change risk assessment, any shortcomings in procedural and guidance information, and recommends areas of improvement in the methodology.

Although we recommend this be undertaken at a national, economy-wide level, it does not preclude the development of climate change risks assessments for regions, communities, sectors or by the private sector, where appropriate.

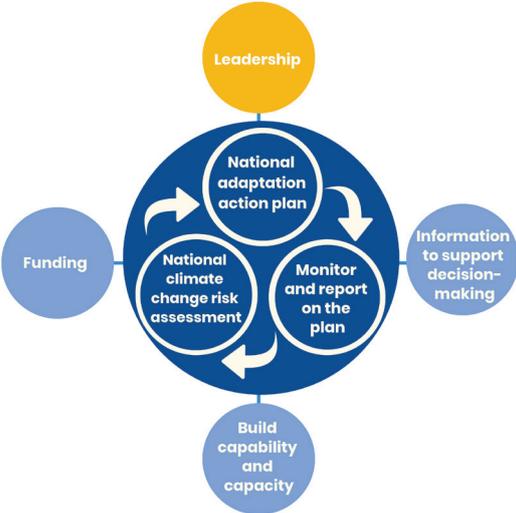
We have recommended core actions including the plan (Action 1), the monitoring of the plan (Action 2) and the national climate change risk assessment (Action 4). Figure 2 illustrates how we propose these will interact.

Figure 2: Relationship between the core actions: the national adaptation action plan (Action 1), monitoring of the national adaptation action plan (Action 2), and the national climate change risk assessment (Action 4)



3.3 Leadership for adaptation

Leadership will mean New Zealand is more organised to deliver effective adaptation and can act dynamically to ensure sustained action



These recommendations are about motivating strong leadership to drive adaptation action and recognising that climate change is the new reality.

In the stocktake, we defined the current roles and responsibilities of central and local governments and other sectors. We also recognised that the lack of a coordinated and planned approach meant leadership was confused. This problem was accentuated by:

- inconsistencies across legislation creating barriers to adaptation implementation. These include:

- timeframes for planning
- standards for flooding
- responsibilities between levels of government for hazard management and land-use planning
- funding and compensation issues that do not align
- confusion between climate change adaptation, hazard management, and resilience and disaster risk management in policies and legislation, standards and guidance across several agencies.

We acknowledged this makes it difficult for central and local government, in partnership with iwi/hapū, to organise themselves proactively and to take action, and for action in the private sector and communities to be consistent when decisions are being made on how to act.

We recommend enduring leadership that supports a coordinated and planned approach, with legislative alignment and clear definition of responsibilities for climate change adaptation, hazard management, resilience, and emergency management. This will:

- guide and regulate action and create incentives
- enable long-term investments to be undertaken with confidence – by the Government, local government, iwi/hapū, the private sector, and communities.

Action 5: Establish governance arrangements that support long-term adaptation action

We recommend consistent and long-term governance arrangements be established to support adaptation action. Doing this will:

- assign responsibilities for developing and regularly updating the national adaptation action plan (Action 1)
- enable monitoring and reporting on the progress of the plan’s implementation (Action 2)
- enable a national climate change risk assessment to be undertaken regularly (Action 4).

These arrangements will:

- ensure future governments stay on track with implementing the plan, and are focused on achieving long-term adaptation goals
- improve the transparency and accountability of government policy implementation on adaptation
- enable adaptation policy to have a focus on the long term and across political, planning and financial cycles
- enable New Zealand to take a more proactive approach to adaptation.

We recommend new governance arrangements be guided by the following principles:

- the principles of the Treaty of Waitangi
- the plan (Action 1) is based on expert advice from all levels of government, iwi/hapū, private sector, and the New Zealand public
- the methodology and framework for assessing climate change risks and vulnerabilities and nationally-consistent datasets (Action 3), and subsequent assessments (Action 4) are informed by science experts and specialists in risk and vulnerability assessment methodologies
- monitoring and reporting of the implementation and effectiveness of the plan (Action 2) is independent from developing and updating the plan (Action 1). This will enable good leverage for action if monitored openly and with a mandatory response from government which prepares the plan
- processes, including reporting, are transparent
- mechanisms are in place for ensuring long-term commitment to the plan (eg, independent reporting to Parliament).

There is currently no national statutory body within New Zealand with leadership and oversight of planning for and assessment of risks from climate change that could facilitate a shift towards a more proactive mode⁹.

The Government's announcement of the Zero Carbon Bill and the proposal to establish, in law, an independent Climate Change Commission provides an opportunity for governance arrangements that support long-term adaptation action. The opportunity provided by the Zero Carbon Bill is discussed in further detail under Action 19.

Action 6: Incentivise and guide ongoing adaptation action including avoiding, accommodating, retreating and defending

We expect that land uses will need to adapt to the changing climate including to extreme events, such as high rainfall and droughts, and increased temperature and wind. Ecosystems will also be affected by climate impacts and management regimes will need to change. There is therefore a need for guidance for the management of such transitions.

Approaches to adaptation can be described as falling in to four categories:

1. **Avoid** places exposed to climate change impacts. For example, locate new developments in low-risk areas.

⁹ New Zealand does not have a track record of leveraging climate change adaptation action in response to the outcomes of monitoring before further climate impacts are felt. Our stocktake highlighted our predominant response is currently reactive to climate-related events. Organisations and institutional mechanisms are currently geared towards this reactive approach.

2. **Accommodate** changes, for example through the enhancement and preservation of natural protection.
3. **Retreat** from at-risk areas over time. For example, an option for existing communities.
4. **Defend (or protect)** against the hazards. This involves hard engineering, such as the construction of groynes, seawalls, breakwaters, bulkheads, stopbanks, and river flood protection structures. This has been the traditional response to coastal erosion and flooding risk management in urban and rural areas. Unfortunately, this ‘defend’ approach has helped increase exposure and vulnerability in some cases, and there are financial limits to such adaptation actions in many locations. As the climate continues to change, engineering solutions may not be feasible. However, consideration could be given to designing systems that fail safely or in a controlled manner and can be repaired quickly.

The New Zealand Coastal Policy Statement¹⁰ (NZCPS) identifies a hierarchy of these approaches and establishes a policy framework for their use in areas subject to coastal hazard risk.

In line with the timeframe used in the NZCPS we recommend adaptation pathways planning over the 100-year timeframe is incentivised across this range of adaptation options (avoid, accommodate, retreat and defend), to reflect different community needs. This approach will:

- use pre-defined ‘triggers’ to help manage transitions between options
- retain flexibility and enable a shift between adaptation actions and pathways in the future
- avoid path dependency and lock-in of assets and people, and unnecessary investments (too early or too late) and thus reduce risk to people and assets.

To encourage a shift to ongoing and proactive adaptation to climate change, we recommend that the following incentives and guidance is used to support action:

- **Rules and measures:** Specific policies and rules at a national, regional or local level to enable appropriate land uses, use of water resources and physical assets, and infrastructure design. Approaches, which are designed specifically for the unique status of Māori land, may also be required.
- **Guidelines:** Specific guidance for communities and practitioners on the use of tools to assess risks and for adaptive planning for climate change. A current example is the Ministry for the Environment’s *Coastal Hazards and Climate Change Guidance for Local Government* (2017),¹¹ and the Department of Conservation’s various guidance notes on the New Zealand Coastal Policy Statement (2010).¹²

¹⁰ <https://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/new-zealand-coastal-policy-statement/policy-statement-and-guidance/>.

¹¹ Ministry for the Environment. 2017. *Coastal Hazards and Climate Change: Guidance for local government in New Zealand*. Wellington: Ministry for the Environment.

¹² Department of Conservation. 2010. *New Zealand Coastal Policy Statement 2010 Guidance Notes*. Wellington: Department of Conservation.

Action 7: Review existing legislation and policy to integrate and align climate change adaptation considerations

We recommend legislation and policies be aligned to support the implementation of adaptation action. Action includes those options highlighted in Action 6: *Incentivise and guide ongoing adaptation action including avoiding, accommodating, retreating and defending*.

We recognise planning will be different for the slowly emerging climate change impacts where risks can be anticipated ahead of damage and loss. This is compared with the sudden onset events where preparedness and building back to be more resilient or somewhere else, will dominate.

The Resource Management Act 1991 (RMA) is the only statute that gives legislative mandate to have particular regard to the effects of climate change.¹³ This includes potential effects of high probability, and of low probability, which have high potential impact, cumulative effects over time or in combination with other effects whether positive or adverse, temporary or permanent and whether past, present or future.¹⁴

The RMA also establishes a hierarchy of planning documents. This includes the New Zealand Coastal Policy Statement and other national policy statements, national environmental standards, national planning standards, regional policy statements, regional plans, and district plans. Through this hierarchy, councils are empowered to control both new and existing development, including where such development may be exposed to avoidable climate change effects. However, we identified in the stocktake that land-use planning frameworks are not currently effective in reducing risks from the effects of climate change. This is due to:

- lack of a clear legal mandate for councils to plan for and take action under the RMA to reduce climate related risk
- competing objectives across legislation and policies related to climate change adaptation, and with resilience and disaster risk reduction¹⁵
- the inadequacy of assessment and planning tools being used under the RMA to account for changing risk and uncertainties when planning now for long timeframes.

Strengthening central government leadership of adaptation will help drive action (Action 5); however, we also need the right mechanisms in place to shape action. We therefore recommend

¹³ RMA, Section 7(i) (Other matters).

¹⁴ RMA, Section 3 (Meaning of effect).

¹⁵ This includes the Local Government Act 2002, Resource Management Act 1991, Building Act 2004, Building Code, Housing Accords and Special Housing Areas Act 2013, Te Ture Whenua Māori Land Act 1993, Soil Conservation and Rivers Control Act 1941, Land Drainage Act 1908, Civil Defence Emergency Management Act 2002, and other instruments of national direction (eg, the New Zealand Coastal Policy Statement, National Policy Statement for Urban Development Capacity, and other relevant national policy statements, such as for freshwater management).

a review be undertaken to identify inconsistencies and misalignment across legislation and policies that affect the ability to undertake climate change adaptation. We recommend this review aim to:

- **Amend the Local Government Act 2002 to specify climate change adaptation as a function of local government and in doing so give a clearer mandate.** Doing this will ensure the dependency between land-use planning and infrastructure provisions is linked. It will also help integrate adaptation into the delivery of all local government functions; for example, the provision of housing, infrastructure, land-use and transport planning; resource management (air, water, land, marine); building and construction; biosecurity; biodiversity; and emergency management; and alignment with rating powers.
- **Remove current legal barriers to implementing adaptation.** This includes providing guidance on the new tests in RMA section 106 ('significant risks' and 'likelihood' of natural hazards for which there is no jurisprudence). It also addresses the current situation where the Housing Accords and Special Housing Areas Act (2013) puts priorities on housing supply ahead of natural hazard management provisions of the RMA.
- Require planning, building and risk management decisions to consider changing climate risks over long timeframes. This will ensure consistency in the way climate change implications are included for both new and existing developments. For example:
 - update the Local Government Act 2002 from its current timeframe of 10 years for long-term plans and 30 years for infrastructure strategies. We recommend a 100-year planning timeframe, to allow decisions to include long-term climate change impacts while taking action now. Doing this will also mean consistency with the New Zealand Coastal Policy Statement for coastal hazard risk management and infrastructure life-span
 - allow building standards to be prescribed for the changing environment over the life of a building and the health and safety consequences for occupiers, by amending the Building Act 2004 and Building Code. We consider the 1-in-50-year flood protection standard prescribed in the Building Code is too low for addressing climate change impacts because it is inconsistent with current flood management design practice (typically the 100-year flood) and does not provide for any increase in flood hazard risk with time
 - clarify responsibilities between central and local government, and also between regional and district councils for hazard management and land- and water-use planning.
- **Align hazards, resilience, disaster risk reduction, and climate change adaptation policies.** Policies in these areas have developed across central government and local government. Resilience policies and plans have developed primarily for disaster risk preparedness and recovery after extreme events. For example:
 - the focus on response means a policy gap exists around the impacts of climate change on the investment lifetime of actions taken today that will be affected by climate changes. This is because not all effects of climate change will manifest as extreme events in disaster situations (eg, sea-level rise, droughts, and native plant pathogens)
 - the Civil Defence Emergency Management Act 2002 and Resource Management Act are not aligned and require new statutory mechanisms to be implemented that link the two

policy domains. This will achieve a better balance between risk reduction, disaster preparedness, and lifelines planning

- **Align** land use, freshwater use (quality and quantity), and consents for subdivisions under the **RMA** with consents for buildings under the **Building Act** and **Building Code**. An integrated approach will reduce exposure and vulnerability to climate related risk.

Action 8: Include the impacts of climate change in central and local government procurement processes

We recommend the long-term impacts of climate change be taken into account in government procurement processes. This is needed to:

- influence a shift in public investment towards physical assets that are climate-resilient and/or deliver co-benefits
- encourage climate risks and co-benefits to be formally factored into decisions on the design, location, construction and maintenance of core publicly funded infrastructure (such as the three waters (including flood management services), transport, telecommunications, irrigation and social sectors). This will minimise the risk of stranded assets through maladaptation
- help drive growth in mitigation and adaptation technologies and practices that build capacity and address emission reductions and are adaptive to changing climate risks. Such policies could also help avoid and reduce further exposure and vulnerability to climate change impacts.

To achieve this we recommend central and local government include climate change in their procurement rules and best practice guidance (eg, Government Rules of Sourcing and the Treasury's Better Business Case Guidance). An essential part of this will include:

- communicating to those responsible for implementing government procurement policy about the benefits of considering climate change impacts of their policies
- integrating clear key performance indicators and expectations and climate change preparedness into value-for-money assessments
- increasing the use of local supply chains, an opportunity that is currently underutilised. This will improve resilience when faced with uncertain international supply chains, and provide a way to improve local economic outcomes. It could also support the transition to a low emissions economy.

Action 9: Update and regularly review organisational planning, risk management, and disclosure requirements

We recommend updating and regularly reviewing organisational arrangements that drive wider public and private sector practices to encourage leadership in adaptation action.

Climate change impacts will affect almost every aspect of public service delivery and business, and early action can reduce risks. However, currently there are few incentives for organisations to start adapting today. Reporting on the impacts of climate change on their service delivery and business and how they are adapting to those impacts, will:

- place organisations in a better position to reduce the costs of climate changes to their businesses
- encourage adaptation innovation and technologies
- help organisations attract sustainable investment funding.

To achieve leadership within organisations, we recommend organisational practices are strengthened to require:

- greater consideration of the implications of climate changes to these organisations' operations
- disclosure of the risks climate change presents to these organisations
- disclosure of the actions these organisations are taking to respond to adaptation
- reporting on progress towards implementing the actions.

In developing consistent, climate-related financial disclosures useful to investors, lenders and insurance underwriters in understanding material risks, we recommend following guidelines from the global Task Force on Climate-related Financial Disclosures¹⁶. The way these are applied in New Zealand could take the form of:

- updated director duties
- additional strategy and planning requirements
- improved risk management practices
- performance management; for example, linking performance indicators with performance management
- financial and non-financial disclosure requirements.

We recommend this action includes organisations in the state sector including public service departments, crown entities, and state-owned enterprises. We also recommend initially targeting those sectors with the greatest potential for leveraging change, including insurance, banking, investments, telecommunications, energy, Māori economic authorities, and three waters and flood management services.

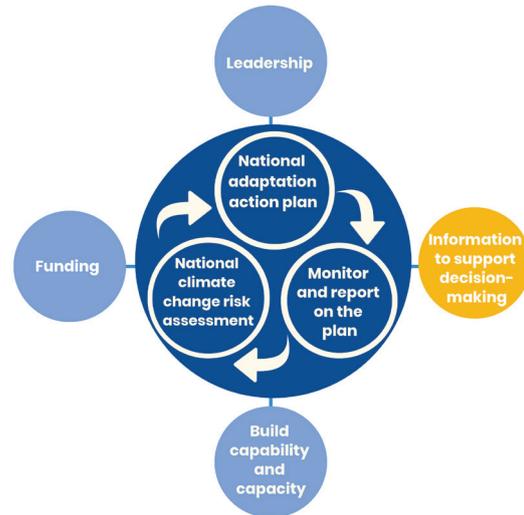
This action could be mandatory (enforced by regulation) or voluntary (by encouraging uptake of the public disclosure of plans and progress in adapting to the impacts of climate change). Developing the plan (Action 1) including clearly defined roles and responsibilities will allow government to lead and provide exemplars to the private sector to take action. This action could

¹⁶ TCFD. 2017. *Final report: Recommendations of the Task Force on Financial Disclosures*. New York City: Task Force on Climate-related Financial Disclosures.

also include provisions for climate change mitigation to reduce greenhouse gas emissions from organisations' operations and thus incentivise synergies between mitigation and adaptation action.

3.4 Information to support decision-making

*Providing information to support decision-making will mean New Zealand is more **informed** to deliver effective adaptation*



These recommendations are about ensuring information on the social, cultural, environmental and economic consequences of climate change is accessible and robust so government, iwi/hapū, the private sector, and communities can make informed decisions on how to adapt.

Our stocktake recognised that a significant amount of information has been produced on the climate-related changes New Zealand can expect. It is important this research continues.

We recommend a focus on **ensuring evidence-based information is kept up-to-date with new knowledge and practice and is accessible so it supports decision-making and a planned and proactive approach.**

Doing this will mean:

- the planned approach to adaptation and the understanding of risks, vulnerabilities and opportunities will be informed by the latest information. Advances in communications technology will enable increasingly faster updates of the information available to inform decision-makers
- information is accessible and in a form that can be used by iwi/hapū within the partnership approach, so New Zealand is well informed to make long-lasting and wise choices about its future
- Mātauranga Māori and the principles of kaitiakitanga through iwi/hapū are used to provide a unique iwi/hapū-centric source of information on climate change adaptation.

Action 10: Strategic and coordinated investment in science and technology for supporting climate change adaptation

We recommend a dedicated strategic fund within the science and technology framework for climate change adaptation research, and greater coordination of climate change adaptation research across existing science challenges and funds.

Our stocktake identified fundamental gaps in scientific research on the impacts and implications of climate change and adaptation approaches. New Zealand's research investments need to fill these gaps, and be guided by a national climate change risk assessment and national adaptation action plan. They also must give effect to the Treaty of Waitangi through partnership with iwi/hapū and by integrating Mātauranga Māori. An example of these gaps is the need for improved understanding of the impact of increases in greenhouse gases on atmospheric processes and the hydrological cycle, which influence the frequency and intensity of river flooding, urban flash flooding, and droughts.

There is also a need for broader research into the implications of climate change and tools and measures for proactive decision-making. This includes impacts and implications research with a focus on changing risks, vulnerability and cost-effectiveness assessments for adaptation action that are appropriate for decision-making over long timeframes. It is important it encompass, for example, biodiversity tolerance limits, biosecurity of the natural environment and primary sector, human health, and the delivery of health and social services.

Any process for adaptation must begin with an understanding of the social and economic context as well as the hazards and climate change impacts. The science required to gain this understanding, such as on people's values and motivations, will inform how risk is determined. Such research will inform the national risk assessment and the development, monitoring and updating of the national adaptation action plan, including processes, tools and measures for implementing adaptation actions.

At present, research on climate impacts, implications and adaptation cuts across various research platforms and programmes, including:

- the National Science Challenges (Deep South Challenge, Resilience to Nature's Challenges, Healthier Lives, Our Land and Water, Sustainable Seas, New Zealand's Biological Heritage)
- Crown Research Institutes' Strategic Science Investment Funding
- Sustainable Land Management and Climate Change Research Programme funding
- Ministry of Business, Innovation and Employment (MBIE) contestable funding.

Although, the current model for the national science challenges successfully fosters collaboration through multi-disciplinary teams, it is within the constraint of their given mission and scope. None of the challenges currently has a primary objective, or funding, that will deliver the broad science needed for dynamic adaptation. For instance, while the Deep South has a climate change focus, it excludes biological systems, yet, the Biological Heritage challenge does not directly consider climate change impacts and implication for our natural environment.

To address the lack of a comprehensive and dedicated adaptation research fund, and the need for better coordination, we recommend:

- Establishing a new platform under MBIE’s Strategic Science Investment Fund that is dedicated to climate change adaptation research. The Strategic Science Investment Fund supports underpinning research programmes and infrastructure of enduring importance to New Zealand and is the current funding mechanism best able to deliver on national strategic priorities for adaptation. This platform will require significant new funding, but may also involve consolidation of existing funds. A single platform will also support our principle that efforts to adapt and manage the risk of climate change are linked with actions to mitigate risk by reducing emissions. Its remit should be broad enough to ensure it delivers science to underpin the other recommendations in our report.
- Funding agencies should give attention to the need for greater coordination across the existing science challenges and funds. We believe this is essential for New Zealand to achieve the proactive and planned approach to addressing changing climate risks. The range of information (and therefore research) needed by governments and communities to make adaptation decisions needs to be identified. This could be developed as a strategy and articulated as a priority in the Government’s Science Investment Plan. This would improve the understanding of climate change for New Zealand society, the economy, and environment and enable adaptation to be implemented.

Action 11: Commission Mātauranga Māori-led measures that reflect cultural impacts of climate change and are developed and managed by iwi/hapū

Mātauranga Māori provides intergenerational knowledge of the natural environment unique to iwi/hapū of Aotearoa. Much work has been completed in the area of cultural indicators with reference to climate change, although important gaps remain. In particular, how these iwi/hapū indicators and the measurement they provide can be used within decision-making relating to climate change.

We recommend building on previous work on indicators and measures, enabling iwi/hapū to measure the cultural impacts of climate change through Mātauranga Māori-led cultural indicators. Measuring the state and change of cultural indicators of climate change could be used to more deeply understand climate change impacts and lead to indigenous adaptation that are locally based, determined by mana whenua and mana wai. This measurement provides a holistic approach, based on mauri (life-force), and provides important perspectives to any climate change interventions and decisions. It should be included into any decision-making.

This programme of work must be led by iwi/hapū and will be accountable to iwi/hapū. It could also be a conduit for the wider application of Mātauranga Māori within the plan, including engagement with iwi/hapū across the country and appropriate decision-making opportunities for iwi/hapū.

Action 12: Communicate nationally what New Zealand can do to adapt through a climate change information portal and other channels

To raise awareness and promote action we recommend the Government communicate nationally the actions New Zealand can take to adapt to climate change. We recommend this be achieved through a climate change adaptation information platform (or portal) and other channels.

Raising awareness is important because the public needs to be clear about the full implications of the complex choices involved in adapting to climate change and about the different impacts and options for adapting in different areas. Strategies for adaptation until now have largely focused on defending people and assets and reacting to climate events. This can increase exposure and vulnerability and expectation for ongoing protection. The focus in this report is to manage transitions over long timeframes.

It will also be essential for the Government to provide information in a way that resonates with communities and allows for local refinement. For example, the knowledge systems of whakapapa (genealogy) and kōrero tuku iho (ancestral knowledge) can activate community understanding of responses to climate change. In some cases, iwi/hapū need to lead action to ensure connection and relevance to their communities.

Local communities and businesses are already seeking greater engagement on climate change. Communicating nationally what New Zealand can do to adapt to climate change will provide a focus for discussion and add value to the investments already made in scientific research on adaptation. There is value in integrating this with a strategy and action plan on what New Zealand can do to transition to a zero emissions economy.

Establishing a climate change adaptation information platform (or portal) will:

- enable households, iwi/hapū, businesses, practitioners, researchers, and policy-makers to access timely and credible information and to connect with one another¹⁷
- increase public and private understanding of climate risks and opportunities, and add value to research outputs by making them more accessible¹⁸
- be a focus for other, complimentary channels for communicating adaptation action.

An important component of this could be the use of multi-media technology to:

- convey scientific information in a more understandable form
- point to useful information sources
- provide ideas on how to adapt

¹⁷ Such portals have been critical in motivating adaptation action in countries such as Australia, Canada, Ireland and the United Kingdom.

¹⁸ Australia and some European Union member states (eg, Ireland) have successfully adopted such an approach.

- provide a platform for members of the public to share ideas and discuss the action they are taking to adapt (eg, the action already taking place in the Hawke’s Bay and South Dunedin that we shared in our stocktake).

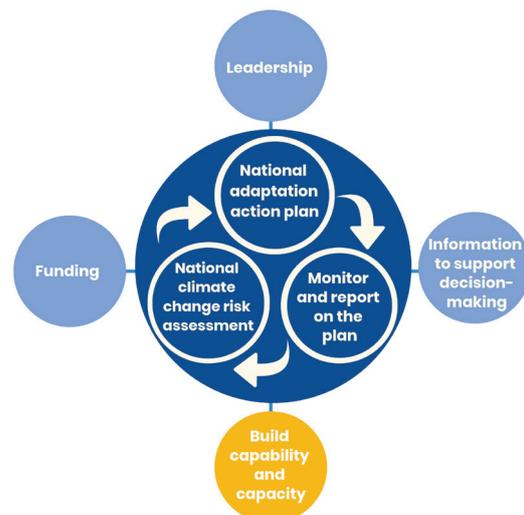
We recommend this platform also include:

- adaptation guidance
- culturally appropriate and meaningful engagement
- tools such as interactive maps
- sector specific information
- serious simulation games and visualisations of the future through climate scenarios
- best practice case studies
- training modules
- webinar hosting
- digital adaptation library of existing information
- information on how to address the impacts of climate change
- historic extreme event database
- key reference material
- information on climate change mitigation and natural hazards.

We consider this will be a strong strategic investment, if developed collaboratively by central and local government, iwi/hapū, the research community, and the private sector.

3.5 Build adaptive capability and capacity

*Building adaptive capability and capacity will mean New Zealand is more **organised** to deliver effective adaptation*



These recommendations are about building the capacity and capability of central and local government, iwi/hapū, the private sector, and communities to implement the prioritised Plan (Action 1) and other actions.

Our stocktake highlighted that many sectors are still at an early stage of adaptation and are becoming **informed**, while a few are **organised** to take action. For New Zealand to successfully adapt to the impacts of climate change, all affected parts of the economy and society must have the capacity and through tools, the capability to act. Having the information to support decision-making (section 3.4) is an important component of this.

Having the capacity and capability to act will mean:

- all parts of society and the economy will be mobilised to take on their role and responsibilities in adapting to climate change. We could expect to see an increase in the pace, scale and dynamic character of adaptation
- local government is able to set clear expectations over the long term and have the expert capability to assess and manage risk
- sectors are able to move from being informed to being organised and taking dynamic adaptive action, as identified in the plan
- organisations are able to build the necessary capability and capacity to fulfil their roles and responsibilities.

Action 13: Establish a centralised service to provide expertise to local government for risk-based decision-making

We recommend a centralised service where experts provide advice to local government on climate change risk and the actions needed to manage it. This action will support local government to plan, make decisions, and discuss with iwi/hapū and the wider community the options to act under a range of climate change scenarios.

The impacts of climate change will vary around the country and increase over time. An example is the flooding challenge currently faced by Dunedin and Auckland (as well as other areas), caused by the interaction between sea-level rise, tides, rising groundwater, topography, and extreme rainfall. Because climate change scenarios play out differently in each location, they will require different types and levels of adaptation depending on what is at risk. Local participation in decision-making will be essential for developing appropriate adaptive plans. These need to be facilitated by local government.

The implementation of effective adaptation is however highly technical, socially interactive, and often expensive. It will require innovative approaches to community engagement. At present, not all local authorities have the resources, skills or experience to execute their role in climate adaptation effectively. Support, based on consistent information and assessment methodologies

and decision tools, is therefore needed. We recommend this service supply expertise to local government when needed and develop peer-to-peer support across councils.

We recommend the advice includes:

- information on how to find and interpret the latest climate change projections
- a consistent set of climate change and socio-economic scenarios for adaptive planning
- risk assessment methodologies compatible with the national risk assessment methodology (Action 3)
- tools to prioritise action, based on risk assessments
- examples of how other councils have dealt with similar issues in other locations, nationally and internationally.

Successful international examples of similar services include the UK Climate Impacts Programme based at the Environmental Change Institute at the University of Oxford, and the National Climate Change Adaptation Research Facility, a collaboration of universities and research institutes across Australia.

Local Government New Zealand has proposed the creation of a ‘local government risk agency’. The business plan for this agency focused on the risks to local infrastructure assets from hazards including those exacerbated by climate change. We recommend this be a starting point for designing such a service; however, it will require a wider focus that explicitly includes adapting to the range of impacts and implications that climate change will bring.

We recommend the service providing the expertise:

- be appropriately resourced to deliver these services
- is co-developed with local government, to ensure their buy-in.

Action 14: Build capability and capacity in climate change adaptation across central government agencies

We recommend central government agencies review their capability and capacity to take action to adapt to climate change and implement the plan (Action 1).

The level of resourcing for some central government agencies does not allow them to consider or address the implications of climate change in their responsibilities. This applies to both the assets and portfolios they manage. We also expect demands on central government agencies to increase as the impacts of climate change become more severe and frequent, and the imperative to take actions from this report is realised. It will be important that agencies have the resources and skills to manage this.

Developing capability across central government agencies will enable local government and the private sector to engage with central government. This will lead to the wider implications of climate change and its cross-sector effects being better understood and given focus.

As a first step, we recommend central government agencies:

- determine staff resources and skill sets required to support adaptation action
- identify the gaps within existing resources.

Action 15: Build capability in climate change adaptation in key professional bodies and industry groups by developing and implementing training and development programmes

We recommend developing a specific climate change adaptation professional development programme for key practitioners. This would support the implementation of the plan and other actions.

Making the shift to proactive and dynamic adaptation will also require new approaches and tools, which are currently available and used internationally, but not routinely in New Zealand. Developing a professional development programme, targeted at building capability, will help to diffuse new tools and frameworks for achieving effective adaptation.

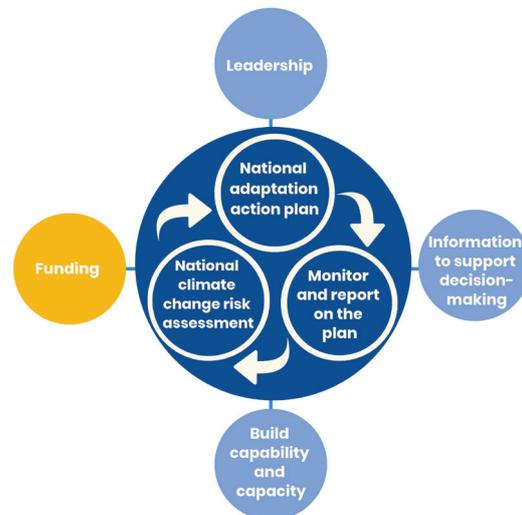
We recommend a climate change adaptation professional development programme:

- be developed and initially delivered by climate change adaptation experts
- be delivered and made available to organisations such as Engineering New Zealand, the New Zealand Law Society, Te Hunga Rōia Māori o Aotearoa (Māori Law Society), New Zealand Planning Institute, Papa Pounamu (Māori technical interest group within the New Zealand Planning Institute), the Resource Management Law Association, New Zealand Society of Local Government Managers, Real Estate Institute of New Zealand as well as developers, accountants, actuaries, auditors, and human resource managers.

Similar training could also be delivered to professionals and practitioners in central and local government.

3.6 Adaptation funding

Adequate funding for adaptation will mean New Zealand is able to deliver effective adaptation and take dynamic action



These recommendations are about having the financial capacity to adapt effectively over the long term. To do so, we need to understand who will bear the costs and how funding of those costs can be sustained across current and future generations.

The costs of action and inaction are likely to be large in scope and scale, across many sectors and environments. For example, provision of central and local government assets and infrastructure, the provision of public services, the transition of businesses and communities, and the protection of taonga and the natural environment.

We recognise who bears these costs and in what proportion, is a fundamental issue for New Zealand. Central and local government, iwi/hapū, business owners, homeowners, investors, and private citizens will all have a role to play.

How these costs can be funded is complex. Many existing and potential sources, methods, tools and incentives, both domestic and international, and public and private could support adaptation. Harnessing the right mix of these to unlock and direct investment into risk reduction is essential if we are to adapt effectively as climate changes unfold.

New Zealand does not have a strong record of investing in risk reduction. Most funding is directed at pre-disaster readiness or post-disaster recovery. For example, the Earthquake Commission (EQC) and private insurance provide natural disaster insurance for land and contents of residential homes. This includes cover for residential land against storm and flood damage and from fire resulting from natural disasters. This has created an expectation that compensation will be available for any events exacerbated by climate change. This becomes a barrier for effective adaptation as it acts as a disincentive for risk reduction. Furthermore, risk-based insurance is likely to become increasingly expensive and/or harder to obtain in high-risk locations, placing pressure on public agencies to fill the gap, which has the potential to create inequities if the gap is not filled.

Anticipatory funding to reduce risk and prevent future losses is largely non-existent. Current funding arrangements are generally applied after the event and in an *ad hoc* manner. Hard choices will have to be made about land use in low-lying areas as sea and groundwater levels rise, and the intensity and frequency of rainfall events and droughts, increase. To avoid the worst disruption, planned investment in risk reduction measures will be required. These are likely to be beyond the financial capacity of local government and its ratepayers alone. Access to adequate and sustained funding is therefore essential.

The current fragmented governance and policy framework identified in our stocktake creates barriers to funding and incentivising investment that delivers effective adaptation.

Action 16: Define funding arrangements for climate change adaptation

We recommend investigating who should bear the costs of climate change adaptation and how it can be funded.

We recommend that a specialist group of practitioners and experts undertake this action. These should be drawn from central and local government, iwi/hapū, sectors such as banking, insurance, and infrastructure; and have expertise in climate change, planning and law, public finance, capital markets, infrastructure financing, and risk management. The group should be serviced by a secretariat with officials across relevant public sector and local government agencies and include significant public engagement.

Defining a funding mechanism for climate change adaptation will provide increased certainty to government, iwi/hapū, businesses, and the public about how the cost of adaptation could be equitably shared and what their contribution would be. It will also help identify the actions needed to unlock and direct both current and future investment in adaptation, so actions can be sustained, given the scale of impacts and their likelihood of compounding and cascading. The aim should be to reduce the exposure of at-risk communities and the physical, economic, environmental and social impacts from the changing climate.

Further investigation is needed on the funding arrangements necessary for adjustments to be made in a timely manner. Funding arrangements should be guided by the principles of successful adaptation, as outlined in this report.

To define appropriate funding arrangements, we recommend the assessment of:

- the nature, scope and scale of the costs for adapting to climate change, including the costs of taking no action based on the risks defined in the national climate change risk assessment
- the principles and options for who should bear these costs and how they will be equitably shared across the public and private sectors. This includes the extent and nature of Crown responsibility to address situations where it may be neither fair nor realistic to expect businesses or households to act

- current funding arrangements, including:
 - funding sources and mechanisms, both public and private, capital and operational, domestic and international, and their capacity, accessibility, sustainability and potential to fund the likely costs of climate change adaptation
 - incentives acting on public and private sector investment in climate change adaptation, how they are used, their effectiveness, consequences and sustainability; for example, EQC policy settings, water management incentives, adverse events policies, and the inequities of current funding models for Māori communities
 - broader practices, barriers and opportunities in developing and maintaining funding arrangements and their implications
 - the lessons learnt from other countries about funding climate change adaptation
- future funding options, including:
 - policy and other changes needed to maintain and develop current funding sources, mechanisms, tools and incentives to stimulate and support investment in risk reduction and climate change adaptation
 - policy and other changes to unlock, create and/or stimulate sources of funding that are new to New Zealand
 - frameworks and practice guidance necessary for assessing the beneficiaries of climate change adaptation actions over time and the apportioning of costs
 - the role that a dedicated anticipatory fund could play modelled on the design features of the NZ Superannuation Fund (eg, flexibility measures such as regular reviews and prefunding, policy commitment devices such as cross-party agreements)
- the full range of policy, tools and practices needed to ensure efficient and equitable adaptive responses by businesses, households and public bodies. This includes the prioritisation and allocations of funds available pre- and post-event to help communities' transition from current and increasingly at-risk situations.

Action 17: Investigate how future costs of climate change adaptation can be reflected in investment and planning decisions

We recommend investigating how the future costs of climate change could be reflected in government investment decision-making. This is needed to align with the long-term nature of the investments required, to capture both financial and non-financial value (tangible and intangible costs and benefits, including social well-being), and to reflect uncertainties and change over the life of the investment.

A range of practices and tools are emerging for defining and measuring costs and benefits, each of which may be more suited to different climate change impacts, communities and specific

applications. These include robust decision-making analysis approaches, including real options and cost-effectiveness analyses, and dynamic adaptive policy pathways assessment, which incorporate time and change into the analysis process.

To support the use of these tools, we suggest practice notes are developed that show users how to apply them in their own circumstances and the conditions under which each can be used.

These investment practices and tools could be used to support local authority infrastructure investment in three waters, including flood management services and roading. This could be complemented by working with the private sector (insurance, banks and real estate) to identify actions that can be taken by central and local government, iwi/hapū, investors, communities, and individuals.

Incorporating future costs of climate change in current investment criteria will help manage risk by signalling future costs and liabilities. This will therefore support more informed and confident planning and investment decisions enabling a shift from short- to longer-term decision-making.

4 Immediate actions

In section 3 we identified the foundational actions New Zealand can take to adapt effectively to climate change. We also recommend **immediate actions**. These are discrete actions that can start now, be achieved relatively quickly and address a specific opportunity to act. These actions are not intended to replace the foundational actions. They include Actions 18 to 21 and are discussed below.

Action 18: Central government to continually reinforce publicly that climate change adaptation is a priority for New Zealand and that the Government recognises the need to link adaptation action with climate change mitigation

Increasing New Zealanders' social and economic awareness that climate change adaptation is a priority is an essential first step to inspire action and engagement in a planned process that will follow. The power of leadership for adaptation cannot be underestimated. It instils confidence in those making hard decisions about reducing exposure and vulnerability often in the face of potential litigation and electoral sanction.

Linking mitigation and adaptation in the same context enables strategies to be developed that can maximise synergies and minimise maladaptation; for example, adaptations that increase emissions, or mitigation that makes adaptation more difficult to implement.

To date, the Government announcements about climate change have primarily been focused on mitigation. It is important that adaptation is also recognised as an essential part of the climate change agenda, because of the nationwide effects of climate change.

Action 19: Implement Actions 1, 2, 3, 4 and 5 using the proposed Zero Carbon Bill to give a consistent and clear legislative mandate for climate change adaptation

This report recommends a risk-based approach with a long-term focus be undertaken to identify and deliver actions that reduce the impacts of climate change in New Zealand. At the core of this approach is a national adaptation action plan that seeks to reduce the risks and vulnerability (Action 1), a system for monitoring and reporting progress (Action 2), and a national climate change risk assessment (Action 4), including standard methodology, framework and datasets for this (Action 3). Essential to this is good governance (Action 5).

We recommend that all of these actions need legislative support for implementation and to be effective in driving adaptive momentum.

The Government has recently committed to passing the Zero Carbon Bill as a cornerstone of New Zealand's transition to a low emission, climate-resilient future. We recommend that the Zero Carbon Bill is used as the primary vehicle for establishing and empowering our proposed adaptation approach, assigning responsibilities for the national climate change risk assessment and the plan, and the monitoring and reporting of implementation. The issue of climate change mitigation and adaptation should not be separated.

The Government is also committed to requiring climate impact assessment analyses for all new legislation. These assessments should consider both mitigation and adaptation and their potential negative, compounding and cascading effects.

The new Zero Carbon Bill must also give effect to the principles of the Treaty of Waitangi, and early engagement with iwi/hapū on adaptation and mitigation will be essential to the overall effectiveness of the Act between Treaty partners.

Action 20: Include adaptation funding in the Government's commitment to hold a public inquiry into the drivers of local government costs and its revenue base

Under the coalition agreement with New Zealand First, the Government has agreed to hold a public inquiry to investigate the drivers of local government costs and its revenue base. Our stocktake highlighted funding as an important barrier to adaptation investment by local government.

We recommend that climate change adaptation be included as a part of local government costs. This will highlight the significant level of investment that needs to occur to reduce risk and the level of damages, in particular, for physical assets and infrastructure future-proofing, potential managed retreat and, in some cases, protection structures. In addition, the findings of this inquiry could be used to help identify how adaptation funding could be incorporated into future local government budgets.

Action 21: When implementing the National Policy Statement for Freshwater Management councils have particular regard to adapting to the effects of climate change

Changes to climate will directly impact our water resources. Regional councils are in the process of setting water quality and flows. This presents the opportunity to link the effects of climate change under the RMA with managing water resources through implementing the National Policy

Statement for Freshwater Management (Freshwater NPS). In setting these parameters it will be important for councils to consider the adaptation needed to achieve the quality and quantity limits under a changing climate.

The existing Freshwater NPS already requires councils to prepare a progressive implementation programme (PIP). We recommend guidance be developed on how to incorporate adaptation considerations into the PIPs, and this be included in an updated version of the existing Freshwater NPS guide.

Publicly highlighting this opportunity signals how climate change can be integrated into decision-making for other domains such as urban development and rural land use.

5 Final word

This is our final report to the Minister for Climate Change and it builds on the momentum created by the stocktake released in December 2017. We would like to see a timely government response to the recommendations we have presented here that defines how and when these actions will be implemented.

A timetable of actions will enable New Zealand to have a credible adaptation plan that is informed, organised and proactively reduces our exposure and vulnerability to the social, cultural, environmental and economic consequences of climate change.

Appendix 1: Background information used to develop the options

New Zealand has to adapt effectively

New Zealand's social, cultural, environmental and economic context

To be effective in our actions to address the impacts of climate change, it is important we reflect the uniqueness of our nation. To achieve this, we considered the following when developing our recommendations.

Relationship with tangata whenua

Iwi/hapū are tangata whenua of Aotearoa. A partnership approach is an obligation under the Treaty of Waitangi. Partnership is also essential for effective decision-making on the action that needs to be taken to adapt to climate change. Iwi/hapū are the source of Mātauranga Māori and this traditional knowledge of the natural environment will help inform the country's adaptation response. Māori communities are particularly affected by climate change because:

- there is heavy reliance on Māori land and the natural world as the cornerstone of cultural, social and economic frameworks
- impacts are felt more widely in less resilient communities due to lower socio-economic conditions in many areas
- significant changes in natural cultural indicators affect Mātauranga Māori.

New Zealand's society, economy and environment

New Zealand's social, economic and geographical situation influence exposure and vulnerability to ongoing climate change and, therefore, the ability to adapt. We have considered these factors because they influence how our recommendations could be implemented.

Society

The structure and location of our communities will influence how they are impacted by climate change as well as their ability to adapt. For example, the most densely populated areas of New Zealand will represent the greatest exposure to climate change impacts, but the ability to adapt is most likely to be lowest in isolated small settlements that have fewer resources.

New Zealand performs well in many measures of well-being, relative to most other member countries of the Organisation for Economic Co-operation and Development (OECD),¹⁹ including in health status and social connections. However, the number of New Zealanders living in poverty has grown over the last decade. Income inequality is high particularly in Māori and migrant communities. It is therefore critical we understand where impacts will be felt the most. For example, which are the most exposed and vulnerable communities? Where are the large population centres? How they are able to cope with and adapt to climate change? An appreciation of the social impacts of climate-related migration from low-lying Pacific islands, and internal displacement as a result of increased frequency of natural hazards within New Zealand, will be increasingly important to avoid further income-related inequality.

Economy

Trade is essential for New Zealand's economic prosperity. Exports of goods and services make up around 30 per cent of gross domestic product, and there is a heavy reliance on imports of raw materials and capital equipment for industry.²⁰ Ensuring trade and climate exposed industries are able to move goods and services to and from markets in a changing climate is essential.

A significant proportion of the services industry and New Zealand's economy is focused on tourism, which relies on the climate and a sustained clean, green New Zealand. The actions we recommend support the integrity of the environment. This will also be essential as New Zealand makes the transition to a low emissions and resilient economy. A clear link between climate change mitigation and adaptation policies is important to ensure action in one area does not have unintended, detrimental consequences in the other.

Unlike many other developed countries, New Zealand relies heavily on a large primary sector. Within this sector are good examples of how New Zealanders are already adapting to a changing climate by modifying land uses, crops and growing methods. As this sector is particularly exposed to greater climate variability and extreme events, its ability to adapt will be challenged by the increasing magnitude and frequency of climate events and their cascading impacts through the economy.

Natural environment

New Zealand's environment is a taonga of paramount importance. It sustains everything New Zealanders are dependent on for healthy and prosperous lives: well-being, culture and economy. New Zealand's biodiversity is an intrinsic part of this, with significant unique natural ecosystems, more than 52,500 species of indigenous animals, plants and fungi that developed here in isolation over 60 to 80 million years. About 90 per cent of land-based animals (including

¹⁹ Organisation for Economic Co-operation and Development. 2017. *Economic Surveys: New Zealand*, Overview June 2017. Retrieved from <http://www.oecd.org/newzealand/economic-survey-new-zealand.htm> (13 December 2017).

²⁰ New Zealand Government. 2016, *New Zealand: Economic and Financial Overview 2016*.

insects), nearly 80 per cent of plants, and 26 per cent of fungi are found only in New Zealand.²¹ This means they are particularly valuable and potentially vulnerable.

The natural environment is already subject to multiple pressures, such as habitat loss, pollution, intense resource use, pests, and human settlement including the impacts of structures at the coast and adjacent to rivers and wetlands. Expected climate change impacts such as increased flood flows and resulting erosion and sedimentation, drought, sea-level rise, and higher temperatures will exacerbate the existing pressures on aquatic ecosystems. In marine ecosystems, increased temperatures, wave action, turbidity, sedimentation, ocean acidification, and a reduction in dissolved oxygen will change ecosystem functions and species. As alpine and sub-alpine ecosystems move to higher altitudes, species will also have diminished habitat range.

Natural environments are therefore at high risk if they cannot cope with the increasing rate of climate change. Having buffers in which ecosystems and species thrive is preferable to operating at the margins of their tolerance levels.

These compounding effects and the interaction of climate change with other stressors have the potential to significantly affect New Zealand's terrestrial, freshwater, coastal and marine ecosystems.

Geography

Eighty-six per cent of New Zealanders live in urban areas, and populations in cities are continuing to grow.²² Projections indicate this trend will continue. New Zealand cities tend to grow out rather than up, and most are located on low-lying floodplains or near the coast. Exposure to climate change impacts in these areas will increase, and all of New Zealand will be affected by the changes as we depend on our cities as economic centres for goods and services and for access to markets and jobs.

Many ports and airports critical to the ongoing operation and success of New Zealand's trade and the economy are concentrated in low-lying or coastal areas. In addition, some of New Zealand's biggest infrastructure networks are due for renewal over the next 30 years, including electricity distribution and the three waters (water supply, stormwater and wastewater). Their design and location need to consider ongoing changes to the climate.²³

²¹ Ministry for the Environment & Statistics New Zealand. 2015. *New Zealand's Environmental Reporting Series: Environment Aotearoa 2015*. Retrieved from www.mfe.govt.nz/sites/default/files/media/Environmental%20reporting/Environment-Aotearoa-2015.pdf (13 December 2017).

²² http://archive.stats.govt.nz/browse_for_stats/population/Migration/internal-migration/urban-rural-migration.aspx

²³ National Infrastructure Unit. 2015. *The Thirty Year New Zealand Infrastructure Plan 2015*. Retrieved from www.infrastructure.govt.nz/plan/2015/nip-aug15.pdf (13 December 2017).

Economy-wide approach to adaptation

In our stocktake, we assessed current progress within sectors. This sector perspective enabled us to form a picture of what action was being taken and where. We recognise the entire economy will be affected by ongoing changes to the climate. To be effective, the economy needs to adapt in a coherent and consistent way across government and sectors, while also recognising the uniqueness within sectors. For example, Māori land ownership has specific characteristics which will constrain land sale when it is necessary for communities to relocate to another area.

Effective adaptation will not happen by sectors working alone. We have therefore designed our recommendations to be applicable across all sectors. This promotes an economy-wide approach and would involve the following:

- **Enabling the integration of climate risks, vulnerability and resilience across all major economic sectors:** Developing risk and vulnerability assessments across all sectors to help inform priorities across and within sectors²⁴, and integrating the consideration of climate risks into relevant existing and/or new policies, planning, practices and programmes.²⁵
- **Clarifying roles and responsibilities across sectors:** Reflecting all sectors are exposed to climate risks and have a responsibility, and in many cases a ‘shared responsibility’ (eg, addressing coastal inundation will involve several sectors, such as transport, primary industries, tourism and coastal communities).
- **Exploring and understanding the interactions of the problem and adaptation actions among different sectors:** Inter-sectoral dependencies across water, energy, land and climate, sometimes referred to as a ‘nexus’ issue.^{26, 27}
- **Looking for co-benefits and cross-sector leveraging:** Producing greater efficiencies with greater benefits through complementary actions (eg, growing forests on marginal land has mitigation, adaptation, water and air quality benefits).
- **Taking a whole-of-government approach to adaptation planning and implementation:** Ensuring there is an understanding that policies across sectors have implications for the ability to adapt, thus allowing government departments to work together to help build a

²⁴ For example, the United Kingdom develops the [National Climate Change Risk Assessment](#) every five years that covers all major sectors (eg, natural environment and natural assets, infrastructure, people and the physical assets, business and industry, and international dimensions). This national assessment helps prioritise adaptation action.

²⁵ For example, in Florida, USA, climate change considerations have been integrated into multiple elements of its Comprehensive Development Master Plan, including land use; transportation; housing; conservation, aquifer recharge and drainage; water, sewer and solid waste; coastal management; intergovernmental coordination; capital improvements; and education. See www.miamidade.gov/planning/cdmp.asp for further information.

²⁶ UNFCCC. 2015. *Taking a Systems Approach to Climate Change Adaptation: Case Study – the Water Energy Food Nexus*. Retrieved from https://unfccc.int/files/adaptation/application/pdf/nwa_3.3_systems_approach_rev.pdf (13 December 2017).

²⁷ Lawrence J, Blackett P, Craddock-Henry N, Flood S, Greenaway A, and Dunningham A. 2016. *Synthesis Report RA4: Enhancing capacity and increasing coordination to support decision making. Climate Change Impacts and Implications (CCII) for New Zealand to 2100*. MBIE contract C01X1225. Retrieved from <http://www.deepsouthchallenge.co.nz/sites/default/files/2017-02/CCII-RA4-Synthesis-report.pdf> (13 December 2017).

more comprehensive and consistent approach. This includes within and between central and local governments.

- **Facilitating multi-sectoral coordination and collaboration:** Developing networks across sectors and at different governance scales (local, national and regional) that can leverage integrated decisions, rather than working in silos.²⁸
- **Acknowledging culture and society is central to an economy-wide perspective:** Recognising that everybody is exposed to climate risks and has a responsibility to take action. Alongside the benefit of including a Māori worldview in our adaptation response, there is an obligation under the Treaty of Waitangi for central and local government to partner with iwi/hapū. This is particularly important because we know many coastal marae, tribal lands, and iwi/hapū businesses, as well as Māori values, will be affected by climate change.

The benefits of an economy-wide perspective are well-established in international and New Zealand literature and in several international agreements to which New Zealand is committed (eg, the Paris Agreement, the Sendai Framework for Disaster Risk Reduction, and the United Nations Sustainable Development Goals). The progressive and ongoing nature of climate change and its potential impacts means the greatest benefits, efficiencies and consistencies are likely to come from initiatives that cross sectors. An economy-wide approach also enables impacts to be assessed and adaptive actions to be designed that are targeted at particular sectors, regions or groups of society, where appropriate.

In doing this, our aim is to provide frameworks, actions and incentives for:

- integrating climate change risks and opportunities into the day-to-day decision-making and long-term planning of all sectors as appropriate
- exploring and improving our understanding of the interactions between the issues and adaptive actions for addressing climate change across and within sectors
- exploring options, defining priorities, and considering co-benefits of effective adaptation.

Actions other countries are taking to adapt to climate change

Adapting to climate change is a global issue. Countries, cities and regions around the world are planning and beginning to implement their own climate change adaptation plans and strategies.²⁹ Countries that have a national strategy or plan include: Australia, Canada, China, European Union member states (eg, Germany, Sweden and the United Kingdom), Japan, and the United States of America.

²⁸ de Guzman E. No date. *Towards Total Disaster Risk Management Approach*. United Nations Office for the Coordination of Humanitarian Affairs – Asian Disaster Response Unit. Retrieved from <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN009657.pdf> (13 December 2017).

²⁹ We are seeing an increasing number of countries developing a national strategy or action plan on climate change adaptation; for example, all of New Zealand's top five principal trading partners have a national strategy or plan (China, Australia, United States of America, Japan, European Union). See Appendix 6 of the *Stocktake Report from the Climate Change Adaptation Technical Working Group* for more information.

While these plans vary in content, depending on demographic, geographic, technological and financial circumstances, they also have common themes. When we relate these themes to what we have defined as effective adaptation, we find these plans have the following common themes:

- **Informed:** plans are based on strong scientific evidence from continued investment in research and aim to raise awareness of the ongoing changing climate conditions.
- **Organised:** plans that:
 - emphasise the importance of coordination, collaboration, cooperation and partnerships between central government and other levels of government, and across sectors and society, and have institutional mechanisms to support this
 - recognise shared responsibilities are important and also acknowledge the importance of national leadership in the form of a national plan and commitment to its implementation
 - identify priority sectors where action is needed including assisting and prioritising vulnerable people and regions
 - integrate climate risks into decision-making
 - look for and take advantage of opportunities for adaptation.
- **Dynamic action:** plans that:
 - take a long-term view and are focused on flexible adaptive actions that enable resilience
 - emphasise the importance of monitoring and reporting on the progress of implementing the strategy or plan
 - recognise the need to be proactive and anticipate risks.

Reviewing how other countries are enabling resilience has helped us test our recommendations.

Appendix 2: Background to the Climate Change Adaptation Technical Working Group

New Zealand needs to be better prepared to adapt to the effects of climate change. To achieve this, in November 2016 the Government asked a group of technical experts across the public and private sectors to provide advice on options for adapting to the effects of climate change.

In December 2017 the group's first report, the stocktake report, was published. That report summarises the expected impacts of climate change on New Zealand over the medium and long term, takes stock of existing work on adaptation, and identifies gaps in New Zealand's current approach.

This report is the group's second and final report. It builds on the evidence provided in the stocktake report and intends to define the options New Zealand has to adapt to climate change.

Group members

The group members include:

Dr Judy Lawrence (Co-chair)	<p>Dr Judy Lawrence is Senior Research Fellow, Climate Change Research Institute, Victoria University Wellington.</p> <p>Judy has a PhD in Public Policy on the adequacy of institutional frameworks and practice for climate change adaptation decision-making. She has led research on community vulnerability, resilience and adaptation to climate change, and on climate change impacts and implications for decision-making with regional and local government and sector stakeholders.</p> <p>Judy currently leads the Cascading Impacts and Implications, and the Adaptive Tools and Measures Projects in the Deep South National Science Challenge and contributes to the Resilience Governance and The Living Edge (coastal) Projects in the Resilience National Science Challenge.</p> <p>Her collaborations internationally have brought new adaptive pathways planning approaches to New Zealand resource management, now being adopted by councils. Since 2005, Judy has been Director of PS Consulting Ltd, a strategy and policy consultancy in science, climate change adaptation and related governance and institutional issues. Before this she was Director of the New Zealand Climate Change Office at the Ministry for the Environment and has held a range of senior positions across government and in research.</p>
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<p>Penny Nelson (Co-chair)</p>	<p>Ms Penny Nelson holds policy responsibility for climate change, the marine environment and hazardous substances and new organisms. This includes oversight of the Environmental Protection Authority. She is also responsible for environmental monitoring and reporting, the Ministry’s interests in the science system, New Zealand’s commitments to international environmental agreements, and leadership of the Natural Resources Sector.</p> <p>Penny brings a strong focus on building partnerships across sectors and a wealth of leadership experience in government, business and the scientific community including the Sustainable Business Council, Ministry for Social Development, Dairy NZ and Landcare Research.</p> <p>Penny has returned to the Ministry, having worked here between 1998 and 2004. Penny holds a Masters of Science (Hons) in Resource Management from Lincoln University and a Bachelor of Arts (Hons) in Political Science and English Literature from Otago University.</p>
<p>Frances Sullivan, Principal Policy Advisor, Local Government New Zealand</p>	<p>Ms Frances Sullivan joined Local Government New Zealand in 2008.</p> <p>She provides advice, sector advocacy, and stakeholder management in the key areas of building regulation and earthquake-prone building policy, climate change, emissions trading, natural hazards, flood risk management, solid waste, biosecurity, biodiversity, and the New Zealand Aid Programme. Frances previously worked for Environment Canterbury as a Programme Manager for land, pests, water, and air and the regulation group.</p>
<p>James Hughes, Climate and Resilience Specialist, Tonkin + Taylor</p>	<p>Mr James Hughes has recently joined Tonkin + Taylor as a climate and resilience specialist. Before this he worked for engineering design experts AECOM (1999-2017).</p> <p>James has been involved in roles ranging from design and construction of major civil engineering projects through to strategic studies focusing on risk, resilience and sustainability. Much of James’ recent work has focused on the areas of resilience to hazards (including climate change), risk assessments, and project sustainability.</p> <p>He has been involved in a wide range of projects within the broader urban resilience field including the Rockefeller 100 Resilient Cities Project, climate change adaptation studies, and infrastructure resilience assessments. Recently he has been helping Local Government New Zealand develop risk management frameworks for consultation as part of the proposed Local Government Risk Agency. He has written and presented extensively on topics relating to risk and resilience as they apply to infrastructure, the built environment, and communities.</p>
<p>Bryce Davies, General Manager, Corporate Relations, IAG</p>	<p>Mr Bryce Davies led the development of the first Resilient New Zealand report on the role that businesses can play together to help New Zealand be better prepared for, and recover from, future natural disasters. Resilient New Zealand was set up by engineering, banking, insurance, telecommunications and aid organisations to identify, champion and advocate ways New Zealand can be more resilient to natural disasters.</p> <p>Before IAG, Bryce held roles across the insurance and banking sectors.</p>
<p>Bruce Wills, farmer and businessman</p>	<p>Mr Bruce Wills and his family farm sheep and cattle on the hills north of Napier and run a small on-farm tourist business. Before farming he spent 20 years in banking and investment in Hamilton, Wellington and Auckland.</p> <p>Bruce has a strong focus on the environment, and is a previous Hawke’s Bay Farm Environmental Award winner. He was the National President of Federated Farmers from 2011 to 2014. He currently holds governance roles with Ravensdown, QEII National Trust, Horticulture NZ, Motu Economic & Public Policy Research, Todd</p>

	<p>Foundation, Primary Growth Partnership P2P, Our Land and Water (National Science Challenge) Cape to City, NZ Poplar & Willow Research Trust, Resilience to Nature's Challenges (National Science Challenge), and ApicultureNZ.</p>
<p>Dr Sam Dean, Chief Scientist, Climate and Atmosphere Centre, NIWA</p>	<p>Dr Sam Dean is an expert on the drivers of climate variability in New Zealand and Antarctica, particularly human-induced climate change.</p> <p>His research has identified the contribution of human-induced warming to intensifying current New Zealand weather extremes like droughts and floods. Recently he has been part of a team investigating the interactions between Antarctic sea-ice, atmospheric circulation, and the Southern Ocean.</p> <p>Sam joined NIWA in 2006 after working as a researcher at the University of Oxford, UK. He began his role as Chief Scientist in 2015, and now oversees NIWA's climate change and hazards science.</p>
<p>Kirk Hope, Chief Executive of BusinessNZ</p>	<p>Mr Kirk Hope is Chief Executive of BusinessNZ, New Zealand's largest business advocacy body, advocating for New Zealand's success through sustainable market-led growth.</p> <p>Kirk previously led the New Zealand Bankers' Association and Financial Services Federation after holding a range of senior positions at Westpac, including Head of Government Relations and Regulatory Affairs. A barrister and solicitor with a master's degree in law focused on regulation of financial services, Kirk also holds a postgraduate honours degree in political science. For five years he was a member of the Commercial and Business Law Committee of the New Zealand Law Society.</p>
<p>Tina Porou, Lead Technical Advisor to the Iwi Advisors Group</p>	<p>Ms Tina Porou is of Ngāti Porou and Ngāti Tūwharetoa descent. Ms Porou is the Lead Technical Advisor to the Iwi Advisors Group and has previously been a member of the Climate Change Iwi Leaders Group (now a part of Pou Taiao – Iwi Leaders Group). Tina is the founding director of Poipoia and holds board of governance positions on the Lake Taupo Forest Trust, the Wharerata Forest Company, and the Pahiitaua Incorporation.</p> <p>Tina's former roles include head of Sustainability, Environment and Communities at Contact Energy and she has been on the board of various entities including the Waste Minimisation Board for the Ministry for the Environment.</p> <p>Tina was announced as a Blake Leader in the Sir Peter Blake Trust 2015 leadership awards and is a member of the New Zealand Order of Merit.</p>
<p>Dr Gavin Palmer, Director – Engineering, Hazards and Science, Otago Regional Council</p>	<p>Dr Gavin Palmer has been Director of Engineering, Hazards and Science at the Otago Regional Council since 2013.</p> <p>Before that he held the position of Director Environmental Engineering and Natural Hazards for nine years. In this role he leads work on considering how best to minimise the risk of natural hazards in the Otago Region (such as flood hazards in South Dunedin). This work includes consideration of the effects of climate change on natural hazards.</p> <p>Gavin has 25 years work experience in the areas of flood protection, land drainage, stormwater management, and natural hazards. He has had technical and management roles within Waikato Regional Council, Auckland City Council, and Watercare Services Ltd.</p> <p>Gavin is a member of the Institution of Professional Engineers of New Zealand.</p>