Resilient ORGANISATIONS

URBAN INTELLIGENCE

RISK SCREENING

Rīpoata Tautuhi Mōrearea

FIRST PASS CLIMATE CHANGE RISK ASSESSMENT

Prepared for the
Buller District Council's
Climate Change Adaptation Planning Programme

First-Pass Climate Change Risk Assessment

Prepared for: Buller District Council

Prepared by: Urban Intelligence Ltd. and Resilient Organisations Ltd.

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Version 1.0	Draft report	17/08/2022
Version 1.1	Updated report, restructuring the elements	01/09/2022
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Quality Assurance Statement		
	Reviewed by:	Dr Tracy Hatton, Resilient Organisations Ltd

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Glossary | Kuputaka

	DEFINITION
Adaptation	The process of adjustment to actual or expected climate change and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC, 2014).
Adaptive capacity	The ability to respond to hazards.
Climate-influenced hazards	Natural hazards that may change in severity or frequency as a result of climate change and associated environmental change.
Domain	Wellbeing or value domains are a hybrid of the NZ Treasury's Living Standards Framework and group values, assets, and systems that could be affected by climate change.
Element	The assets, taonga, people, places, and specific systems that may be at risk. These are grouped into subdomains.
Exposure	The potential to be impacted by hazards.
IPCC	Intergovernmental Panel on Climate Change. This is a United Nations body for assessing the science related to climate change and is the world's foremost authority on climate change.
NAP	National Adaptation Plan
NCCRA	National Climate Change Risk Assessment
Physical risk	Risk arising from either acute (extreme weather) or chronic (increased temperature, sea level etc.) impacts as a result of climatic change.
RCP	Representative Concentration Pathway. Representing various climate change scenarios based on differing levels of atmospheric carbon. These have been largely superseded by SSPs.
Risk	The outcomes (positive and negative) and associated uncertainties, with respect to something that humans value (SRA, 2015).
Sensitivity	The degree to which something is impacted by hazards.
SSP	Shared Socioeconomic Pathway. Representing scenarios where emission reductions will, or will not, be achieved. These have largely replaced the RCPs in recent IPCC reports.
Subdomain	These are groupings of elements to reflect risks. For example, the subdomain "transportation" (in the Built domain) would include roads and other assets.
TTPP	Te Tai o Poutini Plan (TTPP) is the combined District Plan for the Buller, Grey and Westland District Councils.
Transition risk	Risk arising from the economy's shift towards low emissions.
Vulnerability	The degree to which an element is susceptible to damage, based on its exposure.

DOMAINS	
Built environment	Vertical (e.g., buildings) and horizontal (e.g., roads, electricity) infrastructure.
Economy	Set and arrangement of inter-related production, distribution, trade, and consumption that allocate resources.
Governance	The governing architecture and processes in and between governments, and economic and social institutions.
Human	Direct and indirect impacts on people.
Kaupapa Māori	Direct and indirect impacts on Tangata Whenua and taonga.
Natural environment	Aspects of the natural environment that support the range of our indigenous species, he kura taiao (living treasures), the ecosystems, and our blue-green infrastructure.

Executive summary | Whakarāpopototanga

Climate change is already impacting the Buller District. As a result, the Buller District Council has begun its climate change adaptation planning programme as part of the Long-Term Plan (2021-2031). This report summarises a first-pass risk assessment which will be used as a foundation for a detailed risk assessment and subsequent climate change adaptation plan. This first-pass risk assessment is a qualitative identification of risks and builds from the Ministry for the Environment's *Guidance for Local Climate Risk Assessment*. It will enable a comprehensive risk assessment to inform adaptation planning, asset management, and strategic long-term planning within the district.

The key objectives of this first-pass risk assessment were to:

1. Identify the climate-influenced hazards and scenarios that need to be developed to comprehensively understand the Buller district's risk profile.
2. Identify potential risks and opportunities for the Buller District as a result of climate change.
3. Identify elements (assets, taonga, people, and places) that serve as indicators of these risks in the Buller District.

These objectives were achieved through a series of workshops with stakeholders familiar with the Buller District. Risks have been categorised into wellbeing domains modified from the National Climate Change Risk Assessment: Human, Built, Natural, Kaupapa Māori, Economic, and Governance (see table below). The knowledge from these workshops will ensure that the risk assessment focuses on what is important to the Buller community, informed by the views, values, and perceptions of the stakeholders in attendance. There will be regular opportunities to engage and refine this focus throughout the project.

Potential risks for the Buller District identified by workshop attendees

PĀPORI | HUMAN	BUILT ENVIRONMENT | TAIAO HANGA	NATURAL ENVIRONMENT | TE TAIAO
Risk to: • social cohesion and community wellbeing (incl. mental health) • physical health from exposure to hazards • exacerbating and creating inequalities • heritage and culturally significant sites • accessing medical care and emergency services • accessing education • accessing community services • accessing food/resources • recreation • communications • homes and personal assets	**Risk to:** • potable water supply • buildings (residential, commercial, industrial, and other structures) • landfills and contaminated sites • wastewater and stormwater • transportation • electricity, energy and communications	**Risk to:** • indigenous terrestrial ecosystems and organisms • indigenous marine ecosystems and organisms • indigenous freshwater ecosystems and organisms • exotic ecosystems and species • parks and blue-green infrastructure • endangered species • natural structures, formations, and/or regimes (e.g. river channels) • use of natural sites/recreation sites • mahinga kai and cultural resources

Potential risks for the Buller District identified by workshop attendees (cont.)

KAUPAPA MĀORI	ECONOMIC | OHAOHA	GOVERNANCE | MANA WHAKAHAERE
Risk to: • Māori social and cultural wellbeing • waiora - wellbeing/health • Māori cultural sites • mahinga kai species and collection • locality of Tangata Whenua • mauri, wairua and adaptive capacity • Māori/Tangata Whenua autonomy/Te Tiriti rights	**Risk of/to:** • insufficient local government income/excess expenditure • overall financial system (e.g. banks) instability • land-based primary sector viability • tourism sector viability • fisheries sector viability • the insurability of assets • productivity due to supply chain and distribution system disruptions • exacerbating economic inequality • mineral sector • new industries (in particular technology)	**Risk of:** • maladaptation due to processes not accounting for uncertainty and long-term change • climate adaptation not supported by institutions, processes, funding mechanisms • increased litigation • breaching Treaty obligations • maladaptation due to knowledge and capacity gaps • EM system not adequately responding • doing nothing as elected members cannot agree or are not engaged in climate-hazard challenges • failure to follow democratic process due to frequency and scale of impacts • path dependency / sunk cost fallacy • loss of community trust and buy-in

1. Introduction | Whakataki

Climate change presents both risks and opportunities to the Buller District. The present-day impacts of a changing climate and hazardscape are already being noticed within the built and natural environments, and the cascading impacts are being felt in the communities, businesses, and institutions. As the climate continues to change, these impacts will likely be exacerbated. Understanding, with a view to managing and taking advantage of these challenges and opportunities is the objective of a risk assessment and adaptation programme.

Extreme weather is one of the most salient consequences of climate change and has already been experienced in the Buller District. The extreme flood events of July 2021 and February 2022 – estimated by the Buller District Council to cost >100m NZD and 20-45m NZD, respectively – are indications of what a changing climate will bring. Based on current warming alone, climate scientists estimate that at least 30% of recent worldwide weather-related economic losses are attributable to climate change (Frame et al., 2020).

Another threat from climate change is sea level rise. While all of New Zealand is exposed to coastal hazards, the Buller District has one of the highest levels of exposure. Figure 1 shows coastal flood risk based on today's sea level and this is based on coastal flooding alone (excluding planned defensive infrastructure). In addition to threats from the flood waters, these and other at-risk areas may be subject to insurance retreat or rising premiums. As these risks, among others, increase with climate change, the district must begin to adapt.

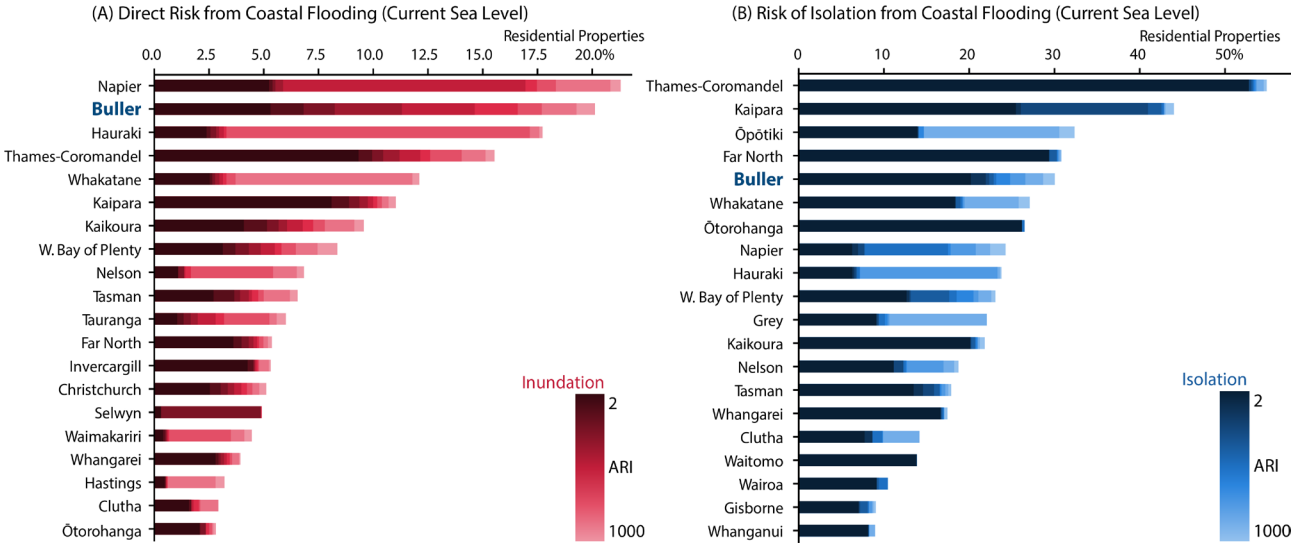


Figure 1: Current coastal flood risk (based on percentage of residential properties affected) in the twenty most exposed territorial authorities in New Zealand. This shows the risk from coastal flooding with annual return intervals (ARIs) between 2-1000 years for current sea level. (A) Inundation occurs when a building is exposed at any depth. (B) Isolation occurs when the roads are flooded such that cars cannot pass. Although this may be temporary isolation, long-term road damage is possible, risking extended isolation. (Source: Logan et al. 2022 based on coastal flood maps from NIWA (2021)).

However, climate change comes with more than physical risks and exacerbated natural hazards: the transition towards a low-carbon economy brings risks of its own. These are known as transition risks and include things like stricter environmental regulations, increased transportation costs and indirect price increases, carbon taxes, and cascading impacts from disruptions elsewhere. A key transition risk for the Buller District is the loss of the coal mining sector. Similarly, there are major opportunities from this transition including for new technology and improved reputation. Risks from climate change therefore are commonly categorised into transition or physical risks and this relationship is shown in Figure 2.

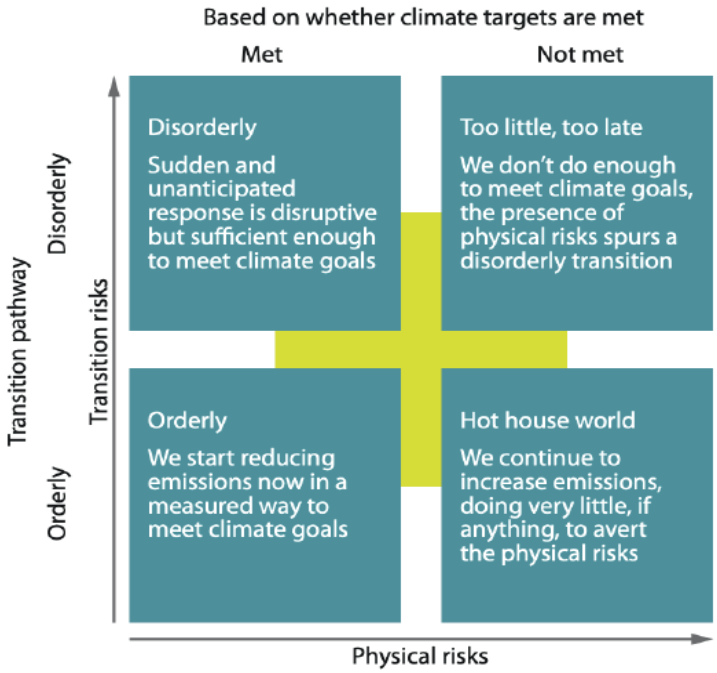


Figure 2: Climate change brings with it physical and transition risks. These are the climate scenarios adopted for New Zealand climate risk reporting with a description of how they can lead to transition and physical risks (NGFS, 2019).

Cognisant of these risks, the Buller District Council has committed to Climate Change Adaptation as part of its Long-term Plan (2021-2031). The LTP 2021 – 2031 adopts the following approaches or principles, which will guide the adaptation planning process:

1. Use science to build scenarios for communities across the district to identify the key climate change related impacts, the likelihood of these occurring, and issue-specific response options
2. Partner with central government, including the Ministry for the Environment, the West Coast Regional Council, and scientific agencies to secure the necessary support for the adaptation planning process
3. Collaborate with the West Coast Regional Council and communities to identify the district's significant social, cultural, and economic values that are under threat
4. Use the adaptation planning process to inform Council's future policies and strategies and Te Tai o Poutini Plan.

As with all of Council's strategic projects, a partnership approach with Ngāti Waewae will be used to ensure cultural considerations, including Te Ao Māori and Mātauranga Māori, are incorporated at every stage of the planning process.

An impact consideration for the adaptation process and further highlighting the importance of proactive planning is the district's socioeconomic profile. At the time of the 2018 census, there were almost 10,000 people living within the district. The median income was $22,900 compared to $31,800 nationally. Almost 25% of the population were older than 65 and less than 13% were aged between 15 and 29. Understanding the needs and vulnerabilities of the community is an important part of the adaptation process.

This report presents the findings of the 'first-pass' risk assessment, which is the third stage of Buller's Climate Adaptation Programme and is the first step to understanding and managing physical climate risks. This is a key step in the overall project to assess climate change risk for the district and develop adaptation plans as detailed in Figure 3.

The key objectives of this first-pass risk assessment are to:

1. Identify the climate-influenced hazards and scenarios that need to be developed to comprehensively understand the Buller District's risk profile (Stage 4).
2. Identify potential risks and opportunities for the Buller District as a result of climate change.
3. Identify elements (assets, taonga, people, and places) that serve as indicators of these risks in the Buller District.

Note that this risk identification is largely limited to physical risks. Transition risks will be considered in later stages of the programme.

The outputs of this first pass are enablers for a hazard assessment (Stage 4) and comprehensive risk analysis and prioritisation (Stage 5 and 6). The comprehensive risk analysis will then be used to inform climate adaptation planning (Stage 7) and wider risk-informed asset management and strategic land-use planning. Ultimately, this process will prepare the district for the changes, enabling the community to become more resilient, sustainable, and well-positioned to take advantage of opportunities that will arise from the transition.

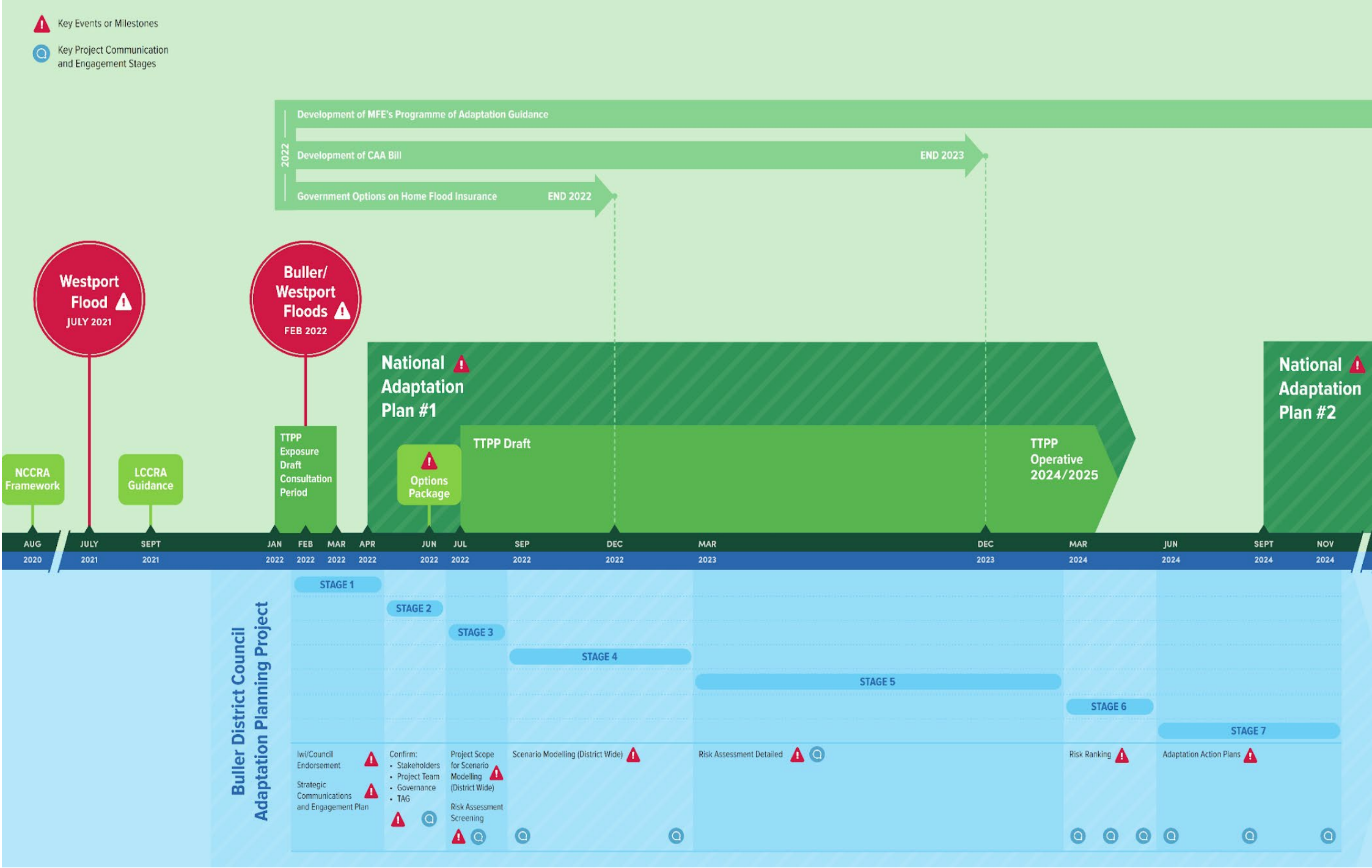


Figure 3: Stages of the Buller District's Climate Adaptation Planning Programme.

Climate risk is uniquely complicated because uncertainty is so inherent, the consequences are highly interdependent across societal domains, and both the uncertainty and consequence vary over time and space. To address this and avoid path dependencies, the comprehensive risk assessment will evaluate consequences and uncertainty over a range of climate scenarios and timeframes, enabling adaptive decision making. It will also consider the risk to six societal wellbeing domains (built, natural, human, Kaupapa Māori economic, and governance), so that adaptive actions can be evaluated for co-benefits and trade-offs.

The overarching objective is to enable climate resilient decisions and development for the benefit of the whole district. Climate resilient development, and the risk from climate change, is the result of cumulative societal choices and actions in multiple areas, Figure 4 (Pörtner et al., 2022). Embedding risk-informed and adaptive decision making throughout Council processes are therefore essential for tackling system-wide challenges like climate change.

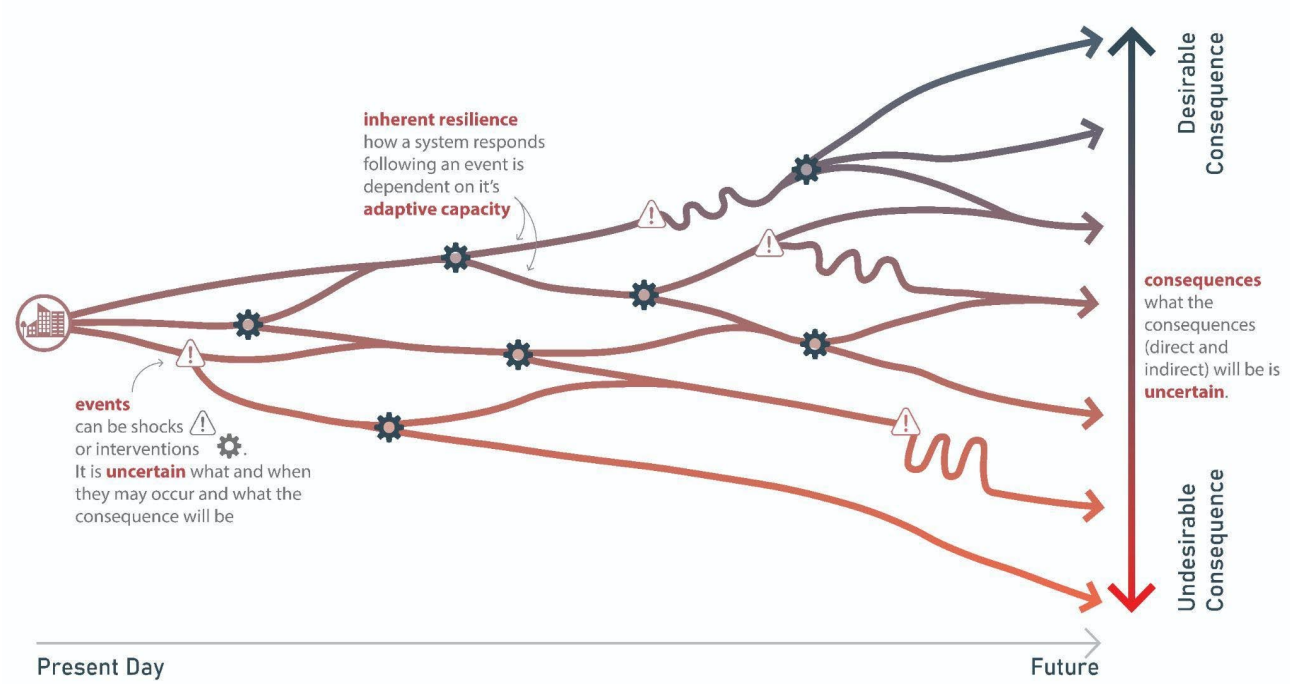


Figure 4: Climate change risk is changing over time and is the product of cumulative societal decisions and other events that lead to consequences (positive and negative). Source: Logan et al. (2022).

This system-wide complexity and interconnectedness of climate risk makes a first-pass assessment necessary. The first-pass assessment provides a qualitative understanding of the local values, related elements, hazards, and dependencies that need to be considered within the subsequent comprehensive assessment of risk. This is consistent with the ISO31000 guidance for risk assessment and the National Climate Change Risk Assessment and the Ministry for the Environment's Guidance for Local Climate Risk Assessment (Ministry for the Environment, 2020, 2021).

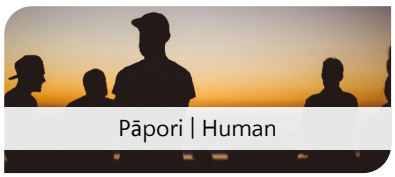
2. First-pass risk assessment framework and approach | Nga aromatawai mōrearea

2.1 Framework and risk domains

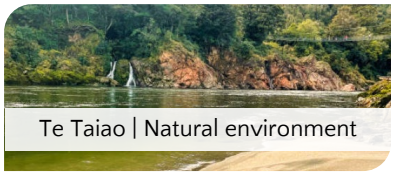
To adapt to climate change, it is necessary to understand what could be affected and how it might be affected. That is, we need to understand the risk. The most general definition of risk is the consequences (positive and negative) of an activity and associated uncertainties (SRA, 2015). Therefore, to understand risk, it is important to evaluate the consequences arising from potential future climate scenarios.

RISK:
The outcomes (positive and negative) of an activity and associated uncertainties.

Consequences are considered in terms of what people value. Therefore, the first step, and the objective of this first-pass assessment, is to identify the **elements** (assets, taonga, people, places) that should be considered in the risk assessment. We evaluate the potential risk to six wellbeing **domains**, modified from the National Climate Change Risk Assessment, Treasury's Living Standards Framework, and He huringa āhuarangi, he huringa ao (Awatere et al., 2021; Ministry for the Environment, 2020; The Treasury, 2021): the Human, Built environment, Natural environment, Kaupapa Māori, Economic, and Governance domains.


Pāpori | Human


Taiao Hanga | Built environment


Te Taiao | Natural environment


Kaupapa Māori

Ohaoha | Economic


Mana Whakahaere | Governance

The Kaupapa Māori domain was proposed, in recognition of the partnership with Tangata Whenua, in order to specifically consider and identify concerns of and opportunities for Māori. These risks also appear in the other value domains due to their interconnected nature.

Risk categories within each of these value domains are referred to as **subdomains**. For example, "Risk to transportation" is a subdomain of the Built Environment domain. Risk to transportation arises due to risk to relevant elements such as roading and community isolation. Through the workshops, these six value domains, subdomain risks, and relevant elements were tested and further developed with local stakeholders and technical specialists.

Consequences will be rigorously assessed through the detailed risk assessment in Stage 5 of Buller's Climate Adaptation Programme. This will include, for all elements to all **hazards**, an analysis of **exposure**, **vulnerability**, and **criticality**. Due to the uncertainty inherent in climatic change and impacts, these consequences will be assessed under different climate conditions (scenarios), enabling adaptive management. Additionally, in the detailed assessment, the strength of the underlying evidence will be assessed to provide further nuance to decision-makers.

2.2 Approach to engagement

Consequences are a key aspect of climate risk and these are considered in terms of what the community values. A bottom-up approach has been used to identify and define these values.

A series of engagement activities, including hui, korero and awheawhe (gatherings, discussions and workshops), were undertaken with key community stakeholders and subject experts. Engagement focused on whakawhanaungatanga (the process of building relationships) to create reciprocal relationships, which foster a long-term connection between stakeholders. These engagement activities were structured around the domains identified in Section 2.1 and provide a 'first-pass,' high-level identification of community values, climate-influenced hazards, and potentially 'at-risk' elements.

A range of stakeholders were engaged in these activities from the following organisations:

- Buller District Council
- Ngāti Waewae
- Buller Electricity Limited
- Waka Kotahi
- National Emergency Management Agency
- Aged Concern
- Flood Recovery Navigator Service
- Home Builders
- West Coast District Health Board
- Department of Conservation
- The Nature Conservancy
- Bathurst Resources Limited
- Development West Coast
- Department of Internal Affairs
- Ministry of Business, Innovation and Employment
- KiwiRail
- Chorus
- New Zealand Lifelines

A full list of attending and invited stakeholders can be found in Appendix A.

Stakeholders clearly recognised the enormous impact that climate change may have on the Buller District. Appendix B illustrates the array of impacts as recognised by workshop participants over the next 50 years.

Hui and korero with local hapū are essential for representing Tangata Whenua and enabling valuable reciprocal and holistic discussions which benefit all parties. It is important to note that Te Tiriti o Waitangi values are upheld by these korero, relationships are also founded, and people are empowered through mutual connections. A further engagement with Ngāti Waewae, Mana Whenua of the district, is currently in the planning phase which will enable the next stages of this programme to:

- Identify and understanding local Tikanga Māori.
- Understand the interconnectivity of Te Āo Māori.
- Identify significant local taonga (treasures).
- Understand how Mātauranga Māori, Te Āo Māori, and Tikanga Māori can be represented by a CCRA.

3. Summary of climate change and climate-influenced hazards for the Buller District | Nga hua o te huringa o te rangi ki Kawatiri

3.1 Climate Change

While climate change is often seen as a distant or future problem, New Zealand and the Buller District are already experiencing the effects. Notably, global annual temperatures have increased by over 1°C in the last century, oceans have risen by 19cm (between 1901-2010), and the frequency and intensity of storms have increased (Ministry for the Environment, 2020). These changes in our climate pose risks to our communities, values and way of life.

Anthropogenic greenhouse gas (GHG) emissions are driving global climate change. This trend is due to Earth receiving more incoming energy from the sun than it radiates back into space, known as climate forcing, due to GHGs insulating the atmosphere. This results in a net gain of energy, which in turn causes warming and risks a series of cascading consequences.

Continued emissions of GHGs will cause further warming and future emissions are highly uncertain. To reflect this uncertainty, the Intergovernmental Panel on Climate Change (IPCC) defined five Shared Socioeconomic Pathways (SSPs) for a range of GHG emission scenarios and predicted climate forcings (Pörtner et al., 2022). These SSPs replace the formerly used Representative Concentration Pathways (RCPs) by capturing socioeconomic drivers and potential emission reduction scenarios. These SSPs provide modelled trajectories for a range of emission scenarios, ranging from SSP1 (the sustainable approach), a 'dramatic emissions reduction scenario' to SSP5 (fossil-fuelled development), a 'steady increase in emission scenario'. Each scenario is correlated to a radiative/climate forcing or change in energy flux in the atmosphere: SSP1-**1.9**, SSP1-**2.6**, SSP2-**4.5**, SSP3-**7.0** and SSP5-**8.5**. For example, Figure 5 shows predicted carbon dioxide emissions for the various scenarios until the end of the century (2100). This uncertainty in the future climate means that communities around the world must embrace adaptive and risk-informed planning if they are to avoid ineffective or detrimental action.

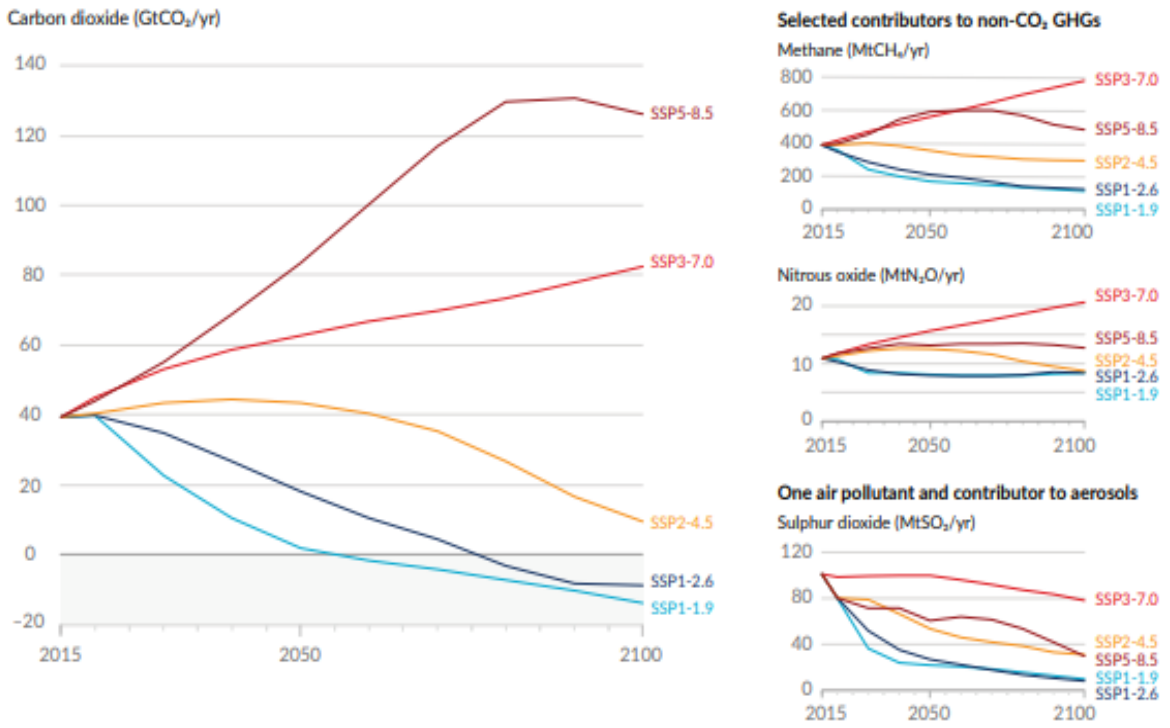


Figure 5: Future annual emissions of CO_2 (left) and of a subset of key non-CO_2 drivers (right), across five illustrative emission scenarios (SSPs) (Masson-Delmotte et al., 2021).

In New Zealand, the average annual temperature increased by 1.1°C between 1910 and 2020 and scenarios forecast by the IPCC range from a further 0.1°C to 4.6°C warming by 2090-2100. According to New Zealand climate researchers, the most likely scenario for New Zealand is an increase between 0.7-3.0°C (Bodeker et al., 2022; Hennessy et al., 2022; Pörtner et al., 2022). Figure 6 shows the predicted range of global temperature variability since 1950, demonstrating a positive trend that is expected to continue under both the SSP2 and SSP5 scenarios until at least the turn of the century. These rising temperatures exacerbate storm intensity, heat waves, rising sea levels, rainfall extremes, melting glaciers and warming oceans.

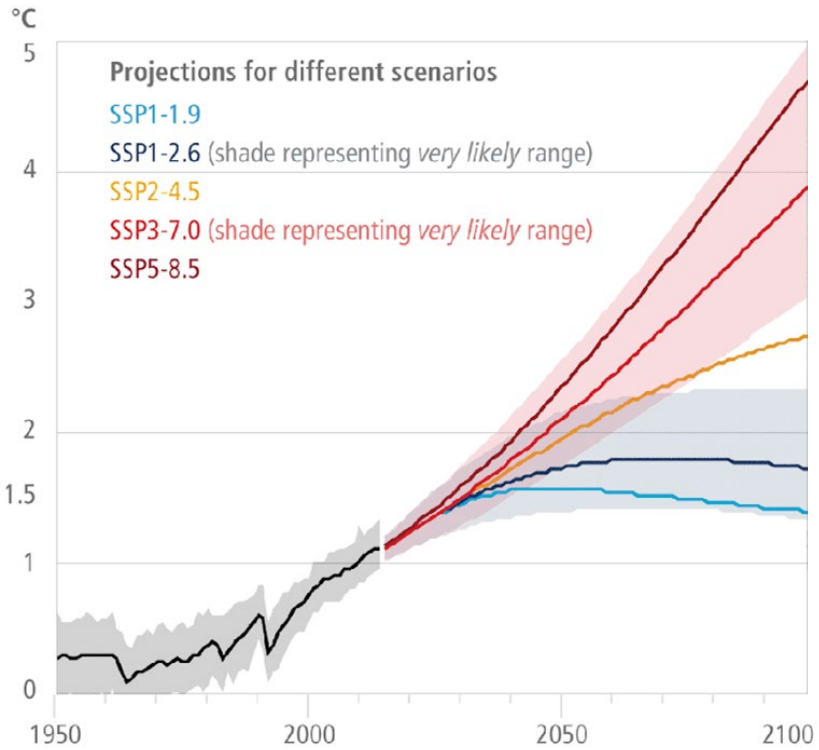


Figure 6: Global surface temperature change (relative to 1850-1900) for different emission scenarios (SSPs) (Pörtner et al., 2022).

3.2 Climate-Influenced Hazards

Sea level rise

Sea level rise (SLR) is the relative increase in sea level due to both climate change and vertical land movement (VLM). Warming global temperatures are the primary driver of sea level rise. As temperatures increase, terrestrial ice melts and thermal expansion of the ocean occurs.

Sea level rise in the Buller District

Buller District has a long coastline; therefore, Buller is highly exposed to SLR. The rate and extent of SLR at a local level is highly uncertain, compounded further by uncertainty in VLM. By 2100 Westport could experience between 0.5m and 1.2m of sea level rise, under SSP2-4.5 and SSP5-8.5, respectively, Figure 7 (NZ SeaRise Maps, 2022).

Impacts of sea level rise

While sea level rise alone has the potential to have substantial consequences on coastal areas, it exacerbates other hazards, including extreme weather events, coastal flooding, and coastal erosion.

SLR is expected to increase the frequency of equivalent impact events. For example, 30cm of SLR in Auckland will result in current day 1 in 100-year high water events occurring once in every 4 years; In Christchurch and Wellington the 1 in 100-year current day equivalent event is expected to occur every year at 30cm of SLR (Lawrence et al., 2021). It can be expected that the Buller District will also experience increases.

Data currently available for the Buller District

NZ SeaRise has data for predicted sea level rise and vertical land movement at 2 km intervals around the coast. The sea-level rise predictions are based on SSP's 1-1.9, 1-2.6, 2-4.5, 3-7.0, and, 5-8.5 (NZ SeaRise Maps, 2022).

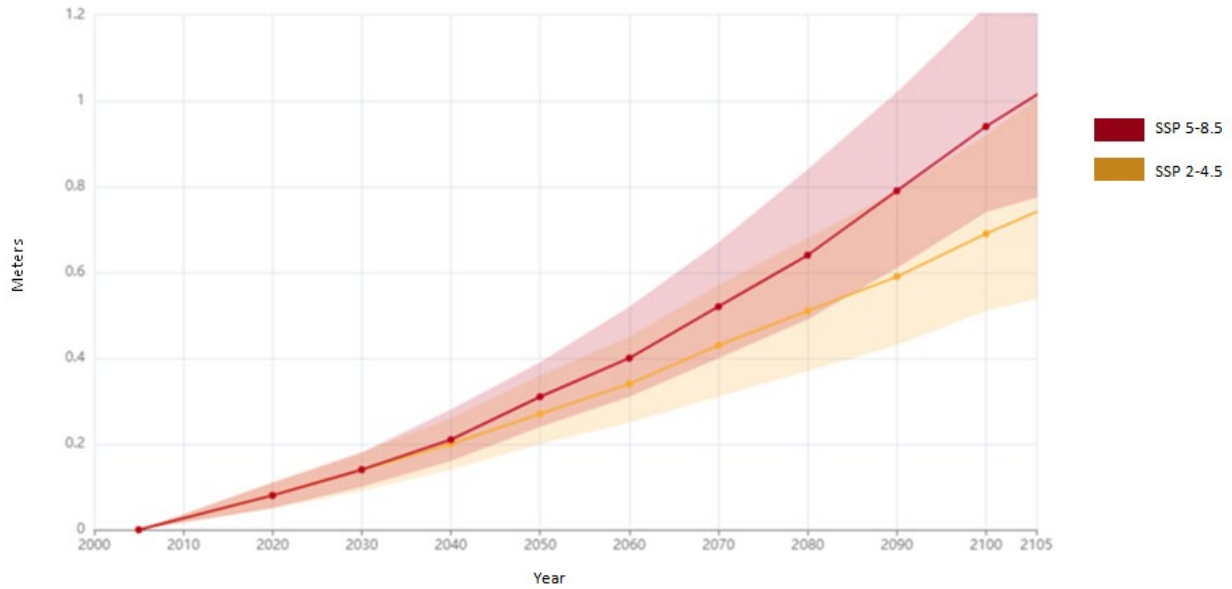


Figure 7: SLR projections including vertical land movement in Westport (NZ SeaRise Maps, 2022).

Coastal flooding

Coastal flooding is the inundation of coastal land by sea water. This can occur due to perigean spring tides (king tides), coastal storm surges, or wave set up (the rising of the mean sea-level in the surf zone). Coastal flooding becomes even more likely when these events occur simultaneously. Sea level rise exacerbates coastal flooding by increasing the baseline sea level (NIWA, n.d).

Coastal flooding in the Buller District

Coastal flooding will be exacerbated due to rising sea levels increasing frequency and intensity.

Sea levels are predicted to increase by 0.3-1.2m by 2100 (various SSP scenarios) as well as storm surges by 1-5% (Bell et al., 2016; Kopp et al., 2014; Pörtner et al., 2022).

Impacts of coastal flooding

There is the potential for a significant proportion of the coastal area and population of the region to be impacted due to the proximity of assets to the coastline (Figure 8).

The percentage of properties in the Buller District exposed to a coastal flood is expected to increase from ≈ 10% to 15-25% by 2060 and 20-30% by 2100 (Figure 8). Properties that are not directly exposed may experience isolation. The percentage of properties that may be isolated due to flooding and road damage could be as high as 60% by 2120. Coastal flooding has wide cascading impacts for communities, tourism, and the district's economy.

Coastal flooding can cause large erosion events where meters of coastline can be lost. Coastal roads may be closed or become hazardous during these events. Stormwater and drainage networks may become overwhelmed.

Pastures damage can occur due to salt burn. This has a prolonged effect taking up to a year for pasture to recover. Reducing the capacity for land to be used productively.

Data currently available for the Buller District

The West Coast Regional Council (WCRC) commissioned coastal inundation modelling for 20cm increments of SLR up to 2m and an ARI 100 storm event. The Te Tai o Poutini Plan (TTPP) includes this data in the form of "Coastal Alert" and "Coastal Severe" overlays indicative of the severity of threat to different areas. The TTPP also has "Coastal Setback" overlay showing areas that may be at risk but modelling has not been undertaken. These maps will be updated when the updated LIDAR becomes available.

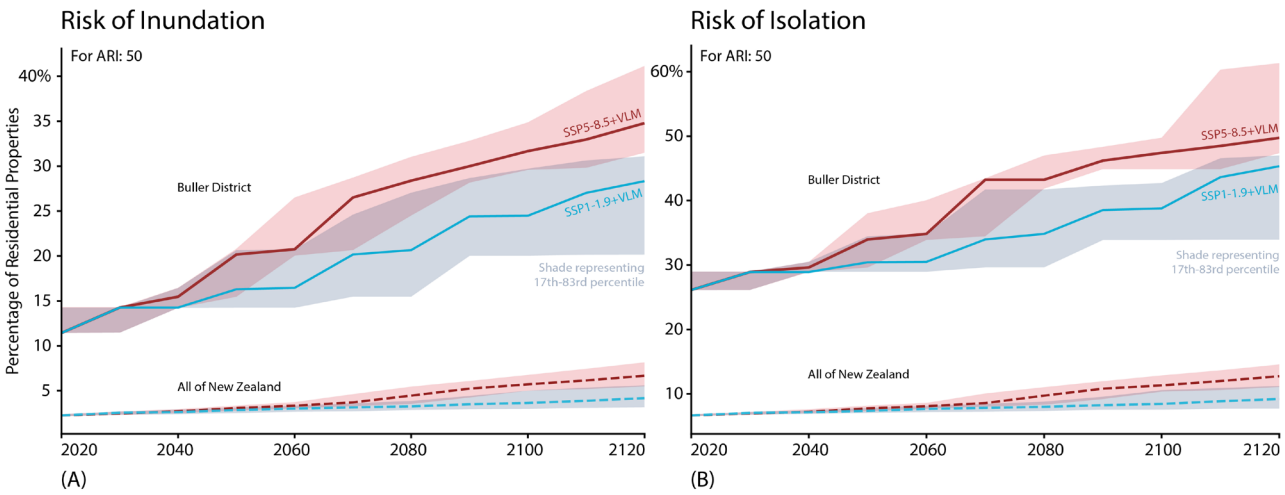


Figure 8: The percentage of residents at risk from inundation and isolation as a result of coastal flooding and how this risk changes over time under different emission scenarios. Risk of inundation refers to the potential of a property being flooded. Risk of isolation is the potential for the property to be cut-off due to flooding on roads, making them impassable. This could lead to longer-term damage and isolation. These results do not include any planned defensive infrastructure and only include coastal flooding. (Source: Logan et al. 2022 based on coastal flood maps from NIWA (2021)).

Coastal erosion

Coastal erosion is the loss of land along a coastal area. Coastal erosion takes on many forms, including beach erosion, erosion of beach barriers (including dunes), river mouth migration, and river mouth extension. Key drivers of coastal erosion include wave-action, tides, currents, wind-driven water, sea level rise, and other impacts of storms.

Coastal erosion in the Buller District

The effects of coastal erosion can be witnessed in areas along Buller's coastline already (Figure 9), however, climate change will increase the rate and extent of coastal erosion (Ministry for the Environment 2001, Ministry for the Environment, 2020).

Erosive patterns along Buller's coastline will significantly increase with rising sea levels and intensified storm surges (Ministry for the Environment, 2020; Rouse et al., 2017).

The severity and timescale of coastal erosion in the Buller District are relatively unknown, however, it is predicted that in Australasia erosion rates may increase by up to 60% (Lawrence et al., 2021).

Impacts of coastal erosion

With a significant proportion of the Buller District's assets located along its 150km of coastline, coastal erosion poses a significant threat to a wide range of assets.

Many of Buller's communities are located on or near the coast. As the sea encroaches these communities are at risk from damage, isolation, insurance retreat, and property value loss.

A significant length of SH6 runs along the coast. It is highly exposed to coastal erosion and may be prone to washouts and closures.

Erosion rate and scale can alter coastal cycles of accretion and erosion, coastal sediment down-drift. This has ramification for ecological environments.

Data currently available for the Buller District

The TTPP has a "Coastal Severe" overlay that includes modelled risk from erosion. NIWA has investigated 13 coastal hazard areas and their potential for erosion (Measures & Rouse 2012). These are also currently being updated.

Figure 9: Coastal erosion at Carters Beach in 2003 (left) and 2019 (right) (Google Earth Pro 2003 and 2019).

Tsunami

Tsunamis are a series of extremely long waves that gather height/amplitude as they move into shallower and shallower water. The cause of a tsunami is often a large and sudden displacement of water in the ocean or a lake, usually resulting from an earthquake or volcanic eruption below or near the ocean/lake floor. These are exacerbated by high sea levels.

Tsunami in the Buller District

Buller District's position on the western coast of the South Island shields it from far-field tsunami, thus the risk from these types of tsunamis is low (Buller District Council., 2006). Tsunamis due to local events are possible, as seen during the 1913 Westport earthquake which resulted in a 1.5m high wave (Buller District Council., 2006)

The intensity of tsunamis is predicted to increase with sea level rise. With 0.5m of sea level rise, tsunami intensity may increase by up to 50% (Li et al., 2018). However, the direct implication of tsunami risk with sea level rise in the Buller District are undescribed at this time.

A significant tsunami in Buller is unlikely to occur due to an alpine fault rupture (Orchiston et al., 2016). Localised tsunami events may occur as a result of offshore aftershocks.

Impacts of tsunami

A large proportion of the Buller District's population and assets are located in low lying coastal areas and therefore exposed to tsunami hazard, a risk that will increase with rising sea levels.

Modelling of a tsunami event in Karamea suggests that the airport north of Karamea, state highway 67 between Karamea and Little Wanganui substation, and the substation at Kongahu is likely to be inundated. This will impact access to the town and electricity supply to the district.

Modelling for Westport shows significant damage to the boat harbour at the north end of the town is expected. The airport is also expected to experience inundation and damage to the runway.

Data currently available for the Buller District

1-in-500 year tsunami events were modelled for some areas in Buller (Westport and Karamea) but these models excluded effect of SLR on tsunami risk (West Coast Civil Defence Emergency Management Group, 2017). NEMA has also released tsunami evacuation maps (Figure 10) (NEMA n.d.), these maps are based on GNS modelling (Gusman et al. 2020, Leonard et al. 2015). A "Coastal Tsunami" overlay is also available in the TTPP.

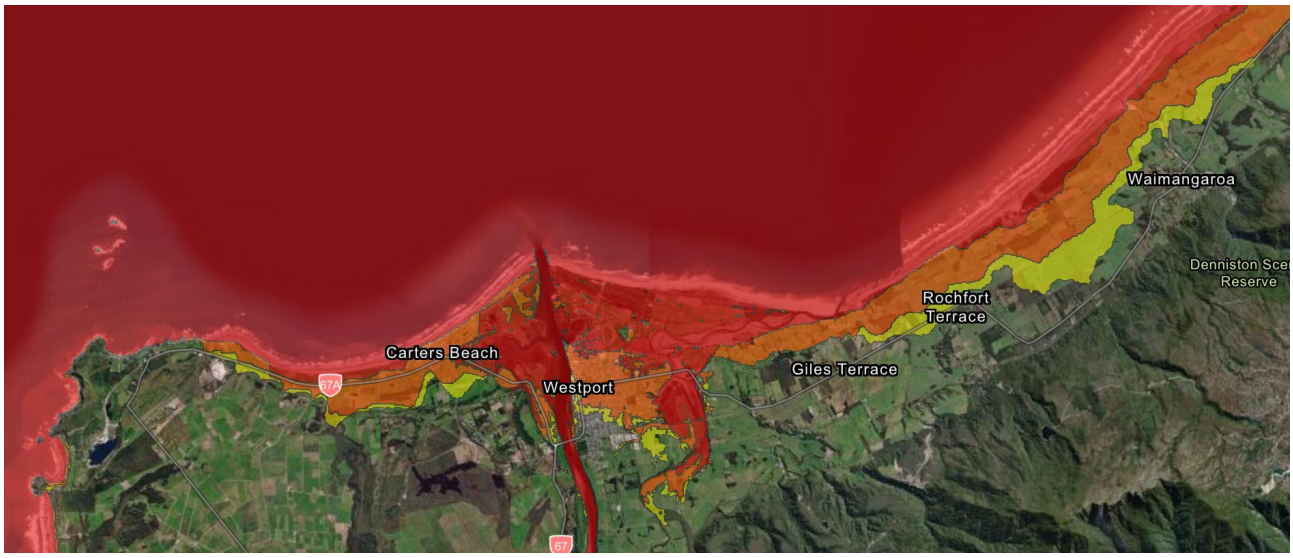


Figure 10: Tsunami evacuation zones (NEMA n.d.).

Groundwater

Groundwater levels and salinity may change due to sea level rise or changes in precipitation in the upper catchment.

Groundwater in the Buller District

Ground water levels can vary due to precipitation, human influences (e.g. ground water extraction), and atmospheric pressure. Sea level rise will also raise coastal water tables (Kumar, 2012).

Impacts of groundwater

High groundwater levels increase the fluvial and pluvial flood risk, reduces agricultural productivity, and exacerbates other hazards.

Shallower ground water can increase the chance of liquefaction during earthquake events.

Increased sea levels may increase groundwater salinity, affecting plants and ecosystems. Salinisation and other types of contamination due to changes in groundwater conditions may impact aquifers Contaminants can rapidly spread within aquifers, making them unsafe to drink without further treatment and negatively impacting those that rely on boreholes for their drinking water.

Higher and more saline groundwater will damage and increase the deterioration rate of buried infrastructure.

Data currently available for the Buller District

Currently, there is no information or analysis to our knowledge about the potential groundwater change and its consequences in the Buller District.

Pluvial (surface water) flooding

Pluvial flooding incorporates two types of flooding: flash flooding and surface water flooding (not river flooding, which is known as fluvial flooding). Pluvial flooding occurs when the inflow of water, generally through intense rain, exceeds the capacity of the ground and/or infrastructure to drain away the water.

Pluvial flooding in the Buller District

Climate change is expected to alter the spatial, temporal and intensity trends of rainfall. During summer and autumn, rainfall in 2090 is expected to remain within 2-5% of 1995 values, but with significant uncertainty (Mullan et al., 2018). Winter rainfall on the West Coast is predicted to increase by 8%-29% by 2090, also relative to 1995 (Ministry for the Environment. 2018).

The combination of increased rainfall intensity and magnitude, rising sea levels and rising water tables are expected to exacerbate the pluvial flood risk in the Buller District (Manning et al., 2015, Zhou et al., 2012).

Impacts of pluvial flooding

Pluvial flooding in the Buller District poses a significant risk to human values and the built environment. If storm water infrastructure becomes overwhelmed due to the large amounts of water, there could be severe impacts for communities.

The direct impacts of flooding can include loss of life, infrastructure, crops, and livestock. This can be devastating to communities as their resources and livelihoods have been destroyed.

Infrastructure like roads can be damaged or flooded reducing the access for emergency services in the short term and tourists and supply lines in the long term.

Data currently available for the Buller District

NIWA has modelled how rainfall will change across the country, but there is no pluvial flood modelling currently available for Buller to our knowledge.

Fluvial (river) flooding

Fluvial flooding is when the amount of water exceeds the capacity of the river. Rainfall in the river's catchment is the primary driver of river flooding in the Buller District. Confinement or alterations of river systems can exacerbate or reduce the extent of a flood.

Fluvial flooding in the Buller District

Fluvial flooding is a substantial risk in the Buller District due to high annual rainfall and main centres constructed around waterways and on natural floodplains.

Similarly, to pluvial flooding, fluvial flood risk is expected to increase in the Buller region. Under an RCP 8.5 (2056-2099) one quarter of people in flood hazard areas on the West Coast can expect a more than 20% increase in mean annual floods, which is higher than any other region (Paulik, Craig, et al., 2019). The flood hazard areas for this study used historic flood and soil profiles to find at-risk areas.

Impacts of fluvial flooding

Fluvial flooding can cause significant damage to infrastructure, the natural environment and humans, as the flow of water can be extremely powerful.

The impacts of fluvial flooding and pluvial flooding are similar, both disrupt access and the local economy as well as potentially damaging property or lead to the loss of life.

Data currently available for the Buller District

The TTPP includes flood modelling for most rivers in the District, with threatened areas categorised as "Flood Severe" and "Flood Susceptibility". These are based on sea-level rise increments of 0, 0.7, and 1m as well as rainfall events with an annual return interval of 50 and 100 years (current day and A1B climate scenarios).

Land slips, debris flows, and falls

Slips, debris flows and falls are mass erosion events, where there is a rapid movement of material. Generally, these occur during rain events but can also occur as a result of earthquakes or undercutting by a river.

Land slips, debris flows, and falls in the Buller District

In the Buller District, climate change is likely to significantly impact erosive processes. Buller's soil is predominantly formed with highly erodible sedimentary material, comprised of podzol and brown soils, with intrusive basement rocks inland (Hewitt, 2010; Rattenbury and Isaac, 2012).

Overall, rainfall intensity on the West Coast is predicted to become more variable, with up to a 29% increase in winter rainfall by the end of the century (Ministry for the Environment. 2018). Higher rainfall intensity and peak river flows also increase erosion, nutrient loads and sediment in waterways, which drives further erosion (Lawrence et al., 2021).

Impacts of land slips, debris flows, and falls

Erosion is predicted to have significant consequences on intense agricultural and sloping land. Erosive processes threaten both coastal and inland environments in the Buller region, with higher potential risk with increasing slope angle. Currently, there is significant risk associated with erosion events, however, changes in precipitation will only increase this.

These mass erosion events can directly impact people and infrastructure removing the material below them, or depositing material on top of them.

Indirect impacts can include landslide damns that impede waterflows to towns or that can burst and send a large amount of water and debris into the flood plains below.

Data currently available for the Buller District

The TTPP has a "Land instability" overlay that identifies land that based on modelling may be susceptible to landslide, debris flow and rockfall. A land slide susceptibility map has also been created for the West Coast Region that has 5 levels of susceptibility and 25 m definition (England, 2022). Changing rainfall patterns are expected to increase the risk from landslides, but no modelling on this has been completed to date.

Extreme wind

Extreme wind events can occur with frontal weather systems, around strong convective storms such as thunderstorms, and ex-tropical cyclones.

Extreme wind in the Buller District

The extreme wind speed in the South Island is expected to increase by up to 10% by 2090 (RCP 8.5) (Lawrence et al., 2021). The frequency of extreme wind events is also expected to increase by 2-5% (Ministry for the Environment. 2018).

Westerly winds will continue to dominate and will likely increase in frequency, especially in winter and spring. Mid-latitude cyclones and other storms are expected to shift poleward, with the potential for a slight reduction in prevalence (Lawrence et al., 2021).

Impacts of extreme wind

While steady wind can be an important resource, strong gusts can damage property, topple trees, and disrupt transportation, communications, and electricity. Changes in extreme wind prevalence and severity may result in significant direct or cascading indirect risk. Extreme winds are often associated with ex-tropical cyclones and frontal weather events, so may have significant capacity to damage infrastructure and exacerbate erosion.

Increased extremely windy days will exacerbate orographic (moist air being forced to rise due to mountains) rainfall related hazards and erosion throughout most of the district. Overall, the direct and indirect implications of climate change driven extreme wind aggravation will be heightened with increasing climate change severity.

Data currently available for the Buller District

NIWA has modelled change in extreme daily wind speed by 2100, but no District specific information is available to our knowledge.

Rising temperatures

The greenhouse effect from carbon dioxide and methane has led to a rise in global average temperatures.

Rising temperatures in the Buller District

The average temperature of the West Coast is expected to increase due to climate change. Up to 1.0˚C of warming is expected by 2040 and as much as 3.0˚C of warming could occur by 2090 (Ministry for the Environment. 2018). Most of this warming will be experienced in summer and autumn (Ministry for the Environment. 2018).

Impacts of rising temperatures

Rising temperatures have geophysical flow on effects, including sea level rise and increased storm frequency and severity. A rise in temperature also will increase the risk from invasive species and vector-borne illnesses, threatening our communities and ecosystems.

Even a subtle change in average temperature can have far-reaching impacts. Ecosystems will change as species migrate to areas that have a more habitable climate. Conditions may become more suitable for invasive species which could adversely affect agriculture, horticulture, and indigenous ecosystems. This increase in temperature could, in some cases, also lead to opportunities for primary production.

Data currently available for the Buller District

A nationwide map of expected temperature rise is available at a 5km resolution for four RCPs until 2100. This data is also available for Westport as a time series for these four RCPS until 2100 (NIWA 2016).

Extreme temperature

Extreme temperatures are typically referring to temperature variations above (extreme heat) normal conditions (Zlatanova, 2014). In the Buller District, climate change is likely to influence local temperatures due to the global warming effect. Warmer temperatures globally will see the emergence of more extreme weather events in New Zealand and the Buller District.

Extreme temperature in the Buller District

By 2090 the West Coast is predicted annually to experience up to 30 more extreme heat days (temperature > 25°C) and 7-18 fewer frost days per year (Ministry for the Environment, 2018). More extreme levels of global temperature rise will result in greater variability and occurrence of local temperatures and temperature extremes (Lawrence et al., 2021).

Changes in albedo (incoming radiation reflected) with changing land cover will significantly influence the prevalence of extreme temperature days.

Impacts of extreme temperatures

While higher temperatures for the Buller District may not pose the risks to life seen in other locations, there are still significant secondary effects such as impacts on productive land-use, native ecosystems, recreational and cultural values. These impacts can have sizable economic, environmental, and social ramifications.

Data currently available for the Buller District

There is data showing the expected number of extreme temperature days (>25 °C) can be found spatial disturbed on a national map with good resolution as well as a time series for Westport (NIWA 2016).

Drought

A drought is when an area or region experiences a relative deficit of rainfall. Droughts are the result of a lack of precipitation or high evaporation (often during summer months), which results in a soil moisture deficit. Although Buller has significant rainfall annually, slight changes in rainfall, wind, or land-use conditions due to climate change could result in relative drought or dry periods in the future.

Drought in the Buller District

The West Coast overall is not likely to see a significant increase in drought conditions. However, the Buller region is exposed to some climate change-driven drought risk, with Cape Foulwind and inland areas (e.g. Springs Junction) potentially experiencing up to a 5% increase in time spent in drought conditions by 2030-2050 and up to 10% by 2070-2090, Figure 11 (Clark et al., 2011). With the more severe SSP scenarios, the frequency, duration and severity of droughts and wildfires will likely be more significant.

Impacts of drought

The impacts of drought are economic, environmental and social. Periods of drought can cause reduced soil moisture and groundwater, which can flow on to result in diminished stream flow, crop damage, and general water shortage. Drought events often have cascading effects for other sectors, such as the agricultural sector, reducing productivity, stock health, and profitability. Buller's reliance on primary industries (39.7% of local GDP) which includes agricultural (≈18% local GDP), exacerbates the potential of drought risk (Development West Coast, 2021). Fire risk, as well as depleted water flow, can also be exacerbated by droughts. Drought can cause problems for hydroelectric power production, for example, at the Buller's Matiri hydroelectric plant.

Data currently available for the Buller District

NIWA has probabilistic projections of droughts at a national scale at 5 km resolution (Clark et al., 2011).

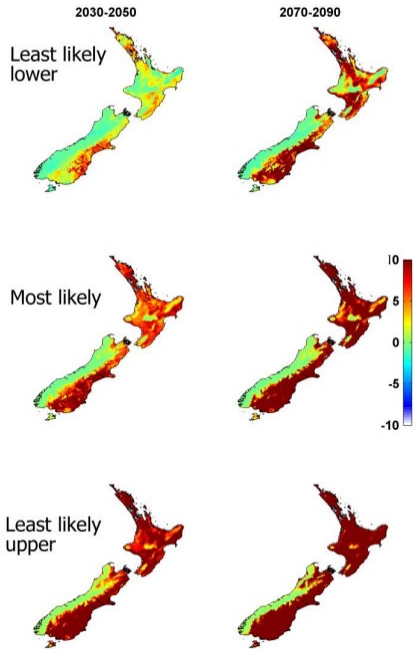


Figure 11: Projected increase in the percentage of time spent in drought from 1980-1999 levels for the A1B emissions scenario" (Clark et al., 2011).

Wildfire

Wildfires are unplanned fires in natural environments such as forests, shrublands and grasslands. Certain conditions increase the risk of wildfires, such as low rainfall, drought, high winds and fuel type (e.g. scrub vs dense forest).

Wildfire in the Buller District

Although Buller District receives some of the highest annual rainfall in New Zealand, it is not immune to fire risk. The West Coast experienced approximately 63 wildfires annually or 2.1% of New Zealand's total wildfires (New Zealand Drought Monitor, 2017).

Due to reduced summer rainfall frequency, the Buller District is likely to experience more frequent drought and fire conditions, especially near Cape Foulwind and inland areas. This is reflected in that current fire conditions are set to become more severe, with the mean length of the wildfire season increasing by two days (67%) across the West Coast by 2080-2095, relative to 2005-2020 (Melia et al., 2022).

Impacts of wildfires

Wildfires pose a significant threat to transportation, essential services, communications and supplies, through potential disruption or damage to infrastructure. They can also result in a decrease in air quality and the destruction of property, resources, natural environments and people.

Data currently available for the Buller District

Fire and Emergency NZ (FENZ) conducted a national wildfire hazard assessment in 2011 at a resolution of 25 metres. The affect of climate change is not included in this assessment.

Marine heatwaves

A marine heatwave is a period of abnormally higher water temperatures relative to the average seasonal water temperature of a particular region of ocean. Oceans absorb a large proportion of the earth's heat, so are highly exposed to temperature changes.

Marine heatwaves in the Buller District

The frequency of marine heatwaves is likely to increase into the next century. As oceans warm around New Zealand, the intensity of marine heatwaves is likely to increase 80-100% by 2100 (Bodeker et al., 2022). Ocean temperature is projected to rise by 1°C by 2045, and 2.5°C by 2090 (SSP5-8.5) (Lawrence et al., 2021).

Impacts of marine heatwaves

Economic activities such as 'Agric Support Services and Hunting', 'Fishing and Aquaculture', and 'Seafood Processing' equate to more than 2% of Buller's GDP (Development West Coast, 2021). A change in marine climate and ecosystems could affect the economic value of Buller's marine-based industries. Marine heatwaves are shown to adversely impact the mortality and spawning of fisheries such as pāua, kōura, as well as a plethora of other species (Lawrence et al., 2021). Changes in marine systems could also affect various Māori (e.g., mahinga kai values) recreational and social values.

Data currently available for the Buller District

National modelling of marine heatwaves with 17 km resolution projected to 2100 has been undertaken (NIWA, 2022).

4. Proposed risk domains and elements | Nga wāhi mōrearea

Risk is assessed across six wellbeing domains, based on the Treasury's Living Standards Framework: Human, Kaupapa Māori, Built, Natural, Economic, and Governance (Table 1). Risks specific to each of these domains are called subdomain risks, e.g. risk to the built environment domain includes risk to transportation and risk to potable water supplies. To assess these subdomain risks, we analyse the exposure and vulnerability of elements and indicators to the climate-influenced hazards. For example, one of the factors to consider when assessing risk to the transportation system is to understand how the state highway network (an element) is affected by coastal flooding (a climate-influenced hazard) under different sea level rise scenarios.

Table 1: The Wellbeing or value domains that will be assessed for their risk from climate change.

Pāpori | Human	Direct and indirect impacts on people.
Taiao hanga | Built environment	Vertical and horizontal infrastructure.
Te taiao | Natural environment	Aspects of the natural environment that support the range of our indigenous species, he kura taiao (living treasures), the ecosystems, and our blue-green infrastructure.
Kaupapa Māori | Cultural	Direct and indirect impacts on Tangata Whenua, and taonga.
Ohaoha | Economy	Set and arrangement of inter-related production, distribution, trade and consumption that allocate resources.
Mana whakahaere | Governance	The governing architecture and processes in and between government and economic and social institutions.

The subdomain risks and the contributing elements can be locally unique. Therefore, workshops were used to test and modify proposed subdomain risks and elements with community leaders and stakeholders. Having identified these elements and subdomains, the necessary data will be collected and the vulnerability assessed in the detailed risk assessment.

This list provides a starting point for the rigorous risk assessment. The subdomains and elements will be continually reviewed, refined, and added to, based on ongoing engagement (with council staff, stakeholders, and through future workshops) and as the understanding of the hazards and cascading risks improves.

4.1 Pāpori | Human

Pāpori, the human domain, reflects how climate change threatens our people and communities. Communities in the Buller District will face a range of hazards and some may have less ability to prepare for, respond to, and recover from these hazards than others. These capacities and community wellbeing is deeply tied into the built and natural environment domains and the subsequent risk assessment will consider indirect and cascading risks. This interconnectedness must be acknowledged when examining human factors (physical and non-physical) that relate to social vulnerability. The factors of social vulnerability that will be considered are explored through three key areas of society:

- Human: People's skills, knowledge, and physical and mental health
- Social: The norms, rules, and institutions of society
- Cultural: The knowledge, heritage, beliefs, arts, morals, laws, and customs of society

Throughout the adaptation planning process, we will engage with communities and provide opportunities to contribute and request information in order to best support those communities.

The proposed subdomains and associated elements are shown in Table 2.

Table 2: Risks to the Human Domain and the associated elements and indicators identified by workshop attendees

Sub Domain Number	Subdomain (Risk)	Elements
H1	Risk to social cohesion and community wellbeing (incl. mental health)	- Cemeteries - Community facilities - Number and demographics of people exposed - Number and demographics of people displaced - Mobility access - Economic index - Political index - Socio-cultural index - Population and demographic change
H2	Risk to physical health from exposure to hazards	- Number and demographics of people exposed - Family harm
H3	Risk of exacerbating and creating inequalities	- Number of Māori exposed - Number of Māori displaced - Number and demographics of people exposed - Number and demographics of people displaced - Availability and cost of housing - Percentage of rental population - Vulnerability (age, deprivation, addiction, health) - Disabled population - Cost of mitigation/retreat
H4	Risks to heritage and culturally significant sites	- Heritage buildings - Marae - Cultural practices - Urupā

Sub Domain Number	Subdomain (Risk)	Elements
		- Pa - Sites of cultural significance - Sites of archaeological significance
H5	Risk to accessing medical care and emergency services	- Health care facilities - Isolation from health care facilities - Disabled population - Capacity of healthcare
H6	Risk to accessing education	- Schools/early childhood education - Isolation from schools - Ability to access basic services (internet, electricity, 3 waters, cellular reception)
H7	Risk to accessing community services	- Community services (town hall, libraries, etc.) - Isolation from community services - Resourcing community services
H8	Risk to accessing food/resources	- Supermarkets - Isolation from supermarkets - Effects on community gardens/ ability to grow their own food. - Power, food, water, cooking - Getting together/meeting
H9	Risk to recreation	- Access to recreational sites - State/availability of recreational sites - Risks to recreational facilities, huts, tracks
H10	Risk to communications	- Telecommunications infrastructure - Residential internet access
H11	Risks to homes and personal assets	- Homes - Investments - Personal possessions

4.2 Taiao hanga | Built environment

Taiao hanga, the built environment domain, focuses on physical infrastructure and assets such as housing, transport, drinking water, waste and stormwater, energy and communications, landfills and coastal defences. The built environment is critical for human activities, supporting our communities and connecting people locally, nationally and internationally. Built assets support communities and are therefore intrinsically connected to the human domain as they provide shelter, drinking water, electricity to heat and cook with, and the ability to travel around the district.

The proposed subdomains and elements are shown in Table 3.

Table 3: Risks to the Built Environment domain and the associated elements/indicators.

Sub Domain Number	Subdomain	Elements
B1	Risks to potable water supply	- Water supply network pipes, pumps, station - Water supply catchment - Water supply extraction
B2	Risks to buildings (residential, commercial, industrial, and other structures)	- Boat ramps - Boat shed - Port buildings - Commercial buildings and facilities - Industrial properties and facilities - Jetties - Residential buildings - Community buildings - Tourism buildings - Accommodation - Hospital and emergency operating centres - Farm processing sites
B3	Risk to landfills and contaminated sites	- Contaminated sites - Landfills - Factories (e.g. cement factory) - Roads (material dependent) - Inactive storage tanks - Transfer stations
B4	Risk to wastewater and stormwater	- Coastal hazard defences - Riverine flooding defences - Septic tanks - Stormwater network pipes, pumps - Wastewater network pipes, pumps, stations, treatment plants
B5	Risk to transportation	- Bridges - Cycleways - Public roads - Railways - Service stations - State highways - Walkways/trails - Airport - Port - Isolation - Connectivity - Carparks
B6	Risk to electricity, energy and communications	- Electricity infrastructure - Gas infrastructure - Mobile towers - Service stations - Storage tanks

4.3 Te taiao | Natural environment

Te taiao, the natural environment domain (Table 4), reflects the risk of climate change on native and exotic flora, fauna and ecosystems on land and in freshwater and marine environments. This includes the implications for te whenua (the land), wai (water), te āhuarangi (the climate) and koiora (all living communities). As well as native and exotic ecosystems and flora and fauna, this domain includes green and blue infrastructure. The indigenous habitats that cover the district are he kura taiao (living treasures); they hold great ecological, cultural, and social significance.

Table 4: Risks to the Natural domain and the associated elements/indicators

Sub Domain Number	Subdomain	Elements
N1	Risks to indigenous terrestrial ecosystems and organisms	- Sites of ecological significance - Contaminated Sites - Landfills - Change in indigenous populations (diversity) - Mahinga kai (populations + access) - Cultural taonga and resources
N2	Risks to indigenous marine ecosystems and organisms	- Sites of ecological significance - Contaminated Sites - Landfills - Change in indigenous populations (diversity) - Mahinga kai (populations + access) - Cultural taonga and resources
N3	Risks to indigenous freshwater ecosystems and organisms	- Sites of ecological significance - Contaminated Sites - Landfills - Change in indigenous populations (diversity) - Mahinga kai (populations + access) - Cultural taonga and resources
N4	Risks to exotic ecosystems and species	- Sites of ecological significance - Sites with pest species - Sites with frequent international arrivals - Change in climate (e.g. alpine) - Connectivity of ecosystems
N5	Risks to parks and blue-green infrastructure	- Cemeteries - Parks, reserves, and sports fields - Community planting - Funding
N6	Risks to endangered species	- Sites of native species - Sites of endemic species - Number/distribution of native species
N7	Risks to natural structures, formations, and/or regimes (e.g. river channels)	- River formations and structures - Engineered structures - River beds
N8	Use of natural sites/recreation sites	- Access to sites - Number of opportunities
N9	Risk to mahinga kai and cultural resources	- Species diversity and population health - Access to resources and sites

4.4 Kaupapa Māori

The Kaupapa Māori domain is proposed to assess risk to Tangata Whenua, Māori communities, and Māori values. Further korero with Ngāti Waewae needs to be undertaken to determine the presentation of these risks as they are interconnected with the other domains. Kaupapa Māori refers to the collective vision, purpose and aspirations of Māori communities and Tangata Whenua. Thus, Kaupapa Māori encapsulates a more holistic, values-based perception of our environment, recognising the mauri (life force), mana (spiritual power/connectivity) and interconnectedness of all taonga (treasures) as per Te Ao Māori (a Māori worldview). Within the Kaupapa Māori domain, the interconnectedness of taonga (both physical and non-physical), the perspectives of Tangata Whenua, and Te Ao Māori will be considered throughout the adaptation planning process to ensure the outcomes align with and enhance these values.

The proposed subdomains and associated elements are shown in Table 5; these proposals are pending further engagement with Ngāti Waewae.

Table 5: Proposed risks to the Kaupapa Māori domain and the proposed associated elements/indicators

Sub Domain Number	Sub Domain	Elements
K1	Risks to Māori social and cultural wellbeing	- Cemeteries - Number of Māori displaced - Number of Māori exposed - Marae - Community facilities - Access to taonga - Ability for Māori customs to be undertaken - Financial abilities of Māori communities
K2	Risks to waiora - wellbeing/health	- Cemeteries - Marae - Impacts on te wai (the water) - Isolation from to taonga sites - Access to essential services - Access to community services - Access to kai/kai moana - Quality of life - Physical injury/mental health
K3	Risks to Māori cultural sites	- Marae - Pa - Wāhi taonga - Culturally significant sites - Archaeological sites of significance
K4	Risks to mahinga kai species and collection	- Sites of ecological significance - Number/amount of significant mahinga kai species affected - Number/amount of mahinga kai sites affected - Access to mahinga kai sites
K5	Risks to locality of Tangata Whenua	- Number of Māori affected/displaced

Sub Domain Number	Sub Domain	Elements
		- Connections between Māori communities and significant sites/other areas
K6	Risks to mauri, wairua and adaptive capacity	- Economic/Financial placement - Physical/Mental health - Cohesion of Māori communities - Access to sites of tapu - Environmental degradation
K7	Risks to Māori/Tangata Whenua autonomy/Te Tiriti rights	- Rights to access taonga - Rights under Te Tiriti - Autonomy of Māori people - Preservation of Māori culture, beliefs, and ideologies

4.5 Ohaoha | Economic

Ohaoha, the economic domain, encompasses the businesses, industries, and other drivers that contribute to the economic wellbeing and livelihoods of the communities within the district (Table 6). Risks to the built, natural, and human domains have the potential to cascade and disrupt economic activity.

Table 6: Risks to the Economic domain and the associated elements/indicators

Sub Domain Number	Sub Domain	Elements
E1	Risk of insufficient local government income/excess expenditure	- Rating base - Money spent on emergency operations - Money spent on recovery operations - Insurance costs or coverage - Central government support
E2	Risk of overall financial system (e.g. banks) instability	- Financial institutions performance - Credit/fund availability (business and homeowner)
E3	Risk to land-based primary sector viability	- Operating profit per hectare - Hectares of productive land - Months of production - Regional accessibility - Skilled workforce availability
E4	Risk to tourism sector viability	- Accessibility of key attractions, cycleways, and tracks - Number of hospitality venues - Number of tourism operators - Labour availability
E5	Risk to fisheries sector viability	- Fish stocks - Wharf and port functionality - Regional accessibility - Labour availability
E6	Risks to the insurability of assets	- Accessibility to insurance (availability and affordability) - Equity of access to insurance

Sub Domain Number	Sub Domain	Elements
E7	Risks to productivity due to supply chain and distribution system disruptions	– Roads, Bridges – Warehouses – Port – Airport – Railway line
E8	Risk to exacerbating economic inequality	– Income disparity – Deprivation – Economic diversity
E9	Risk to mineral sector	– Quantity of rare earth minerals – Availability of skilled workers – Profit per hectare – Accessibility to sites
E10	Risk to new industries (in particular technology)	– Internet access – Liveability/lifestyle – Reputation

4.6 Mana whakahaere | Governance

Mana Whakahaere, governance, is the steering architecture and processes of interaction and decision-making that exists in and between local and central government, and economic and social institutions. That is, it is the relationships between, coordination mechanisms for, and processes undertaken by the state, market and civil society to address collective issues (Driessen et al., 2012; Lange et al., 2013). Governance permeates all aspects of New Zealand, from the Treaty partnership between Māori and the Government (the Crown) to the relationship between local government and communities, from the economy to the built environment and natural ecosystems.

The proposed subdomains and risk indicators/elements are shown in Table 7.

Table 7: Risks to the Governance domain and the associated elements/indicators

Sub Domain Number	Sub Domain	Elements
G1	Risk of maladaptation due to processes not accounting for uncertainty and long-term change	– Guidance on infrastructure design and planning under uncertainty – Suitability of regulations (e.g. building code) to cope with climate change
G2	Risk that climate adaptation is not supported by institutions, processes, funding mechanisms	– Financial and guidance support from central government – Regional government support and collaboration – Planning process timeframes
G3	Risk of increased litigation	– Community discontentment – Transparent decision processes
G4	Risk of breaching Treaty obligations	– Community tolerance – Capacity of local iwi to support adaptation
G5	Risk of maladaptation due to knowledge and capacity gaps	– Skilled workforce – Higher education levels
G6	Risk that EM system will not adequately respond	– Funding for EM system – Skilled workforce

Sub Domain Number	Sub Domain	Elements
G7	Risk of doing nothing as elected members cannot agree or are not engaged in climate-hazard challenges	– Democratic process
G8	Risk of failure to follow democratic process due to frequency and scale of impacts	– Submissions to Council on LTP etc. – Staff numbers – Local government finance
G9	Risk of path dependency / sunk cost fallacy	– Money invested in 'hard' interventions
G10	Risk of loss of community trust and buy-in	– Guidance on infrastructure design and planning under uncertainty – Suitability of regulations (e.g. building code) to cope with climate change

5. Opportunities | Whai wāhitanga

While the previous section focused on adverse risk, there is also the potential for opportunities arising from climate change impacts and our response to these. The engagement process also sought to identify these opportunities, which are presented in Table 8. These opportunities are specific to the Buller District. Although they have not been explored in detail, recognising the potential pathways is a step towards building a climate change resilient community.

Table 8: Opportunities identified within each domain

Domain	Opportunities
Pāpori | Human	• Opportunity for creative planning • Opportunity for growth • Opportunity for community health growth • Opportunity for Māori engagement and leadership • Opportunity for Pākehā and Māori collaboration and mutual understanding • Opportunity for coordinated community adaptation strategies • Opportunity to develop cultural and community support/engagement centres • Opportunity to improve local services and community (e.g., healthcare) • Opportunity to build safer and more healthy housing • Opportunity for technological advancement
Taiao hanga | Built environment	• Opportunity to lead the national conversation around the climate transition • Opportunity to present ourselves as a top desirable location • Opportunity for master planning: where and what does the future look like • Opportunity for sustainable development through risk management • Opportunity to build future infrastructure's resilience to hazards • Opportunity to rethink blue green infrastructure • Opportunity to rethink future land use
Te taiao | Natural environment	• Opportunity for co-benefits of wetlands and other natural environments/ecosystems • Opportunity to expand, restore and enhance ecosystems • Opportunity for nature-based solution employment • Opportunity for restoring native - exotic balance • Opportunity to reconnect natural ecosystems • Opportunity for environmental education • Opportunity for sustainable agriculture integration • Opportunity for carbon sequestration
Kaupapa Māori | Cultural	• Opportunity for Pākehā and Māori collaboration and mutual understanding • Opportunity to enhance Māori values across the community • Opportunity to enhance Mahinga Kai
Ohaoha | Economic	• Opportunity for prosperity and creation of industry and jobs from climate mitigation and adaptation strategies • Potential for new industries
Mana Whakahaere | Governance	• Future focused and relevant policy/legislation • Opportunity to increase standards across the board

6. Next steps and recommendations | Nga mahi panuku me nga tohutohu

As shown in Figure 3, this report will be used to support and inform the following project stages:

Stage 4a - Gap analysis

A gap analysis was performed to identify what data is already available at an appropriate scale to undertake a risk assessment for the Buller district,

Stage 4b - Hazard assessment

The hazard assessment is necessary to develop spatial models of the extent and severity of different hazards under different climate scenarios. Existing hazard modelling will be collated and evaluated for its suitability for use in this climate risk assessment; necessary considerations include whether a sufficient range of climate scenarios are modelled and whether the extent encompasses the district. Subsequently, and based on resource availability, hazard modelling will be commissioned from specialist modellers such as NIWA, GNS, Aqualinc, and others. The climate scenarios and data format must be decided and consistent between hazard models for subsequent integration into the risk assessment. In tandem with the hazard assessment, data for the identified elements will be collated. This includes spatial information for infrastructure assets as well as sites of ecological and cultural significance.

Stage 5 and 6 - Risk assessment and prioritisation

The comprehensive risk analysis will utilise the outputs of the Stage 4 hazard assessment as well as the subdomains and associated elements proposed in this report. This stage will be presented as an interactive online tool (Figure 12, Figure 13) that enables an increased understanding and communication of risks within the Buller District. Specifically, this work will integrate both direct and indirect risks, including the consequence, uncertainty (including evidence and strength of knowledge assessments from key stakeholders), criticality and vulnerability.

The Risk Explorer (Figure 12, Figure 13) will include both spatial and temporally varying risk information for each domain, subdomain, and element within the Buller District. This information will enable risk-informed community engagement, adaptation decision-making, asset management, strategic land use planning, and internal and external reporting. Additionally, the nature of the Risk Explorer allows for an iterative yet consistent platform to communicate risk to numerous stakeholders whilst enabling the Buller District Council to update its risk information as new information, data, or research and methods become available.

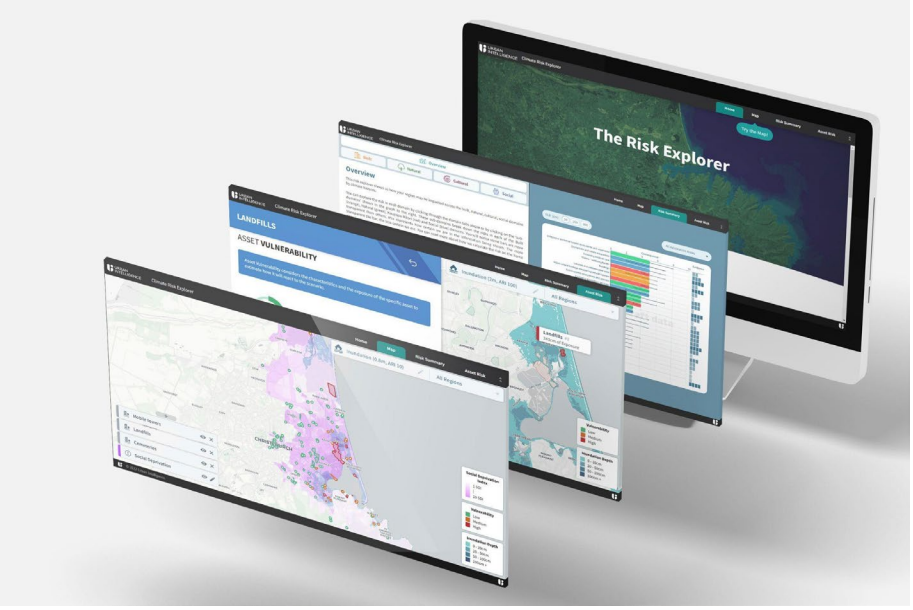


Figure 12: Stage 5 and 6 deliverables, the Risk Explorer, is used to communicate the findings of the detailed risk assessment.

Figure 13: Risk prioritisation: The Risk Explorer includes a ranking of consequences alongside the strength of evidence so that risk can be prioritised and easily reported. This is an example for the Built Environment domain, and the Explorer enables the user to view how this changes for different scenarios considering all of the domains or any single one.

Stage 7 - Adaptation planning

Due to the uncertainty inherent in climate change, decision making must be adaptive. Adaptive management involves flexible planning that recognises that interventions can fail once certain environmental conditions are reached. For example, an X-metre sea wall may only be suitable for less than Y centimetres of sea level rise; as SLR nears Y centimetres, this would signal that a new option is necessary and further increases would trigger a shift in strategy. Several approaches for decision-making under uncertainty are available (Lawrence et al., 2021), and there is ongoing research around the strengths and limitations of each for New Zealand communities.

Adaptive strategies will be combinations of different adaption options. These options are generally categorised as:

Maintain	We continue to live in an area, while increasing the community's risk awareness, environmental monitoring, and smart land-use planning.
Accommodate	We continue to live in an area by raising our tolerance to hazards. This could include adapting our buildings and infrastructure or managing stormwater and groundwater.
Protect	We protect our assets and homes from hazards through natural or engineered interventions such as seawalls or beach renourishment.
Relocate	We support and encourage the community to relocate away from hazardous areas. This involves leadership and signalling from the government through the location of new activity centres such as schools or hospitals (and other investment), and buyout or leaseback schemes to enable homeowners to move.
Avoid	We avoid investing in at-risk areas by using planning tools such as zoning or setbacks.

Once a suite of evaluation options has been identified, they can be evaluated for their risk-reduction effectiveness, cost feasibility, emission-reduction potential, and their impacts (co-benefits or trade-offs) across all of the societal wellbeing domains outlined in Section 2.

Based on the effectiveness and cost feasibility of the options, adaptive pathways must be developed with, not for, the communities. This will involve significant and likely ongoing community engagement. This will be conducted using a diverse group of community and rūnanga representatives from each of the (to be) identified adaptation areas. Some district-wide representation should also be included as well as youth voices where possible. The role of this community group is to provide informed recommendations to the Council on adaptation options that allow the community to respond to changes over time. The engagement in each adaptation area will be supported by a technical advisory group (TAG) that will aid with the creation of adaptation pathways. Members of the TAG are experts in their fields from across a number of agencies and are able to provide information, advice and guidance to support climate-related decision-making.

Together, this climate change adaptation programme will provide the Buller District with the evidence base to transition towards a sustainable and resilient community. The outputs will have benefits beyond adaptation planning, enabling informed asset management, spatial planning, and hazard management. There are huge opportunities if Buller District positions itself as one of the leaders of New Zealand's climate change transition.

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8. Appendices | Āpitihanga

Appendix A: Workshop attendees

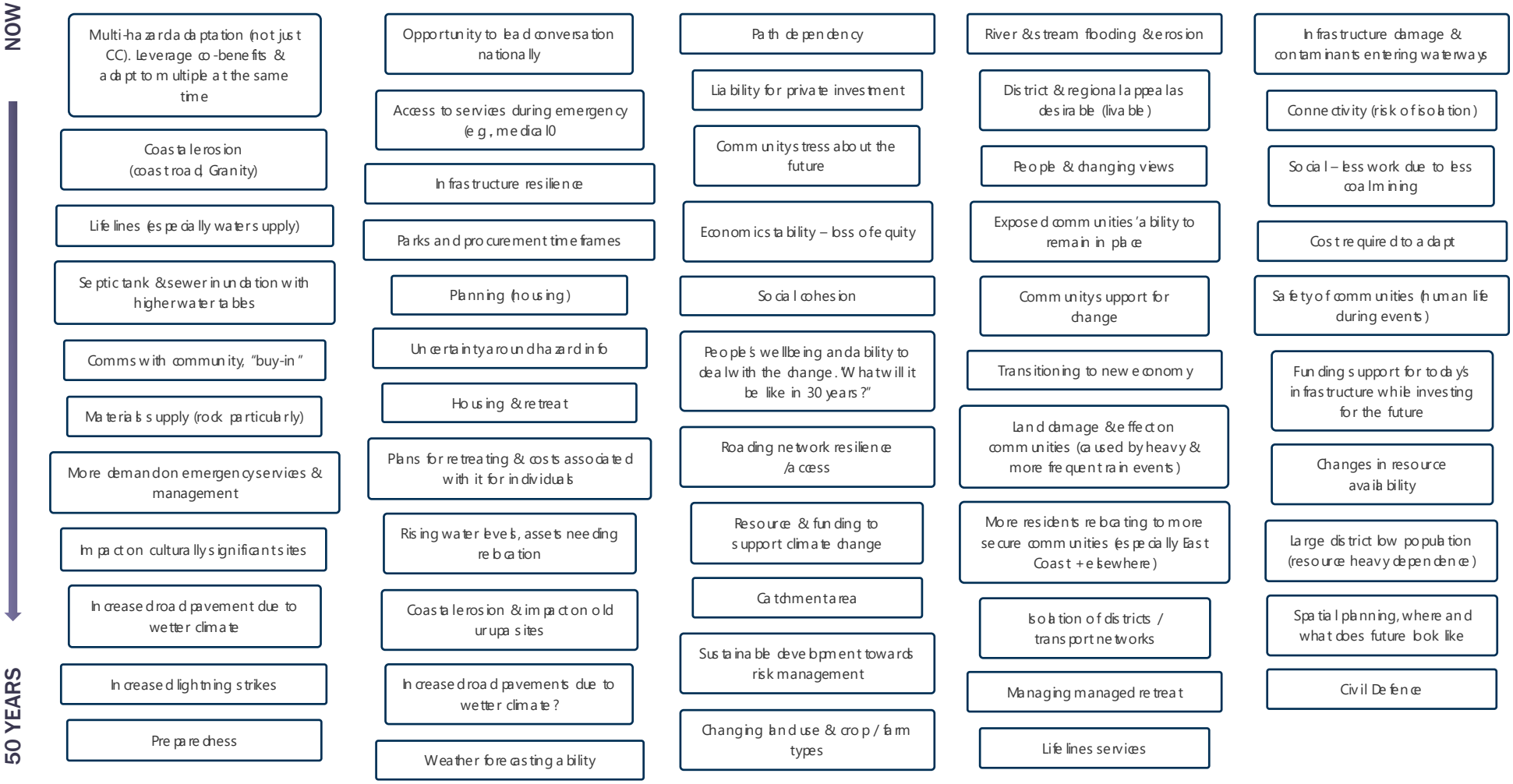
Table 9: Representatives able to attend initial engagement workshops and invited persons

DOMAIN	ATTENDEES	INVITED BUT UNABLE TO ATTEND
Natural environment	Scott Freeman & Suvi van Smit (DOC) Heath Milne (DWC & Tourism West Coast) Pip Lynch (Ngāti Waewae) Debs Martin (TNC online attendance)	Sean Judd (BDC) Rachel Vaughan (WCRC) Francois Tumahai (Ngāti Waewae) Ned Tauwhare (Ngāti Waewae) Zak Shaw (DWC) Erik van Eyndhoven Laura Coll John Hill
Built environment	Mike Duff, Mike Williams, Sean Judd, & Paul Zaanen (BDC) Pip Lynch (Ngāti Waewae) Clark Nelson (BEL) Colin Hey (Waka Kotahi) Jamie Cleine (BDC Mayor) Jonathan Jull (NEMA online attendance)	Oliver Prescott (KiwiRail) Francois Tumahai (Ngāti Waewae) Ned Tauwhare (Ngāti Waewae) Tom Williams (MoE) Carissa du Plessis Sean Judd (BDC) Jo Armstrong (TTPP)
Human environment	Marg Lilly (Aged Concern) Maraea Casey (Flood Recovery Navigator) Pip Lynch (Ngāti Waewae) Lorraine Scanlon (Home Builders) Steph Newbury & Shayne Barry (Flood Recovery BDC) Phil Rutherford, Dave Hawes , Rosalie Sampson (BDC Councillors) Diane Longstaff (WCDHB)	Francois Tumahai (Ngāti Waewae) Ned Tauwhare (Ngāti Waewae) Jane George (WCDHB) Tui Marama (Youth rep) Bob Dickson (Recovery) Phil Wheble (WCDHB) Mikaere Clarkson (Kawatiri Youth Voice)
Economy	Richard Tacon (Bathurst) Heath Milne (DWC) Jamie Cleine (BDC Mayor) Krissy Trigg (BDC) Penny Bicknell (Flood Recovery BDC) Pip Lynch (Ngāti Waewae)	Lyn Carmichael (MPI) Francois Tumahai (Ngāti Waewae) Ned Tauwhare (Ngāti Waewae) Cheyanne Amai (Talleys) Ray Mudgway (Westland Mineral Sands) Katie Milne (World Farming Organisation) Rod Fox (BDC) Jo Birnie (DWC) Mark Radloff (NBS)
Governance	Jo Howard, Phil Rutherford (BDC Councillors) Sean Judd (BDC) Pip Lynch (Ngāti Waewae) Pam Johnston (DIA online attendance) Suzy Paisley (NEMA online attendance) Rachel Townrow (BDC, in part) Jamie Cleine (BDC Mayor, in part)	Francois Tumahai (Ngāti Waewae) Ned Tauwhare (Ngāti Waewae) Sharon Mason (BDC CE) Grace Hall (LGNZ Director) Lisa Marquat (MfE / NCC) Sarah Anderson (MfE)

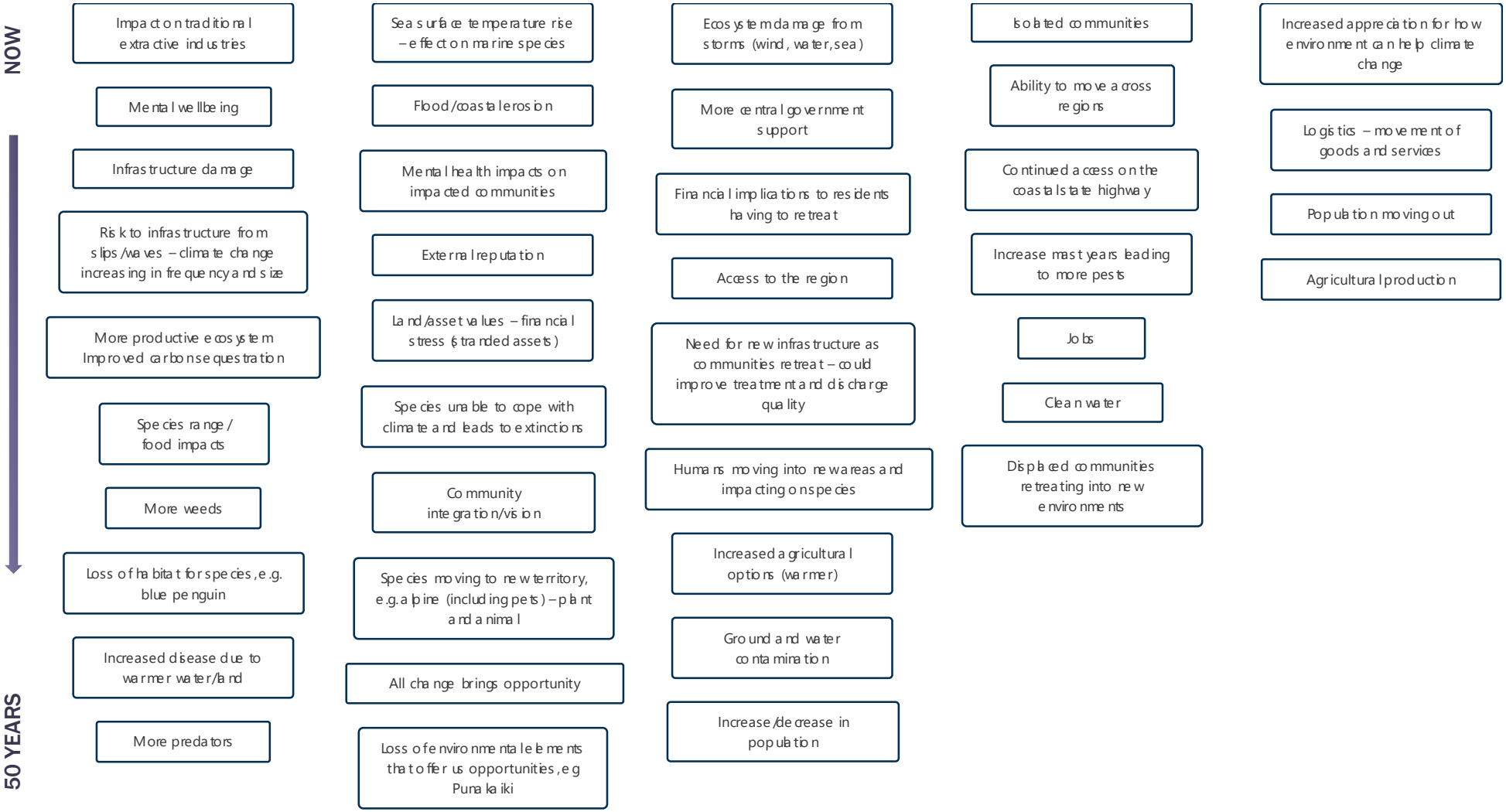
Appendix B: Impacts identified over the next 50 years

This appendix includes the ideas shared by the participants in the workshops. They are included verbatim as a record of this process and have been reflected throughout the report.

Biggest threats – overall

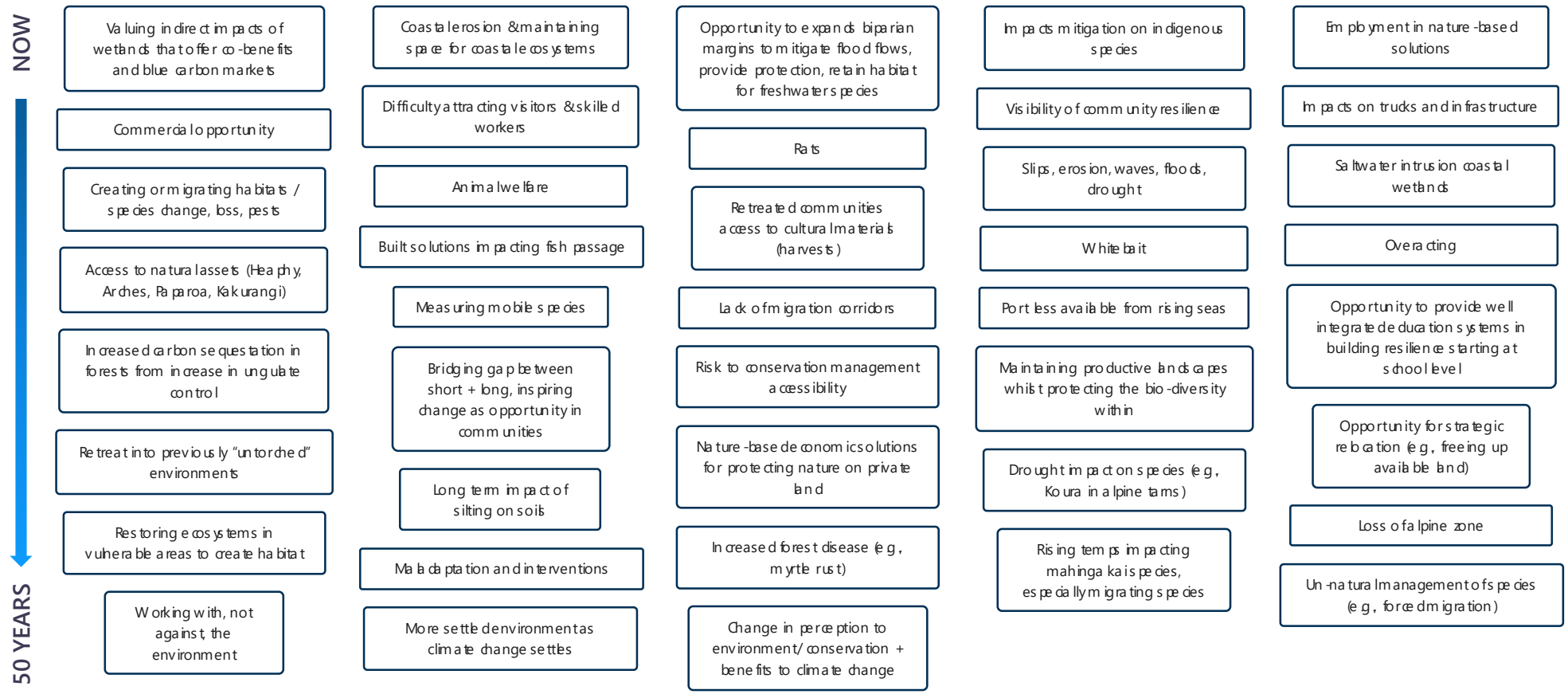

NOW
50 YEARS
Multi-hazard adaptation (not just CC). Leverage co-benefits & adapt to multiple at the same time
Coastal erosion (coast road, Granity)
Life lines (especially water supply)
Septic tank & sewer inundation with higher water tables
Comms with community, "buy-in"
Materials supply (rock particularly)
More demand on emergency services & management
Impact on culturally significant sites
Increased road pavement due to wetter climate
Increased lightning strikes
Prepare chess
Opportunity to lead conversation nationally
Access to services during emergency (e.g., medical0
Infrastructure resilience
Parks and procurement timeframes
Planning (housing)
Uncertainty around hazard info
Housing & retreat
Plans for retreating & costs associated with it for individuals
Rising water levels, assets needing relocation
Coastal erosion & impact on old urupa sites
Increased road pavements due to wetter climate?
Weather forecasting ability
Path dependency
Liability for private investment
Community stress about the future
Economic stability – loss of equity
Social cohesion
People's wellbeing and ability to deal with the change. "What will it be like in 30 years?"
Roading network resilience /access
Resource & funding to support climate change
Catchment area
Sustainable development towards risk management
Changing land use & crop / farm types
River & stream flooding & erosion
District & regional appeal as desirable (livable)
People & changing views
Exposed communities' ability to remain in place
Community support for change
Transitioning to new economy
Land damage & effect on communities (caused by heavy & more frequent rain events)
More residents relocating to more secure communities (especially East Coast + elsewhere)
Isolation of districts / transport networks
Managing managed retreat
Life lines services
Infrastructure damage & contaminants entering waterways
Connectivity (risk of isolation)
Social – less work due to less coal mining
Cost required to adapt
Safety of communities (human life during events)
Funding support for today's infrastructure while investing for the future
Changes in resource availability
Large district low population (resource heavy dependence)
Spatial planning, where and what does future look like
Civil Defence


NOW
50 YEARS
Opportunity to create a central cultural evacuation hub to create a sense of connectiveness, safety, and wellbeing.
Challenge of lack of living accommodation
Collaboration – doing things **with** people not **to** them.
Coastal erosion – isolated communities and access to those communities
Increase in mental health and psychosocial issues
Ability for supplies to get to people in emergency events
High risk to communications / power networks with weather events
Loss of lives and properties
Economic base effects – tourism, farming.etc.
Challenges
Uncertainty/unknown
Time taken for planning
Risking cost
Emotional stability
Accepting climate change
Retreat from vulnerable locations will be an issue of affordability for many
Opportunity to investigate and explore new paths of employment, specifically for our communities.
Opportunity to create new areas for social economic growth
The mental wellbeing of a significant portion of our community is a current issue
Healthy home initiatives
Mental health services in Buller for stressed people, help needed. Those that cannot settle in heavy rain.
Agreeing the way forward. No value in indecision or infighting.
Access on roads due to flooding and storms
Changeable weather impacting farming
#8 wire thinking will help us adapt
Better public transport within district - rail
Buller has many of the elements that will be most affected by a changing environment
We get to redevelop our town, our community
Challenge of Te Ao Māori world view re natural resource and habitats
Challenge – employment opportunities above the living wage
Cost of dealing with the present effects – cost of research with no implementation. Effect mentally on many of our communities.
Clean water supply
Overflows of sewage and stormwater into waterways
Working with barriers – vulnerable people making unsafe decisions because of personal situation / health / finances – geographic isolation
Work 'with' people – inclusive invite to be part of the journey
Capacity of emergency services due to increase events
Opportunities
Genuine collaboration
Transparent communication
Build trust and confidence
Build psychological wellbeing
Better living conditions due to new homes means healthier people
Challenge of vulnerable residents – social economic
Vulnerable people moving into risk prone areas
Community already stressed. People and resource already stressed.
Increase/decrease in population
AF8 earthquake
Low socio-economic area
Coastal communities
An aging population that does not necessarily understand the impacts
Biggest risk/challenge is getting cohesive action, ie. working together – also biggest opportunity
More cohesive community
Transport infrastructure – roads/airport
Communities needing to retreat and the impacts on their investments
Self-sustainable living!
AF8 earthquake
Opportunity to begin integrating understanding of Te Ao Māori world view.
Challenge of no central evacuation centre to cater for residents fully functional
Coal fires effect on atmosphere and health
Enough healthcare workers for all areas
Isolation
Low rating base – district has limited resources
The district has a high index of deprivation
High %aged population
Multiple risks from sea, river, slips, etc.
Challenge of process for making decisions. Opportunity for collaborative and inclusive governance
Loss of roads along the coastline – isolating communities
Improved infrastructure of treatment of wastewater in retreated communities

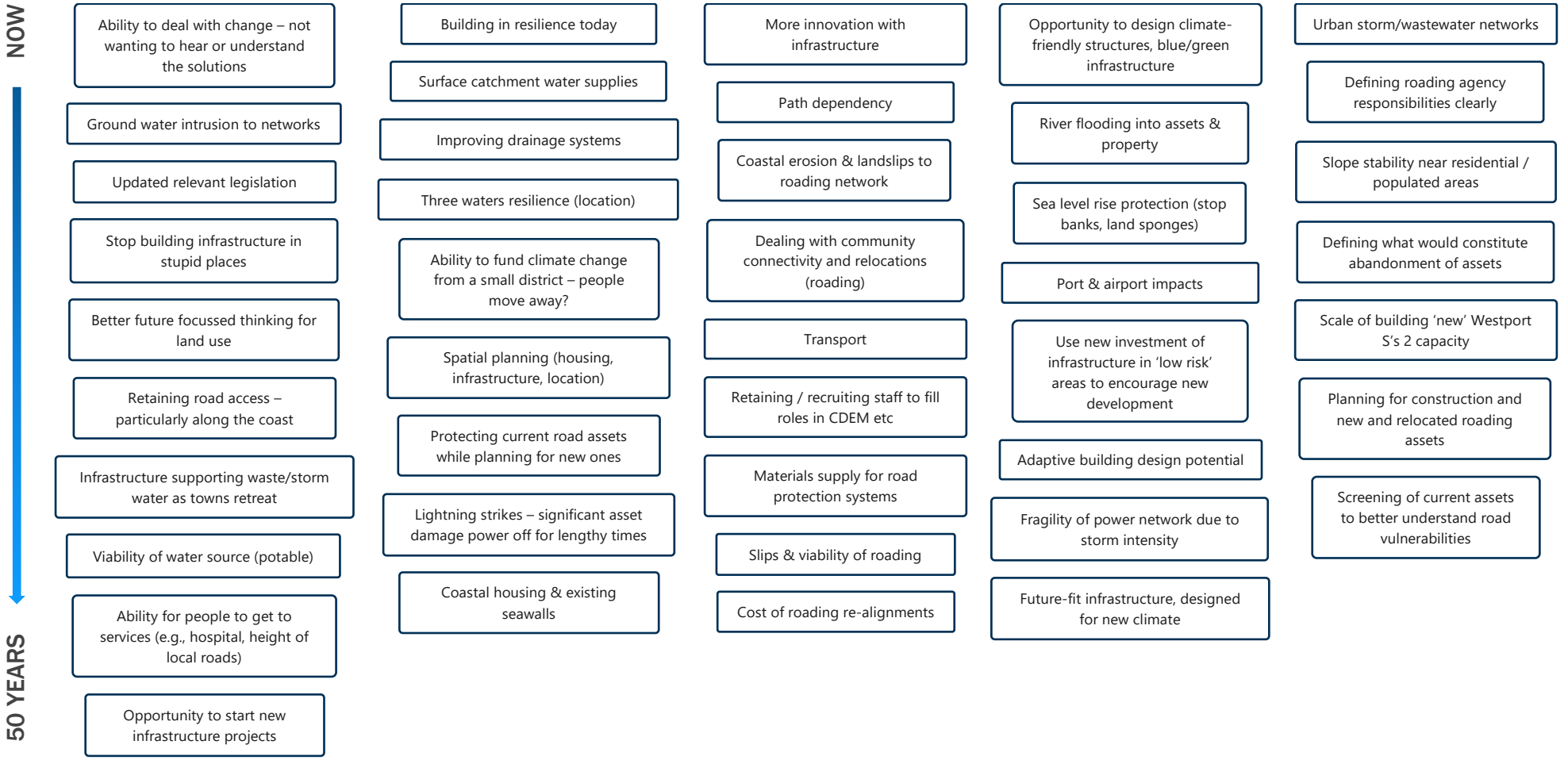

NOW
50 YEARS
Impact on traditional extractive industries
Mental wellbeing
Infrastructure damage
Risk to infrastructure from slips/waves – climate change increasing in frequency and size
More productive ecosystem Improved carbon sequestration
Species range / food impacts
More weeds
Loss of habitat for species, e.g. blue penguin
Increased disease due to warmer water/land
More predators
Sea surface temperature rise – effect on marine species
Flood/coastal erosion
Mental health impacts on impacted communities
External reputation
Land/asset values – financial stress (stranded assets)
Species unable to cope with climate and leads to extinctions
Community integration/vision
Species moving to new territory, e.g. alpine (including pests) – plant and animal
All change brings opportunity
Loss of environmental elements that offer us opportunities, e.g Puna kaiki
Ecosystem damage from storms (wind, water, sea)
More central government support
Financial implications to residents having to retreat
Access to the region
Need for new infrastructure as communities retreat – could improve treatment and discharge quality
Humans moving into new areas and impacting on species
Increased agricultural options (warmer)
Ground and water contamination
Increase/decrease in population
Isolated communities
Ability to move across regions
Continued access on the coastal state highway
Increase mast years leading to more pests
Jobs
Clean water
Displaced communities retreating into new environments
Increased appreciation for how environment can help climate change
Logistics – movement of goods and services
Population moving out
Agricultural production

Biggest threats from a domain perspective

Natural environment



Built environment



Human


NOW
50 YEARS
Need places to go → evacuation centre. Focus on safety for people
Opportunity for creative planning for future
Funding
Get people to accept and understanding – agree way forward
People contributing to society
Health is not just the responsibility of a DHB
High deprivation means most people's investment is in their homes. Risk to homes = lack of financial options
Neighbour support
Greater potential for tech-based economy
Transparent communication
Changing dynamics to towns as people move inland
Old housing stock will be removed in flood/hazard areas, meaning newer (healthier) homes
De/increase in population
Ability to access emergency services
Medical care – mental health not able to deliver
Working together
Marketing opportunity for growth if we become a progressive community
Potential for Westport to be part of "Blue Highway"
Post-traumatic growth/resilience building
Cheap housing in District attracts people from lower socio-economic sector into high risk areas
Strong governance
Opportunity to create resilience invest in local support agencies & NGOs
Exodus from the district due to uncertainty
Build safe and better
Māori protocols of the natural environment
Can health services cope? Roads blocked, no way in.
Diminishing values
Protect against the immediate effects where possible
Support those affected most to adapt and accept
Changes in population (including increase in retirees)
Loss on equity in home due to flooding risk
Higher percentage of vulnerable people (age and beneficiary)
Working together
Opportunity to gradually move people to safer areas
Changes to natural environment (flora & fauna, tourism)
Wraparound services for all the community, especially the tamariki
Very poor health services within the region
Impacts on physical & mental health / opportunity to teach people about looking after mental wellbeing
Isolation
Worries of where to go to higher ground if needed more communication
Wouirua
Less able bodied people to do full complement of tasks
Navigators to walk alongside/with people
Financial implications from retreat
Risk to commercial investment & jobs
Opportunity for long-term community navigators to help people with adaptation options
Uncertainty of monetary value on properties
Opportunity for Māori understanding opening conversation
Being prepared for long lengths of isolation
Limited communications
Whanau relationship breaking down
Social connection
Global shortage of healthcare workers
Homelessness/loss of possessions
People feeling stuck - having no choice to improve their wellbeing
Need for adaptability in planning
Loss of cultural sites, particular in coastal areas
Develop a permanent community cultural hub/evac centre to support our communities
Cultural understanding of wellbeing
Vibrant community with health services available for all

Economic

NOW

50 YEARS

- Agricultural sector events impact
- Agricultural sector productivity and input costs
- Access to funds to grow/establish business due to negative sentiment.
- Pressure on traditional industries
- Need for business community/innovation thinking within Buller – future thinking
- Tech development
  - growth in remote working
  - SAAS – international opportunities
  - smart technology/AI
- Uncertainty around number of tourists coming if we are cut off
- Opportunities for new development
- Tourism – what will bring people here?
- De-carbonisation policy
- Migration – skilled workforce
- Transport costs rising
- Ability to add value locally – coal/HMS (blue carbon)
- Volatility in commodity markets
- Renewable energy investment
- Jobs – creating employment through the process
- Training and education
  - upskill population
  - training from school age to retain youth
  - retraining for a new era
- Opportunity to 'redesign' coastal margins
- Opportunity to learn from similar "new" climate areas – what works for them now.
- Educating all ages – how to reach all groups/ bring next generation on journey
- Transport infrastructure movement of goods
- Ability to access central government funding when all of NZ is impacted
- Engineering – high tech opportunities and building on current strengths
- Shaping a 'new' town / moving a town/district
- Coastal effects damage tourism
- New agricultural opportunity - crops
- Skills shortage to support business
- Costs associated with retreat and new infrastructure
- Impact on already low productivity
- Investment in infrastructure
- How will we protect supply chains? Build resilience to lifelines?
- Primary industry – horticulture, aquaculture opportunities?
- Port reliability
- Self-sufficiency – food – water - employment
- Local focus business (needs population)
- Movement of people to seek work out of the area
- Lack of certainty reduces home ownership
- Imposed regulatory costs
- Tourism
  - Opportunities - eco/environment
  - new product
- Impacts on finances if access to mahinga kai and cultural materials decreases
- Port development – import/export
- Prioritising adaptation investment
- Digital economy – positive and negative
- Competitive advantage post extractives

Governance


NOW
50 YEARS
Better understand local government roles
Opportunity to link the risk of adaptation assessment with the TTPP into a shared government structure
Climate change must be front and centre for future councils
West Coast media is highly politicised
Community acceptance of the changes needed
Need to be well informed and backed with science
Greater collaboration with central government
Changes in the way local government is organised
Local government won't be able to access as much funding from central government
Opportunity – Buller recovery steering group has provided a forum to bring different levels of government together
Governors must have a good understanding and buy-in to the impacts of change
Low community awareness and engagement
Opportunity to form a better relationship and integrated governance between central, regional, local and iwi
How to get the full voice of the community – not just the squeaky wheel
Lack of capacity to effectively respond
Climate and flood risk do not recognise geographical/ political boundaries, e.g. Buller vs West Coast
Risk of maladaptation litigation due to inadequate action /mistiming.
Greater community consultation
Opportunity to make media your climate change/risk awareness allies
Solution focused
Ability for institutions to follow decision making processes with increased frequency and scale of events
Ngāti Waewae will be partners in decision making
Risk of increased damage costs and insufficient financing
Risk of conflict disruption and loss of trust
Limited funding in small community – low rating base and possibly declining
Capability, capacity, financing, uncertainty, gaps in knowledge, communication, leadership, cultural aspects
Political environment – climate deniers are outspoken in this region
A lot of new infrastructure may be needed in a short timeframe
Potential communication issues – lose touch with affected communities
Decisions will need to be made based on limited/incomplete information
Natural leaders will step up within their communities
Existing planning decision making and legislative frameworks inadequate
Decisions based around electoral cycles
Imperative that councils work collaboratively – central government, NGOs, etc.
Ability to change outcomes for the better
Communities could become more self-sustaining
Decisions and planning will need to occur to determine where communities can retreat to
District could be a leader in producing green energy – hydrogen production
Competition for resources – loss of value in assets
Services being impacted by climate change