SEPTEMBER 2025

Climate Adaptation Plan

2025-2028

CONTENTS

1. Executive Summary	**4**
2. Our context	**5**
3. Understanding our climate risks	**7**
3.1. Our physical climate risks	8
Highlight: Northland to Auckland flood repairs	*8*
3.2. Cost of climate impacts to KiwiRail	10
4. Framework for our plan	**12**
4.1. Knowledge and information	13
Highlight: Using nature-based solutions to manage stormwater	*13*
4.2. People	15
Highlight: Keeping our people safe through use of Severe Weather Event Management frameworks	*15*
4.3. Governance, strategy and processes	17
Highlight: Increasing transport network resilience after the Kaikoura Earthquakes	*17*
5. Assets and Operations	**19**
5.1. KiwiRail's resilience strategy in a changing climate	19
5.2. Asset management approach – the Adaptation Cycle	20
5.3. Managing our assets to reduce flooding and slips risk	22
Highlight: Midland River Protection Works	*22*
Highlight: Upgrades in Dunedin create flood-resilient assets	*23*
5.4. Planning for coastal and temperature change	26
5.5. Effective Operations - Recovering Rapidly	26
6. Measuring progress	**28**
7. Key Terms	**30**

Bridge damage following Cyclone Gabrielle, February 2023

1. EXECUTIVE SUMMARY

Rail moves large volumes of people and freight and is vital to the efficient functioning of our transport system. KiwiRail's rail and ferry services also play an important role in enhancing the resilience of our transport network.

However, New Zealand's climate is changing in ways that is affecting KiwiRail's ability to efficiently move people and freight around the country. Climate-related natural hazards such as flooding, slips, coastal erosion, and fires are affecting the reliability of our rail services and causing damage to our assets.

These natural hazards will become more frequent and severe in future due to climate change. We need to make changes now to how we manage our assets and services. By proactively managing our key climate risks, flooding and slips, we can maintain more reliable services and reduce the need for costly repairs to assets after extreme weather.

Our adaptation plan, KiwiRail's first dedicated response to climate impacts will guide us to manage these natural hazards more effectively. In this plan we outline some of the improvements that KiwiRail has already made to our asset management and operational processes to respond to a changing climate.

We also outline future steps KiwiRail will take to:

- Enhance our knowledge and understanding of climate risks
- Increase our peoples' capacity and capability to effectively manage climate impacts
- Embed climate adaption principles into our governance, decision making and the way we manage our assets and operations.
- Make our assets and operations more resilient to climate impacts by taking a risk-based approach and prioritizing maintenance and renewals of critical lines.

Our approach is aligned with New Zealand's National Adaptation Plan, which directs infrastructure providers to be proactive in understanding their climate risks and to take action to reduce the vulnerability of assets exposed to climate change. Our goal is to create a more climate-resilient rail system. Being climate resilient will mean that we can effectively anticipate, prepare for and respond to the impacts of a changing climate, avoiding service disruption through track closures where possible and quickly restoring service delivery when high impact events occur. By acting now, we can help to reduce the impact and costs of climate change to KiwiRail in future.

2. OUR CONTEXT

KiwiRail provides essential services to New Zealand supporting the movement of freight and passengers. Our rail network moves around 15 million tonnes of freight a year, including 18 per cent of New Zealand's imports and exports. The metropolitan rail networks we maintain support 25 million passenger trips a year in Auckland and Wellington. Our ferry services move around 73,000 commercial vehicles and 600,000 passengers a year, as well as providing a crucial connection for freight.

Rail also provides many wider benefits - reducing congestion, improving air quality and road safety and avoiding more than 410,000 tonnes of greenhouse gas emissions a year.

The rail network provides an alternative to the roading network, enhancing the resilience of our transport system in the face of natural hazards, such as earthquakes and extreme weather events. For example, after the Kaikoura Earthquakes the rail line provided a crucial alternative connection for freight movements to State Highway One.

KiwiRail is also a critical infrastructure provider with an extensive asset base. We manage around 3700 km of rail track, and more than 1300 rail bridges, 100 tunnels and 850 buildings. Over the last 10 years there has been a significant Crown investment into our rail system and assets, including building the City Rail Link in Auckland, purchasing new rolling stock (locomotives and wagons) for passenger and freight transport and renewing and upgrading metropolitan rail infrastructure in Auckland and Wellington. These upgrades will make our networks more resilient to future climate impacts.

However, many rail assets built over the last 150 years have not yet been renewed and are not designed to modern standards. They are not always resilient to current climate conditions and will become increasingly vulnerable in future as climate impacts worsen. Figure 2.1 illustrates climate impacts KiwiRail has experienced over the last ten years.

KiwiRail is funded to maintain and renew assets along the national rail network through the Rail Network Investment Programme (RNIP). This is guided by the Government Policy Statement on Land Transport and our Statement of Corporate Intent. Figure 2.2. sets out the relationship between key strategic documents, government and local transport policy and this Adaptation Plan.

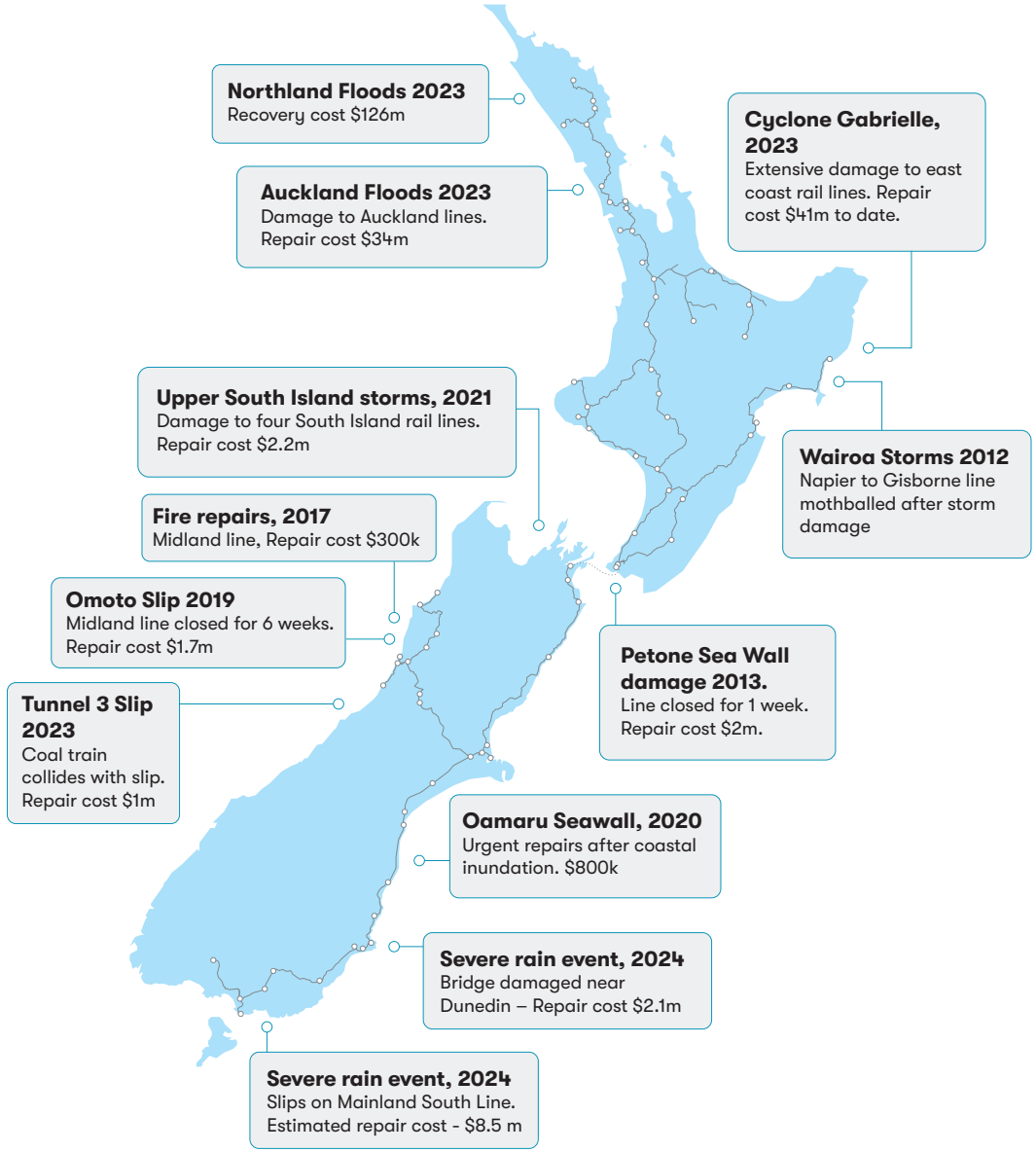


Figure 2.1. *Significant weather damage events experienced by KiwiRail since 2013*

Through our RNIP funding there are actions we can take to improve the resilience of our network. Adjustments to our operational programme to carry out targeted maintenance and capital renewals projects will improve our asset condition, enabling them to withstand larger weather events. Developing proactive weather and emergency management plans and ensuring immediate availability of rail materials for repairs will reduce the time that our tracks are closed following damage. Because funds are limited, we will prioritise the most cost-effective actions to increase climate resilience, focusing first on investment into metropolitan and priority freight lines. We will also look to partner with the New Zealand Transport Agency (NZTA), local government and other stakeholders to enhance resilience of our assets where possible.

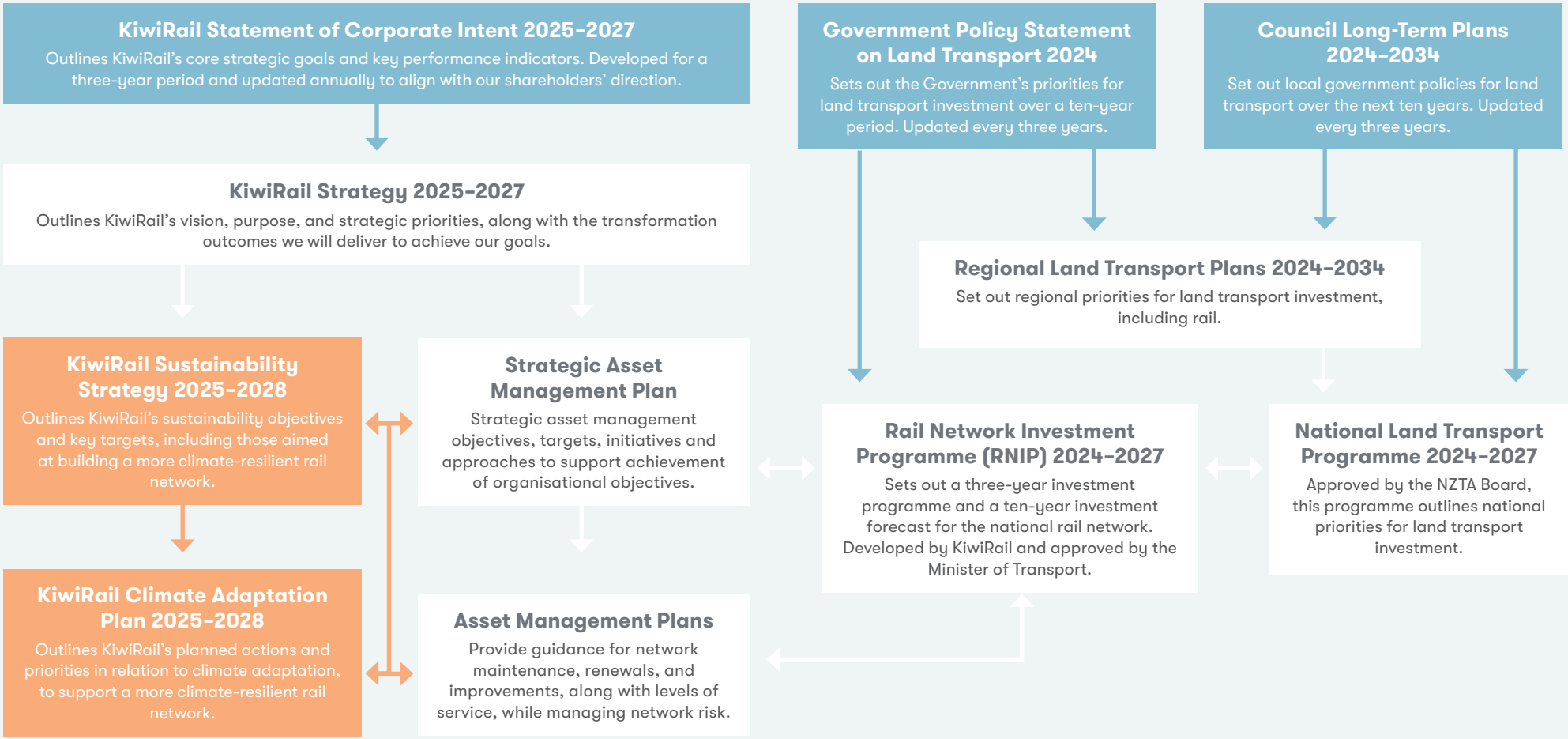


Figure 2.2. *Relationship between KiwiRail Adaptation Plan and other plans and strategies that guide our work*

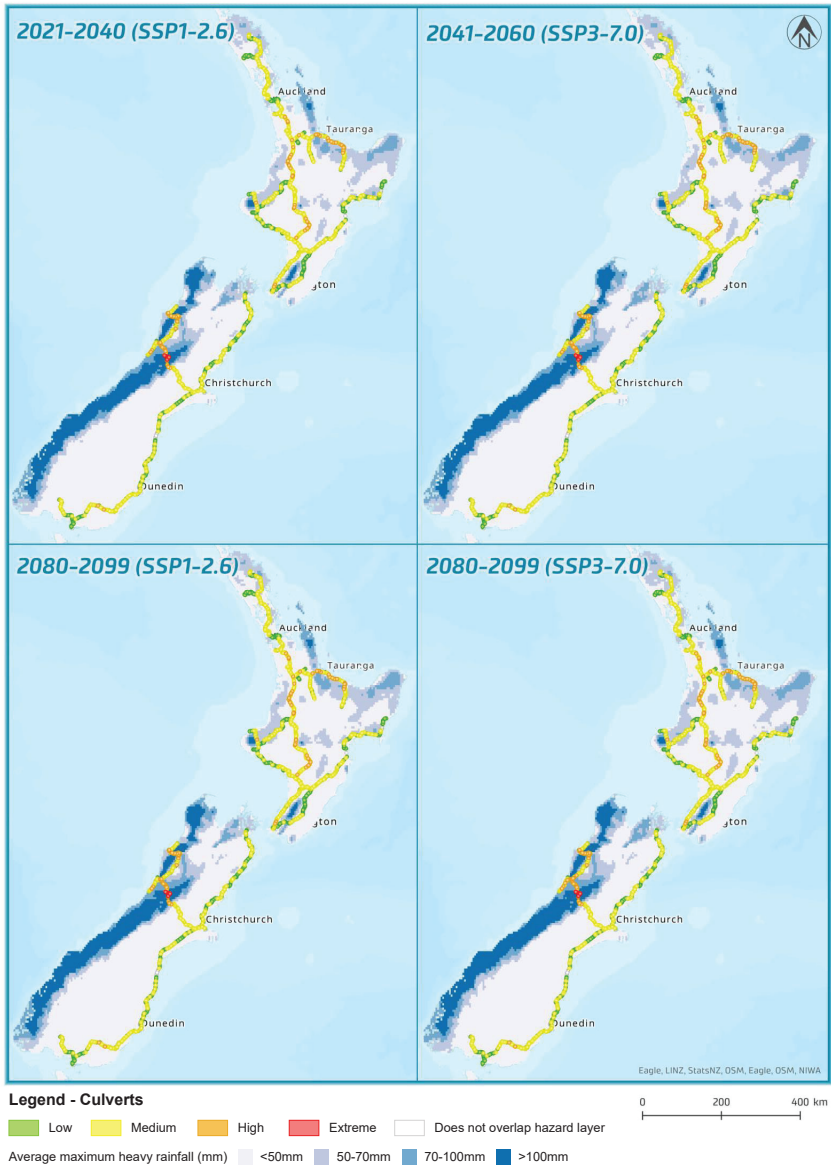


Figure 3.1. *Map of rain risk from our physical climate risk assessment*

3. UNDERSTANDING OUR CLIMATE RISKS

We have carried out several studies to understand our exposure to climate risks. We will continue to gain more data about our exposure to specific hazards and the condition of our assets, improving our knowledge over time. This will inform our delivery of targeted maintenance and planning for adaptation options for specific rail lines and sites. A summary of completed research is outlined below.

Climate Resilience Programme Business Case, 2023:

This assessment focused on the rail track, including assets such as our bridges, culverts and tunnels, and their vulnerability to natural hazards such as flooding, coastal inundation, coastal erosion, winds and slips. The business case identified more than 200 sites that required interventions to increase resilience. Various packages of interventions required to deliver a more climate resilient network were evaluated, with costs ranging from $280,000 to $7.3 billion. The preferred option, focused on protecting high and medium priority lines, cost approximately $1.2 billion. KiwiRail cannot deliver this package of works within our current budgets, but it has informed the development of this adaptation plan and prioritisation of works in our investment plan – RNIP 2024-2027.

Physical climate change risk assessment, 2024:

This study considered climate change risk to a broader range of KiwiRail's assets, including our yards, container terminals, land holding and structures. It assessed the climate risk to KiwiRail's assets over three time periods (2021-2040, 2041-2060 and 2080-2099). Hazards assessed included coastal inundation, coastal erosion, river and surface flooding, hot days, heavy rainfall and strong winds (see example map in Figure 3.1).

Risks were assessed across two shared socio-economic pathways (SSP), developed as part of global climate models for the International Panel on Climate Change Sixth Assessment Report. The two SSP pathways used in this study were:

- **SSP1-2.6:** This pathway envisions a world that progressively and successfully focuses on achieving sustainable development outcomes, which includes low population growth, proactive policy orientation, and a rapid shift towards efficient and clean energy technologies. Warming levels reach 1.8°C by 2100.
- **SSP3-7.0:** This pathway depicts a world with little cooperation between countries, leading to insular, security-focused policies, slower economic development, and technological progress, along with higher population growth. Warming levels reach 3.6°C by 2100.

Interislander climate risk assessments, 2024:

These draft climate risk assessments focused on the risks to the terminals at both Wellington and Picton. Key climate risks identified included future sea level rise, coastal inundation and flooding.

Climate Scenarios, Risk and Opportunity assessment, 2024:

KiwiRail developed climate scenarios (building on the Transport Sector Climate Scenarios developed by the Aotearoa Climate Circle), to help us assess our climate risks and opportunities over time and in different warming scenarios. We developed three scenarios:

- **On-Track (orderly)**: International efforts lead to rapid decarbonisation and warming is limited to 1.5 °C by 2100
- **Slow Coach (disorderly)**: After a slow start, aggressive decarbonisation policies limit warming to 1.6 °C by 2100
- **Off the Rails (hot house)**: Greenhouse gas emissions continue to rise and warming reaches in excess of 3 °C by 2100, with much more severe physical climate impacts.

We used these scenarios to assess our climate risks and opportunities and to assess the resilience of our business to future change. This assessment covered both our physical risks (e.g., flooding, sea level rise) and transitional risks (social, political, legal and technological changes).

More detail on our climate scenarios and the risks identified is available in our Climate Risk and Opportunity Assessment which can be found on our website.

These studies will help to inform the delivery of future actions to manage our risks, reducing the ongoing and future cost of climate impacts to KiwiRail and our customers. This Adaptation Plan focuses on responses to physical risks only. The main physical climate risks we have identified are summarised in Table 3.1.

3.1. OUR PHYSICAL CLIMATE RISKS

Table 3.1 outlines the most material physical climate risks for KiwiRail, the key locations impacted, the consequences and a summary of our response. These risks are presented at a high level, and the magnitude of risk will vary for specific locations and assets. All these risks will increase over time as our climate changes, particularly in the Off the Rails (hot house) scenario.

HIGHLIGHT

NORTHLAND TO AUCKLAND FLOOD REPAIRS

The North Auckland Line was badly damaged in the January 2023 extreme weather event and again during Cyclone Gabrielle.

There were more than 200 damaged sites, including many major landslides and smaller slips. Repairing the line in Northland cost KiwiRail over $126 million and took 20 months to complete.

In total, 500 metres of retaining structures were installed, 28 bridges were repaired and 25,000 tonnes of ballast were replaced. After the North Auckland Line reopened to trains in late 2024, Fonterra increased its rail volume back to pre-storm levels of 16 rail wagons per day.

Freight volumes in Northland are expected to increase to 23 million tonnes by 2042. With major roads into the region also subject to climate impacts, rail is crucial to developing an efficient, resilient and integrated transport system for Northland.

Table 3.1. *Key physical risks to KiwiRail, expected consequences and our response*

Risk	Consequences	Our response
Extreme temperature - Risk to assets (tracks) due to extreme temperature, leading to movement and buckling. In the short-term, this risk is most evident in Northland, Auckland, Gisborne and east coast areas of the South Island.	• Risk to our people (customer, staff and public) from accidents, derailments etc • Declining service reliability (freight, passenger and tourism services) • Customers choose other transport options (loss of revenue) • Key rolling stock, equipment and sites become isolated • Management attention and resources diverted to disaster response • Increased cost of building or renewing assets (to meet higher resilience standards) • Increased costs of unplanned repairs to assets • May not be economic to repair some assets - leading to line or site closures • Increased insurance costs • Reputational damage.	• Use Severe Weather Event Management Frameworks to reduce risk to people – early warning systems and preparedness • Enterprise-wide responses: Develop Protect Accommodate Retreat Avoid (PARA) framework, develop / pilot Dynamic Adaptive Pathway Planning approaches, readiness planning & emergency exercises with other lifeline utilities and service providers • Vegetation management (to reduce risk of fires and trees blocking track after storms) • Proactive asset-specific responses: to be developed based on risk assessment (condition of asset, criticality of asset, level of risk) • Asset management (eg: renewals): Design standards improved to address climate change; betterment targeted where appropriate. • Collaboration - Work with key stakeholders such as NZTA, central and local government and ports to enhance resilience of rail assets.
Coastal inundation – Acute risks to assets (tracks, container sites, yards, landholdings, ferry terminals) and people due to coastal inundation, causing damage and disruption to operations. Around 2% of our tracks are exposed to this risk, increasing to 7% by 2100. Lines at risk include the East Coast Main Trunk around Tauranga, North Island Main Trunk in the Auckland metropolitan area, Main North Line around Kaikōura and Main South Line.		
Coastal erosion – Chronic risk to assets (tracks, container sites, yards, structures) and people due to coastal erosion. This could lead to damage or complete loss of assets. Approximately 6% of our tracks are exposed to this risk, increasing to 7% by 2100. Sites include Main North Line around Kaikōura, Main South Line from Timaru southwards.		
Slips and slope instability (due to heavy rainfall) – Risks to assets (tracks, container sites, yards, structures, landholdings, rolling stock) and people due to slips. Land instability is common across much of the network. Areas with many identified slip risks, include Central North Island, Arthur's Pass, Wellington, the Kaikoura Coast, and north of Dunedin.		
River and surface flooding - Risks to assets (tracks, container sites, yards, structures, landholdings) and people due to river and surface flooding. Around 31% of our tracks are exposed to this risk, particularly tracks south of Dunedin, Greymouth to Westport, in the central North Island and Wellington to Palmerston North.		
Extreme wind and weather - Risk to assets (overhead lines, yards, container sites, ferries, terminals) and people due to extreme wind / weather. This risk impacts areas across the rail network and our ferries. Snow fall can damage assets in the Southern Alps.		
Fire - Risk to assets (overhead lines, yards, container sites, structures) and people due to wildfire and risk of fire being caused by KiwiRail operations.		

3.2. COST OF CLIMATE IMPACTS TO KIWIRAIL

Managing climate impacts already comes at significant cost for KiwiRail and causes disruption to our customers. These impacts will worsen in future – Figure 3.2 shows key climate projections up to 2100 including increased numbers of hot days, strong winds and extreme rainfall events.

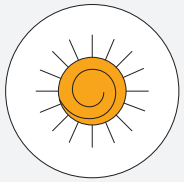
In total, repairs to rail assets relating to weather impacts have cost more than $230m over the last ten years (see Figure 3.3). This includes two major events – the Auckland Floods and Cyclone Gabrielle. KiwiRail also experiences many smaller floods, slips and other climate events that require repairs or cause disruption to services. Since January 2023, KiwiRail has cancelled 2,800 freight and passenger train and ferry services due to weather conditions (see Figure 3.3).

Weather conditions such as flooding and high temperatures, which contribute to speed restrictions on the network, have also led to around 905 hours of delayed services for our passengers (see Figure 3.4).

Weather events can create significant disruption for our freight customers if they result in a prolonged rail line closure. Closing a metropolitan rail line can also have major impacts on passenger flows and congestion.

As an example, a major storm in Wellington in 2013 closed the Hutt Line for several days. This put significant pressure on the roading network, with traffic clogging state highways, all major arterial roads, and the Wellington CBD.
The Ministry of Transport subsequently estimated the cost of these increased travel times at around $1.33 million per day.

Closures to the rail network in Auckland after the Auckland Floods in January 2023 also disrupted commuter movement around the city. As our cities grow, resilience of public transport networks will become increasingly important.

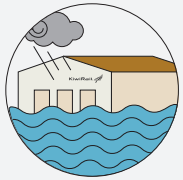


Temperature

More hot days (maximum daily temperatures over 25° C) are projected for most of New Zealand, with the north and east North Island most affected.

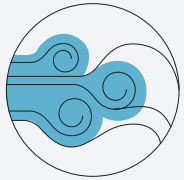
Rainfall

Extreme rainfall events (leading to flooding) are projected to become more frequent and intense across the entire country.



Sea-level rise and coastal hazards

Sea level rise is projected to reach approximately 0.5-1.0m by 2100.



Strong winds

There will be more windy days per year in most of the South Island by 2100. Extreme winds (due to ex-tropical cyclone events) will become more intense.

Figure 3.2. *Future Climate Impacts over Time*

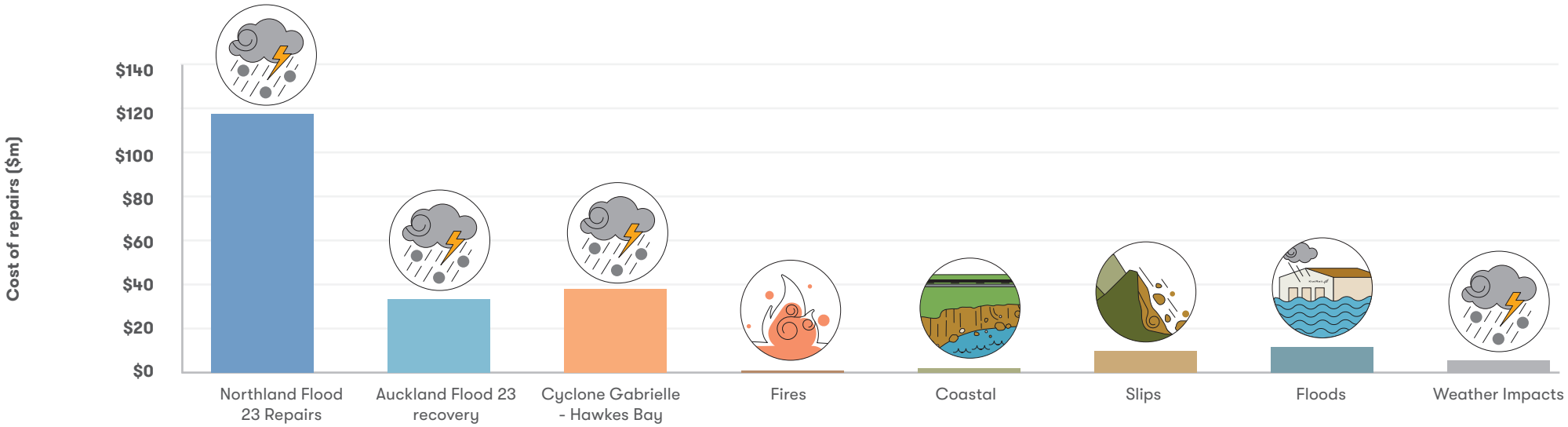


Figure 3.3. *Cost of emergency or reactive repairs to KiwiRail from weather impacts 2013-2024*

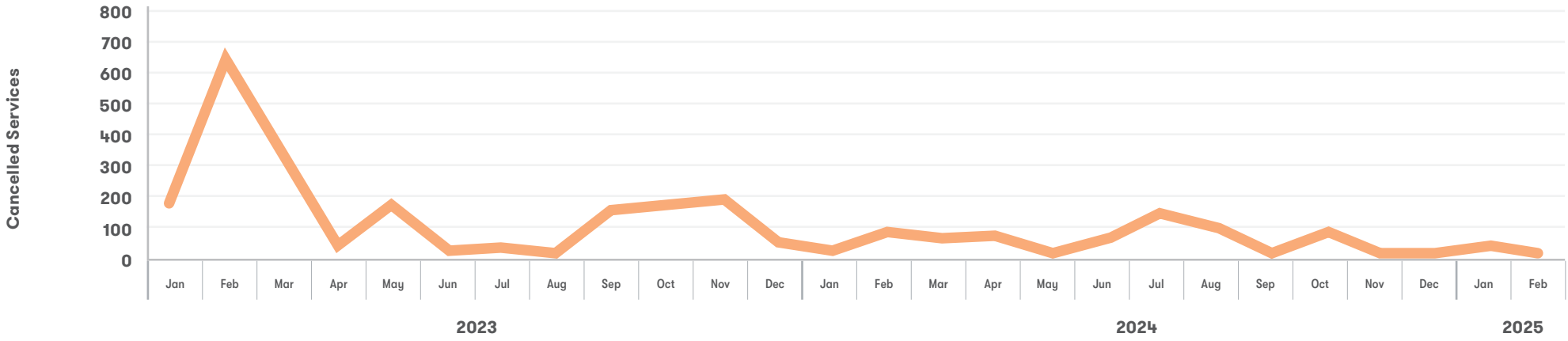


Figure 3.4. *Number of cancellations caused by weather impacts Jan 2023 to Feb 2025*

4. FRAMEWORK FOR OUR PLAN

Our work on climate adaptation is guided by a framework that includes four pillars as shown in Figure 4.1. We will aim to prioritise the most cost-effective actions within each pillar and focus our efforts on the services and assets most critical to KiwiRail's financial sustainability.

Figure 4.1. *Framework for Climate Adaptation Plan*

4.1. KNOWLEDGE AND INFORMATION

Having accurate, accessible and up to date information about our climate risks is a priority identified for infrastructure owners in the New Zealand National Adaptation Plan. Understanding our risks is important to inform our asset management strategy and effectively prioritise our investment in maintenance, renewals and upgrades of our assets. We completed a physical climate change risk assessment in 2024 and we will update this regularly. It is also important for us to understand the plans that other agencies, customers and partners have in relation to climate resilience. For example, we will seek opportunities to collaborate with the NZTA, Auckland Transport, Greater Wellington Regional Council and others to enhance the resilience of our transport assets.

Working with other agencies is also critical to ensure resilience of the transport network during and following weather events. By planning with other lifeline utility providers, we can identify areas of shared vulnerability and locations where the rail corridor offers an alternative to the roading network, which can enhance resilience and support recovery after a large-scale event. The rail corridor in some parts of the country also contains critical telecommunication and power assets, highlighting the importance of KiwiRail collaborating with other utility providers.

To support effective emergency management for New Zealand, KiwiRail must also contribute to national response plans, share critical information and improve coordination with other essential infrastructure providers. We will put in place enabling mechanisms, processes and resources to share information with external stakeholders, including our regulators, funders, National and Civil Defence and Emergency Management groups and government agencies.

Finally, we will engage with iwi and community members to understand their priorities for climate resilience in relation to specific projects we deliver, such as construction of assets to protect our coastline. Our desired outcomes and actions we will take over the next three years are shown in Table 4.1.

HIGHLIGHT

USING NATURE-BASED SOLUTIONS TO MANAGE STORMWATER

KiwiRail is building two new rail stations in southern Auckland, at Drury and Paerātā, to provide sustainable commuting options for residents in these high growth areas.

We will manage stormwater through nature-based solutions, enhancing wetlands near the Paerātā and Drury Rail Stations. This will provide enhanced habitat for native biodiversity, including freshwater species and lizards in the wetland margin.

We will also restore a stream near Drury Rail Station through planting of natives, maintenance of stream fences and providing improved passage for native fish. In total KiwiRail expects to plant over 40,000 native plants around the stations

Table 4.1. *Knowledge and information - Outcomes and actions*

Desired outcomes:

- Up-to-date climate projection / hazard data readily available for all KiwiRail assets
- We understand climate adaptation plans of key partners (e.g., NZTA) and interdependencies of our assets with other lifeline utility providers
- We understand mana whenua and community priorities in relation to climate adaptation and resilience

Current actions

Completed / Ongoing actions

- Physical climate change risk assessment completed
- Climate scenarios, risk and opportunity assessment completed
- Ongoing engagement with mana whenua and community in relation to their climate adaptation priorities through our delivery of infrastructure improvements and renewals.
- Ongoing engagement with our customers to understand their plans for key sites and how we can work with them to enhance resilience of their supply chains

Future actions

- Physical climate risk data made accessible to all KiwiRail staff through GIS (geographic information systems for spatial mapping) system
- Update climate scenarios, transitional and physical climate risk and opportunity assessment regularly – every three years
- Maintain strong relationships with other relevant agencies involved in climate adaptation (e.g., NZTA, AT, lifeline utilities) to better understand their adaptation plans and identify opportunities for collaboration in relation to capital works

4.2. PEOPLE

Our people are key to effectively managing climate impacts. We will upskill relevant teams so they understand the information we have gathered about climate risks and effectively apply this to their roles in line with our asset class strategies. To achieve this, we will develop a climate adaptation training framework to ensure that the right staff receive appropriate training to integrate consideration of climate risks and resilience into their work.

Training will enable staff to identify the most cost-effective ways to respond to climate risks and ensure we avoid investing into stranded assets or maladaptation (responses that are intended to enhance resilience but can increase vulnerability or cause other unintended negative consequences).

We will ensure that roles and responsibilities in relation to climate adaptation are clearly understood and defined across key teams who support our work in this area such as our Asset Management, Environment, Engineering, RMA and Regional infrastructure teams. Key actions we will take are outlined in Table 4.2.

HIGHLIGHT

KEEPING OUR PEOPLE SAFE THROUGH USE OF SEVERE WEATHER EVENT MANAGEMENT FRAMEWORKS

KiwiRail uses severe weather event management frameworks to keep our staff and the customers safe. Our operational and infrastructure teams actively monitor weather forecasts and receive specialised advice from forecasters. If risky conditions are forecast, senior leaders will decide in advance whether services should be cancelled.

We have remote sensors in place at high-risk locations such as the Buller Gorge and Arthurs Pass to monitor hazards such as rainfall, snow fall or rock movements. If hazards exceed our acceptable risk thresholds then train services are delayed or cancelled.

Our Interislander team uses a wide range of weather modelling data and forecasts to make sailing decisions. If swells are forecast to be unsafe for our vessels we will cancel those services and rebook passengers and freight on the next possible ferry.

Table 4.2. *People - Outcomes and actions*

Desired outcomes:

- **Accountability and capacity** – Staff roles and responsibilities in relation to climate adaptation are clear and we have sufficient capacity to manage climate risks effectively
- **Capability** – We upskill our people so they can undertake their roles and responsibilities related to climate adaptation effectively
- **Relationships** - We maintain relationships with key networks, organisations and experts on climate adaptation outside of KiwiRail

Current actions

Completed / Ongoing actions

- Provided training to relevant teams on results of physical climate risk assessment.
- Implementation of Severe Weather Event Management frameworks protect our staff and customers.

Future actions

- Develop Climate Adaptation training framework for staff
- Support staff to identify most cost-effective way to respond to climate risks – develop tools for assessing costs vs benefits of various approaches to mitigate risk
- Educate staff regarding climate risk data and how to use it in risk assessments, design of assets and project delivery
- Develop framework to document roles and responsibilities of teams in relation to climate adaptation actions
- Establish Climate Resilience Working Group to deliver actions in Adaptation Plan

4.3. GOVERNANCE, STRATEGY AND PROCESSES

KiwiRail has processes in place to ensure effective governance and strategic oversight of our work on climate change. Our Board and Executive Leadership Team receive regular updates on sustainability, including climate adaptation. We will develop a monitoring and reporting framework to enable them to provide more strategic guidance and direction in this area. More analysis of the climate impacts we are experiencing and better understanding of the costs of carrying out repairs and of disruption of services will inform how we maintain, renew and upgrade our network infrastructure.

The cost of insuring our rail network is increasing over time, partially because of the increasing frequency of damage from climate impacts. KiwiRail will continue to look at options for transferring risk in a cost-efficient manner, through either traditional or non-traditional insurance options. We will also provide advice to Government on the impact of weather-related events to KiwiRail's operations and the cost of options for adaptation. We will make submissions to inform development of national level policies and plans such as the second National Adaptation Plan.

Our design and delivery of assets is already consistent with requirements and standards of local government for stormwater management and other risks through the consenting process. We plan to apply for global consents for culvert maintenance in parts of our network, to streamline our maintenance processes and ensure we effectively manage climate and environmental risks. We will also develop tools and guidance, such as a Climate Adaptation and Resilience Policy, to help our staff embed consideration of climate risks into our design standards and business cases. Table 4.3 outlines key actions we will take.

HIGHLIGHT

INCREASING TRANSPORT NETWORK RESILIENCE AFTER THE KAIKOURA EARTHQUAKES

In November, 2016 the Kaikōura Earthquake caused major damage to both State Highway One (SH1) and the Main North Line Railway, with all road, rail and coastal links to Kaikōura closed. During the immediate aftermath KiwiRail's ferries played a vital role in transport resilience – carrying critical supplies and equipment from the North to the South Island.

NZTA and KiwiRail formed an alliance to repair damage to road and rail assets – the North Canterbury Transport Infrastructure Recovery (NCTIR). Working collaboratively, the two agencies repaired more than 3,300 damage points. The rail line and road were realigned in places and sea walls were installed to increase resilience to future coastal storms. Debris barriers and slope stabilisation measures were put in place to manage risk from future slips.

The rail line re-opened in September 2017 after 9 months. It then played a valuable role in moving critical equipment to enable further road and rail repairs, before SH1 was also re-opened in December 2017. Many of the works that were delivered as part of NCTIR have made the rail and road network more resilient to slips in subsequent weather events, keeping remote rural communities connected.

Table 4.3. *Governance, strategy and processes – Outcomes and Actions*

Desired outcomes:

- **Governance** - We have clear governance arrangements and leadership oversight of our climate adaptation work programme
- **Strategic integration** - Climate adaptation is integrated into our strategy, policy and asset management plans
- **Investment** - The RNIP and other funding mechanisms support work which increases the climate resilience of our network
- **Reporting** - KiwiRail provides regular and transparent updates to stakeholders on our progress towards creating a more climate-resilient rail system

Current actions

Completed / Ongoing actions

- Governance - Board receives regular updates on sustainability, including climate adaptation
- Leadership – Our Chief Infrastructure Officer and Chief Financial Officer provide co-sponsorship of our Climate Resilience workstream
- Climate Resilience Steering Group of senior leaders established, to guide delivery of strategic climate resilience initiatives
- Developed asset class strategies for Below Rail assets which align KiwiRail's strategic priorities with asset management objectives
- Explore options to insure our assets in the most cost-effective way, including considering non-traditional options

Future actions

- Develop frameworks and tools to embed consideration of climate adaptation into our asset management strategies, business cases and capital allocation, including through the RNIP
- Better quantify current and future financial impacts of climate change to KiwiRail
- Provide advice to the government on funding requirements of options for adaptation and increasing resilience of the rail network to climate impacts
- Develop a climate adaptation principle'to provide guidance to our teams on appropriate emissions pathways to use when designing assets.
- Establish monitoring and reporting framework on climate impacts to KiwiRail to support prioritisation of future climate adaptation investment
- Deliver a partial, voluntary disclosure of our work on climate adaptation annually through our Integrated Report and work towards completing a full Climate Related Disclosure.
- Develop global consent applications for culvert maintenance in priority sections of our network

5. ASSETS AND OPERATIONS

5.1. KIWIRAIL'S RESILIENCE STRATEGY IN A CHANGING CLIMATE

KiwiRail is committed to operating a safe and compliant network, as required under the Railways Act 2005. To maintain this commitment in the face of a changing climate, KiwiRail has adopted a range of strategies to enhance network resilience.

Central to this strategy is the concept of resilience—defined as the ability of services to return to operational levels as quickly as possible following a disruptive event (see Figure 5.1).

Resilience can be improved by minimising service loss through targeted capital renewals and robust asset maintenance, which are key focuses of the RNIP investment programme. It can also be enhanced by reducing the time required for recovery through operational strategies that support rapid response and restoration.

To support these outcomes, KiwiRail has developed a Severe Weather Management Standard, engaged engineering consultants under regional civil emergency contracts, introduced standardised digital civil incident templates for faster and more consistent reporting, and implemented standardised design specifications to ensure critical materials can be stockpiled and readily deployed when needed.

Together, these initiatives strengthen KiwiRail's ability to respond to climate-related risks while continuing to operate a safe and reliable rail network. These actions are discussed in more depth below, along with future improvement plans.

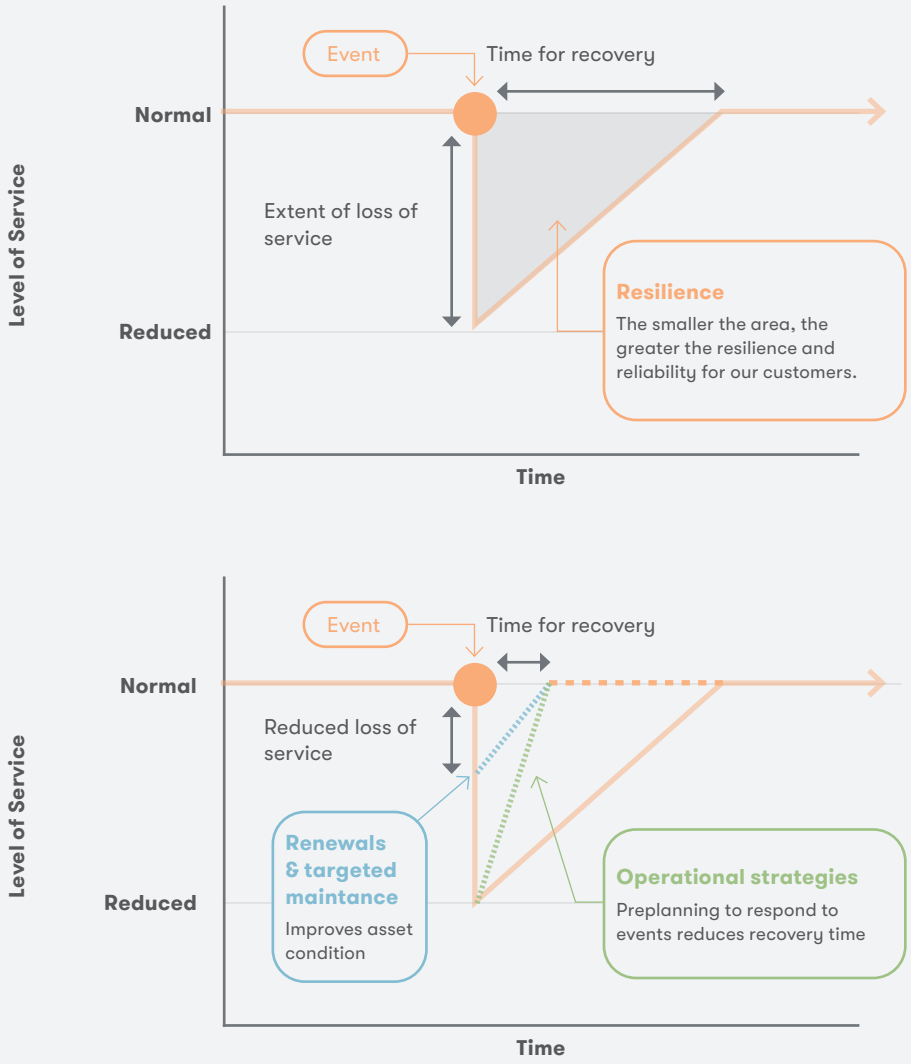


Figure 5.1. *Triangle of Resilience Concept*

5.2. ASSET MANAGEMENT APPROACH – THE ADAPTATION CYCLE

Over the last five years KiwiRail has made significant improvements to strategic asset management approach and knowledge of the condition of our assets. This is crucial to creating a more climate resilient network by helping us prioritise and target our work and investment.

We will continue to gather information to enhance our approach, such as enhancing our understanding of the potential risk of landslips from slopes and retaining walls on our network, and ensuring the appropriate capacity of our culverts. When delivering site-specific climate resilience interventions, we will follow the Adaptation Cycle outlined in Figure 5.2. This will ensure that we monitor and learn from the success of our adaptation interventions, adjusting our approach over time.

In managing our climate risk and planning for the future, we will use the Protect, Accommodate, Retreat and Avoid (PARA) framework, as shown in Figure 5.3. This will help guide our response to climate risks and ensure we select the most cost-effective adaptation option for each situation.

Where it is possible and affordable, we will seek to protect assets or redesign them to accommodate climate impacts. In cases where these options are not viable, we will consider the feasibility of retreat. This is discussed in more depth in Section 5.4 - Responding to coastal change. We will also use our knowledge of climate risk to avoid situating new assets in hazard prone areas.

Protect: We can protect assets from climate hazards using both engineering and nature-based solutions. From a coastal perspective, this includes engineering options such as seawalls and barriers, and nature-based solutions such as dune creation and strengthening. From a flooding perspective, both catchment management and culvert design can reduce the impacts of flooding on rail networks.

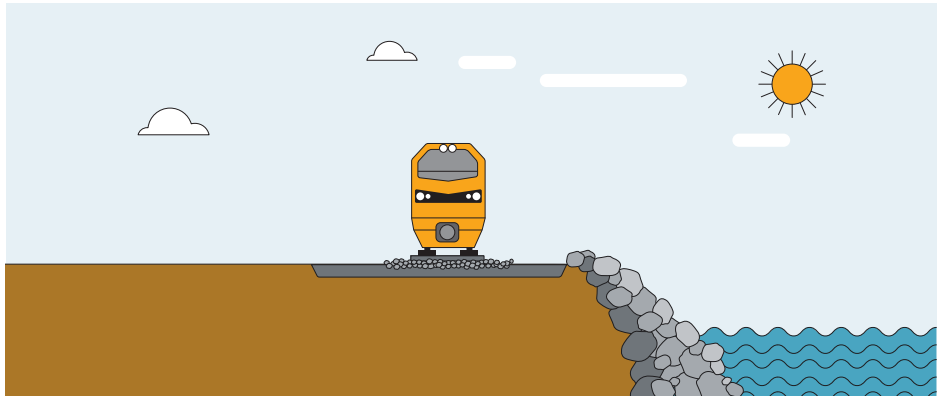
Accommodate: We can accommodate climate risks by accepting they will occur and designing assets to cope with the impacts of these risks. This could include using smart technology and sensors to give real-time alerts to cancel trains or developing alternative solutions to enable critical freight and passenger movements in high-risk areas (e.g., road bridging).

Figure 5.2. *The adaptation cycle*

Retreat: We can relocate existing assets away from high-risk areas. This may be a necessary adaptation option when alternative adaptation strategies (such as protect and accommodate) are intolerable. Infrastructure can be moved to a new location, through relocation of a site or realignment of rail track, and the area can be repurposed, for example, into a walkway or reserve. Relocation of assets will require significant investment, which may not always be feasible or cost-effective.

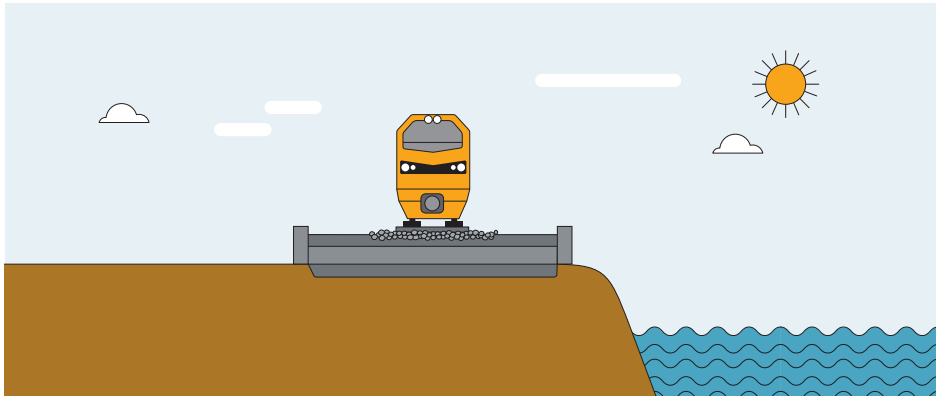
Avoid: We can be proactive and avoid locating new assets, such as rail track, container terminals or freight hubs, in areas prone to climate hazards such as flooding or coastal inundation.

Details of how we will apply the adaptation cycle and PARA framework to specific asset classes are outlined below.



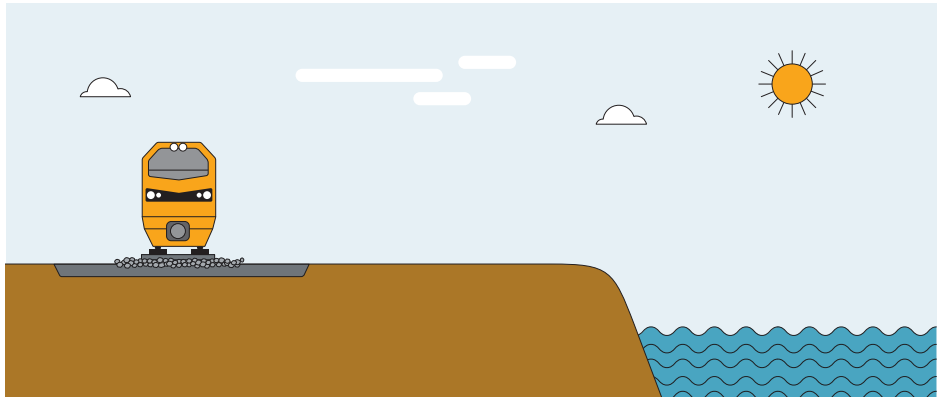
Protect

Protecting assets from climate risk, for example:
sea walls or slope stabilization



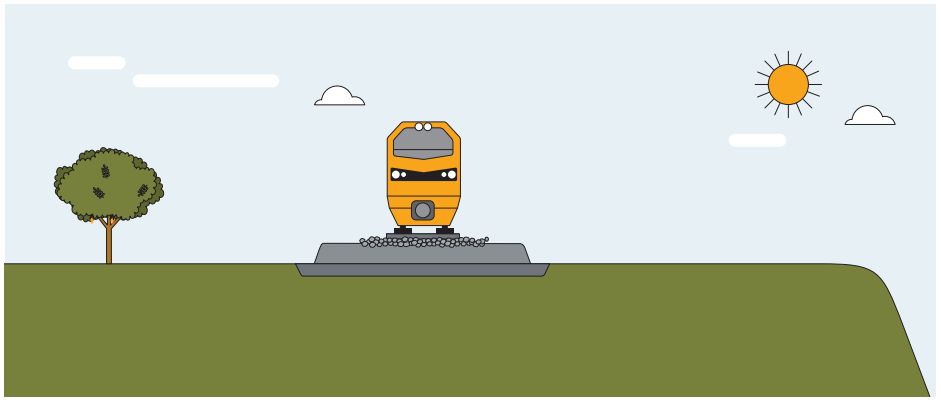
Accommodate

Designing assets to cope with climate change impacts



Retreat

Relocating sites or realigning rail track away from high-risk areas



Avoid

Locating new assets away from hazard prone areas.

Figure 5.3. *Protect, Accommodate, Retreat and Avoid Framework*

5.3. MANAGING OUR ASSETS TO REDUCE FLOODING AND SLIPS RISK

The two most common climate risks that impact our services are flooding and slips. Damage from these events costs us significantly in terms of repairing and replacing assets and impact customer satisfaction through causing less reliable services. With both risks generally caused by rainfall, focusing on how we manage our drainage assets, such as culverts, will help us to manage these risks.

Culverts:

The drainage pipes installed under rail tracks are one of our primary tools for managing water across the rail network. When culverts are undersized or in poor condition, they significantly increase the risk of flooding and track washouts during heavy rainfall events. KiwiRail manages approximately 12,500 culverts across our network. Over the next three years, we will take targeted actions to improve culvert performance during extreme weather. This includes assessing hydraulic capacity and exploring opportunities for proactive maintenance. Where feasible, smaller culverts will be replaced with larger ones capable of carrying more water. All renewal designs will incorporate consideration of future climate change impacts.

Our ability to deliver full culvert renewals within our funding envelope is limited. We will use a risk-based asset management strategy that prioritises investment in the culverts posing the highest risk to the network. The prioritisation methodology considers both culvert condition and the potential consequences of failure, particularly in relation to customer impacts.

Culverts are currently monitored on a six-year inspection cycle. These inspections record culvert condition and inform risk management plans developed by engineers. These plans may include maintenance actions such as debris clearance, headwall repairs, or increased monitoring frequency. From 2025 onwards, improving drainage maintenance will be an increased focus. Effective drainage is essential to mitigate broader network risks, given the cascading impacts flooding can have on track integrity, embankments, and other critical civil infrastructure.

HIGHLIGHT

MIDLAND RIVER PROTECTION WORKS

Between 2022 and 2024, KiwiRail delivered a major project to enhance the resilience of the Midland Line against river erosion. The project, with an approximate cost of $15 million, involved risk assessment, implementation of river protection works, and the strategic stockpiling of materials to support future rapid-response efforts.

The assessment involved categorising sections of the Midland Line adjacent to major rivers on both sides of the Southern Alps into risk profiles. For each section identified as having erosion potential, tailored mitigation strategies were proposed.

These ranged from increased monitoring to the design of physical river protection measures such as riprap-armoured embankments and groynes. All solutions incorporated projections of future climate change impacts.

By 2024, river protection works at high-risk locations were successfully implemented. In addition, surplus riprap material was stockpiled to ensure KiwiRail can quickly respond to future major flood events. As of mid-2025, there have been no significant incidents related to river erosion along the Midland Line.

HIGHLIGHT

UPGRADES IN DUNEDIN CREATE FLOOD-RESILIENT ASSETS

During the last three years KiwiRail has delivered a major upgrade of our Hillside workshops in South Dunedin. Initial designs revealed that the site was at risk of flooding and coastal inundation. The project team re-used crushed concrete from demolition of old buildings at the site to raise the new workshop to 2 metres above sea level.

In 2024, KiwiRail also delivered a renewal of a timber bridge 194 MSL outside Dunedin, which had been damaged by flooding in the past.

During the recent flooding events in Dunedin in October 2024, both assets performed well and were not damaged by flooding. While parts of our rail network near Dunedin remain exposed to flooding, these examples demonstrate how renewals can create more climate-resilient assets.

Slopes:

Slips from slopes around the network pose a major risk to KiwiRail, and the level of risk can change over time due to environmental conditions, either deteriorating after major rainfall events or improving as slopes revegetate and stabilise. Risk management of slopes requires robust understanding of the inherent stability of slopes and potential trigger levels of events that could cause failure (i.e., slips).

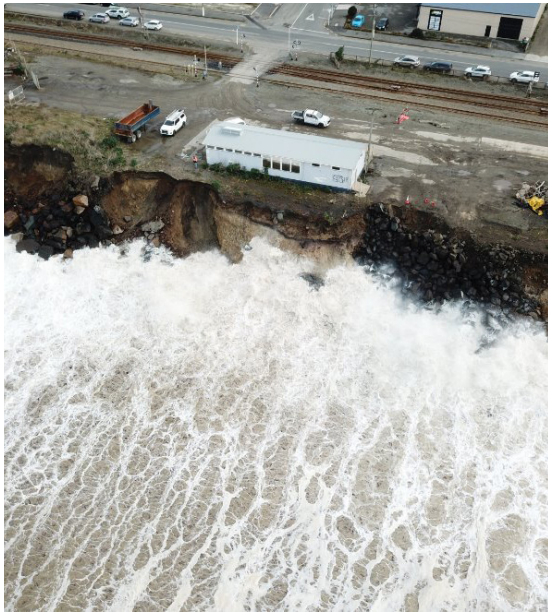
Over the past three years KiwiRail has enhanced its capacity to manage slopes. In 2025 we published a revised methodology for assessing slope risk which will enable us to identify which slopes pose the highest slip risk to the network. We will use this information to develop risk management plans, including design and implementation of slope stabilisation solutions, increased monitoring, or a triggered response plan associated with a weather event of a certain level

Retaining Walls:

Retaining walls are critical structures implemented to either prevent a slope from failing onto the track (overslip) or retain the track embankment in place under the track (underslip). Major rainfall events can cause failure of retaining walls if these assets are not managed effectively. RNIP 1 funding has enabled major improvements to the way retaining walls are managed at KiwiRail. For example, we have enhanced our standards to identify risk posed to the track from retaining walls and identified approximately 9 km of retaining walls along the network that should be added to our regular inspection schedule. Delivery of our retaining wall asset update strategy will continue through funding included in RNIP 2024-2027, providing essential data to prioritise risk-based asset renewals.

River and coastal protection:

Large sections of the rail network are located next to rivers and coastal areas, making them vulnerable to scour and erosion. These hazards are expected to worsen with ongoing climate change. During the first RNIP (2022–2024), a significant portion of the investment budget—approximately $29 million—was allocated to assessing and remediating network sections exposed to these risks, for example on the Midland River. KiwiRail will continue to use a range of operational strategies to manage risk of river flooding and improve asset resilience through funding provided in the second RNIP (2024-2027) as shown in Figure 5.4. These include enhanced monitoring using drones for condition inspections, and the strategic stockpiling of riprap material to enable rapid stabilisation of embankments affected by scour erosion.



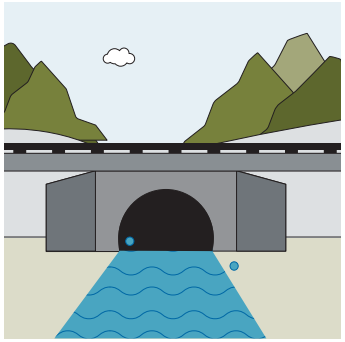
Bridges:

We own more than 1,300 bridges, with more than half of these being exposed to river and surface flooding. The vulnerability of our bridges is increased by their age and condition – the average age of a KiwiRail bridge is ~80 years and more than a third of our bridges are over 100 years old. We are seeing more abrasion on bridge supports and scour due to more frequent and intense flood events which are being compounded by more gravel entering the rivers from glacier melt. Our timber bridges in coastal areas are also at risk from damage by marine teredo worms, which are expanding their range southward due to warm ocean temperatures. More occurrences of fungal attack of the timber elements of our bridges is also occurring due to warmer winters.

We have developed standard bridge designs that are aligned to NZTA's bridge manual and will increase bridge resilience by raising the height of the bridge deck above flooding. Our funding to replace bridges is limited and will be focused on the most critically at-risk assets. We will prioritise renewals to priority rail lines that carry the heaviest rail freight volumes and are most critical to our customers' operations. Figure 5.4 shows our current planned investment through the Rail Network investment Programme and metropolitan rail budgets into workstreams that have a resilience benefit, including $56 million into replacing or renewing bridge assets. We target our renewals and maintenance using techniques such as structural health monitoring. to identify which bridges and elements are most in need of repair and extend the life of the assets. We will also use detailed monitoring of braided rivers to identify where potential changes in a river may cause a bridge element to fail.

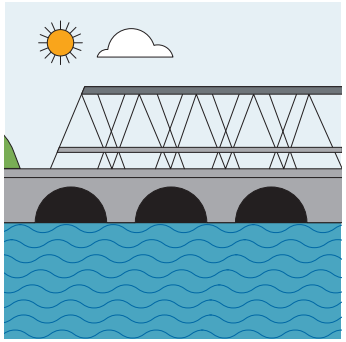
We will extend the life of our bridges through delivering partial renewals of key bridge components, such as wrapping timber bridge elements or piers in concrete and steel to make them more resilient. We are sponsoring research with Auckland University of Technology and Michigan University to extend the lives of rail bridges through advanced analysis, testing, automation and improving design standards, with a goal of building rail bridges that could have extended lives of up to 500 years or more.

Napier bridge PNGL 217 reopening after Cyclone Gabrielle



Culverts

$6 million to renew 29 culverts



Bridges

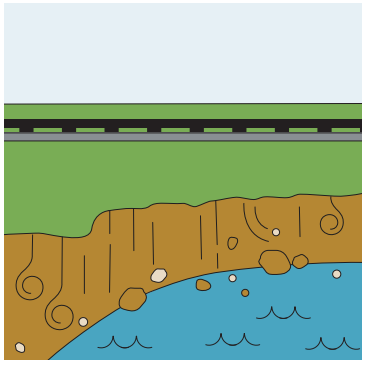
$56 million to replace or strengthen aged bridges

Weather events recovery

$56 million for ongoing recovery in Northland and Hawkes Bay

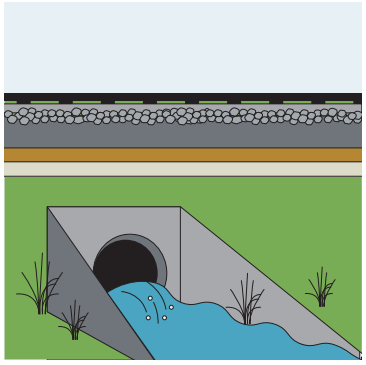
Slip prevention

$21 million to stabilise slopes and retaining walls



Coastal & River protection

$10 million to deliver 16 km of river and coastal protection



Drainage

$27 million to improve drainage along 19 km of track

Figure 5.4. *KiwiRail workstreams that have a climate resilience benefit in second RNIP - FY26-FY27*

**Investment and delivery plans are subject to change, due to external events beyond KiwiRail's control which may require re-allocation of funds.*

5.4. PLANNING FOR COASTAL AND TEMPERATURE CHANGE

Coastal change:

Parts of KiwiRail's track network, our container terminals, and yards are exposed to coastal erosion and inundation, with the risk predicted to rise over time due to sea-level rise, particularly in a hot-house scenario. In some cases, it may be possible for us to protect these assets in the short-term with interventions such as seawalls or dune replenishment.

Longer term, KiwiRail may need to consider whether assets need to be moved or if we need to engage in managed retreat from some locations. In these cases, we will use Dynamic Adaptive Pathway Planning (DAPP), to help us identify trigger points for when we will need to change our asset management approach. The DAPP approach develops a series of actions over time (pathways) along with a series of triggers. For example, as the sea-level rises, the frequency of hazard events (e.g. flooding) may exceed an agreed trigger, signalling it is time to further protect an asset or consider relocating it. In parts of the country where local councils are also planning for change, such as South Dunedin, we will engage with local government to inform plans for our assets.

Temperature change:

When temperatures are higher than a rail network has been designed for rail track can buckle, causing delays or derailments. Higher temperatures and droughts also increase fire risk both alongside the track and from rail operations and make it more likely that temporary speed restrictions need to be applied to rail lines during maintenance periods. As temperatures increase, we will review and amend our technical standards. This may include things like changing the neutral temperature of our rail or changing the design temperature for our overhead line (OLE) in parts of the network where we run electric trains.

5.5. EFFECTIVE OPERATIONS - RECOVERING RAPIDLY

Given the extent of KiwiRail's network, our exposure to climate risk and our limited budgets it is not possible for us to ensure the entire network is resilient to all climate impacts. We focus our investment on ensuring climate resilience on our higher priority lines and on a quick recovery and return to service after extreme weather events. This is particularly important for parts of the rail network that are remote or cannot be accessed by road, making it difficult to re-route freight and passengers, and to gain access to make repairs.

We have already put in place emergency contracts to enable local experts to rapidly assess damage to our network when our own engineers and inspectors cannot travel to remote locations. We will investigate the feasibility of storing key materials (such as sleepers, track) around the country so we can respond rapidly when damage occurs. Using standardised designs for more asset types will mean we can deliver repairs or replacements more rapidly, without need for lengthy design processes or optioneering.

We are developing business continuity plans to ensure that we have contracts and processes in place to allow rapid re-routing of freight after an extreme weather event.

Customers want more proactive communication before and during extreme weather, to enable them to understand the level and likely duration of disruption to their services. Once an event has occurred our customers need to know what we are doing to repair assets, how long repairs are likely to take and how we will get their freight get to the destination as soon as possible. We are working to enhance customer communication about disruption across our rail and Interislander services as part of our wider transformation programme. A summary of the desired outcomes and key actions we will take in relation to our assets and operations is shown in Table 5.1.

Table 5.5. *Assets and Operations – Outcomes and Actions*

Desired outcomes:

- We understand the state of our assets, their criticality and their vulnerability to physical climate risks, and we use this information to prioritise works on our network
- We deliver our renewal and maintenance works in ways that enhance the climate resilience of our assets while minimising costs
- We understand and effectively manage risks to people - our staff/customers/ the public – from chronic and acute climate impacts
- We effectively manage impacts of climate disruptions to our customers

Current actions

Completed / Ongoing actions

- Our Strategic, National and Regional Asset Management Plans include consideration of climate risks and guidance that informs Asset Class Strategies
- Renewal and maintenance activities that KiwiRail delivers through the RNIP enhance climate resilience
- Standardise design for civil assets to enable more rapid recovery after damage to the network and minimise design costs
- Develop alternatives to effectively re-route rail freight after weather events in high-risk areas, to minimise delays and disruption for our customers.
- Established emergency response contracts for local experts to assess damage after extreme weather events (to ensure rapid access)
- Enhance proactive communication of climate disruption to our customers, before, during and after events

Future actions

- Develop climate resilient design criteria and guidance for specific asset classes and review our existing technical standards
- Pilot use of Dynamic Adaptive Pathway Planning for at least two specific assets
- Use LIDAR (light detection and ranging) technology to capture more detailed geospatial information about the network, to better understand risks like slips, scour around river and coastal structures and undertake more frequent structural inspections of bridges and towers in remote areas
- Landslip prevention – Continue updating slope risk, enhance our asset management data relating to retaining walls and increase inspections of retaining walls.
- Culverts – Undertake further hydrologic catchment analyses to identify where KiwiRail has culverts that are under sized for modelled water flows.
- Explore options for KiwiRail to stockpile critical materials in key locations so we can repair assets more rapidly after climate damage
- Explore options to enhance our proactive maintenance of drainage assets to reduce flooding impacts
- Explore with NZTA and our customers how rail can support resilience of road freight movements.

6. MEASURING PROGRESS

KiwiRail is at the beginning of our climate adaptation journey and developing and embedding the systems and processes needed to identify and track meaningful measures of climate resilience will take some time.

A key action in our plan is to develop a monitoring and reporting framework for climate adaptation. In the short-term, over the next one to three years, initial key metrics and targets that will be tracked include:

- Cost to KiwiRail of repairing weather and slip impacts each year
- Maintain or reduce where possible, the percentage of culverts on priority lines that are at condition 5 (where 1 is best condition, 5 is worst condition – culvert is damaged or collapsed) – current baseline as of FY25 is 4.4%
- Percentage of actions from our Climate Adaptation Plan that are on track for delivery (targeting 70%).

We will use these interim measures as we develop a more detailed monitoring and reporting framework. In future, we will explore how to develop more effective measures of how rapidly we are recovering from disruption and damage to our assets.

Over the next three years delivering the actions in this Climate Adaptation Plan will support KiwiRail to build the foundation for a strategic and coordinated approach to climate adaptation. By understanding our climate risks, implementing improvements to manage them and monitoring the impact of our response, we can work towards creating a more climate resilient system.

Repair works underway after Cyclone Gabrielle, 2023

Appendix

7. KEY TERMS

Term	Definition
Climate change adaptation	The process of taking action to prepare for and adjust to actual or projected impacts of climate change to reduce harm or realise benefits.
Climate change	Observable change in global climate variables that is attributable, directly or indirectly, to human activity, through the emission of greenhouse gases, in addition to natural causes.
Climate impacts	The consequences of realised risks from the interactions of climate-related hazards such as flooding, coastal inundation and landslides. For critical infrastructure, impacts can include asset damage, and loss of service which has economic, social, cultural, health and wellbeing impacts.
Climate scenario	A plausible representation of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships.
Climate-related risks	The potential negative impacts of climate change on an entity. These include physical risks related to the physical impacts of climate change such as increased extreme weather events (acute) and longer-term shifts (chronic) like increasing temperatures or sea level rise; and transition risks related to the transition to a low-emissions, climate-resilient economy, such as policy, legal, technology, market and reputation changes.
Climate-related opportunities	The potential positive climate-related outcomes for an entity, e.g. through efforts to mitigate and adapt to climate change.
Critical infrastructure	Infrastructure that provides essential services including utility services, such as water, wastewater and stormwater, electricity, gas, telecommunications, and transportation networks such as road, rail, airports, and ports.
Dynamic-Adaptive Pathway Planning	A planning tool that enables asset owners to explore the outcomes of multiple scenarios and develop a flexible but clear roadmap for asset management which is responsive to a range of future uncertainties. It is based on making decisions as conditions change, before severe damage occurs, and as existing policies and decisions prove no longer fit for purpose.
Electrification	Replacing fossil fuel-based systems with electric alternatives, e.g. adopting electric trains or replacing diesel ferries with battery-electric alternatives.
Maladaptation	Actions that may lead to increased risk of adverse climate-related outcomes, including increased greenhouse gas emissions, increased vulnerability to climate change and reduced welfare, now or in the future. Maladaptation is usually an unintended consequence.
Resilience	For critical infrastructure: The state of being able to avoid service disruption through track closures, or maintain or quickly restore service delivery, when high impact events occur. Climate resilience is the ability to anticipate, prepare for, and respond to the impacts of a changing climate.
Vulnerability	Being predisposed or more likely to be adversely affected. Elements that contribute to this concept include sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

KiwiRail