He Mahere Ārai Āhuarangi
Climate Action Roadmap

September 2023

Waikato
REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

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Te takatū o Waikato rohe
We're making a stand for a climate resilient Waikato

The Waikato can be a more resilient region that works with and for the natural environment and actively supports its people to transition to a thriving net carbon zero economy.

We can make changes to look after people, nature and the things that sustain our quality of life, but we must act now and with greater urgency to reduce greenhouse gas emissions.

Responding to climate change requires all parts of society to transition to a net zero emissions economy. The council recognises that our responses to climate change present a mix of economic and social opportunities, alongside necessary changes and challenges. We know that transitions usually benefit some groups more than others so we will involve and support those most affected to reduce negative social, economic, and environmental impacts, while seeking opportunities.

We also have much to gain by appropriately incorporating mātauranga Māori as we adapt and reduce emissions by applying sustainable practices aligned with te ao Māori.

This 2023 update of our first *Climate Action Roadmap* published in 2020 is a call to our regional community to work together to accelerate the pace of change. It has been updated to incorporate international, national and council directions, including the Intergovernmental Panel on Climate Change (IPCC) *Sixth Assessment Report* published in March 2023, changes in New Zealand legislation, the *National Adaptation Plan* and the *Emissions Reduction Plan*, and our own council's strategic direction 2023-2025. It signals how Waikato Regional Council will work with others to support the transition to a climate-resilient, low emissions society that's less vulnerable to disruption, more affordable and better for health and wellbeing.

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How we'll do it

A focus on wellbeing and how we respond to climate change is woven through all the priorities of *Takatū Waikato | Making a Stand for the Waikato: Strategic Direction 2023-2025*. Aligned with the strategy, the *Climate Action Roadmap* identifies nine pathways to work with others to reduce emissions and adapt to the changes we're already experiencing.

All pathways are important and depend on the sustained engagement of all sectors of society working collaboratively toward mutually agreed targets. Our response and commitments set out in each pathway will guide conversations with staff, iwi partners and stakeholders, and guide investment decision-making for our *Long Term Plan 2024-2034.*

A *Climate Action Work Plan* will be developed for the projects committed to in the long term plan. We have also developed a *Climate Change Response Position Statement*, which is a summary of all our existing policies and positions to help the council and council staff address climate change mitigation and adaptation in non-regulatory decision making.

Our purpose

Working together for a Waikato region that has a healthy environment, vibrant communities and strong economy.

Healthy environment

A resilient and sustainable region that works in harmony with the natural environment, one that's actively transitioning to net carbon zero and fosters the growing of our indigenous biodiversity.

Vibrant communities

A connected and inclusive community where people are actively engaged with whanau and families, communities and governance. A region with a vibrant Māori culture and one that celebrates diversity, participation and understanding.

Strong economy

An innovation leader with a diversified economy that attracts people to the region and builds their capabilities.

Our council is committed to working with iwi partners, businesses, industry sectors, infrastructure providers, non-governmental organisations, community groups, local and central government and others to come up with agreed solutions for a more inclusive, productive and climate resilient economy.

We invite people to talk with us about how we can work together to reduce our emissions or build resilience to climate change. Contact details are at the back of this roadmap.

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Te horopaki ā-ao
Global context

The understanding of climate change has shifted from a perception of just an environmental problem to one that is recognised as a threat to financial systems, social cohesion, health and wellbeing, and national and international security. Projections for local climatic changes present significant implications for our environment, the safety of our communities and the economy.

"If we act now, we can still secure a liveable sustainable future for all."

IPCC Chair Hoesung Lee
20 March, 2023

In 2018, the world's leading climate scientists, through the Intergovernmental Panel on Climate Change (IPCC), highlighted the unprecedented scale of the challenge required to keep warming to 1.5°Celsius and the significant impacts if we do not[1]. Since 2018, the IPCC has published its Sixth Assessment Report (AR6), with a synthesis report for policy makers published in March 2023. These reports present the most recent state of knowledge of climate change science, its widespread impacts and risks, and climate change mitigation and adaptation.

In these reports, the IPCC warns that the challenge has become even greater due to a continued increase in greenhouse gas emissions. Human activities have caused our planet's climate to warm at a rate faster than anything people have experienced in at least 2000 years.

The pace and scale of what has been done so far, and current plans, are insufficient. However, there are multiple, feasible and effective options to reduce greenhouse gas emissions and adapt to human-caused climate change, and they are available now.

More than a century of burning fossil fuels as well as unequal and unsustainable energy and land use has led to global warming of 1.2° Celsius above pre-industrial levels. This has resulted in more frequent and more intense extreme weather events that have caused increasingly dangerous impacts on nature and people in every region of the world.

From any increase in global warming, we can expect:

- an increasingly variable water cycle
- long lasting changes in our ocean, sea level and the earth's frozen regions
- extreme weather events.

Every increment of warming results in rapidly escalating hazards. More intense heatwaves, heavier rainfall and other weather extremes further increase risks for human health and ecosystems. Across the world, people are dying from extreme heat and climate-driven food and water insecurity, which are expected to increase with increased warming. When the risks combine with other adverse events, such as pandemics or conflicts, they become even more difficult to manage.

In this decade, accelerated action to adapt to climate change is essential to close the gap between existing adaptation and what is needed. Meanwhile, keeping warming to 1.5°Celsius above pre-industrial levels requires deep, rapid and sustained greenhouse gas emissions reductions in all sectors. Emissions should be decreasing by now and will need to be cut by almost half by 2030 if warming is to be limited to 1.5° Celsius.

The AR6 concludes with the realisation we have left the stable climate in which our cultures, cities, agriculture, economies and the infrastructure were developed, and warns that future changes to our climate and how they affect us will depend on the choices we make today[2].

As the climate changes, so must we.

1 IPCC. 2018. Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty: Summary Report for Policymakers. Geneva, Switzerland: IPCC

2 Press | Climate Change 2021: The Physical Science Basis (ipcc.ch)

Kua tūhonohono katoa
It's all connected

Our environment is made up of many interconnected processes in climate, air, water and biodiversity that keep our planet stable and habitable.

People depend on stability of the environment for economic and food security, access to energy, reliable infrastructure, physical and mental health, cleaner water and less air pollution. It's in our interest to protect the planet.

The planetary boundaries concept, developed by the Stockholm Resilience Centre in 2009, identifies a set of nine planetary boundaries based on the interconnected processes that regulate the stability and resilience of the Earth system. These are the 'safe' environmental limits within which people can continue to develop and thrive. Crossing these boundaries increases the risk of tipping points, critical thresholds at which even small changes can cause large scale abrupt or irreversible environmental changes.

The planetary boundaries work has been regularly updated, most recently in May 2023, to incorporate socially 'just' limits at which people are not exposed to significant harm from planetary changes. The addition of justice takes account of the fact that everyone, particularly the most vulnerable, has a right to a healthy environment, clean water, food, energy and health.[3]

This new study finds almost all of the 'safe' environmental Earth system boundaries have been breached, and that adding the justice perspective further tightens many of the original boundaries. For example, human beings are considered to be relatively 'safe' up to 1.5 degrees of global warming. However, at the current 1.2 degrees increase, we're already seeing environmental disasters causing direct impacts on people's homes, livelihoods and quality of life, including here in New Zealand. At current projections based on current policies, the planet is on a trajectory towards 2.7 degrees.[4]

These findings increase the urgency with which we must work towards existing sustainability goals, including the Paris Agreement for climate, the Kunming-Montreal Global Biodiversity Framework, and the 2030 Sustainable Development Goals. Climate change, biodiversity and water quality are interconnected, as are wellbeing and economic stability. The interconnectedness means the sustainability goals for our environment, communities and economy must all be considered and addressed together, rather than being traded off against each other.

"This study brings into focus the human dimension of the climate debate. In putting a number on human needs and impacts, it shows how the protection of the planet is inseparable from the success of communities, societies and economies. These boundaries enable businesses to understand their fair share of resources and responsibilities, and to take measurable action to minimise their footprint on the planet that also helps improve human wellbeing.

"Every fraction of a degree of warming has a direct impact on people's lives and livelihoods, from undermining food security and displacing families from their homes to increasing the risk of disease and so much more. There has never been a more urgent need for leaders to take transformational action to limit global warming, protect nature and build a just economy for all."

Prof. Xuemei Bai, Distinguished Professor, Australian National University and co-author of *Safe and just Earth system boundaries*.

3 Rockström, J., Gupta, J., Qin, D. *et al.* Safe and just Earth system boundaries. *Nature* 619, 102–111 (2023).
4 Climate Action Tracker

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Planetary boundaries New Zealand

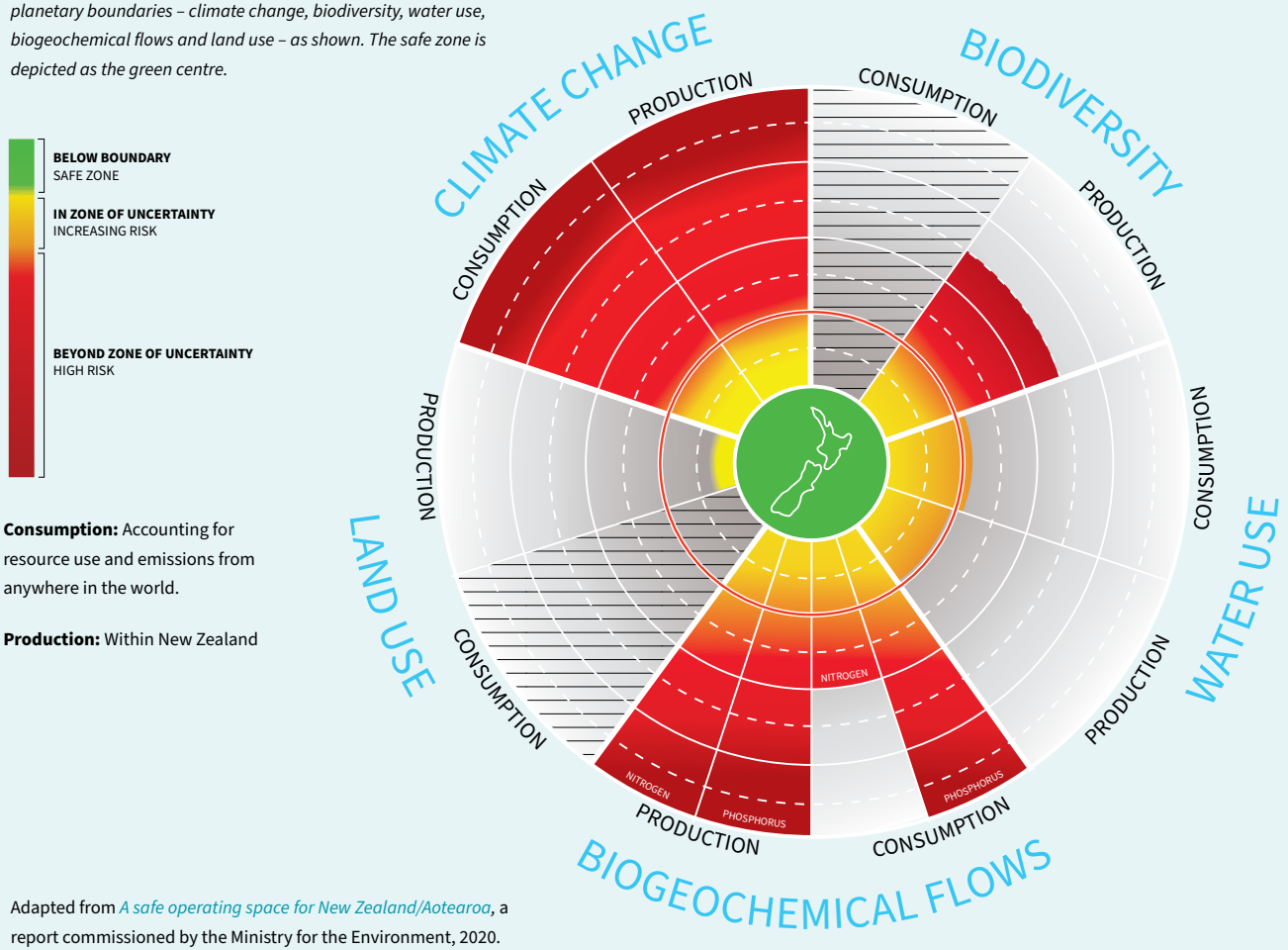
A report commissioned by the New Zealand Ministry for the Environment in December 2020 quantified five of the nine planetary boundaries relevant to Aoteoroa. These were climate change, land use, freshwater use, biogeochemical flows (nutrient use, mainly nitrogen and phosphorus) and biodiversity. The report found that New Zealand exceeds its fair share of the earth's resources and atmosphere related to climate, biodiversity, nutrient use and deforestation.

The report provides context for Waikato communities to consider interconnected environmental pressures and our opportunities for reducing these and working with nature to create a more sustainable and resilient region.

This *Roadmap* invites discussions about the interconnectedness of climate change, natural habitat and biodiversity loss, as well as soil and water quality, and how we might tackle them. Nature-based solutions are central to our response to these issues. Restoring mauri through wetland restoration, for example, sequesters carbon, regenerates aquifers, provides natural flood protection, and enhances the wellbeing of the whenua, of iwi and of wider communities.

Five planetary boundaries translated to New Zealand

New Zealand exceeds the global safe operating space for five planetary boundaries – climate change, biodiversity, water use, biogeochemical flows and land use – as shown. The safe zone is depicted as the green centre.



Consumption: Accounting for resource use and emissions from anywhere in the world.

Production: Within New Zealand

Adapted from *A safe operating space for New Zealand/Aotearoa*, a report commissioned by the Ministry for the Environment, 2020.

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Ngā matapae āhuarangi mō te rohe
Climate projections for the Waikato

For New Zealand, future projections show a warmer, wetter and windier climate, with more extreme daily and seasonal variation and inconsistent geographic effects.

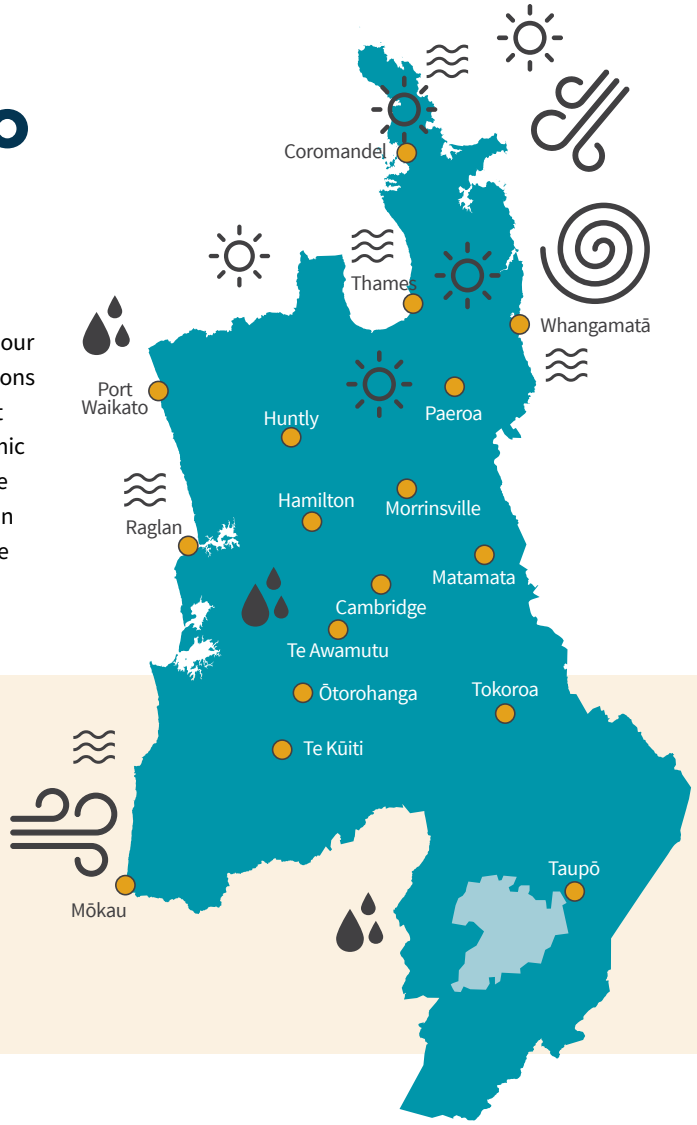
Over the next century[5], the Waikato region can expect rising sea levels, more extreme weather, warmer summers and milder winters with seasonal rainfall shifts[6]. It is projected that drought risk will increase in the north and east over spring and summer, and there may be seasonal changes in rainfall and wind in the west. These climatic changes have implications for local communities, many of which are located along the coast or in floodplains.

To help with its decision making, the council commissioned detailed climate projections for the Waikato region, using the most recent international climate modelling data (CMIP6) and several scenarios from the AR6. Trends in average seasonal and annual mean, maximum and minimum temperatures were explored; patterns in average seasonal and annual precipitation, run-off, wind speed, daily extreme precipitation, daily extreme wind speed and an annual drought index were analysed; and, in terms of socio-economic variables, historical water-take statistics examined.

The implications for our region are that we must future-proof our decisions and pivot from basing resource management decisions on known past measurements of our environment to one that includes modelled projections. The future will be more dynamic and we are already starting to see more weather extremes, the cumulative effects of which we have not experienced before. In this changing climate, we need to develop confidence to make decisions under increasing uncertainty.

Summary of projected climate changes for the Waikato region

- Warmer. Increased drought.
- Increased rainfall intensity.
- Increasing sea levels.
  Increased storm surge.
- Increased westerly winds (winter and spring).
  Increased north easterly winds (late summer and autumn).
- Increased tropical cyclones.



5 Projections are nominally referred to as occurring over the next century, but some changes are recognised to occur beyond this due to time lags in natural systems. An example is the ongoing expectations of sea level rise over coming millennia.

6 Yinpeng, L, Urlich P, Yu J, Rogers H (2021). Waikato Regional Climate Impacts Report Applying CMIP6 Data. Hamilton. Prepared for Waikato Regional Council by CLIMsystems Ltd.

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Huringa āhuarangi me ngā mōrearea māori
Climate change and natural hazards

Climate change is expected to increase the frequency, severity and impact of many natural hazards in the Waikato.

Coastal inundation and coastal erosion caused by sea level rise is the natural hazard commonly associated with climate change, but others include river flooding and land instability from extreme rainfall events, and heat waves, drought and fire from extended periods without rain and increased temperatures. Together, and including other natural processes such as land subsidence, the impacts will be greatly increased and wide-ranging.

The Waikato Regional Hazards Portal and Coastal Inundation Tool are key online resources our communities can use to identify and make informed decisions about their exposure to natural hazards. Improved natural hazard information will shortly[7] be available in Land Information Memorandum (LIM) reports to allow property owners and buyers to easily access information on natural hazard risks affecting properties.

There is real potential for the insurance industry to withdraw, or partially withdraw, from selected parts of coastal, river or landslide-prone settlements in the region due to increased climate change risk. The behaviours of insurance companies will be an important catalyst for change in the changing climate.[8]

Coastal inundation and erosion

Coastal inundation and erosion already occur in many places in the Waikato, and impacts worsen during king tide and storm events. In our region, coastal inundation is currently a risk to 8000 people, $1.46 billion[9] worth of buildings and 540 square kilometres of productive land.

A 1 metre rise in sea level will mean present day 1-in-100-year extreme sea level events will happen with much more frequency and impact more than 11,000 residents, $2.2 billion worth of buildings and 630 square kilometres of land in the Waikato region if no future coastal protection or adaption occurs.[10]

Homes have already become uninhabitable in Port Waikato due to major sand dune erosion.

7 An amendment to the Local Government Official Information and Meetings Act 1987 on the provision of natural hazard information on LIMS is due to be passed into legislation in 2023. This amendment is considered a critical action under the National Adaptation Plan to enable the public to make informed choices.

8 Deep South Challenge: *Climate change and the withdrawal of insurance*

9 NIWA Client report: Coastal Flooding Exposure Under Future Sea-Level Rise for New Zealand

10 Coastal Flooding Exposure Under Future Sea-level Rise for New Zealand

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Sea level rise and ground water

Sea level rise also affects groundwater levels in coastal aquifers. This can have the effect of:

- increasing the water table, affecting the structure, usability and integrity of buried infrastructure, especially relevant to public three waters services and to private septic tanks
- affecting the foundations of infrastructure such as highways, rail and stopbanks
- increasing liquefaction risk
- shifting the position of the freshwater-saltwater interface of rivers, which could increase the area of saltwater inundation
- increasing the amount of groundwater that may need to be drained from low-lying coastal lands
- saltwater intrusion into groundwater bores.

River flooding

River flooding is likely to increase with more frequent and more intense rainfall and in coastal areas exacerbated by sea level rise. Groundwater tables will also be higher, exacerbating flooding. The Waikato region has extensive flood management schemes and land drainage networks, all built to provide agreed levels of service. However, with climate change these may be unable to provide the level of protection they used to without considerable additional investment. Continual ongoing development in drained or flood protected areas further increases what and who is exposed to risk from flooding.

Land instability

Intense rainfall and river flooding are drivers of increased land instability, including landslides and erosion. Longer dry periods can increase the risk of land instability as dry cracked ground is more prone to failure during intense rainfall. Landslides occur in steep catchments where the geology (weak soils) is prone to erosion and when soils become over saturated. The Coromandel Peninsula is particularly prone to landslides, as seen during Cyclone Gabrielle in February 2023 with damage to many roads, including the closure of State Highway 25A due to a massive under slip. Erosion is also very common on outer river bends due to high energy water during flood events.

Te Aroha flooding, February 2023

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Drought

Northern and eastern parts of the Waikato region are at risk of increased drought, which will have a particular impact on our agricultural and horticultural industries. Places like the Hauraki Plains rely heavily on reticulated water, particularly in the farming industry, however, with increased drought and more dry days there is likely to be reduced water availability. Additionally, heat stress on animals and reduced pastural feed add an economic burden and have implications for food production.

The Waikato region experienced a dry 2019, with annual rainfall well below the long-term average. This was followed by a record-breaking summer of low rainfall. Ruakura weather station recorded its driest summer (December 2019 to February 2020) and year (2020) on record, with January and February 2020 recording just 16 millimetres of rainfall.

Recent experience has highlighted the potentially significant cost of drought. The North Island drought of November 2007 to April 2008 cost the New Zealand economy $2.8 billion.[11]

Wildfire

The warmer drier climate will cause an increase in extreme fire weather days and longer fire seasons. This has implications for the potential number, frequency and impacts of future wildfires, as well as for Aotearoa New Zealand's carbon sequestration ambitions and financial capital in planted forests.[12] Recent research has highlighted that the conditions that led to the devastating 'Black-Summer' fires in Australia will occur every 3-20 years in areas of the Mackenzie Country, Central Otago and Marlborough.[13] Wildfires in other parts of the country can still affect the Waikato, such as if the high voltage transmission system between the South Island and North Island is impacted by wildfire.

Increases in temperatures

Extreme heatwaves are among the fastest-changing meteorological hazards in a warming world with impacts on human health, animal welfare and economic productivity.

Heatwaves in New Zealand over recent summers are already causing wide-ranging effects. Summer heatwaves in 2017/18, 2018/19 and 2021/22 saw the warmest months on record, with many more warm days (≥ 25°C) than usual. These warm season heatwaves (from November to March) all produced dramatic climate impacts across New Zealand, including marine heatwave conditions and major loss of glacier ice volume in the Southern Alps.[14] Higher temperatures also impact our critical infrastructure, for example, high temperatures can degrade roading infrastructure.

While the Waikato region may not reach the highest daily temperatures in New Zealand during a heatwave, our high afternoon temperatures and humidity can combine to produce significant heat stress. Such extreme events can persist for several days at a time with overnight temperatures offering little respite. Recent research suggests that for the northern half of the North Island, less variation from day-to-day will mean larger risks, as further warming occurs over the twenty-first century.[15] Further work is needed to understand the impact of projected temperature increases and heatwaves on different sectors and communities in the Waikato.

An increase in temperature also means fewer frost days. We're already seeing the impact of a warmer climate on winter recreational activities and tourism. In 2022, Tongariro National Park had record-breaking low snowfall, with financial implications for Ruapehu Alpine Lifts and the surrounding towns and businesses.

11 Adapting to drought in the Waikato 2021, Waikato Regional Council Technical Report 2021/28, p6
12 Langer et al. (2021), Adapting and mitigating wildfire risk due to climate change: extending knowledge and best practice. Scion Client Report No. 36230991.
13 Langer et al. (2021), Adapting and mitigating wildfire risk due to climate change: extending knowledge and best practice. Scion Client Report No. 36230991.
14 Salinger et al, Coupled ocean-atmosphere summer heatwaves in the New Zealand region: an update, Weather and Climate (2023), vol 42, issue 1,
15 Harrington LJ and Frame D (2022), Extreme heat in New Zealand: a synthesis, Climatic Change (2022) 174:2

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Te mātau ki ngā mōrea āhuarangi
Understanding our climate risks

Understanding the projected changes and their impacts is a key first step in securing intergenerational social, economic, cultural and environmental wellbeing in a changing climate.

To better understand the specific climate change risks for the Waikato and support adaptation planning, we are committed to developing a comprehensive climate change risk assessment for the region. This risk assessment, the first for our region, will bring together a collective understanding of climate risk across all aspects of our environment, our people, our property and our economy at a regional scale across a range of climate scenarios and timeframes.

In 2022, we completed the first phase of our regional climate change risk assessment. Iwi and key stakeholders identified and catalogued climate risks across our region via a regional survey and a series of engagement workshops.

Further detailed assessment of climate risks is being progressed in 2023. The final report will be shared region wide, for everyone in the Waikato to understand the regional impacts of climate change.

Adapting to climate change and a focus on climate resilience is embedded in each of the roadmap pathways.

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Ko tā Aotearoa whakautu
New Zealand's response

A range of legislation, national direction and policy determines our role as a regional council in responding to climate change.

The Paris Agreement is an international commitment to limit global warming to well below 2° Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase to no more than 1.5° Celsius. For global warming to remain below 2° Celsius, emissions reductions of 60 per cent to 80 per cent by 2050 must be achieved.

The Climate Change Response Act provides a framework for New Zealand to contribute to the global effort under the Paris Agreement. This Act, alongside associated policies, plans and regulations, are the Government's main response to climate change.

New Zealand has a national emissions reduction target of reducing greenhouse gases to net zero by 2050 and to reduce biogenic methane by between 24 per cent and 47 per cent.

To do this, the Government is using a system of emissions budgets, of which the first three (2022-2025, 2026-2030, 2031-2035) were published in May 2022.

Waikato River, Hamilton

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Emissions Reduction Plan

New Zealand's first *Emissions Reduction Plan* contains strategies, policies and actions for achieving our first emissions budget and contributing to global efforts to limit global temperature rise to 1.5˚Celsius above pre-industrial levels. This requires Aotearoa to reduce emissions by an extra 11.5 megatonnes of carbon dioxide equivalent ($MtCO_2e$) between 2022 and 2025. The Government is required to act to reduce emissions across the economy, all parts of government, and support all New Zealanders to make the most of the transition to improve living standards.
The *Emissions Reduction Plan* is based on five principles:

- playing our part
- empowering Māori
- equitable transition
- working with nature
- a productive, sustainable and inclusive economy.

National Adaptation Plan

This plan sets out what actions the Government will take over the next six years to help all New Zealanders adapt and thrive in a changing climate. It includes a programme of work to support councils to take action and adapt to climate change. It brings together existing actions and proposed future work to:

- enable better risk-informed decisions
- drive climate-resilient development in the right places
- lay the foundations for a range of adaptation options, including managed retreat
- embed climate resilience across government policy.

Resource management reforms

The resource management system is being reformed, in part, to provide a better way to respond to climate change.

It shifts from a reactive stance of managing the adverse environmental effects of activities that use natural and physical resources to one that is designed to achieve social, economic, environmental, and cultural outcomes. It will do this by integrating the roles of regional, city and district councils through a Regional Planning Committee. The committee will be responsible for:

- preparing and maintaining a regional spatial strategy under the Spatial Planning Act that will identify areas at risk of climate effects and less risky areas for investment and development, including where critical infrastructure to service new developments could be placed
- preparing and maintaining the regulatory plan within each region that contains settings for resource allocation and land use, known as combined plans under the Natural and Built Environment Act.

Both the regional spatial strategy and the combined plan will be directed by a National Planning Framework (modernised national direction currently made up of national policy statements, national environmental standards and regulations), which is in turn informed by the *National Adaptation Plan* and the *Emissions Reduction Plan*.

A third piece of legislation, the Climate Adaptation Act, is being prepared to support community engagement where retreat from a location is required due to intolerable risk. It is anticipated that the new system will take seven to 10 years to become operative in the Waikato. The existing resource management system will continue to determine the region's climate change response until the combined plan is operative for the entire region. However, central government may put some transitional measures in place or bring forward certain aspects of the new system to better address the impacts of climate change in resource management and enable faster emission reductions, for example, applying the new National Planning Framework to the existing resource management system and fast tracking consenting processes.

Our commitment

Each region has a unique greenhouse gas emissions profile, based on their different soils, topography, demographics, geography, climate and industries. Therefore, each region will contribute to the national target in different ways.

The council is committed to doing its part to contribute to national emissions reduction targets. We are doing this by reducing emissions in the delivery of local government services in the Waikato, such as public transportation, and in exercising our role, as a regulator, to address climate change.

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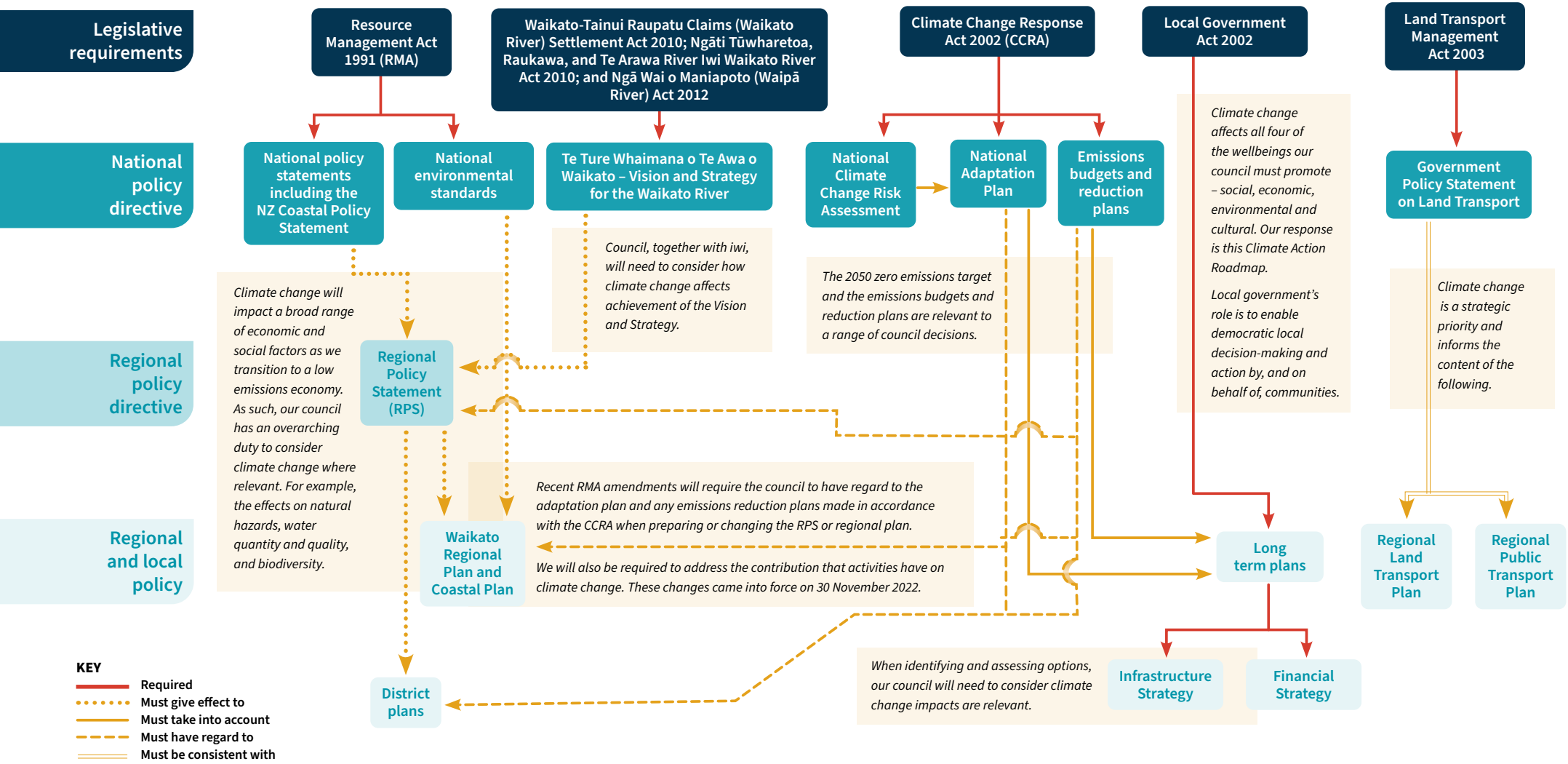
How legislation guides our climate response



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Te tuku haurehu i Aotearoa
Emissions in New Zealand

New Zealand's Greenhouse Gas Inventory is the official annual report of all human-induced emissions and removals of greenhouse gases in New Zealand. The most recent inventory contains all major emissions trends from 1990 to 2021.[16]

Between 1990 and in 2021, gross emissions rose 19 per cent. However, since 2006 when gross emissions peaked, emissions have stayed relatively stable with yearly fluctuations.

The five emission sources that contributed the most to the increase were:

- enteric fermentation due to an increase in the dairy cattle population (methane) (up 7.4 megatonnes of carbon dioxide equivalent ($MtCO_2e$))
- fuel use in road transport due to traffic growth (carbon dioxide) (up 5.9 $MtCO_2e$)
- agricultural soils due to increased fertiliser use (nitrous oxide) (up 2.1 $MtCO_2e$)
- fuel use in manufacturing and construction, due to economic growth leading to increased production (carbon dioxide) (up 1.5 $MtCO_2e$)
- use of hydrofluorocarbon-based refrigerants in industrial and household refrigeration and air conditioning systems that replaced ozone-depleting substances (1.5 $MtCO_2e$).

Net emissions between 1990 and 2021 increased by 25 per cent. Net emissions include gross emissions combined with the emissions and removals from land use, land-use change and forestry (LULUCF)[17]. Historical planting rates and harvesting cycles have a large impact on the net amount of carbon dioxide removed by our forests in any given year. Despite this, since 1990, LULUCF has remained a net carbon sink.

From 2020 to 2021, gross emissions decreased by 0.7 per cent to 76.8 $MtCO_2e$, mainly due to decreases in emissions across the agriculture sector.

The agriculture and energy sectors contributed the most to New Zealand's gross emissions in 2021 at 49 per cent and 41 per cent respectively. Emissions from road transport, a sub-category of the energy sector, made up 16 per cent of gross emissions.

"I don't think I've ever felt as sad or as angry about the lost decades that we spent bickering and arguing about whether climate change was real or not, whether it was caused by humans or not, whether it was bad or not, whether we should do something about it or not, because it is clearly here now, and if we do not act, it will get worse."

Honourable James Shaw, Minister for Climate Change, during Cyclone Gabrielle, March 2023

16 Ministry for the Environment. 2020. New Zealand's Greenhouse Gas Inventory 1990-2018: Fulfilling reporting requirements under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Wellington: New Zealand Government

17 Land Use, Land-Use Change and Forestry (LULUCF). The LULUCF sector keeps track of greenhouse gases from land use such as forests, crops and pasture. This is separate from the livestock emissions reported in the Agriculture sector. It covers changes that occur in soils and vegetation from land management and land-use change, and is the only sector where both emissions and removals of carbon dioxide occur.

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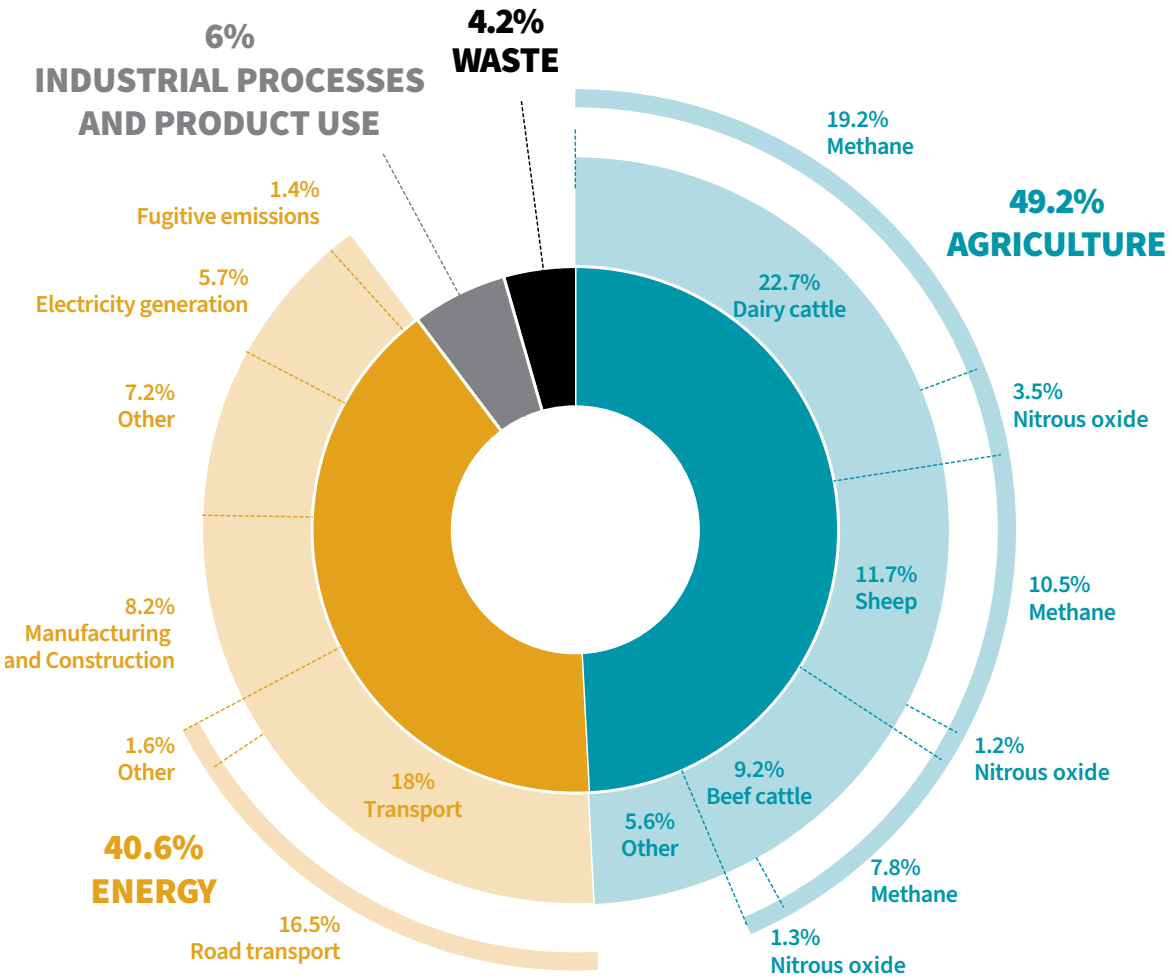
New Zealand's greenhouse gas inventory 1990-2021



Note: These are the most recent figures but provisional until reviewed by UNFCCC.

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Te tuku haurehu i te rohe
Emissions in the Waikato region

The emissions profile of the Waikato region enables us to identify opportunities for reducing greenhouse gases.

The regional greenhouse gas emissions inventory provides an understanding of the Waikato region's emissions profile over time. Compiled every three years, the inventory follows the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC)[18], which is considered best practice for community-based inventories. The first baseline greenhouse gas emissions inventory for the Waikato region was for the 2015/16 financial year[19].

The most recent inventory, for 2021/22[20], indicates that activities within the region generated approximately 12.0 megatonnes of carbon dioxide equivalent ($MtCO_2e$). Gross emissions have decreased by 3 per cent since the 2015/16 baseline year. On a per capita basis, the Waikato's gross emissions remain significantly higher than the national average. This means that future government policy initiatives to reduce greenhouse gases may have a significant impact on Waikato people, economically and socially.

The biggest opportunities for reducing the region's emissions exist within sectors where they are highest. Agriculture remains the largest contributor to the total gross emissions for Waikato (67 per cent), followed by transportation (16 per cent) and stationary energy (13 per cent). On road petrol and diesel contribute to approximately 86 per cent of the transportation emissions and the main source of emissions from stationary energy is natural gas consumption.

Trends over the three inventories undertaken to date have been similar, with modest changes seen within each sector year to year. The three sectors with greatest changes are:

- transport, with an increasing but fluctuating trend between years
- agriculture, with a downward trend based largely on animal number reductions (particularly dairy and sheep)
- forestry (the largest change), with increased harvest volumes significantly reducing the sector's overall sequestration, which is used to offset other emissions.

18 World Resources Institute. 2014. Global protocol for community-scale greenhouse gas emission inventories: An accounting and reporting standard for cities. USA: World Resources Institute
19 Stancu C, Marquart M. 2017. Waikato Region greenhouse gas inventory - July 2015 to June 2016. Auckland: Prepared for Waikato Regional Council by Envirostrat and AECOM.
20 EnviroStrat Ltd (2023). Waikato Region Greenhouse Gas Emissions Inventory for the period 1 July 2021 to 30 June 2022. Auckland. Prepared for Waikato Regional Council by EnviroStrat Ltd.

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The region's emission's profile for 2021/22 showed forestry removed 14 per cent of total gross emissions, compared with 44 per cent in 2018/19.

Increasing native forest has an important role in our region's long-term response to climate change. As well as increasing carbon sequestration, benefits of increasing native forest include increased biodiversity and improving soil health, while providing food, shelter and breeding sites for native species.

It is proposed that greenhouse gas emissions arising from the drainage and disturbance of organic soils such as our Waikato peatlands be included in future regional inventories.

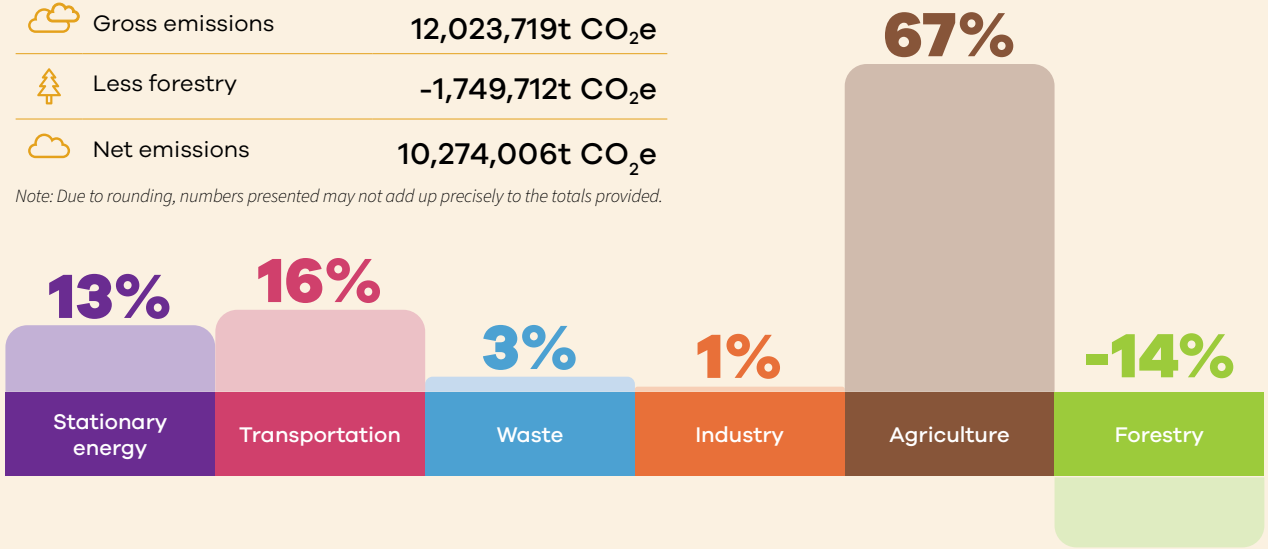
Quick facts

- Waikato region's per capita net emissions are approximately 35 per cent higher than the national average (23.7 v 15.0 tCO_2e per capita).
- Agricultural activities generate 67 per cent of all emissions.
- Waikato region's per capita agricultural emissions are more than twice the national average (16.0 v 7.4 tCO_2e per cap), showing the dominance of agricultural emissions in the Waikato.
- 91 per cent of carbon sequestration in the Waikato comes from exotic forest and 9 per cent from native forest.

Waikato emissions in 2021/22

Gross emissions	12,023,719t CO_2e
Less forestry	-1,749,712t CO_2e
Net emissions	10,274,006t CO_2e

Note: Due to rounding, numbers presented may not add up precisely to the totals provided.



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Agriculture – a regional strength and an opportunity

The council aims to enable Waikato farmers to be national leaders in the adoption of climate smart practices and technologies. We will do this by aligning our farmer education and support services with those of industry bodies and central government.

The Waikato is one of the most productive agricultural regions in New Zealand. Dairy and meat products make up around two-thirds of the Waikato's international exports. Most of the towns in the Waikato are highly dependent on agriculture for their economic sustainability. We all have an interest in the enduring success of our primary industries.

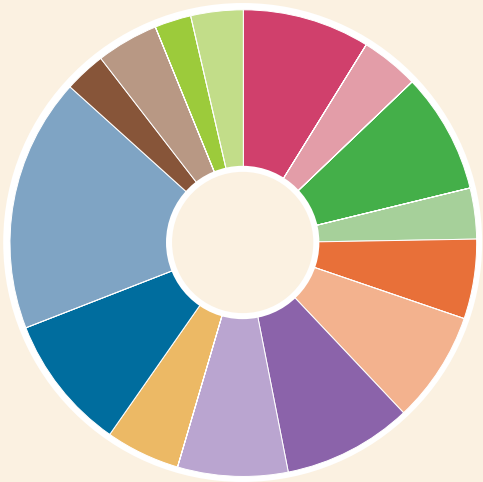
Dairy farming is dominant. It was recently estimated that the Waikato has 3051 dairy herds – about 28.3 per cent of the total herds in New Zealand[21] – and, economically, dairying brings in $1.6 billion (around 5 per cent of regional gross domestic product) each year to the region, as well as employing about 10,000 people.

The agricultural sector also includes sheep, beef and goat farming, horse breeding and horticulture. Vegetable growing, which used to be centred around Pukekohe, has expanded and shifted south to the Matamata area.

Those working in agriculture fully appreciate that weather patterns are changing, as this affects their livelihood. Farmers are already changing traditional management systems and learning to work with a changing climate. New technologies and improved genetics are being developed to adapt to changing conditions and reduce emissions. Farmers are also planting a significant number of trees, protecting existing forest lots and creating and protecting wetlands. Recent legislation has mandated all farmers to prepare and implement farm environment plans to address impacts on fresh water. Many of the actions also provide climate change response benefits.

Export markets are increasingly cognisant of emissions from land use, and these may result in formal or informal trade barriers in the absence of an appropriate climate response.

Structure of the Waikato economy (value added by industry) [22]



- Agriculture
- Other primary
- Primary manufacturing
- Other manufacturing
- Utilities
- Construction
- Wholesale and retail
- Healthcare and social assistance
- Education and training
- Other services
- Property related services
- Distribution
- Information media, telecoms etc
- Financial and insurance services
- Public admin and safety

21 New Zealand Dairy Statistics 2021-22, page 16, Dairy NZ

22 Statistics New Zealand (infoshare.stats.govt.nz), table reference: RNA001AA, data downloaded 24 March 2023 , 10.45am.

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Kia heke tā tātou tuku haurehu
Reducing our footprint

At Waikato Regional Council, we've been been measuring and reducing our greenhouse gas emissions since 2016.

When we started our programme to measure and reduce our greenhouse gas emissions in 2016/17, the aim was to achieve a 45 per cent reduction in carbon dioxide by 2030 from our base year and be net-zero by 2050. However, in 2018/19, our CO_2 emissions were 30 per cent lower so the council endorsed a far more ambitious greenhouse gas emissions reduction plan to achieve a 68 per cent reduction by 2030.

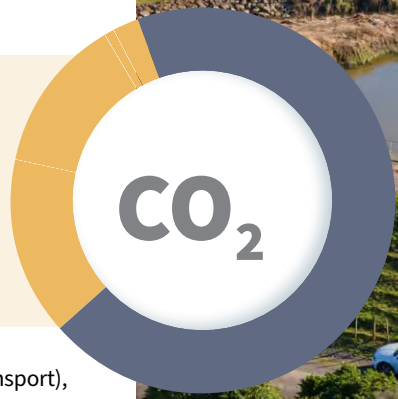
From 2023, the council will be reporting against the 2018 ISO emissions reporting standard, which requires an organisation to look more broadly at the scope of its inventory and include a wider range of indirect emissions, such as those in our supply chain. Such indirect emissions are known as additional scope 3 emissions, or categories 4 to 6 in the 2018 ISO standard. This will increase the number of emissions sources in our GHG inventory and will likely require the setting of new targets.

Additionally, since the 2020/21 reporting period, we have reported emissions from the regional public transportation services our contractors deliver on our behalf: our bus services and Te Huia passenger rail between Hamilton and Auckland. This showed our emissions for public transport were 6945 tCO_2e, compared to all our other corporate emissions of 945 tCO_2e. Given the scale of emissions from public transport services, these measurements are shown separately in our emissions reporting for 2021/22, with reduction objectives set through the *Regional Public Transport Plan*.

We produced

44% LESS

2021/22 compared to 2016/17 (base year)



In terms of our corporate emissions (excluding public transport), the most significant ongoing emissions sources are diesel and electricity (50 per cent and 25 per cent of operational emissions respectively as at 2021/22). Our flood pumps are a significant contributor to electricity and diesel emissions, therefore we're focusing on optimising the efficiency of our flood pump operations.

For all the emission sources that we have direct control over, we are using a mix of behaviour, operational and investment interventions to reduce our emissions. These are set out in our annual Greenhouse Gas Emissions Inventory and Management Report.

We're continuing to increase our understanding of the impact of land drainage services delivered by the council on emissions from organic soils. We'll be updating our future corporate inventories to include the findings of a technical report on organic soil emissions in the Waikato region, as well as include emissions from organic soils in future regional inventories.

Mill Road pump station, Paeroa

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Transitioning to a more circular economy

Waikato Regional Council will look to integrate circular economy principles into its internal operations, while also working with others to transition to a more circular economy.

Circular economy refers to an economic system that minimises waste and aims to keep materials and products in use. If well implemented, designing out waste will also reduce greenhouse gases, as keeping products and materials in use both reduces energy expended in manufacturing processes and retains embodied energy.

While the council does not control or pay for waste management infrastructure or operations, it does set policy on a range of environmental issues and facilitates joint work between waste officers from the 11 territorial councils in the region.

Our commitment

- Monitoring and optimising the energy performance of our flood protection schemes and drainage networks.
- Transitioning the corporate vehicle fleet to low and no carbon fuels.
- Monitoring and optimising the use and energy performance of our buildings and depots, including putting solar panels on some buildings.
- Flexible working arrangements and support for a wide range of sustainable travel choices to reduce commuting costs and emissions.
- Preference for virtual meetings and online conference attendance to reduce travel.
- Continuous review and improvement of procurement processes to favour the circular economy to reduce greenhouse gas emissions, raw material use and other negative impacts on the environment and society.
- Staff training and communication campaigns to help build a network of sustainability leaders at work and further afield.
- Appropriately incorporating mātauranga Māori into circular economy practices to learn from and apply sustainable practices aligned with te ao Māori.
- Integrating circular economy principles into the council's internal processes and operations.
- Facilitating communication, engagement and cooperation between local authorities and other public organisations, mana whenua and stakeholders to support the development and implementation of circular economy practices in our region.

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Ki te hoe
Community engagement

This council is committed to supporting Waikato communities adapt to a changing climate and a low-emissions way of living.

Responding to climate change requires a transformation of the way we live, one that we all must make together to reduce our emissions and adapt to a new climate.

Mitigation requires nationwide and multi-agency alignment, as well as reducing household carbon emissions. We can all do our part, such as reducing waste, turning lights and computers off when not in use, walking and biking for short trips, taking public transport or having an electric vehicle rather than relying on fossil fuels. In our survey of Waikato residents, Your Environment What Matters, which we hold every three years, the 2022 results show that a strong majority of people feel concerned about the effects of climate change, and an increasing number had undertaken activities to reduce greenhouse gas emissions.

Adaptation focuses on local action and requires community engagement at a local level. It can sometimes involve taking practical actions that may be hard to accept right now to manage future risks from climate impacts, protect communities and strengthen the resilience of the economy.

Climate Action Camp, 2022

Our regional resilience work supports our territorial authorities to create tailored solutions for the diverse range of needs and values of local communities affected by climate change. Working with communities is important from the outset.

Empowering youth to be leaders

Through the Waikato Enviroschools programme, we're inspiring and empowering young people to take action to create a sustainable future and reduce the negative impacts of climate change. Activities like climate camp support student learning and encourage them to act locally and make the shifts needed for an equitable, low-emission society.

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Through community panels, we learn about the things that are important to communities, including economic, social and cultural values, and how these values might change with a changing climate. The information helps to tailor bespoke solutions for communities, as no two communities will experience climate change in the same way.

Some communities will be disproportionately affected by climate change. A key principle of both the *National Adaptation Plan* and *Emission Reduction Plan* is an equitable transition that is fair and inclusive, and we are committed to helping achieve this for the Waikato. This means working closely with different groups to understand their needs, supporting our communities through the changes, and upholding Te Tiriti o Waitangi.

Encouraging community action

We have contestable funds, including the Environmental Initiatives Fund, for environmental restoration, community initiatives and education that support climate change response. More information about community funding can be found at the *Community funding and investment* pathway on page 69.

Our commitment

- **Understanding what communities, and iwi and hapū, value most and making it easy for people to participate in decisions and actions that affect them.**
- **Strengthening our role as a trusted source of timely, relevant and high-quality information, and making it easy for people to access environmental, economic and social information.**

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Ngā pātuitanga ki te Māori
Partnerships with Māori

Upholding the principles of Te Tiriti o Waitangi is central to the *National Adaptation Plan* and *Emissions Reduction Plan*. This means our region's climate responses are made in partnership with Māori.

Māori responses to climate change are holistic and long term, therefore critical for a future-focused and resilient Waikato region. They draw on mātauranga Māori perspectives and scientific expertise and incorporate a uniquely Māori understanding of environmental, whānau and community wellbeing.

This understanding will guide our work with iwi and Māori organisations to frame climate change risks, adaptation and mitigation, and influence how we prepare for, respond to and recover from the impacts of climate change.

Climate change and the Māori economy

Economic wellbeing and environmental wellbeing are intertwined. The regional Māori asset base is over $6 billion – approximately 15 per cent of the national collective Māori asset base.

This asset base is mostly made up of primary industries (60 per cent), including property, energy, agriculture, forestry and fishing industries. For this reason, a lot of research is being done on climate change impacts and opportunities for iwi, hapū, whānau and Māori business.

Climate change risks

The council recognises how the following risks could potentially affect Māori interests, kawa (protocols) and tikanga (cultural practices), as well as diverse expressions of mana (authority, dignity, influence, governance) and kaitiakitanga (inherited guardianship of resources for intergenerational sustainability).

- Risks to Māori social, cultural, spiritual and economic wellbeing from loss and degradation of lands and waters, as well as cultural assets such as marae, due to ongoing sea level rise, changes in rainfall, drought and extreme weather events.
- Risks to Māori social, cultural, spiritual and economic wellbeing from loss of species and biodiversity due to greater climate variability and ongoing sea level rise.
- Risks to cultural heritage sites due to ongoing sea level rise, extreme weather events and increasing wildfire risk.
- Risk of a breach of Treaty obligations from a failure to engage adequately with and protect current and future generations of Māori from the impacts of climate change.
- Risks of exacerbating existing inequities and creating new and additional inequities due to differential distribution of climate change impacts (Māori are already disproportionately represented among vulnerable groups such as low-income families).

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Regional iwi and hapū responses to climate change

A number of iwi/hapū consider climate change in their environmental management plans or are developing their own climate change plans and strategies. These identify and address short, medium and long-term needs, and respond to the challenges and opportunities of climate change and transitioning to a low emissions economy.

Iwi Māori are working with Waikato Regional Council and other key stakeholders on the Waikato Regional Climate Change Risk Assessment, which will include the uniquely Māori approach as expressed in *He huringa āhuarangi, he huringa ao: a changing climate, a changing world.*

Iwi have identified the need to be further informed about the cause and effect of climate change on the natural environment, so those effects are understood and managed. They have also signalled their desire to be involved in the review, development and implementation of strategies and policies related to climate change, both at a national and regional scale.

Recent severe weather events have increased awareness of the imminent need for Māori communities and marae to be more prepared and resilient against future events and their impacts.

As a consequence, there is an increased focus on the need for the council to partner with iwi in response to climate change to broaden our collective understanding of both short and longer term responses to these impacts.

During recent national engagement, many iwi/Māori indicated eight key initiatives they are eager to make progress on[23]:

- developing land-use transition strategies
- developing native afforestation and transitional forest strategies
- restoring wetlands and the associated whakapapa and mātauranga
- exploring blue carbon and other low emissions and environmentally sustainable economic prospects
- progressing food security and food sovereignty strategies
- progressing parakore and sustainable waste management and waste minimalisation initiatives
- increasing planning along coastlines and waterways
- relocating urupā and other culturally significant taonga.

Craters of the Moon, Taupō

23 Climate Change Commission: 2023 Draft advice to inform the strategic direction of the Government's second emission reduction plan, page 73

Our commitment

The council is committed to working with Māori, iwi, hapū and marae communities (iwi Māori) to enable adaptation and mitigation actions that will safeguard their cultural, social, economic and environmental health and wellbeing, now and into the future.

We recognise iwi Māori diversity and the need for tailored engagement strategies, therefore, we commit to meaningfully engage and consult with iwi Māori and to explore opportunities to have them represented at the decision-making table. Challenges for the council and Māori in responding to climate change include capacity, capability and resources.

- We will continue to advocate for government funding to enable responses by Māori, for Māori and with Māori, and to better enable Māori to work with us on shared climate action community-led initiatives.
- We will continue to work collectively with iwi Māori and central government agencies to progress climate action across our region, including in the development of more localised climate risk assessments, adaptation planning and Māori community and marae resilience.
- We will continue to share climate change information and our expertise to support iwi Māori to build resilience within their communities and to reduce the impacts of climate change on sites of significance such as urupā, wāhi tapu, marae and the region's Māori economic base.

In the delivery of our climate commitments, which are set out in the nine pathways of this roadmap, our aim is to be collaborative, culturally responsive and community led, and to achieve equitable outcomes for iwi Māori.

This means we will identify specific risks relevant to Māori, iwi, hapū and marae communities, and ensure all adaptation and mitigation measures seek to recognise, respect and integrate Māori perspectives, values and knowledge.

We will continue to meet our Treaty settlement obligations through designing and carrying out our climate action activity, in a way that:

- gives effect to *Te Ture Whaimana o Te Awa o Waikato (Vision and Strategy for the Waikato River)*
- recognises and provides for the vision, objectives, outcomes and values within Te Kaupapa Kaitiaki (the catchment plan for the Taupō catchment)
- meets our joint management Treaty settlement obligations for Te Wai o Maniapoto
- meets our obligations arising from upcoming and future Treaty settlements.

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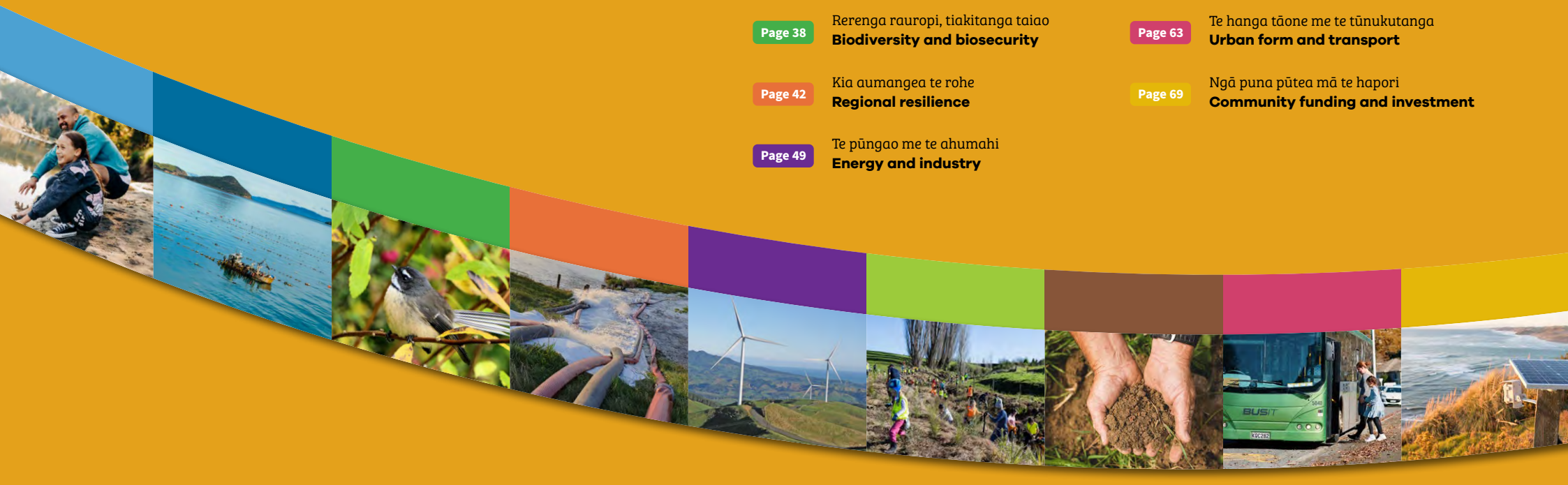
Ngā ara o te mahere
Roadmap pathways



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Wai
Water

A changing climate will impact on the availability of water in our region. It is expected there will be less rainfall across the Waikato overall, but the rainfall we do get will arrive quickly as intense storm events. On the other hand, we will have increased drought intensity and frequency with implications for water availability and water quality.

The Waikato region has historically been considered a relatively water-rich region. However, in the 10 years to 2020, the region recorded the lowest average rainfall in more than 50 years. Less rain and more evaporation have resulted in decreased river flows. At the same time, water use has increased, meaning that some of our rivers are exceeding their allocation limits.[24]

Many of our rivers, lakes and estuaries are degraded as a result of human activities, such as agriculture and urban development. National regulation and iwi settlement legislation, for example *Te Ture Whaimana o Te Awa o Waikato (Vision and Strategy for the Waikato River)*, direct us to stop further degradation and drive improvements over time. Greater controls on all water users will be required to deliver improved outcomes.

Achieving a secure supply/demand balance will require investigation of options for storage and distribution, becoming more efficient in the ways we use water and relooking at how we manage allocation. The present resource management system uses a first in, first served approach, but this has led to inequities and inefficiencies, and in places an inability to achieve agreed freshwater objectives and align with Te Mana o te Wai. The resource management system reform focuses on the best outcomes regarding the allocation of water, addressing iwi rights and interests and the changing climate.

24 Koh, S. S. & Jenkins, B. 2022. *Trends in hydrology and water resources*. Waikato Regional Council Technical Report 2022/06.

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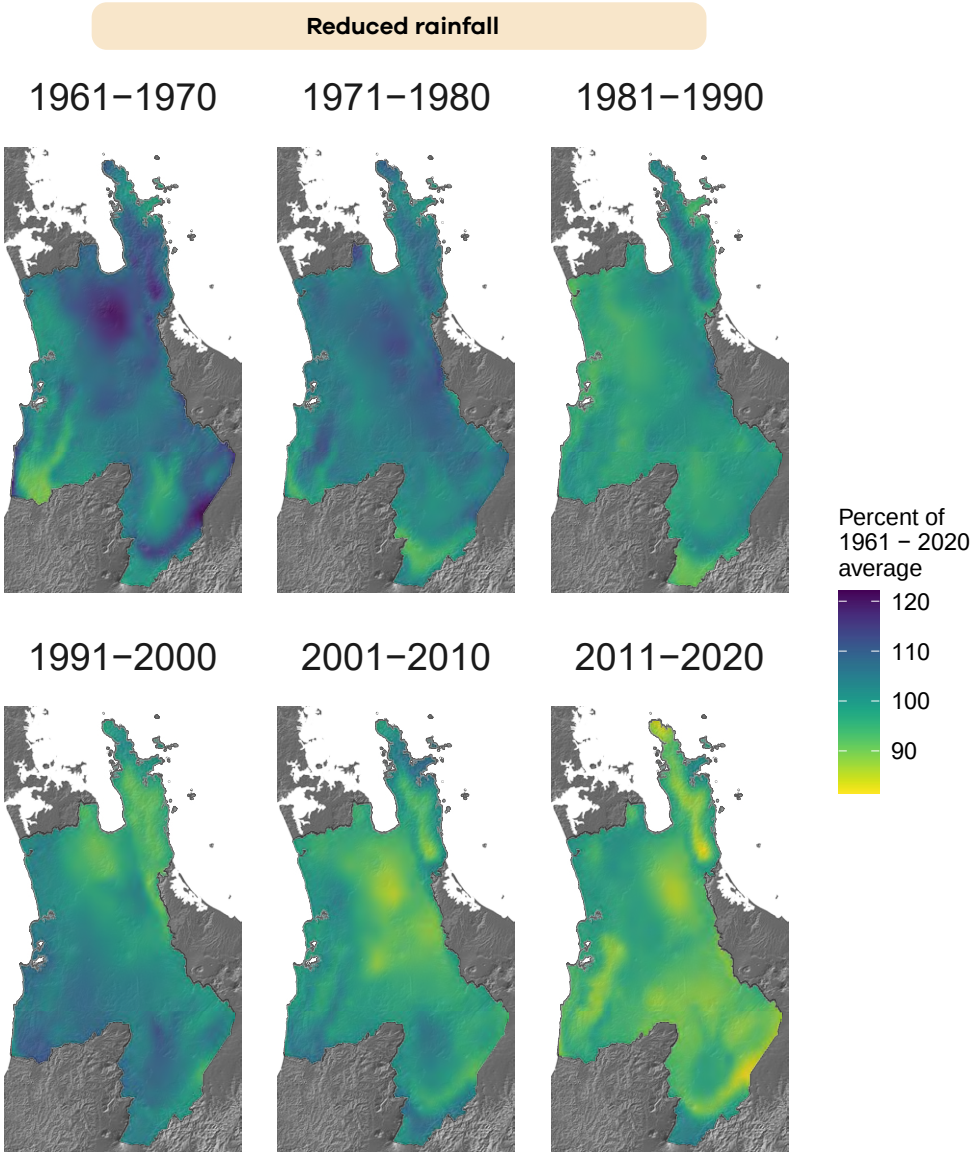
How climate change impacts this pathway

Climate change presents challenges to the availability of water for allocation and will be a major factor controlling land use patterns and future regional growth.

Two things will greatly impact water allocation into the future: nutrient loads, as a result of land use intensification, and increasing droughts, with low flow conditions lasting longer and becoming more severe.

The impacts on water of projected periods of low rainfall in combination with increased temperatures include:

- less habitable environments with potential negative impacts on instream indigenous biodiversity
- a need to increase the resilience of town water supplies, including factoring in population growth
- less ability for waterways to assimilate contaminants and heated discharges from point sources, requiring redesign of wastewater treatment plants to increase effluent quality and/or not allowing discharges to waterways for extended periods of time or permanently (with potentially considerable financial implications for new water management entities)
- for landowners without reticulated supply, particularly marae and isolated Māori rural communities, reduced or alternative water use choices and/or the cost of funding additional water supply, storage and treatment options
- potential changes to land use, for example, different types of pastoral agriculture, horticulture and forestry, which require less water.



Note: This analysis uses rainfall data from the NIWA Virtual Climate Station Network dataset, which is available as a region-wide dataset from 1960.

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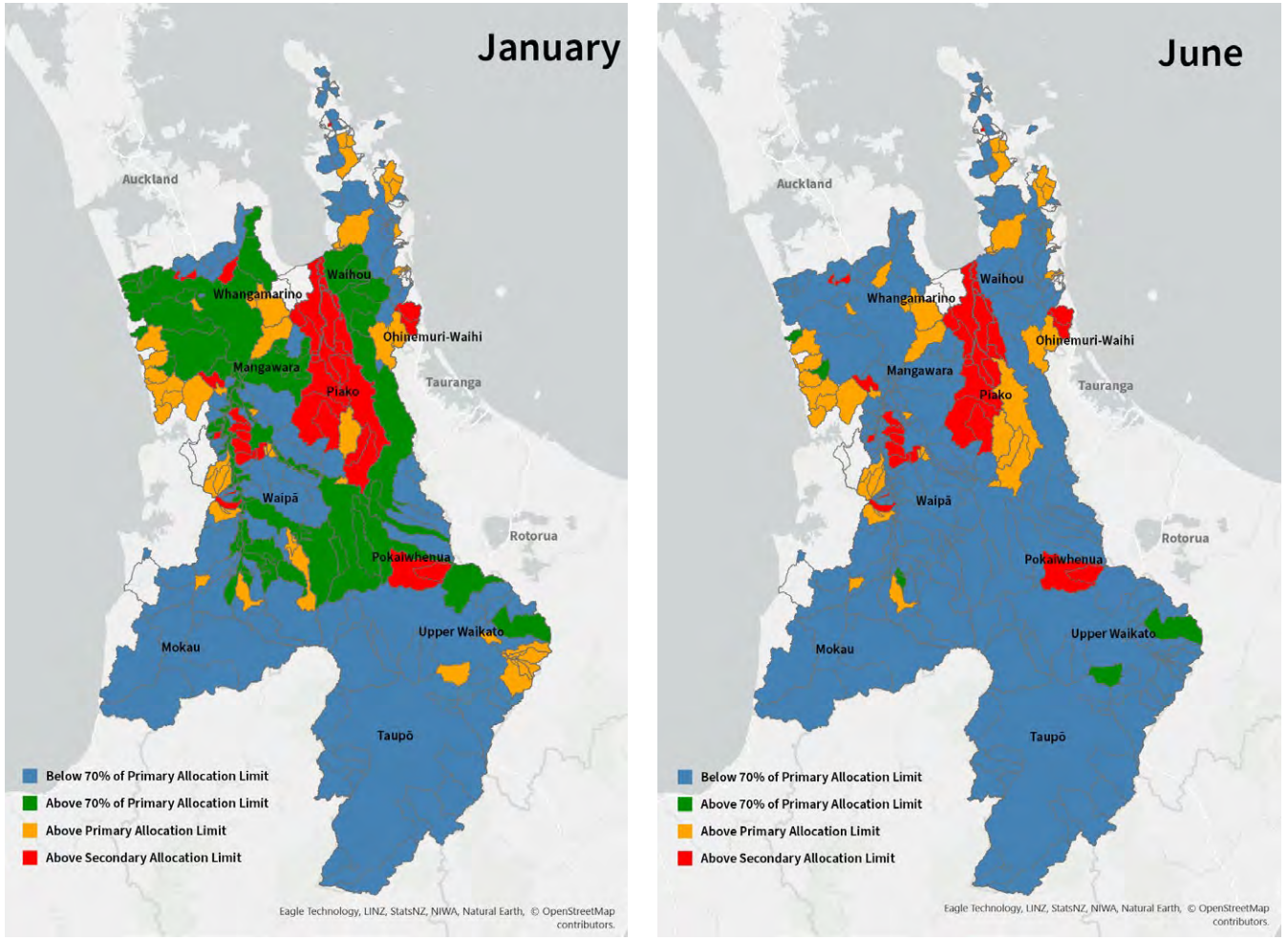
How we are responding

Water allocation is solely a regional council activity and is actioned through Resource Management Act policy and plan settings and resource consent applications. Allocation is particularly critical during low flow or drought conditions. Takes from, and discharges to, waterbodies are managed through authorised use, checked for compliance and, if required, enforcement is undertaken.

A substantial freshwater policy work programme, *Healthy Rivers/Wai Ora: Plan Change 1* and the implementation of the *National Policy Statement for Freshwater Management* (NPS-FM), is well progressed. This work programme addresses freshwater management in a way that responds to our changing climate and achieves *Te Ture Whaimana* to restore the health and wellbeing of the Waikato River.

To support freshwater management in the Waikato region and understand the challenges it faces in both the current and future climate, we have substantial research and monitoring programmes. Our most recent *State of the Environment*[25] report outlines the climatic trends our region is seeing and the impact on water availability and quality.



Allocation pressure in summer and winter. The Piako and Whangamarino catchments have very high allocation pressure. The Mōkau, Waihou and Mangawara catchments have low allocation pressure.

25 Waikato Regional Council: State of the Environment 2022

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Building on our 2017 *Waikato Freshwater Strategy*, and in response to concerns held by the Waikato Mayoral Forum, we have drafted a *Waikato Water Security Strategy*. In this strategy, we have signalled the need for a coordinated regional water management plan to address reduced water security and will start on this work in 2023/24. As part of this work, and in our work to implement the NPS-FM, we will continue to work in partnership with iwi Māori, recognising the rights and interests of Māori in water under the Treaty of Waitangi.

Many actions in other pathways also contribute to the achievement of this pathway, such as the protection of freshwater species and ecosystems in *Biodiversity and biosecurity*, planting for freshwater quality in *Afforestation and habitat restoration* and the implementation of freshwater farm plans in *Agriculture and soils*.

Requirements to address the degraded health of waterbodies have become a national priority with the Essential Freshwater regulations introduced by the Government in 2020. The concept of Te Mana o te Wai is at the heart of these regulations and puts the wellbeing of water above any human or commercial wants or needs, and therefore is an important consideration for this council when it comes to developing and implementing plans and strategies for fresh water.

Waikato River, Hamilton

Working with rangatahi

Kura Waitī Ki Kura Waitā is a programme launched in 2022, developed by Te Toki Voyaging Trust and funded by Waikato Regional Council.

Combining waka tētē with mātauranga Māori kaupapa, the programme's purpose is to advance mātauranga Māori in environmental education – in both traditional and creative contemporary ways – and to develop career pathways for rangatahi (youth).

The programme helps young people understand how they can make a difference in protecting, restoring and revitalising our waterways and addressing the impacts of climate change. It helps build a sense of connection to te taiao, encouraging future kaitiaki through an intergenerational framework in which whakapapa, pūrākau, whānau and iwi all play critical roles.

Kura Waitī Ki Kura Waitā aligns with and helps give effect to *Te Ture Whaimana.*

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Our commitment

Goals for success from the council's strategic direction

- Increase regional water security through a multi-stakeholder plan to ensure wellbeing and resilience within defined environmental limits for the next 30 years.
- Put the health of our region's waterbodies and freshwater ecosystems first when making decisions, giving effect to Te Mana o Te Wai and Te Mana o te Awa.
- Leverage our investment in catchment and river restoration work through funding partnerships and community actions, contributing to long term water quality improvements.

1.1	Work proactively with city and district councils to have a consistent approach to help our communities understand possible sources of water and how to make the most of every drop, using smart ways of capturing, storing, using and recycling water.
1.2	Consider wide ranging water storage methods, for example, using nature-based solutions in wetlands, including protection and restoration/expansion, which are a priority of the *National Adaptation Plan*, and the creation of constructed reservoirs at a variety of scales.
1.3	Ensure surface freshwater allocations (quality and volume) are modelled using the most recent 30-year distributions, thereby creating a moving baseline.
1.4	Seek further opportunities for iwi- or hapū-led environmental monitoring programmes and responses that utilise both mātauranga Māori and scientific methods.
1.5	Require, through appropriate resource consent conditions, the recycling of water from industrial processes and treatment plants to limit nutrients, heat and chemical contaminants going into waterways during drought conditions.
1.6	Engage with the Government on its Water Availability and Security Programme to ensure that the Waikato's needs and opportunities are advocated for and met.

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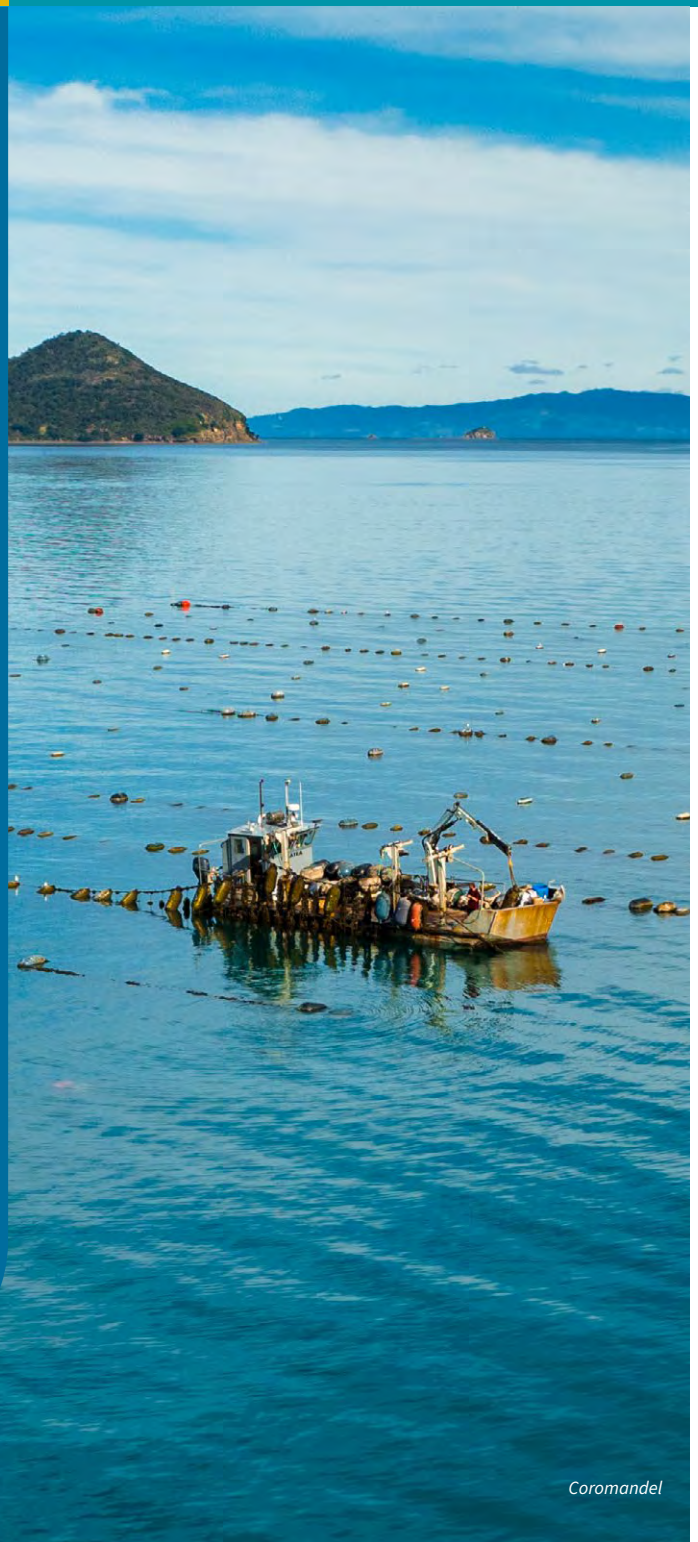
Te takutai me te moana
Coastal and marine

While we have limited ability to influence the trajectory of ocean temperature and acidification, our management of the lands and waterways can reduce stressors to increase the resilience of marine ecosystems to climate-related changes.



Coromandel

Waikato Regional Council controls the use of space and resources in over 10,000 square kilometres of coastal marine area (CMA), from shallow intertidal areas through to over 400-metre-deep waters, as well as coastal dune areas and foreshores. These areas include a range of ecological communities, from coastal wetlands through to karepō/seagrass meadows, shellfish beds, and rocky reefs.

Significant economic activity is derived from the region's 'blue economy' based in and around its marine areas, including from fishing, aquaculture, transport and tourism. The Hauraki Gulf Marine Park is one of New Zealand's foremost centres for the aquaculture sector, especially for mussels.

Ecological communities form on a foundation of environmental factors such as water depth, temperature and chemistry, in unique combinations. As the climate changes, so too will these underlying factors.

Marine species and communities will need to adapt to ocean temperature changes, acidification and sea-level rise. For some, this may not be possible, and invasive species may thrive.

Flow-on effects mean many other organisms are at least indirectly affected by projected changes, for example, as a result of predator-prey or symbiotic relationships.

Given the strong connection to upstream environments, the coastal marine area is sensitive to land and freshwater uses. We have an important role to play in managing upstream activities for the health of sensitive coastal receiving environments in a changing climate.

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How climate change impacts this pathway

Coastal and marine areas are among those that are most exposed to the already unavoidable effects of climate change. Our oceans are being impacted in ways that change physical and chemical ocean processes and reduce biodiversity, with consequences for human communities.

The major climate change impacts on the marine environment will continue to worsen, even if targets for reducing emissions are achieved globally. They are:

- ocean warming and associated marine heatwaves (peak temperature events)
- ocean acidification
- sea level rise
- ocean deoxygenation.

These effects influence other processes and will modify current sediment and nutrient stressors, further affecting the composition and functioning of ecological systems. From a te ao Māori perspective, these changes affect the mauri of ecosystems and risk taonga species, kai moana, kaitiakitanga and manaakitanga practices, the transmission of knowledge to future generations, wāhi tapu and marae along the foreshore[26]. Climate change will also likely affect aquaculture, a key economic sector for parts of the region.

With rising sea levels, the intertidal zone may get squeezed out by structures such as stopbanks and seawalls, leading to the loss of those ecosystems and the services they provide.

Blue carbon captured by oceans and coastal ecosystems may represent important opportunities in our region to meet climate change commitments, such as considering alternative uses of marginal coastal land that would restore healthy ecosystems at the same time. For example, in areas like the Hauraki Gulf, salt marsh and seaweed plantations, when healthy, are important carbon sinks.

In the Waikato region, we are already seeing the impacts of a changing climate on our coastal and marine environment.

- From April 2022 to April 2023, the Hauraki Gulf experienced six marine heatwave events, the longest being 94 days[27]. On the west coast near Raglan, four marine heat waves occurred, the longest being 188 days.
- Bleaching of sponges on rocky reefs, a phenomenon not previously documented in New Zealand, was associated with the heatwaves in the Hauraki Gulf in 2022. Sponges have enormous ecological importance because of their water-filtering services, and they provide a home for other animals.
- In the Firth of Thames, ocean acidification primarily due to eutrophication associated with riverine nutrient inputs has already led to pH levels that had been predicted globally for 2100[28].
- We have also seen deaths of birds in our estuaries and coastal wetlands around the Firth of Thames, from events associated with drought, warm water and decreased oxygen levels.

Whitianga

26 Awatere, S., King, D. N., Reid, J., Williams, L., Masters-Awatere, B., Harris, P., Tassell-Matamua, N., Jones, R., Eastwood, K., Pirker, J., & Jackson, A-M. 2021. *He huringa āhuarangi, he huringa ao: a changing climate, a changing world*.

27 Moana Project. 2023.

28 Law, C. S., Zeldis, J. R., Bostock, H., Cummings, V., Currie, K., Frontin-Rollet, G., MacDonald, I. T., Mikaloff-Fletcher, S., Parsons, D., Ragg, N. & Sewell, M. 2019. *A synthesis of New Zealand ocean acidification research, with relevance to the Hauraki Gulf* (Technical Report No. 2020/16). National Institute of Water and Atmospheric Research, Wellington, New Zealand.

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How we are responding

The way we use and manage land, fresh water and marine environments will influence how resilient our coastal and marine ecosystems are to climate change[29]. The council has a key role to play in managing and regulating land and freshwater activities to reduce stressors on the coastal and marine environment. High nutrient and sediment loads in water, together with increasing temperature, acidification and deoxygenation, will have greater combined impacts on marine ecosystems than any one factor alone[30].

We have reviewed our *Coastal Plan*, the rulebook for activities in the coastal marine area, in response to issues that have emerged since it became operative almost three decades ago, and to address legislative changes and national and regional policy direction. Key elements proposed in the plan, out for consultation in mid-August 2023, include specific policies around adapting to climate change, and that we manage the coastal marine area considering the impacts of climate change.

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Our commitment

Goals for success from the council's strategic direction

- Adopt a ki uta ki tai – mountains to sea – approach to consider coastal ecosystems as sensitive receiving environments.
- Work with communities, iwi and hapū to carry out integrated coastal and catchment management planning and restoration activities to protect and enhance coastal and marine ecosystems.
- Partner with communities and iwi and hapū to deliver a future-focused coastal plan.

2.1	Support and empower landowners to reduce harmful impacts of land-based activities that compound the effects of climate change and impact on the coastal marine area (CMA).
2.2	Manage and restore coastal and marine environments to promote the resilience of species, communities and habitats against the unavoidable impacts of climate.
2.3	Monitor ecosystems and support research to understand where opportunities exist to facilitate adaptation.
2.4	Regulate activities in the CMA and in catchments affecting the CMA to support long-term sustainable use and the enjoyment and the blue economy it provides.
2.5	Investigate links between catchment activities, water quality and the health of ecosystems in the coastal and marine environment and apply a mātauranga Māori lens.
2.6	Research the implications on activities in the CMA due to climate-related changes in CMA ecosystems.
2.7	Support investigation of blue carbon (sequestration) opportunities, and advocate for blue carbon to be recognised in national carbon accounting systems.

2.8	Actively participate in and contribute to the Hauraki Gulf Forum and initiatives, which will enable implementation of *Revitalising the Gulf: Government action on the Sea Change Plan*.
2.9	Contribute to the implementation of the Government's Clean Hull programme to reduce the spread and impacts of marine pests and consider implications for the regional coastal plan.
2.10	Engage with the Government as it develops its 3D coastal mapping for assessing the impacts of sea-level rise and modelling the impacts of tsunami and storm surges on communities, infrastructure and biodiversity to ensure that the region's needs and opportunities in a changing climate are met.
2.11	Work with iwi and industry to finalise the regional aquaculture strategy, ensuring that climate change implications are appropriately incorporated and align with the Government's *Aquaculture Strategy.*

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Kāwhia

Rerenga rauropi, tiakitanga taiao **Biodiversity and biosecurity**

Indigenous biodiversity holds intrinsic value and mauri. Healthy ecosystems provide us with many benefits and, in return, we have a responsibility to care for them. Yet we continue to exert pressure on these systems.

In the Waikato region, we have a wide variety of terrestrial, fresh water, coastal and marine ecosystems that support many indigenous species.

In a healthy state, wetlands, native forests and coastal areas act as significant carbon sinks and provide ecosystem services that reduce the impacts of climate change, such as flooding, erosion and sedimentation.

But our ecosystems are in decline, and many are degraded[31]. A range of pressures such as fragmentation, clearance and pest plants, animals and diseases, and climate change will negatively impact on them even further[32]. Some of our highly specialised species, or those with limited distribution, may not even be able to adapt.

The Waikato region has been highly modified through the drainage of wetlands and clearance of indigenous forest for a range of human land uses, predominantly pastoral agriculture, which has greatly diminished the extent and health of our indigenous biodiversity.

By protecting and restoring our indigenous biodiversity in key localities, we can help reduce the effects of climate change.

31 Waikato Regional Council: State of the Environment 2022
32 Department of Conservation: Biodiversity in Aotearoa - an overview of state, trends and pressures

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How climate change impacts this pathway

Not all indigenous biodiversity will be able to adapt to the forecast climate trends, let alone the possible abrupt changes as we pass through warming thresholds. Warmer temperatures, increased rainfall, wind, drought and more severe weather events will add to their stress. These include highly specialised species such as the long-tailed bat, Archey's frog and the swamp helmet orchid. Our highly-fragmented kahikatea forests and subalpine habitats are also particularly vulnerable.

Our indigenous flora and fauna, under threat from a changing environment, may also become overrun by more resilient exotic species. We can expect new pest plants and animals and diseases that are adapted to warmer temperatures to become established and many existing pests to expand their range[33], affecting our indigenous biodiversity and our primary industries. Controlling invasive species in the Waikato region is important not just for our indigenous species but also for the wellbeing of our people and our economy.

Changes in the timing of annual and seasonal events can result in increased native plant fruiting and masting, which, if left unchecked, will lead to increased frequency and scale of pest outbreaks.

All these factors impact on the mauri and mana of the living environment, and therefore the ability of iwi, hapū and whanau to practice kaitiakitanga, in accordance with tikanga Māori, and to gather kai moana and mahinga kai (customary food gathering). For example, increased ocean acidity means shellfish such as taonga species pāua may have to use more energy to grow their shells, which leaves less for tissue growth and reproduction.

Weed with a bad bite

Native to tropical and sub-tropical South America, alligator weed is one of the world's worst invasive aquatic and terrestrial weeds. It out-competes pastures, crops and native plants, is toxic to stock, and blocks waterways and drains. As temperatures increase due to climate change, alligator weed has the potential to become more widespread in the Waikato, devastating the environment and agriculture.

33 Department of Conservation: Biodiversity in Aotearoa - an overview of state, trends and pressures

How we are responding

Our roles in biosecurity and biodiversity are mainly set out by the Biosecurity Act and the Resource Management Act. We must consider the effects of climate change when protecting areas of significant indigenous vegetation and significant habitats of indigenous fauna. We do this by providing policy direction in the *Waikato Regional Policy Statement* that territorial authorities must implement in their district plans. Policy direction for the freshwater and marine environments is implemented by the *Waikato Regional Plan* and the *Regional Coastal Plan*. We also provide leadership to prevent, reduce or eliminate adverse effects from harmful organisms in the Waikato region and New Zealand, including through the *Regional Pest Management Strategy*.

We work with a wide range of people, groups and agencies – mana whenua, landowners, community groups central government, territorial authorities and neighbouring regional councils – to achieve biodiversity and biosecurity outcomes for the Waikato region. Many of our current biodiversity and biosecurity programmes already help indigenous species and ecosystems build resilience to climate change. However, we need to expand and develop these programmes if we are to have regionally resilient ecosystems and species, particularly as our understanding of the likely impacts of climate change grows.

By retiring and regenerating less productive land, riparian planting along waterways and creating corridors of vegetation between the fragments of forest that remain, we can start to improve our native ecosystems to make them more resilient to climate change, as well as mitigate the effects of climate change on our region.

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Our commitment

Goals for success from the council's strategic direction

- Work with partner agencies to have an agreed region-wide biodiversity accord in place.
- Progress a prioritised strategic pathway for our region that protects and restores biodiversity out to 2050 and beyond.
- Work with others to protect ecosystems, human health and economic activities though effective pest management.
- Support and empower people to protect and restore the natural environment and taonga species by integrating their efforts with councils and other agencies.

3.1	Engage with central government as it develops an integrated work programme to address together climate change and biodiversity loss, and delivers the second implementation plan for *Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020* (ANZBS) to ensure that the region's needs and opportunities are met.
3.2	Advocate for and support increased inter-regional and central government commitment, including funding to establish effective responses to climate change impacts on biodiversity and biosecurity.
3.3	Increase our understanding of the extent and values of indigenous biodiversity in the region (for example, the regional biodiversity inventory and our monitoring programmes) and consider how the Government's development of mātauranga Māori indicators of climate impacts on the natural environment can support this action.
3.4	Support research and increase our understanding of: • climate change risks to the region's indigenous ecosystems and species, ensuring that these are integrated into planning and policy considerations • the spatial considerations to address current and future climate change impacts on indigenous biodiversity • the carbon impact from drainage of our wetlands and the loss of existing forests and other ecosystem-types • the risks of biosecurity incursions as a result of climate change and the implications of these for the region and resourcing.

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3.5	Promote, progress and fund current and emerging initiatives and programmes that are actively committed to the restoration, sustainability and protection of indigenous ecosystems.
3.6	Expand habitat protection, restoration and enhancement programmes to increase the viability, geographical extent and connectivity of indigenous terrestrial ecosystems in the region.
3.7	Develop approaches that support resilience and recovery of indigenous biodiversity from climate change effects and increase public support for climate change initiatives, such as increased opportunities for community led monitoring programmes and connection to our natural environment.
3.8	Advocate to central government for a world-leading biodiversity credit scheme to complement and counterbalance the Emissions Trading Scheme (ETS) and to incentivise permanent indigenous forests and their related ecosystem services and benefits.
3.9	Work proactively with district councils to have a consistent approach to the management of indigenous biodiversity that will result in improved environmental outcomes for these ecosystems and advocate for consistency, alignment and appropriate implementation of the *Waikato Regional Policy Statement* direction for indigenous biodiversity across the region.

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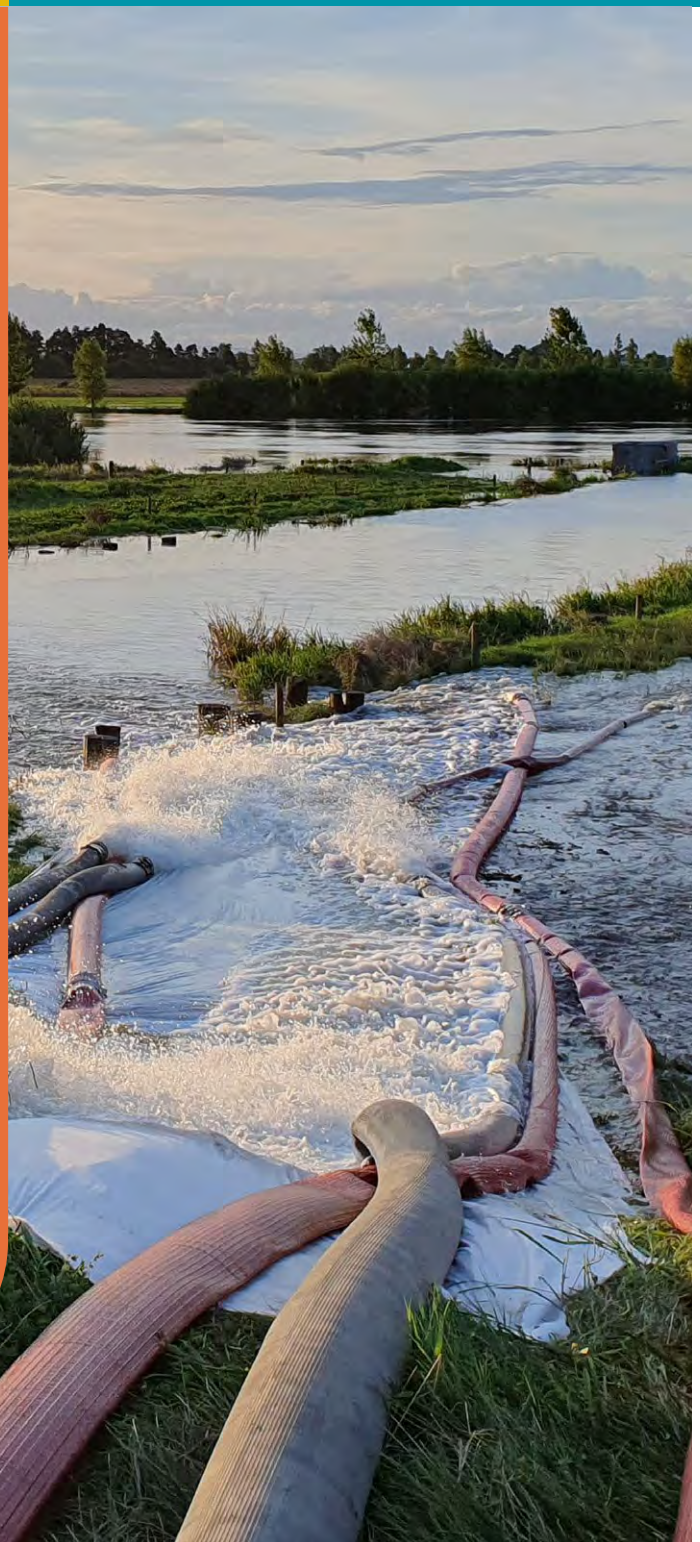
Kia aumangea te rohe
Regional resilience

We have left behind the climate we have known, and with this the Waikato region faces new and growing risks from climate change-induced natural hazards. The increasing impacts of climate change threaten community resilience and wellbeing, infrastructure, the environment and our economy.



The Waikato region is already feeling the impacts of our changing climate – hotter temperatures, drier droughts, bigger and more frequent weather events.

Cyclone Gabrielle in February 2023, following hard on the heels of Cyclone Hale and the Auckland Anniversary weekend flooding events, exposed some of the vulnerabilities of the region. The effects on critical infrastructure, such as roading, was substantial in parts of the region, while the impacts from flooded pastures and damaged forests will be felt for some time to come.

In many situations, the only long-term mitigation action that will eliminate risk from the effects of projected sea level rise and flooding is planned relocation from existing developed areas. In developed coastal areas or currently productive rural areas such as the Hauraki Plains and Lower Waikato catchment, the socio-economic and cultural implications of relocation is a significant issue, affecting property, livelihoods and way of life. Careful consideration of potential transition pathways and timing will be needed.

Unlike flooding, where the problem is too much water in a short period of time, drought is effectively a slow-moving, supply-side 'shock' that will particularly affect the economic wellbeing of the Waikato region, which has always been based on having plentiful water. While droughts typically do less damage to capital assets than floods, reduced incomes and associated higher costs mean they can have severe economic impacts.

> **New Zealand has already experienced the disruption on food production as a result of severe weather events, contributing to higher food prices and increasing inflation.**

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How climate change impacts this pathway

Transformational change is required to ensure our communities and our economy are resilient to climate change. We must take bold and deliberate steps to change the way we plan and fund investment in infrastructure. This means long-term thinking and planning that considers whether and where communities can evolve and grow, as well as managing the increasing risks to our existing buildings and infrastructure. This needs to be achieved in a way that secures intergenerational social, economic, cultural and environmental wellbeing.

As the climate changes, some communities will be more vulnerable to the effects than others, including those living in more isolated places or with fewer resources available. Many Māori communities are particularly vulnerable due to their location near waterways. The arrival of climate refugees, both nationally and internationally, will also need to be planned for.

The council's flood and land drainage schemes have provided the region with many resilience benefits. This infrastructure was developed over the last 80 years and primarily consists of stopbanks, pump stations, floodgates and drainage networks. Climate change may mean some of this infrastructure is no longer fit for purpose. Reassessments of the level of services provided by this infrastructure will be required, and in any case significant investment will be required just to maintain current levels of service.

In coastal areas, flooding may be exacerbated as high tides prevent flooded rivers from discharging to sea. Additionally, 92 per cent of the region's freshwater wetlands have been drained[34], impacting their ability to reduce flood risk by slowing water run-off and act as carbon sinks. Assuming current land use can be maintained in a changing climate, upgrades to drainage or flood management infrastructure may become financially and environmentally unsustainable.

There are mitigation options that can be implemented to allow communities to continue to live in the coastal environment. Sand dune restoration and engineered protection structures, such as sea walls and stopbanks, could be used to provide respite from the effects of flooding, coastal inundation and associated erosion. However, in some locations these will only buy time until a long-term strategy can be developed, agreed upon and implemented. In many cases, seawalls and stopbanks may cause negative effects on other parts of the community and environment. The proposed Climate Adaptation Act is expected to provide a framework to manage the cost of retreat and decommissioning and potentially abandoning land or assets.

Waitakaruru, Firth of Thames

Parts of the Hauraki Plains and the Aka Aka lowlands in Lower Waikato are protected from coastal water levels by stopbanks, which could be breached by increasing storm surges and rising sea levels.

34 Denyer, K. & Briggs, C. 2022. *Extent of freshwater wetlands*. Waikato Regional Council Technical Report 2022/19.

How we are responding

The council recognises that working with communities, partnerships with Māori and a whole-of- government approach are essential to address these issues. Changes in resource management, spatial planning and climate adaptation support this type of holistic approach. We are in the early stages of transition to this new legislative and regulatory environment[35] and there is still uncertainty around how the regional council's functions, existing legislative responsibilities and community adaptation processes will evolve.

As the details of the new legislation and transition timetable become known, Waikato Regional Council and territorial authorities will need to work together to prepare for the new system. A planned and considered spatial response will allow the entire region to increase resilience by transitioning to less risky places and ensuring all new development and infrastructure address the effects of projected sea level rise and flooding in flood plains and river corridors. In preparation, we are developing a better spatial understanding of the constraints and opportunities for land use, including:

- natural hazards
- indigenous biodiversity values
- appropriate areas for nature-based solutions, such as catchment scale buffer zones, to store water, slow run-off and allow for inland movement of intertidal habitats
- appropriate areas for the relocation of future flood defences and corridors to provide 'room for the river'
- where community infrastructure, such as roads, water systems and electricity networks, should be built out to 2050 and beyond.

In the meantime, we are continuing to work closely with the region's territorial authorities and communities to support people living in priority locations to understand their risks from climate change. We're helping these communities to plan for their future through the development of community adaptation plans that include agreed community risk thresholds and triggers. We established the Waikato Regional Resilience Programme in our *2021-2031 Long Term Plan*, with the aim of reducing the current and future impact of natural hazards in the Waikato region by:

- ensuring sufficient information on natural hazards and risk to support decision making
- managing risk consistently across the region, working with communities to agree natural hazard risk thresholds and management options.

◀ *Pastures died after being inundated during a severe cyclone at Kaiaua in 2018. Many properties and infrastructure were also damaged in the storm surge.*

35 Climate adaptation legislation, the Spatial Planning Act, the Natural and Built Environment Act and the *National Planning Framework*.

Wharekawa Coast 2120

The coastal environment is highly dynamic and coastal inundation and coastal erosion, from severe weather events, exacerbated by climate change, are already impacting coastal properties. Even properties not directly impacted by coastal hazards will be impacted by critical infrastructure failures in severe weather events, such as roads and water, power and communications networks.

Communities and landowners along the Wharekawa Coast – the west coast of the Firth of Thames –are already experiencing first-hand such impacts during extreme weather events. A community-led plan, called Wharekawa Coast 2120, is being developed to allow the communities, councils, service providers and iwi to look at the range of issues they face over the next 100 years and plan a response. The project started after a severe cyclone in January 2018 caused flooding, affecting community facilities and services, houses, properties, farmland and recreational areas.

Waikato Regional Council's regional resilience team has helped the residents determine their risk thresholds for the impacts of coastal inundation and river flooding during moderate and major events to inform an adaptation plan.

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Currently the primary land use controls for managing location, development and expansion of communities and infrastructure sit with relevant district councils using district plans. However, the *Waikato Regional Policy Statement* provides for the regional council to control the use of land for the purpose of decreasing risk from natural hazards, such as inundation from rising sea levels and river flooding, where the risk is intolerable (primary hazard zones). To date the Waikato Regional Council has not identified any primary hazard zones. However, our work with specific communities on adaptation planning, for example, as part of the Wharekawa Coast 2120 project, will assist in progressing this.

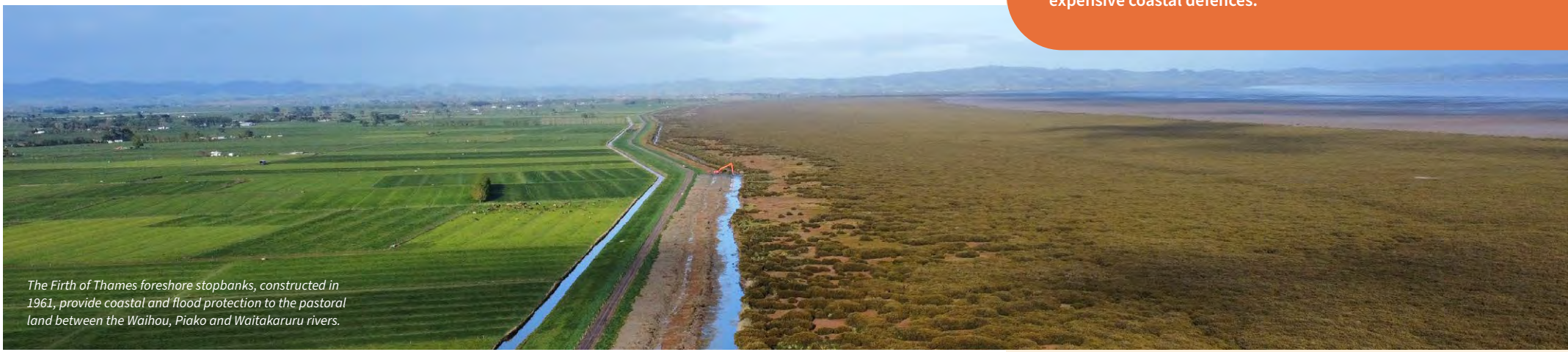
Where retreat, relocation, retirement of land and alternative land uses are not considered to be options, the *National Adaptation Plan* and the *Emissions Reduction Plan* provide for nature-based solutions to be prioritised in policy, planning design and decision making. We will continue to support and advocate for nature-based solutions in our integrated catchment management and policy work programmes, as well as in our research, collaborations and work with communities.

A key goal of the council is for infrastructure in the region to be financially and environmentally sustainable and climate resilient out to 2050 and beyond. We intend to engage with communities, and iwi and hapū in the development of a sustainable flood management and land drainage infrastructure strategy that considers land uses, working with nature, and funding. To support the implementation of our infrastructure strategy, the council has developed a *Sustainable Infrastructure Decision-Making Framework* (SIDF). To be tested over the term of the *2024-2034 Long Term Plan*, the SIDF provides a transparent and defensible investment decision-making process to help the regional council make sound, long-term investments in the region's critical flood management and drainage system assets. It is evidence-based and incorporates sustainability, with the four wellbeings – economic, social, environmental and cultural – at its core.

Nature-based solutions for coastal inundation

- Restoration and creation of wetlands and native forests within catchments to intercept and store water, reduce peak flows, increase base flows and manage highly erodible catchments.
- Reinstating natural river processes to provide more storage at peak flows.
- Enhancing natural coastal defences (such as dune vegetation, sediment supply, and mangroves) in preference to hard infrastructure (which also contain embodied carbon).

The cost of insurance is likely to increase and, at some point, certain assets may become uninsurable. The value of capital invested in coastal property is likely to be affected, which may lead to increasing requests for expensive coastal defences.



The Firth of Thames foreshore stopbanks, constructed in 1961, provide coastal and flood protection to the pastoral land between the Waihou, Piako and Waitakaruru rivers.

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Our commitment

Goals for success from the council's strategic direction

- Engage communities, iwi and hapū in the development of a sustainable flood management and land drainage infrastructure strategy that considers land uses, working with nature and funding.

4.1	In preparation for the future regional spatial strategy, develop a better spatial understanding of constraints and opportunities for land use.
4.2	Ensure future climate projections and the expected impact of climate change on our flood management and drainage schemes, networks, levels of service and costs are clearly signalled in our infrastructure strategy, *Regional Asset Management Plan*, and catchment and zone plans.
4.3	Implement the *Sustainable Infrastructure Decision-Making Framework* for flood management and land drainage infrastructure investment to provide a robust and transparent means of making significant and complex investment decisions. The social, cultural, environmental and economic wellbeings will be explicitly included in decision making.
4.4	Understand the full range of options available for the flood management systems in specific catchments, such as nature-based solutions (for example, wetlands and making room for the river by expanding floodways), scheme efficiency improvements, engineered solutions (for example, building higher stopbanks) and retreat.
4.5	Prioritise nature-based solutions where appropriate and promote the multiple outcomes and co-benefits that such solutions can achieve.
4.6	Reduce the emissions associated with the construction and operation of flood management and land drainage infrastructure.
4.7	Promote coordinated and collaborative adaptation action among communities, iwi and hapū and stakeholders, including territorial authorities, businesses and non-governmental organisations, and enable community-led action whenever possible.

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4.8	Work collaboratively with city and district councils for consistent approaches to improve community resilience to climate change hazards and impacts through public education and local planning.
4.9	Enable a consistent approach to adaptation across the Waikato region by: • developing regional climate change adaption guidelines to bring together best practice climate modelling, data and information specific to the region • creating a regional hub of Waikato region natural hazard and risk information to inform adaption planning, contributing to national platforms • co-ordinating knowledge-sharing between regional stakeholders, iwi and hapū and territorial authorities through the Regional Resilience Programme and forums such as the Regional Hazards Forum.
4.10	Investigate options for regional risk thresholds, signals and triggers to inform community adaptation plans.
4.11	Support territorial authorities and communities to apply central government's approach to developing community adaptation plans with affected communities, iwi, hapū and stakeholders. This approach provides for staged responses in the short, medium and long term defined by clear and agreed actions.
4.12	Collaborate with communities, iwi, hapū and stakeholders to: • identify where the current risk of natural hazards is intolerable (primary hazard zones) • assess where the future risk of natural hazards will be intolerable.
4.13	Support the region's territorial authorities use of planning controls to reduce the risk of climate-exacerbated natural hazards on existing and future developments.
4.14	Collaborate with central government and research institutes to: • improve regional hazard and scientific information and address gaps • expand the knowledge base for hazard risk thresholds, signals and triggers, for both the built and natural environments, to inform adaptation planning.
4.15	Engage with the Climate Change Commission and central government on the *National Climate Change Risk Assessment for New Zealand* and *National Adaptation Plan* and future iterations to ensure regional conditions and interests are included.

4.16	Prepare and maintain a regional climate change risk assessment, bringing together a collective understanding of climate risk across all aspects of our region's environment, communities, property, infrastructure and economy across a range of climate scenarios and timeframes.
4.17	Using the regional climate change risk assessment, develop a regional overview of priorities for adaptation planning and key projects needed to address any identified information gaps.
4.18	Work with iwi, hapū and marae communities to incorporate traditional knowledge and values into risk assessment, planning and implementation and develop adaptation options that support Māori values and aspirations, such as kaitiakitanga (intergenerational sustainable guardianship), manaakitanga (reciprocity and hospitality) and rangatiratanga (self-determination/self-reliance).
4.19	Engage with central government and iwi and hapū on how expanded government funding for Māori to build community resilience could be utilised in the region.
4.20	Work with external agencies and partners, such as Waka Kotahi NZ Transport Agency and the Waikato Lifelines Group, to enable infrastructure, investment and planning decisions that support greater community and sector climate resilience.
4.21	Understand the implications of future climate projections to appropriately plan, prepare and resource for emergency management events and recovery from such events.
4.22	Advocate for the development and deployment of a region-wide marae preparedness programme to complement actions already taken in the wake of 2023 weather events.
4.23	Engage in the Government's work programme to modernise the emergency management system to ensure the region's needs in a changing climate are advocated for and met.
4.24	Work with Fire and Emergency New Zealand and research institutes to understand how we can best use our regulatory settings and regional relationships to manage the increasing wildfire risk in our region.
4.25	To reduce climate change risks to landfills and contaminated sites: • continue the development of tools for the evaluation of climate risks to landfills and contaminated sites, over time expanding the region's coastal landfill risk model to include riverine landfills • advocate for a refresh of the Contaminated Land Management Framework to explicitly consider climate risks and provide a platform for risk screening of all contaminated land, not just landfills.
4.26	Support communities through the transition by educating, informing and developing tools.

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Te pūngao me te ahumahi **Energy and industry**

The energy and industry sectors are vital for achieving Aotearoa New Zealand's emissions budgets.

We must rapidly cut the greenhouse gases we're putting into the atmosphere. Phasing out fossil fuel use and reducing demand, while switching to clean energy sources like wind, solar, hydro or geothermal, is key in our transition to net-zero carbon emissions.

The Waikato region already provides about one-third of New Zealand's current electricity generation capacity, with one large thermal power station, nine geothermal power stations, 10 large hydro power stations, wind turbines and many co-generation plants. We also have a robust grid for electricity transmission, thanks to our abundant energy resources and partly to our location next to New Zealand's biggest consumer of electricity – Auckland. These factors make our region an ideal place for future investment in energy.

Transitioning to fully renewable energy has the benefit of increasing security of supply and reducing costs to communities, business and industry by limiting exposure to emission unit costs and global supply shocks. An energy supply that is secure, reliable, affordable and resilient also supports the wellbeing of all New Zealanders. Energy efficiency improvements and fuel switching benefit businesses by reducing energy use, improving productivity and increasing the economic resilience of domestic producers. Improved energy efficiency, by individuals, business and industry, also helps reduce the demand on the energy system.

The Government is undertaking significant action and investment to decarbonise process heat. These actions – alongside actions to encourage greater energy efficiency, support electrification and increase the uptake of low emissions fuels – support industrial decarbonisation.

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How climate change impacts this pathway

As a nation, we need to rapidly decarbonise our energy system and industry by moving away from fossil fuels to renewable energy sources.

Renewable energy projects can create employment opportunities, generate revenue for the community, and provide a sustainable source of income, including for Māori. Renewable electricity production aligns with values of sustainable development (kaitiakitanga) when balanced against Māori environmental and cultural protection, restoration and preservation principles to reduce the environmental impacts.

The electrification of transport, decarbonisation of process heat in industry and population growth will increase demand for electricity. To meet national greenhouse gas emissions reduction targets, the country needs to add an average of 400-500 megawatts of new renewable generation annually until 2050[36]. This equates to a 174 per cent increase in current capacity.

Increases in temperature and other climate measures, such as rainfall, humidity, wind, etc, will likely also increase energy demand, as well as change the ability to generate electricity and deliver it reliably. Experiences with power outages during and after tropical cyclones demonstrate that even short disruptions to energy supplies are serious problems.

Property scale solar generation is an opportunity to both reduce energy demand and increase energy resilience in severe weather events for homes and marae communities, which are often stood up as civil defence centres. However, at present, the solar buy-back rates offered by retailers for excess electricity do not provide a strong financial incentive for householders to install solar energy systems.

A well-planned transition away from fossil fuels and towards increased renewable electricity generation can help reduce energy costs for business, industry and New Zealanders, increase energy independence and create high-wage jobs. It can also be an opportunity to improve our productivity as we adopt clean technologies and improve energy efficiency.

How we are responding

Providing for the demand for renewable energy is one of the six significant issues already addressed in the *Waikato Regional Policy Statement* (RPS). The RPS supports access to natural resources for energy and has prioritised the direct use of energy, where applicable, to minimise conversion and transmission losses. The geothermal policy is the most advanced, with clear regulatory directions favouring the use of renewable geothermal energy.

Opportunities for renewable energy

- Offshore wind farms on the west coast.
- Large, property-scale solar photovoltaic (PV) in the north and east, where pastoral land use is challenged by drought – land use can be changed to combine sheep grazing with utility scale solar arrays.
- Pumped water hydro schemes and battery storage in the region to overcome intermittency of renewable supply, the impacts of water availability on hydro generation and for flexibility during peak demand
- The co-location of production forests and large geothermal development systems in the southern part of the region presents an opportunity to directly use the geothermal energy (heat) to dry timber rather than burning waste wood, which could be used for other purposes such as biofuels or feedstock for a bioplastics industry.
- Floating solar PV arrays could be considered as covers for artificial and wastewater treatment ponds, or even for degraded natural waterbodies like storage reservoirs, subject to technical investigations.
- Wave energy technology could be explored by mapping wave resources and the feasibility of connections with existing land-based resources, such as transmission lines, port facilities, engineering repair workshops and marine support technician services.
- Biofuel crops could be grown for industrial process heat and potentially electricity generation. To offset greenhouse gas emissions from current fossil fuel use, biofuel crops must have a high calorific value and be fast growing; be able to be harvested by mechanical means (easy terrain); be grown near to the use of the crops so as not to negate the emissions advantage by long transport distances. This also has large scale land use change implications and could be seen as a climate adaptation response to the projected challenges to pastoral land use.

36 Market Development Advisory Group. 2022. *Price discovery under 100% renewable electricity supply*.

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Our commitment

Goals for success from the council's strategic direction

- Work with iwi partners and stakeholders to agree options and equitable pathways to help guide industries and communities to reduce use of fossil fuels and increase energy efficiency in our transition to a resilient, low emissions economy.
- Deliver an updated regional energy strategy and facilitate an increase in access to and use of renewable energy.
- Achieve year on year progress toward reducing the council's own corporate emissions, including through our supply chain, consistent with New Zealand's target for net zero greenhouse gas emissions by 2050.

5.1	Understand how our region is likely to change (land use, economy, industries, energy profile) as we reduce reliance on fossil fuels and transition to a low-emissions economy and ensure that appropriate regional policy statement and regional plan settings are in place to enable regional opportunities to achieve this transition.
5.2	Review policies and rules in regulatory plans to: • include promotion of energy efficient developments and associated supporting infrastructure • facilitate access to energy rich natural resources as a substitute for use of fossil fuels • ensure present regional policy statement settings for outstanding natural features and landscapes are compatible with the land use changes associated with grid-scale solar PV sites.
5.3	Actively engage in the development of offshore renewable energy to ensure regulatory settings are in place and fit for provision of appropriate transmission infrastructure to connect ocean-based developments off the region's west coast.
5.4	Advocate to electricity generators and retailers, distribution network operators and central government to remove commercial barriers to property scale (distributed) PV generation of electricity.

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5.5	Work with relevant stakeholders, including network operators, Transpower, territorial authorities and iwi, to ensure existing electricity transmission infrastructure and new elements (generation and transmission) are designed and located to futureproof for a changed climate.
5.6	Advocate for increased Māori involvement in renewable electricity generation and ensure that Māori values are integrated into any decision-making processes.
5.7	Understand the benefits of and drawbacks to innovative energy technologies, such as waste to energy.
5.8	Consider consents for GHG air discharges and make changes to regional plan and relevant policy statements to be consistent with national direction.
5.9	Work collaboratively with territorial authorities to develop a consistent approach when considering the use of council property to support community renewable electricity generation and battery storage initiatives.

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Te whakatupu ngāhere me te whakatō tupu **Afforestation and habitat restoration**

Planting is a proven nature-based solution to reduce carbon dioxide levels in the atmosphere. Trees store carbon and release oxygen and don't rely on new technology or technology yet to be invented. Planting can be a helpful supplement to reducing carbon emissions at the source.

Planting the right tree, in the right place, and protecting trees from pest species, delivers a range of benefits.

Forests, particularly indigenous forests, provide diverse social and environmental benefits. These benefits include habitat for indigenous biodiversity, erosion control, landscape-scale water security, flood mitigation and improved water quality, green job opportunities and the exercise of kaitiakitanga. Planting indigenous species that are culturally significant to Māori communities can help preserve cultural heritage.

Commercial plantings, such as cropping for fibre, fuel/energy or feedstocks for the organic chemicals industry, are also important as they contribute to our regional economy.

Creating carbon sinks through afforestation is a key part of New Zealand's approach to achieving its emissions reduction targets. Planting new forests locks up carbon in trees as they grow and, under current policy settings, generates carbon credits that can be sold through the Emissions Trading Scheme (ETS). This scheme creates a strong incentive for land use change from agricultural uses to forestry.

However, careful thought needs to be given to changing land use to forestry, especially for exotic forests, as it creates a commitment to maintain that forest for an extended period at the expense of other land use opportunities and exposes forestry owners to the fluctuating price of carbon. The loss of agricultural activity and associated jobs through changes in land use has become a key concern, particularly in local communities that rely on that industry. These risks are accentuated with absentee ownership of forestry where ETS revenues do not flow to the local community.

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Although forestry has an important role to play in meeting emissions reductions targets by sequestering carbon, it is not a replacement for reducing emissions at the source.

How climate change impacts this pathway

Planting widespread monoculture forests may help reduce net emissions but they face climate-related risks themselves, and release carbon when they die. Cyclone Gabrielle in 2023 flattened thousands of hectares of forestry in the Taupō district, while hundreds of landslips in the Hūnua Ranges during the Tasman Tempest weather event in March 2017 blocked the Ardmore water supply treatment plant for 10 days.

Other climate-related risks, for example, wildfires in the northern and eastern parts of the region, and biosecurity incursions, are also expected to increase. Such risks are potentially heightened by exotic monoculture planting, while permanent and/or indigenous forestry may better support biodiversity values, which underpin natural capital. Good design of forests, including appropriate use of tree species and a combination of protection and production forests, will help minimise these risks.

On-farm planting offers a combined-use of land that can also support objectives for water quality and biodiversity. Unfortunately, recognition by central government of on-farm planting to offset emissions is yet to be developed.

How we are responding

Planting and habitat restoration is a proven nature-based solution to climate change and water quality, among other benefits.

There are a range of national and regional initiatives to promote planting of forest species as living sinks to increase carbon stocks, many of which the council is involved in. They include but are not limited to the New Zealand ETS, Trees That Count, MPI Hill Country Erosion Fund and Jobs for Nature. The *Waikato and Waipā River Restoration Strategy* identifies afforestation of erosion prone land in key catchments as a priority for funding by organisations investing in catchment management, including Waikato River Authority and Waikato Regional Council.

Many of our catchment management programmes work closely with iwi, hapū and iwi Māori organisations. This collaboration can help iwi and hapū to manage their land for multiple long-term benefits, including carbon sequestration, climate resilience, adaptation to climate change, and supporting the development of local economies.

Right tree – right purpose – right place

The planting of pine to maximise the financial opportunities from the ETS has the potential to create extensive monocultures of exotic forests, changing the face of our rural landscapes and communities.

However, some sites may not ever be economic to harvest, such as highly erodible land, and landslips on recently harvested forests can affect community and catchment resilience by placing downstream infrastructure and habitat at risk.

The 2023 weather events in Gisborne and Hawke's Bay have highlighted significant issues relating to sedimentation and slash that can occur with monoculture exotic forests, while in Taupō area, more than 5000 hectares of production forest suffered from wind throw during Cyclone Gabrielle. The risks, and possible flow-on effects of this type of planting need to be carefully assessed in each situation.

Monoculture exotic forests are also susceptible to climate-influenced biosecurity issues and wildfires, with an increase in wildfires projected for the northern and eastern parts of the region.

Planting the right mix of trees, particularly indigenous species, in the appropriate location, will increase catchment resilience by minimising these risks.

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Our commitment

6.1	Promote awareness of the climate risks and landscape and farm-scale transformational changes to land use that will be needed in our region to respond to climate change, and supporting land users to adapt.
6.2	Review and update zone and catchment plans with a climate lens to address the key issues identified in this roadmap.
6.3	Incentivise afforestation and planting programmes in priority catchments through targeted rates and in partnership with the Ministry of Primary Industries, Waikato River Authority, Department of Conservation and others. Priority will increasingly be given to native afforestation and planting programmes.
6.4	Investigate opportunities for the council to make use of a voluntary carbon market or incentivise additional planting as a result of such a market.
6.5	Ensure the right trees are planted in the right place, including recognising the impact of future climate projections on location, species and the ability to harvest.
6.6	Promote the use of carbon calculators to raise awareness of the carbon sequestration benefits of planting indigenous tree and shrub species.
6.7	Refine models to identify suitable farmland for planting that will be economically feasible and provide the best return for carbon sequestration, increased freshwater quality, positive biodiversity outcomes and community resilience and safety.
6.8	Engage with Māori communities in the planning and implementation of afforestation and habitat restoration programmes.
6.9	Continue to support iwi and hapū-led restoration and climate resilience projects, as well as capacity building to lead such projects.
6.10	Consider opportunities for alternative land uses for the council-owned land between rivers and stopbanks, which is currently leased to farmers for grazing.

6.11	Collaborate with Waikato Forestry Users Group to encourage and support good forestry practices.
6.12	Advocate for a review of the National Environmental Standards for Plantation Forestry to ensure they are appropriate for a changing climate.
6.13	Engage with the Government as it progresses its forestry planning and advisory service to ensure that regional needs and opportunities are met. The proposed service will help to reduce climate risks by providing data-informed advice and planning tools, establish a network of advisors to support local government, and support groups such as rural communities, producers and Māori with land management, economic development and job creation.
6.14	Consider opportunities and partnerships for collective impact to increase wetland habitat and restore and protect native forests.
6.15	Identify landscape/catchment scale planting priorities to inform the Regional Planning Committee's preparation of the future regional spatial strategy.
6.16	Use differential regulatory settings to encourage land uses and planting regimes that achieve the hydrology, soil conservation, biodiversity and community resilience outcomes of the future regional spatial strategy.
6.17	Continue to leverage our investment in catchment and river restoration work through funding partnerships and community action focused on these benefits.

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Ahuwhenua me te whenua haumako **Agriculture and soils**

Soil protection and health is important. It contributes not only to wider environmental improvements but also to food and fibre security and the economic success of agricultural sector.

Agriculture plays a key role in the economic and social wellbeing of the Waikato region, with dairy and meat products making up approximately 60 per cent of the region's international exports.

The sector is an important contributor to the region's $6 billion Māori asset base, mostly made up of sheep and beef farming, dairying and forestry.

Agriculture depends on soil health for its success. How land is used and managed is one of the greatest modifiers of soil condition, the ability of soil to be resilient in the face of a changing climate and the amount of carbon stored in soil, as well as soil biodiversity. At the same time, the agricultural sector is highly exposed to the impacts of climate change, as well as to the responses of international markets to sustainability and emissions.

For these reasons, how rural land and soils are used and managed is among the region's biggest challenges and opportunities.

Agriculture is a key economic sector for the Waikato but is also the region's highest emitting sector. Farming generated 8.1 $MtCO_2e$ in 2021/22, accounting for 67 per cent of the region's emissions. The most significant contributor was methane (6.7 $MtCO_2e$), mostly coming from the natural digestive processes of ruminant farm animals. Methane makes up 56 per cent of the region's overall emissions, which makes it a significant challenge.

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We have around 83,000 hectares of organic soils in the Waikato, including the 10,201ha Kopuatai Peat Dome; that's roughly 40 per cent of New Zealand's peatland resources. Of this total area, more than 65,000ha have been drained, mostly for productive purposes such as pastoral agriculture, cropping, horticulture and peat mining. Drainage and cultivation have resulted in ongoing peat subsidence, greenhouse gas emissions and, if left unchecked, will lead to the loss of our peat resource.

Soils in Waikato

Soils are a finite resource as they take thousands of years to develop. To avoid depleting soil carbon and the loss of productive topsoil, we must focus on retaining soil carbon in agricultural soils. As well as contributing to the resilience of agriculture, improving soil health has the additional benefits of improving biodiversity and water quality.

Soils contain twice as much carbon as the atmosphere and three times the content of vegetation.[37] This makes soils the second largest carbon sink after the ocean. However, from a climate change perspective, it is not the total amount of carbon in soils that matters – rather, it is whether the amount of carbon changes over time.

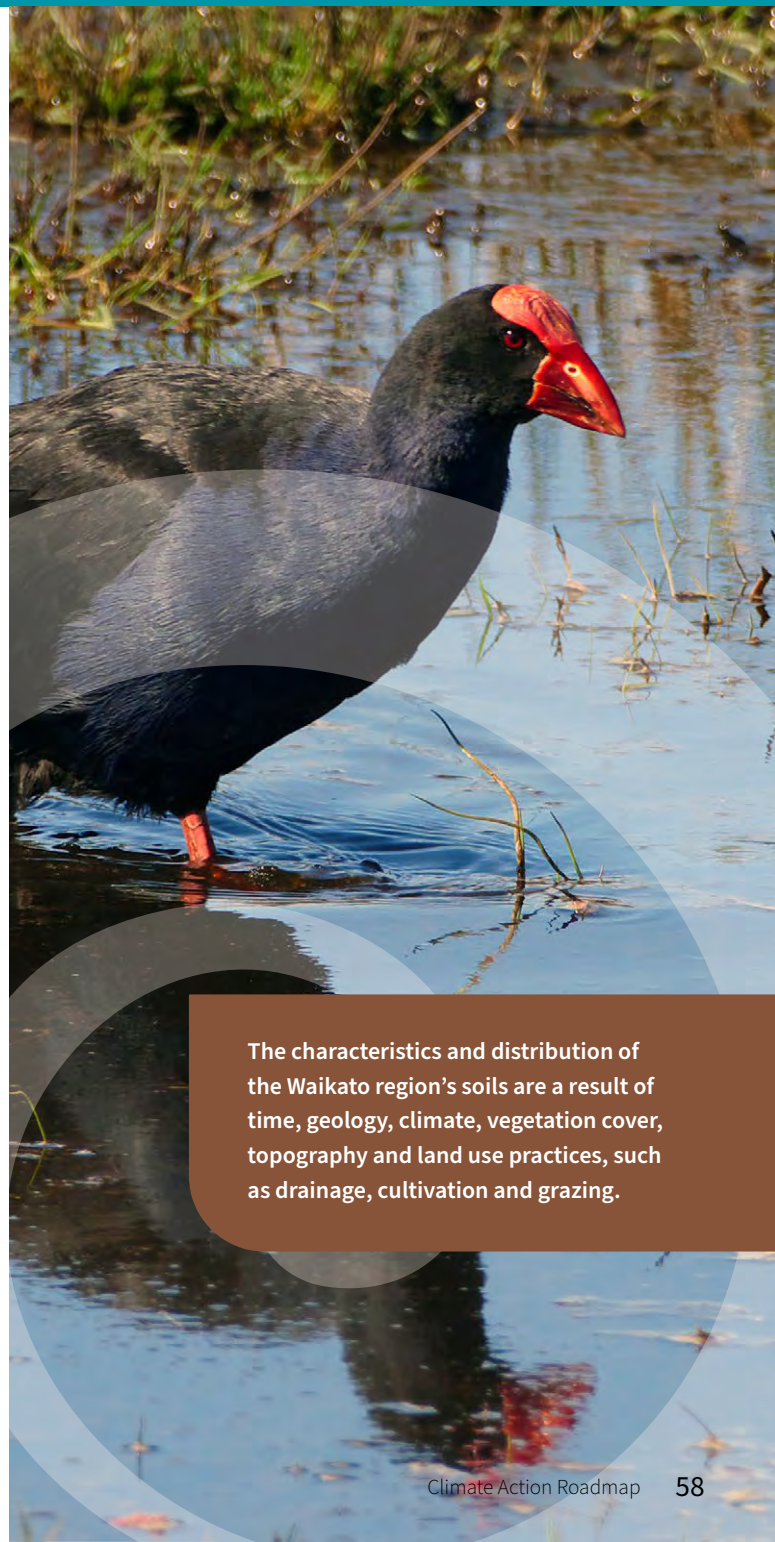
Inappropriate land management practices, such as the removal of vegetation, inappropriate earthworks and excessive cultivation, can greatly accelerate the rate of erosion – and therefore the potential release of stored carbon.[38] Forty-three per cent (more than 1 million hectares) of land in the region has high potential for erosion.[39]

The Waikato region is made up of a range of soil types, including organic – or peat – soils. Organic soils are formed in wetlands that, when in their intact (undrained) state, represent a net greenhouse gas sink.

Peat subsidence causes drainage problems, can draw down the water table on adjacent wetlands, and can adversely affect infrastructure, such as roads and buildings, and provision of services.

Drained peatlands contribute to our regional carbon footprint. We are the first region in New Zealand to account for emissions from the drainage of organic soils.[40] A supplementary technical report to the latest regional greenhouse gas inventory estimated those emissions at 1.5 $MtCO_2e$ per year. This is equivalent to the greenhouse gas emissions from 333,795 petrol-powered passenger vehicles driven for one year.[41]

It is unknown how long it takes for rewetted systems to become greenhouse gas sinks, although there are international examples of rewetting land and/or finding alternative wet land uses, such as paludiculture, that limit or reduce greenhouse gas emissions. Further research and trials in a New Zealand context are needed to fill these knowledge gaps.



The characteristics and distribution of the Waikato region's soils are a result of time, geology, climate, vegetation cover, topography and land use practices, such as drainage, cultivation and grazing.

37 Batjes, N. & Sombroek, W. 1997. Possibilities for carbon sequestration in tropical and subtropical soils. *Global Change Biology* 3(2): 161-173.

38 Basher, L. R. 2013. "Erosion processes and their control in New Zealand". In *Ecosystem services in New Zealand – conditions and trends*, edited by John Dymond, 363-374. New Zealand: Manaaki Whenua Press.

39 New Zealand Land Use Resource Inventory

40 2013 Wetland Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands

41 Calculated using Greenhouse Gas Equivalencies Calculator

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How climate change will impact this pathway

The climate we have known has changed and will continue to do so. The land uses that have evolved in the Waikato region will be increasingly challenged by higher temperatures and extreme events, such as storms, floods, drought and even fires, which will impact on the productivity of commercial land uses under current farming systems. Low lying areas, such as the extensively drained Hauraki plains, are particularly vulnerable to flooding events and sea level rise. Some or all of the drainage systems in these areas may become uneconomic to continue in the changing climate.

There is an increasing focus nationally and internationally on the importance of sustainable production and soil carbon, both for maintaining good soil health and mitigating greenhouse gas emissions. Export markets are becoming increasingly cognisant of emissions from land use, and these may result in formal or informal trade barriers in the absence of an appropriate climate response. Local producers will need to respond to these pressures. Currently, much of our region's production undergoes relatively low levels of processing before export, meaning industries remain exposed to commodity markets. Shifting to higher value, low climate-impact products, including through new technologies, can help to reduce this exposure.

Given the potentially significant contribution that changes in soil carbon could make to New Zealand's total agricultural emissions, it is essential to understand trends and identify management practices that reduce the loss of soil carbon or can increase it.

A long-term national scale study[42] is underway to determine whether New Zealand soils are gaining or losing soil carbon. More work is needed to estimate the emission rates, understand carbon storage capacities of different New Zealand soil types, and investigate opportunities to increase soil carbon storage and offset emissions[43].

He Waka Eke Noa, the primary sector climate action partnership between the Government, the primary sector and Māori, has developed farm planning guidance on greenhouse gases that includes sections on adaptation and assessing risks and opportunities to build resilience to climate change.

42 Project by Manaaki Whenua: Soil carbon research programme

43 For an overview of current knowledge of New Zealand soil carbon stocks, trends and management options, see the related fact sheet "Reducing New Zealand's agricultural GHGs: Soil carbon" (NZAGRC & PGGRC, 2015)

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How we are responding

We are committed to working constructively with land users, industry and central government on the regional transformation that is required to meet the climate change challenges faced by the region.

The council's Primary Industry Engagement team is currently focused on the implementation of regulatory farm plans for fresh water to give effect to the *National Policy Statement for Freshwater Management* (NPS-FM). By addressing agricultural practice and contaminant losses to freshwater bodies, freshwater farm plans will help reduce the impacts of increasing low flow conditions on waterways as a result of climate change. Although the actions in farm plans are focused on freshwater management, many actions will also deliver multiple benefits such as greenhouse gas reductions at the farm scale and improved soil health.

Managing multiple land drainage systems and flood management schemes across the region is a key function of the council, which is becoming increasingly challenged as the climate changes. A key goal is to engage with with land users and iwi and hapū in the development of a sustainable flood management and land drainage infrastructure strategy for a changing climate that considers land uses, working with nature and funding. Including the emissions from drained peatlands in our regional and corporate greenhouse gas inventories will assist us to identify the impacts of changes in the future.

There is an increasing focus on the importance of sustainable production and soil carbon both for maintaining good soil health and mitigating greenhouse gas emissions. Changes in soil carbon could potentially make a significant contribution to New Zealand's total agricultural emissions.

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Our research and monitoring programmes, as well as collaborations with other agencies, to support this pathway are wide ranging. They include soil, water, biodiversity, biosecurity and habitat restoration and have a strong focus on enabling agricultural adaptation and reducing emissions in the region. Through this work we aim to provide confidence to land users to move away from business-as-usual practices and shift towards climate resilient nature-based solutions such as biodiverse yields, paludiculture, blue carbon, wetland creation and restoration.

Preparing for the region's future regional spatial strategy, arising from the resource management reforms, also requires long-term objectives for land use change in response to climate change. Planning regarding high population growth along the Waipā-Hamilton-Waikato corridor is already requiring choices to be made between urban and rural land uses. Consideration of a changing climate when making decisions on these matters is required by national direction in the *National Policy Statement for Urban Development* and the *National Policy Statement for Highly Productive Land*.

Our commitment

Goals for success from the council's strategic direction

- Enable the Waikato region's farmers to be national leaders in the adoption of climate smart practices and technologies by aligning our farmer education and support services with those of industry bodies and central government.
- Engage with land users and iwi and hapū in the development of a sustainable flood management and land drainage infrastructure strategy for a changing climate that considers land uses, working with nature and funding.

7.1	Support landowners and land managers by: • evaluating new science and using this information to advise on proven land management practices backed by science • collecting data and information (such as through inventories, trials, research) to provide confidence to move away from business-as-usual practices and shift towards climate resilient nature-based solutions such as paludiculture, blue carbon, wetland creation and restoration • understanding how the economic outcomes of farm systems and land use in our region may need to evolve in a changing climate • promoting best practices for land management to protect carbon stocks in the soil, in a way that aligns with the NPS-FM and freshwater farm planning.
7.2	Collaborate with research institutes and central government on research, data collection and sharing to ensure regional requirements for soil emissions and management, unconventional carbon sinks (indigenous species, wetland species, and soil carbon) and agricultural adaptation are well represented.
7.3	Account for greenhouse emissions from organic soils in the regional greenhouse gas emissions inventory to understand the relative contribution of organic soils to total regional emissions.

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7.4	Improve understanding and management of drained peatlands in the region through: • collection of peat depth, extent and subsidence information to update local peat resource information • development of a spatial index of peatland vulnerability to understand areas where the impacts of subsidence and greenhouse gas emissions are likely to be greatest, and therefore prioritise a response • testing of mitigations to reduce subsidence and greenhouse gas emissions • investigation of transformational land use opportunities that could potentially stop subsidence and net greenhouse gas emissions • development of a good practice guide for future peatland management in a changing climate.
7.5	Advocate for a co-ordinated approach between central government (MPI), local government, He Waka Eke Noa and industry bodies in terms of farm planning requirements and solutions and, wherever possible, support farmers with integrated farm planning solutions within the regulatory implementation of freshwater farm plans.
7.6	Advocate for stability of Emissions Trading Scheme settings in a way that is complementary to the intended outcomes of the He Waka Eke Noa partnership.
7.7	Advocate for the inclusion of non-conventional carbon sinks in the Emissions Trading Scheme, or equivalent.
7.8	Promote awareness of the landscape scale transformational changes to land use that will be needed in our region to respond to climate change and support land users with information on adaptation options.
7.9	Promote the co-benefits of indigenous planting and the establishment of wetlands to reduce waterborne contaminants, capture and store greenhouse gases and improve indigenous biodiversity.
7.10	Include soil conservation and peat management in a changing climate in the wider review of the *Waikato Regional Plan*.
7.11	Work with territorial authorities to ensure regional soil conservation actions achieve co-benefits for emission reductions from land use.
7.12	Prepare a regional scale land use strategic plan for projected future climate conditions that will inform the future regional spatial strategy.
7.13	Prepare to use differential regulatory settings to encourage land uses and planting regimes that achieve the water movement, soil conservation, biodiversity and community resilience outcomes of the future regional spatial strategy.

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Te hanga tāone me te tūnukutanga **Urban form and transport**

Our urban form and transport system shape the way we live. While this integrated system provides the foundation for thriving communities, if poorly formed it can also establish and then perpetuate unhealthy urban form and travel patterns, as well as exacerbate vulnerabilities in some communities.

Urban form, growth and travel behaviour all influence climate change.

A low-carbon urban environment, with a multi-modal transport system that includes public transport and walking and cycling options, has benefits beyond reduced greenhouse gas emissions, such as:

- improved individual and community wellbeing, health and safety outcomes
- improved air and water quality
- a more equitable region
- access to low carbon markets
- less congestion for those that need to drive
- increased productivity
- a more accessible and connected region
- more affordable travel
- resilience to fuel price increases
- energy security.

However, our urban areas were planned and constructed to accommodate cars as the dominant transport mode, at the expense of other ways to travel. Zoning provisions in district plans often separate land uses, making it difficult to live, work, play and shop in one locality or suburb. As a result, activities are spread over a larger area, encouraging more driving. Sprawl increases both individual transport costs and emissions and external costs such as building and maintaining roads and parking facilities, congestion, accident risk, and emissions.

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Climate change impacts are not distributed equally, and vulnerable populations such as low-income or rural communities are often disproportionately affected by weather events and poor urban and transport planning. Our planning for urban form and public transport needs to be accessible, affordable, reliable, safe, inclusive and efficient to support these communities.

Planning that supports low-emissions urban form (the location, shape, size, density, and configuration of settlements) through more mixed-use, medium- and high-density development close to high activity centres creates more accessible, healthy, resilient and vibrant towns and cities. Higher densities result in lower operational emissions per dwelling and allow infrastructure, including the road network, to be used more efficiently, avoiding or delaying the need for more infrastructure and further emissions.

Improved transport options are important to reduce the number of short car trips with single occupants, remove the dependency on cars by those living far from employment, education, commercial areas and recreation, and reduce traffic problems like congestion and greenhouse gas emissions.

Our region's greenhouse gas emissions are expected to be impacted, to some extent, by a growing population, particularly around Hamilton and in the north of the Waikato district. In the subregions of Waikato and Waipā districts and Hamilton city, demand for dwellings is projected to increase by about 56 per cent from 2020 to 2050.[44] Accommodating this growth will be challenging and good planning to support low-emissions urban form will be vital.

44 Future Proof Te Tau Titoki. 2022. *Future Proof Strategy*.

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How climate change impacts this pathway

The long-term effects of climate change will increase the hazard risk to homes, communities, infrastructure and the transport network.

Climate or weather-related risks that are relatively common in New Zealand's urban environments are river flooding, coastal erosion and inundation, and various forms of land instability. Other less common risks include the potential for extended drought, with consequences such as reduced access to water supply or fire risk, and high winds.

All urban areas are also to some extent 'heat islands', which can locally exacerbate elevated air temperatures.[45] Urban heat islands are caused by the mass of heat absorbing materials in the urban environment, such as roads, pavements and rooftops. Good urban design and heat island cooling strategies provide an opportunity to reduce the heat island effect as our climate warms.

The resilience of our road transport network to climate change, whether it be sea level rise, coastal and riverine flooding, or increasing temperatures, is critical to secure social and economic wellbeing in the Waikato region. The network is one of New Zealand's busiest because of its strategic location in the upper North Island. It is a corridor region between Auckland and the rest of New Zealand to the south.

According to NIWA, the Waikato region has approximately 558 kilometres of local and arterial roads in areas that would be impacted by a rise in sea level of 1.2 metres above the current coastal 1 per cent annual exceedance probability (AEP) levels.[46] Additionally, 2750 kilometres of our roads are exposed to known or mapped floodplains[47], predominantly around the lower Waikato River and Hauraki Plains which have 4600 hectares and 22,148 hectares below sea level, respectively.

How we are responding

A regional transition to a low emission urban form, infrastructure and transport system is within the direct control of local government, by working together at both regional and territorial level.

We need to change the way we use land and resources and provide infrastructure so that our urban areas generate lower emissions and are resilient to the impacts of climate change. The transition needs to be well-signalled and inclusive, maximising opportunities and minimising disruption and inequities.

On the back of strong population growth, New Zealand's greenhouse gas emissions from transport fuels have increased by nearly 70 per cent from 1990 levels and continue to increase. Overall, transport emissions make up 17 per cent of New Zealand's gross emissions profile, and 92 per cent of that is due to road transport. The Waikato region contributes 14 per cent of national vehicle emissions. Vehicles reliant on fossil fuels are now the fastest growing source of greenhouse gas contributions to the environment.

45 Allan, S. & Tait, A. *Impacts of climate change on urban infrastructure and the built environment: a toolbox.*

46 Paulik, R., Stephens, S., Wadhwa, S., Bell, R., Popovich, B. & Robinson, B. 2019. *Coastal flooding exposure under future sea-level rise for New Zealand*. Prepared for The Deep South Challenge by National Institute of Water and Atmospheric Research Ltd.

47 Paulik, R., Craig, H. & Collins, D. 2019. *New Zealand fluvial and pluvial flood exposure*. Prepared for The Deep South Challenge by National Institute of Water and Atmospheric Research Limited.

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Our commitment

Goals for success from the council's strategic direction

- Lead and encourage land-use decisions that shape sustainable, resilient transport networks to ensure communities have affordable access to services, amenities and social life.
- Improve safe, accessible and affordable low emissions passenger transport options for our communities, with a particular focus on frequency and reliability.
- Advocate for infrastructure and investment decisions that support greater climate resilience and a rapid transition to a low carbon freight and distribution network through the upper North Island.

8.1	Complete an update to the *Waikato Regional Policy Statement* to integrate the requirements of the *National Policy Statement on Urban Development*, and to implement changes to the *Future Proof Strategy* that will require councils to plan for growth and ensure well-functioning urban environments for all people, communities and future generations.
8.2	Work collaboratively with relevant territorial authorities to implement the national direction for urban development, including supporting reductions in greenhouse gas emissions through good urban design, as interpreted through the *Waikato Regional Policy Statement*.
8.3	Undertake a change to the *Waikato Regional Policy Statement* to integrate the requirements of the *National Policy Statement for Highly Productive Land*, which will require councils to manage the subdivision, use and development of highly productive land, in turn avoiding further urban sprawl and enabling urban form that reduces transport emissions.
8.4	Realise the objectives of the *Regional Land Transport Plan* to provide a transport system that delivers emissions reductions and enhances communities' long-term resilience to the effects of climate change.[48]

48 The 2024 RLTP is currently being developed. Addressing climate change is likely to be given high priority.

8.5	Realise the objectives of the *Regional Public Transport Plan* to: • deliver an integrated network of public transport services that enhances accessibility and wellbeing • electrify the bus fleet (and develop associated charging infrastructure) to enable net-zero public transport for the period 2025-2050 • support and promote the expansion of mass transit, such as the Te Huia passenger train connecting Waikato and Auckland and a rapid and frequent bus network in the Hamilton-Waikato metro area • support community transport providers to change to electric vehicles (EVs) where there are appropriate charging facilities at their destination, and sufficient funding available.
8.6	Complete the *Regional Transport Emissions Reduction Plan* and work collaboratively with territorial authorities to: • improve the overall efficiency of the transport system by avoiding the need to travel or reducing trip lengths through appropriate urban form and land use patterns • create the right conditions for people to use less carbon intensive transport modes, such as walking, cycling and public transport in urban areas, which will also help ease congestion and improve health and safety outcomes.
8.7	Understand the different vulnerabilities of our communities to enable future urban form and transport planning and actions to be targeted to support those most vulnerable to the impacts of climate change.
8.8	Support the uptake of EVs by working with territorial authorities to develop a regionally consistent and enabling approach to charging infrastructure.

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8.9	Work with territorial authorities to develop regional guidelines for nature-based, climate-friendly urban design, transport and infrastructure networks, including: • contributing to a review of the Regional Infrastructure Technical Specifications to ensure it supports a low emission urban form and innovation for whole of transport and infrastructure system emissions reduction, provides for infrastructure which will be resilient in a changing climate and incorporates learnings from the weather events in early 2023 • using water-sensitive urban design, which mimics natural processes and uses soil and vegetation to manage stormwater and reduce the need for carbon intensive concrete pipes • integrating green spaces and natural features into urban areas to help with temperature and flood control, improve air quality and create wildlife corridors.
8.10	Work with adjoining regional councils to support inter-regional connections, including public transport, freight and passenger rail and EV charging, that result in reduced transport emissions while contributing to the collective upper North Island strategic transport network.
8.11	Investigate options to offset interim and currently unavoidable transport emissions, focusing on nature-based solutions and initiatives that also increase environmental and social resilience.
8.12	Advocate to central government and territorial authorities to ensure that transport services and options for rural communities and provincial towns are improved and options for on-demand public transport in provincial towns are investigated.

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Ngā puna pūtea mā te hapori **Community funding and investment**

Climate change is no longer considered to be just an environmental challenge. It has wide-ranging impacts, including threatening financial systems and economic security. Funding and investment decisions have important roles to play in mitigating emissions and supporting adaptation.

Raglan

Finance is a key tool in responding to climate change by aligning investments and spending with climate objectives and supporting and enabling others in climate action initiatives.

There are many layers of uncertainty already impacting investments, such as post-pandemic economic circumstances characterised by higher inflation, a complex geo-political landscape and a changing regulatory environment, including a move to a low-emissions economy. The value and insurability of underlying investment assets may be further affected by a world destabilised by climate change. In this environment, understanding and managing the exposure of investments and assets to climate risk is crucial. Sustainable finance mechanisms need to consider the climate impacts of funded activities, and how climate resilient investments might be.

At the same time, it is well recognised that responding to climate change is not solely a government, business or financial response. All sectors of society have a role to play, including individuals in their activities and spending. Here in the Waikato region, many community groups, iwi Māori organisations and non-governmental organisations are leading the way with community-led climate action.

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How climate change impacts this pathway

As climate change becomes more apparent and increasingly impacts on day-to-day life, we expect communities will want to respond with faster action and will have a growing interest in accessing community funding from a range of sources.

Climate change materially impacts the performance of investments and, in recent years, the costs of extreme weather events have impacted business sectors, including the insurance industry, severely.

There are three ways that climate change can affect financial stability.[49]

1. Physical risks: The impacts today on insurance liabilities and the value of financial assets that arise from climate and weather-related events, such as floods and storms that damage property or disrupt trade.
2. Liability risks: The impacts that could arise tomorrow if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible.
3. Transition risks: The financial risks that could result from the process of adjustment towards a lower-carbon economy. Changes in policy, technology and physical risks could prompt a reassessment of the value of a large range of assets as costs and opportunities become apparent.

49 Carney, M. 2015. Breaking the tragedy of the horizon - climate change and financial stability. Speech presented at Lloyd's of London, London, September 29, 2015.

How we are responding

The council has investment funds that are aligned with its climate objectives and has contestable funds to support community initiatives. The implications of climate change are also routinely considered in the council's financial decisions and through its risk and assurance activities.

The council's Risk and Assurance Committee monitors our activities to mitigate the risks of climate change on council business, as well as how we affect the climate. The committee is particularly interested in understanding and mitigating the effects that a disrupted climate might have on service delivery and legislative obligations.

Under the Zero Carbon Act, councils are reporting organisations. The act enables the Minister for Climate Change or the Climate Change Commission to request that a reporting organisation provides information about its governance, risk identification, and management as it relates to climate change mitigation and adaptation. To meet potential foreseeable reporting requirements, the council follows the recommendations of the Task Force on Climate-related Disclosures[50] to disclose its climate-related risks and opportunities.

The council follows the principles of responsible investment, which embodies an internationally accepted framework for investors to manage environmental, social and corporate governance issues in a manner consistent with improving long-term investment returns.

Waikato Regional Council's investment fund was set up from the sale of the council's Port of Tauranga and Port of Auckland shares in the mid 1990s, with investment returns used to fund special projects, finance internal borrowings and reduce the overall level of rates. The Statement of Investment Policy and Objectives[51] sets out a framework for the appropriate management of the fund and includes a climate change investment strategy, which has four elements:

1. Reduce: Involves measuring the carbon footprint of investments and targeting a reduced exposure to carbon through active divestment from fossil fuels and other relevant portfolio exposures. Regular monitoring is carried out on the portfolio, to assess the carbon intensity of the portfolio and its resilience to climate change.
2. Analyse: Integrates climate change considerations into the investment framework across the portfolio.
3. Engage: Involves working with the fund's investment managers to help them actively consider climate change in their strategies and encouraging voting to support climate change initiatives within listed holdings.
4. Search: Involves actively looking for investments that will benefit from a changing climate or the transition to a low carbon energy system.

The council has a variety of contestable funds for regional services, economic development, environmental restoration and protection and education. These funds provide the council with an opportunity to enable and incentivise community action to build resilience and/or reduce emissions. The criteria of each fund are aligned to the council's strategic priorities and the United Nation's Sustainable Development Goals. The council will continue to look for opportunities to support sustainable, climate related projects in the fund evaluation process.

50 Task Force on Climate-related Financial Disclosures. 2017. Final report: Recommendations of the Task Force on Climate-related Financial Disclosures. Switzerland: Financial Stability Board.
51 Waikato Regional Council. 2021. Statement of Investment Policy and Objectives – Waikato Regional Council. Accessed from Finance and Services Committee Agenda 19 May 2021

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Our commitment

9.1	Follow the Principles of Responsible Investment, which embody an internationally accepted framework for investors to manage ESG issues in a manner consistent with improving long-term investment returns
9.2	Continue to work with the council's strategic investment advisor to ensure fund investment processes and practices reflect good industry practice and remain current with emerging opportunities.
9.3	Monitor central government's work to consider whether to extend the application of mandatory climate-related disclosures to ensure our climate reporting and disclosure practices will meet foreseeable future requirements.
9.4	Review existing mechanisms through which the council distributes funds (such as the Regional Development Fund) to ensure that climate-related criteria are considered.
9.5	Explore opportunities for multi-organisation funding of community and iwi Māori projects to increase the collective impact of funding and the sharing of in-kind resources.
9.6	Promote and advocate to the Regional Strategic Partnership Fund for projects to support the region's industries and businesses to manage the transition to a low-emissions economy.

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Waikato
REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

He taiao mauriora **Healthy environment**

He hapori hihiri **Vibrant communities**

He ōhanga pakari **Strong economy**

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We invite you to talk to us about how we can work together to reduce our emissions or build resilience to climate change.

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