The Aotearoa Circle

Mā te Kaitiakitanga ko te Tōnuitanga
Prosperity Through Guardianship

NATURAL INFRASTRUCTURE PLAN

Part 3: Case studies

Demonstrating the fiscal and economic case for natural infrastructure through leading practice case studies.

Contents

Introduction

Why investment in Natural Infrastructure matters

By recognising natural infrastructure as the productive infrastructure that it actually is, we can strengthen our economy, reduce risk, create jobs, and build a future we can proudly say we helped shape.

Aotearoa New Zealand's economy is intrinsically linked to the environment. With 70% of our exports reliant on natural resources, investing in resilience and natural capital is not a trade-off - it is a win-win.

That's why we believe our Natural Infrastructure Plan presents a 1 + 1 = 3 investment: it addresses today's challenges while building capacity for tomorrow.

It also points to the need for a shift in conversation beyond hard engineering solutions that may appear cheaper upfront, but often cost more over time in maintenance, repairs and lost co-benefits.

We understand why infrastructure matters. Roads move goods and services. Pipes deliver water and power. Bridges connect communities and enable commerce.

Natural infrastructure is less visible and therefore less valued. It exists in wetlands, native forests, dunes, rivers and floodplains. It quietly provides flood mitigation, water filtration, erosion control, carbon sequestration and temperature regulation without invoices, contracts or maintenance schedules.

Nature may be the most undervalued infrastructure asset we have. And because we undervalue it, we underinvest in it.

For too long, we have framed economic growth and environmental health as competing interests. This Plan demonstrates that we can - and must – achieve both. By doing so we can capitalise on the multiple benefits that investment in natural infrastructure offers - often with lower, long-term operating costs.

And as the New Zealand Infrastructure Commission Te Waihanga has identified, long-term strategy and planning are essential to guiding infrastructure investment and enhancing national resilience. This Plan adds a powerful tool to our infrastructure toolkit to support this.

Practical Actions

The Natural Infrastructure Plan has been developed through a coalition of 200+ contributors with over 10,000 combined hours of research, debate and collaboration. It reflects deep expertise and shared ambition.

What it is not is a list of aspirations. Instead, it provides practical actions from clear policy levers for government to significant opportunities for business, leadership and investment.

The plan also includes six case studies demonstrating the measurable benefits of incorporating nature-based solutions into infrastructure planning.

It encourages decision-makers to widen the lens through which infrastructure investments are assessed.

The Investment Decision Toolkit, for example, provides a structured way to evaluate natural infrastructure alongside traditional engineered solutions.

Public agencies, private companies and iwi can use these tools to compare options, assess long-term value and capture multiple co-benefits.

When making decisions that will shape infrastructure for decades, the greatest risk is not choosing the wrong option. The greatest risk is failing to consider all available options.

Natural infrastructure is not an environmental add-on. It is a credible, investable infrastructure asset.

By investing in natural infrastructure, we can reduce the risk in insurance, improve returns on investment, and know we will have enduring growth.

The question is no longer whether we can afford to invest in natural infrastructure.

It is whether we can afford not to.

Vicki Watson

Chief Executive
The Aotearoa Circle

About The Aotearoa Circle

The Aotearoa Circle, a unique leadership organisation, convenes public and private sector partners to tackle complex climate and nature challenges that threaten economic growth and future prosperity.

We know that our economy is intrinsically linked to our natural capital, yet it has been declining for decades.

That's why we have a mission and a deadline. If nature loss is not halted and reversed by 2035, Aotearoa New Zealand will reach a tipping point with lasting consequences for our economy, communities and global standing.

Our work considers pressing climate change and nature challenges facing our key sectors - from agriculture, energy and seafood to transport, finance, and tourism. We do this by delivering practical, cross-sector solutions that reduce risk, strengthen resilience, and ultimately aim to restore natural capital.

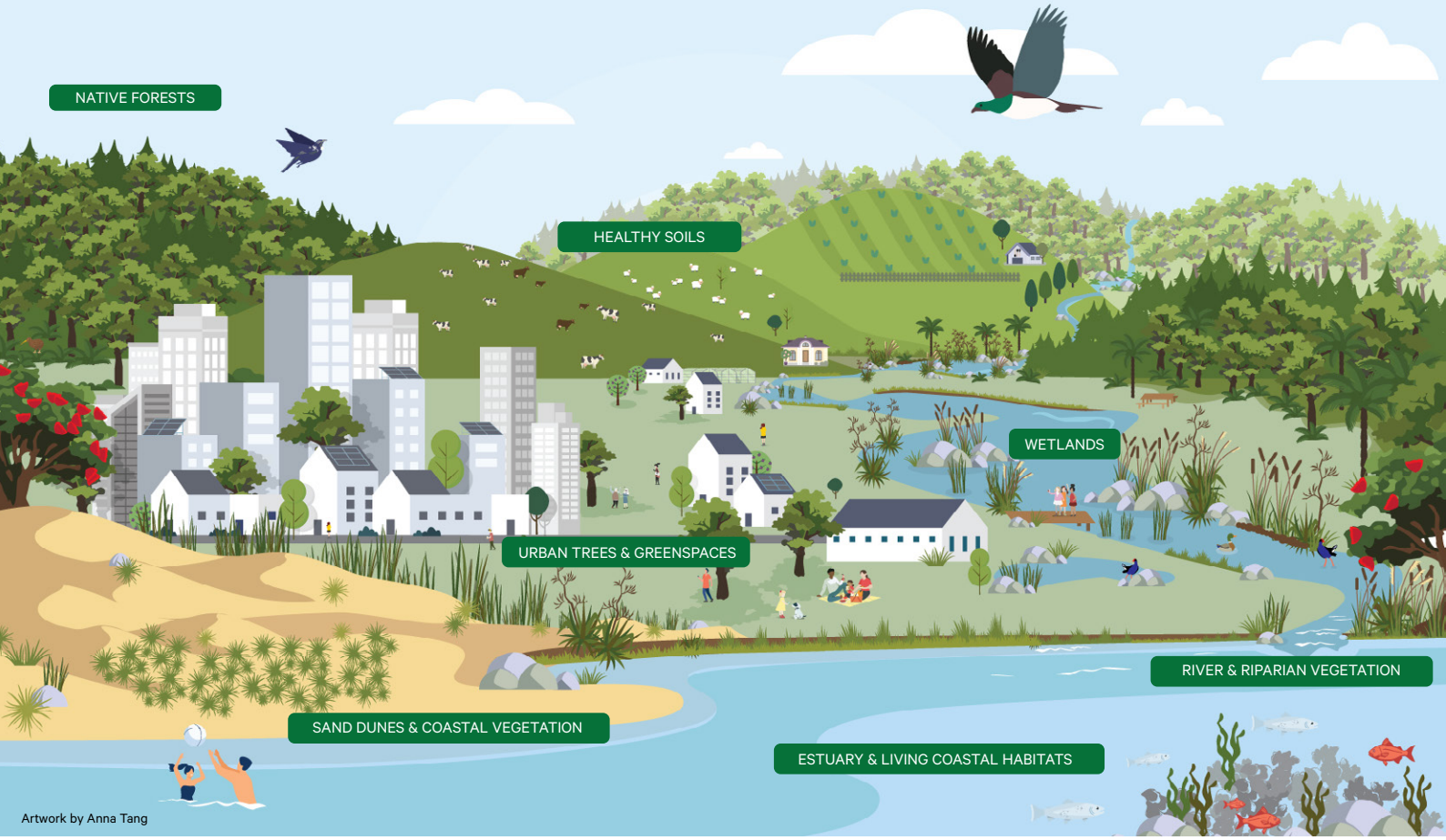
The Circle is guided by Guardians (our Board) and strengthened by future voices through our Rangatahi Advisory Panel (RAP) who actively participate in major workstreams, including the development of this plan.

Formed in 2019, our co-founder Sir Rob Fenwick stated at the time that, “Time is running out for the treasures of nature that we love, and it is worth using every last breath, all of our collective energy, to save our land and secure our future.”

Sir Rob’s vision continues to inspire and guide us each day.

www.theaotearoacircle.nz

What is natural infrastructure?



NATURAL INFRASTRUCTURE	SERVICES IT PROVIDES
NATIVE FORESTS	• Stabilises slopes and reduces erosion and landslides • Regulates water (slows runoff, sustains baseflows, improves quality) • Habitat for native species; supports cultural values and recreation • Stores carbon over long timeframes; provides local cooling and shade
RIVER & RIPARIAN VEGETATION	• Filters sediment, nutrients and some pathogens before they reach waterways • Shades streams, lowering temperatures for aquatic life • Stabilises banks and reduces erosion • Provides habitat corridors for native species and inanga spawning areas
WETLANDS	• Temporarily store floodwaters and buffers stormwater • Retain water and supports drought resilience • Filter nutrients and contaminants, improving water quality • Sequester and stores carbon (notably peat systems) • Provide habitat and mahinga kai values
URBAN TREES & GREENSPACES	• Reduce urban heat and provide shade for people and places • Intercept rainfall and reduce stormwater runoff • Improve air quality and support urban biodiversity and wellbeing
SAND DUNES & COASTAL VEGETATION	• Trap and stabilise sand, reducing coastal erosion • Buffer storm surge and waves; enable natural shoreline adjustment • Provide habitat for coastal species and protect communities and assets inland
ESTUARY & LIVING COASTAL HABITATS	• Attenuate waves and help stabilise shorelines • Filter water, cycle nutrients and improve clarity • Store “blue carbon” in sediments and vegetation • Provide nursery habitat that supports fisheries and biodiversity
HEALTHY SOILS	• Provide the foundation for food production by cycling nutrients, retaining moisture and supporting fertile land • Reduce erosion and sediment loss when healthy, protecting waterways and downstream ecosystems • Help buffer flooding by absorbing, storing and slowly releasing water across the landscape • Filter contaminants and improve water quality before water reaches rivers, estuaries and aquifers • Store carbon and support soil biodiversity that underpins ecosystem resilience

A. About this report

Purpose

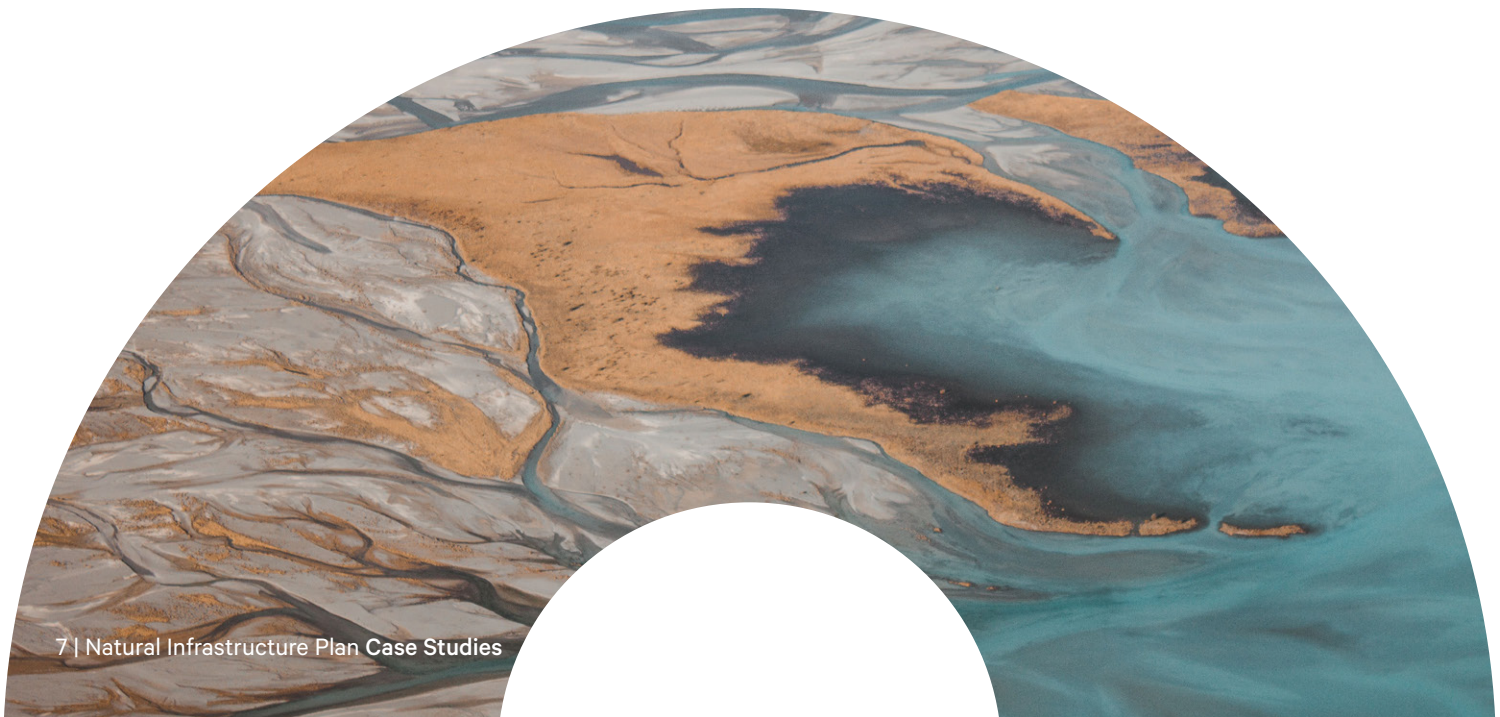
The six case studies presented in this report demonstrate how applying natural infrastructure to our infrastructure challenges is not only financially cost efficient and effective but capable of delivering multiple benefits.

These case studies show how a nature-based alternative can be a cost-effective way to support, enhance, or replace traditional infrastructure.

They show how natural infrastructure offers strategic alignment with our infrastructure challenges whilst providing cost efficient value-for-money alternatives to traditional infrastructure delivering.

In addition, the case studies also outline that using natural infrastructure also affords investors with multiple benefits and outcomes.

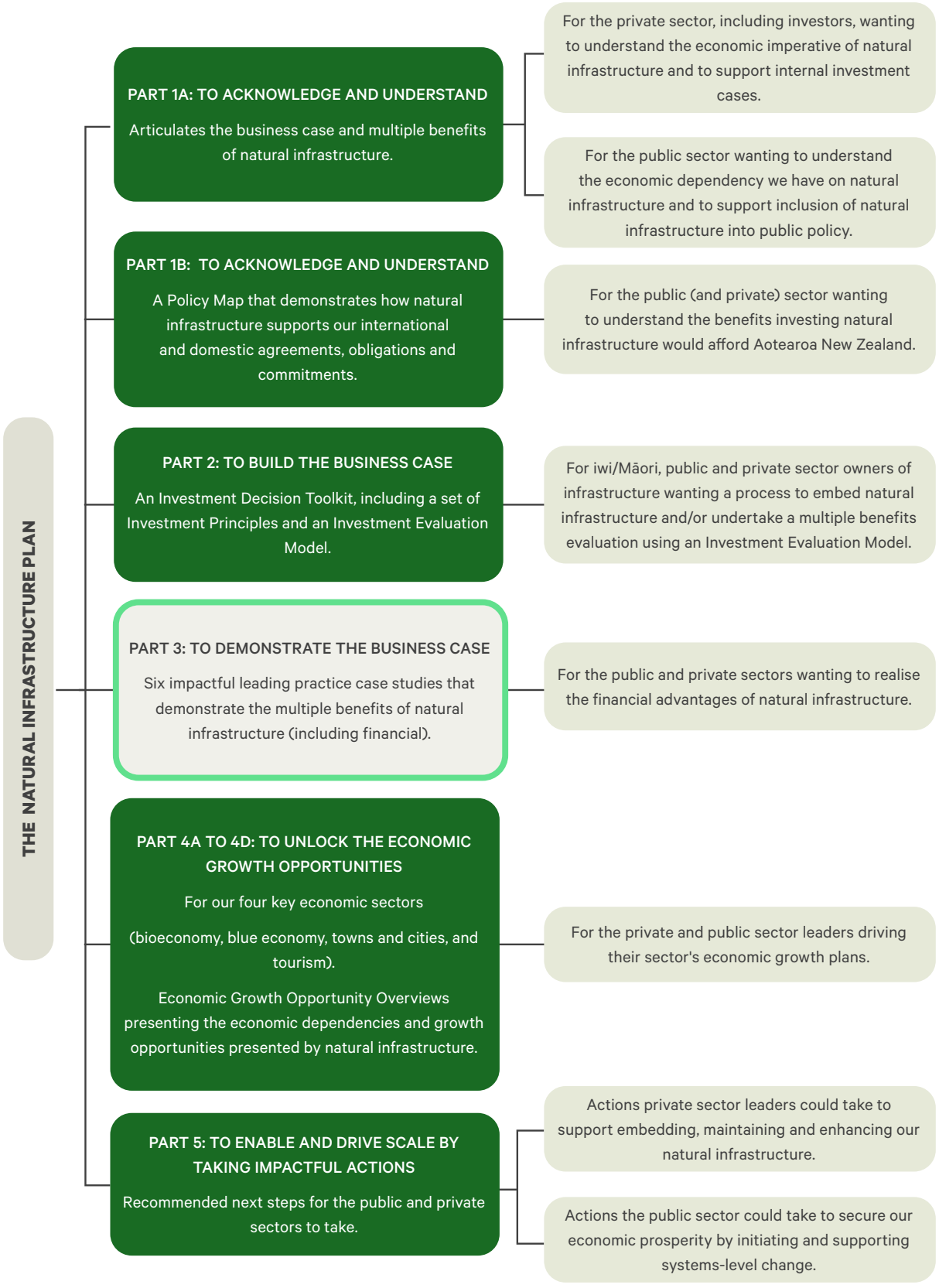
This report has been prepared to support The Aotearoa Circle's Natural Infrastructure Plan (released 4 March 2026).



Structure of the Natural Infrastructure Plan

The Natural Infrastructure Plan comprises several sections framed against the five objectives. Each has a specific purpose and intended audience.

Note: Parts 1B, 2, 3 and 4A-4D are available as separate PDFs to download.



Next Steps – The Opportunity

It is envisaged that public and private sector leaders draw inspiration and ideas from these case studies when considering an infrastructure investment.

It is envisaged that natural infrastructure is seen as critical infrastructure, and that by using nature to improve our resilience, we can support both urban development and nature development. These case studies aptly demonstrate you can do both and a natural infrastructure investment delivers not only financial benefits, but also environmental, resilience, cultural and social benefits.

To embed, maintain and enhance our natural infrastructure, system-level changes are required. These system-level changes, and other recommendations, are contained within the Natural Infrastructure Plan.

B. Selecting and developing the case studies

Selecting the case studies – the long-list of potential options

Whilst there are numerous case studies available demonstrating the environmental benefits of natural infrastructure, few provide detail on financial benefits.

Through this work, The Aotearoa Circle sought to redress this situation, and to provide real life, replicable, and scalable case studies where the economic benefits were clear.

To achieve this, a long list of potential case studies was developed. The search for case studies was extensive, involving the following:

- a survey asking for examples through Partners of The Aotearoa Circle
- specific requests to public and private sector stakeholders involved in the natural infrastructure space
- a review of numerous publications from organisations in Aotearoa New Zealand and internationally
- project contributions from Beca Directors involved in, and aware of, client projects.

Each potential case study was then assessed and selected for full analysis using the following criteria. The project:

- Supports our existing network infrastructure (e.g., land transport, water and waste, airports, etc.)
- Supports at least one of our key economic sectors (e.g., bioeconomy, tourism.)
- Factually demonstrates the economic business case
- Delivers measurable positive benefits to our natural environment
- Delivers multiple benefits (including social and cultural) at scale (e.g., can be replicated, can be easily implemented, etc.).

To ensure the case study had the financial data, extensive efforts were made. This included further research of publicly available information, as well as direct inputs from owner organisations.

Having assessed the case studies against the criteria, and evaluated data availability, a short list of case studies surfaced.

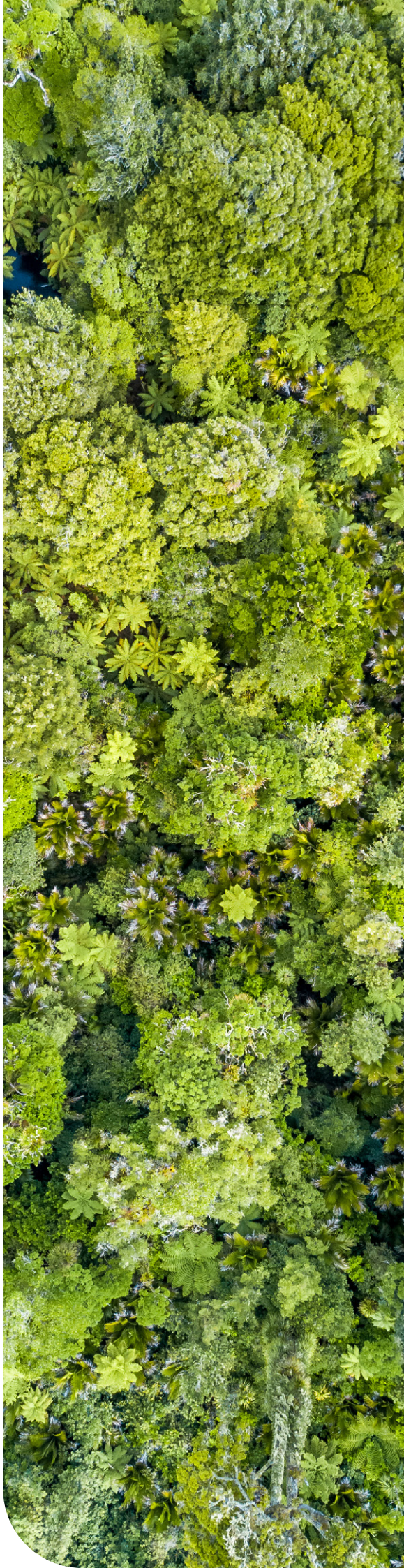
Developing the final case studies

The final case studies were developed using publicly available information enhanced by data provided by the organisations and people involved in the projects.

With good qualitative information available on the projects, context and outcomes, the focus for each case study was to develop and define the economic context (i.e. risk or opportunity drivers), financial benefit data and environmental benefit data.

For some projects this data was readily available, and for others this required additional effort by the organisation to quantify, whilst respecting the commercial sensitivity of the projects.

A summary of the final case studies selected is presented in Table 1.



DEVELOPING THE CASE STUDIES

Table 1: Overview of case studies demonstrating the business case for natural infrastructure

Case study	Title	Existing network infrastructure supported	Economic sector(s) supported	Economic growth facilitated by the natural infrastructure	Delivers financial benefits	Delivers positive environmental benefits	Delivers social /cultural benefits
1	**Kaipara Moana Remediation, Auckland/Northland**	Water and waste	Bioeconomy Blue Economy	Sustaining primary production, local jobs, protecting harbour and key fishery nursery	✓	✓	✓
2	**Tangaroa Stream, Waitara Flood Resilience Scheme, Taranaki**	Water and waste	Towns and cities	Protection of residential and business assets for economic continuity and city growth	✓	✓	✓
3	**Queensland Reef Credit Scheme, Australia**	Water and Waste	Bioeconomy Blue Economy Tourism	Sustaining primary production, tourism/fisheries value protection and growth	✓	✓	
4	**South-West Christchurch Resilient Urban Development**	Water and waste	Towns and cities	Residential and industrial urban development/uplift	✓	✓	✓
5	**Auckland Airport, Innovative Stormwater Project**	Water and waste Ports and airports	Towns and cities	Airport operational expansion	✓	✓	
6	**Kirimoko Park, Residential Development, Wanaka**	Land transport Water and waste	Towns and cities	Development costs reduction, supporting urban growth	✓	✓	✓

C. Evaluating the successful outcomes of the case studies

Each of the case studies were evaluated against the following:

- **Deliverability**: using key Investment Principles developed by The Aotearoa Circle to support natural infrastructure investment, (see "What makes a good natural infrastructure project – Guiding principles to support credible natural infrastructure investment) each study was assessed to unpack the principles they applied to successfully deliver their multiple benefits.
- **Strategic alignment:** the case studies were evaluated against Aotearoa New Zealand's national infrastructure priorities[1].
- **Value for money**: using the multiple value and benefits Investment Evaluation Model for natural infrastructure, developed by The Aotearoa Circle to support the Natural Infrastructure Plan, the value for money for each case study was evaluated.

Deliverability

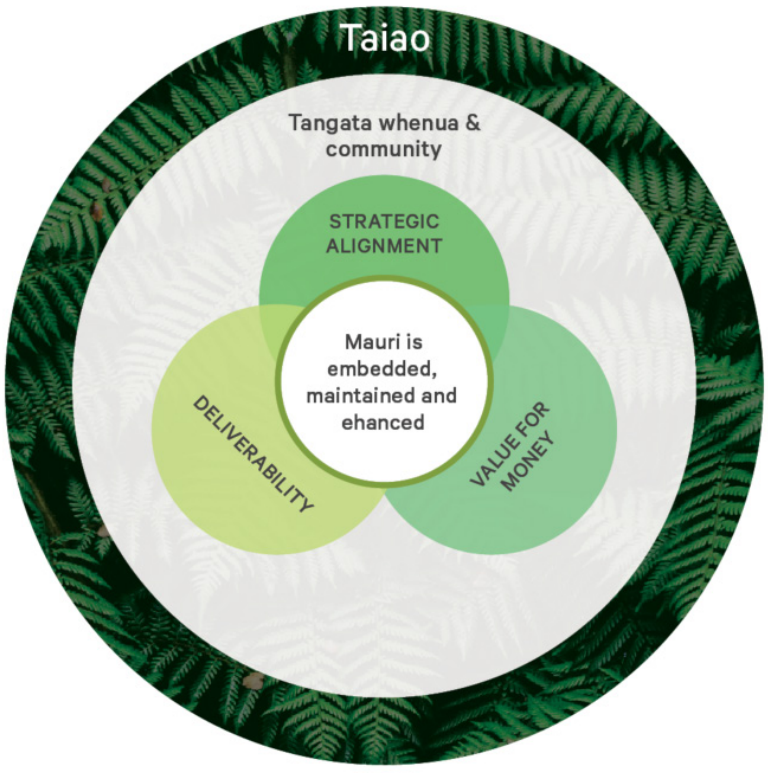
To support greater investment in natural infrastructure, The Aotearoa Circle developed a set of Investment Principles. These principles outline what must be true for natural infrastructure investment to be credible.

The Investment Principles are:

- **Principle 1:** Taiao – credible ambition and outcomes through valuing the natural world
- **Principle 2:** People – there are opportunities for community and tangata whenua co-creation
- **Principle 3:** Strategic alignment – there is alignment with the infrastructure priorities New Zealanders need
- **Principle 4:** Value for money – there are direct and indirect benefits and outcomes from the investment
- **Principle 5:** Deliverability – the solution achieves positive intergenerational multiple outcomes.

Applying the Investment Principles, the case studies confirmed the key enablers and success factors required to enable and drive the investment in natural infrastructure at scale.

The Investment Principles and key enablers that supported the successful outcomes from the case studies is summarised in Table 2.



1 https://tewaihanga.govt.nz/our-work/infrastructure-priorities-programme/assessment-criteria

EVALUATING THE CASE STUDIES

Table 2: Alignment of the case studies to the Investment Principles that support credible investment in natural infrastructure.

Case study	Title	**Investment Principle 1:** Taiao - credible ambition and outcomes through valuing the natural world	**Investment Principle 2:** There are opportunities for tangata whenua and community co-creation	**Investment Principle 3:** Strategic alignment – there is alignment with the infrastructure priorities New Zealanders need	**Investment Principle 4:** Value for money – there are direct and indirect benefits and outcomes from the investment	**Investment Principle 5:** Deliverability – the solution achieves positive intergenerational multiple outcomes
1	**Kaipara Moana Remediation, Auckland/Northland**	✓	✓	✓	✓	✓
2	**Tangaroa Stream, Waitara Flood Resilience Scheme, Taranaki**	✓	✓	✓	✓	✓
3	**Queensland Reef Credit Scheme, Australia**	✓		✓	✓	✓
4	**South-West Christchurch Resilient Urban Development**	✓	✓	✓	✓	✓
5	**Auckland Airport, Innovative Stormwater Project**	✓		✓	✓	
6	**Kirimoko Park, Residential Development, Wanaka**	✓		✓	✓	✓

D. Strategic alignment with Aotearoa New Zealand's Infrastructure Strategy Objectives

To demonstrate their contribution towards priority outcomes, each case study was assessed against the five key long-term Strategic Objectives for New Zealand's infrastructure. These five objectives include:

- **Enabling a net-zero carbon emissions Aotearoa New Zealand** through rapid development of clean energy and reducing the carbon emissions from infrastructure.
- **Supporting towns and regions to flourish** through better physical and digital connectivity and freight and supply chains.
- **Building attractive and inclusive cities** that respond to population growth, unaffordable housing and traffic congestion through better long-term planning, pricing and good public transport.
- **Strengthening resilience to shocks and stresses** by taking a coordinated and planned approach to risks based on good-quality information.
- **Moving to a circular economy** by setting a national direction for waste, managing pressure on landfills and waste-recovery infrastructure and developing a framework for the operation of waste-to-energy infrastructure[2].

As shown in **Figure 1** below, **each case study aligned with at least one of the Infrastructure Strategy's five key objectives.**

Collectively, the case studies directly contribute towards supporting towns and regions to flourish, building attractive and inclusive cities, and strengthening resilience to shocks and stresses.

Figure 1: Selected case studies: collective alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

2 https://tewaihanga.govt.nz/our-work/infrastructure-priorities-programme/assessment-criteria

Value for money

Recognising that value means the net fiscal, economic and wellbeing benefits of an asset or investment proposal over its life cycle, each case study was assessed against the multiple value and benefits Evaluation Framework, developed by The Aotearoa Circle to support the natural infrastructure investment. The multiple values, associated with natural infrastructure, included financial, risk and resilience, environmental, social and cultural value.

The collective and measurable value afforded by the case study projects is provided in Figure 2.

The case studies demonstrate that natural infrastructure delivers financial value.

For example,

- **Case study 1**: KMR delivered improved economic prosperity and Return-on-Investment. The Return-on-Investment is $3.94 per $1 invested. This will primarily be returned to the local and national economies. The payback period for these investments has been estimated at 3.63 years (for benefits to permanently outweigh costs).
- **Case study 2:** The nature-based solution saved $400,000 in CAPEX, almost 7% of the total budget by taking a less intrusive, more natural approach to daylighting, with less earthworks, less soil disturbance, and less impact to taonga.
- **Case study 3:** The Queensland Reef Credit Scheme has delivered a positive return-on-investment of between 5 and 10 times the initial investment.
- **Case study 4:** The Christchurch City Council has avoided $14million in capital costs to date by favouring a natural infrastructure solution.
- **Case Study 5:** Auckland Airport, through use of a Coupled Wetland Biofilter will save on operational and maintenance costs, as well as benefit from an extended design life.
- **Case study 6:** Kirimoko Park – using a Water Sensitive Design approach meant the subdivision design was 22% more cost effective than a traditional approach to stormwater management. Using natural infrastructure delivered improved private development yield, avoided hard infrastructure costs, avoided costs of future proofing and avoided environmental remediation costs.

Further financial performance of these natural infrastructure investments is provided in the case studies.

The case studies demonstrate that natural infrastructure delivers value across risk and resilience, environmental, cultural and social elements.

For example,

- **Case study** 1: The Kaipara Moana Remediation project will provide 712 new employment opportunities for the region. The actions will also improve on-farm productivity and provide a benefit-to-cost ratio of 22% and payback period of 4.5 years due to increased pasture income.
- **Case study 2:** Tangaroa Stream has provided improved flood resilience for public and private assets, including resilience for approximately 60 properties, an intermediate school, a high school, a marae, a community pool and associated roading network.
- **Case study 3:** Provides a model to drive international investment which delivers on environmental improvements to land and water quality, thereby restoring and protecting an asset which contributes AU$9billion to Australia's economy[3].
- **Case study 4:** The Christchurch City Council has delivered on improved flood resilience whilst integrating economic growth and urban development. Due to the use of natural infrastructure the flood risk has reduced, meaning that the land has been able to be developed to accommodate city growth, whilst also providing improved protection of hundreds of properties in the downstream river. This helps reduce insurance premiums for home and business owners[4].
- **Case study 5:** For Auckland Airport, the nature-based solution required a third of the land compared to a traditional approach, freeing up valuable space for aeronautical activities.

3 https://www.barrierreef.org/uploads/GBRValue-FullReport-Oct25.pdf

4 Treasury data shows insurers honing in on flood-risk properties | RNZ News

The design also benefits local biodiversity with around 20,000 native plants within the wetland and 2,600 within the raingarden.

- **Case study 6:** The Kirimoko Park division has improved drainage and flood management, improved water quality, improved infrastructure resilience, as well improved hydrology. By contrast, should a 'business as usual' traditional infrastructure approach have been used, the benefit would have been solely linked to drainage and flood management.

Figure 2: Case study collective multiple benefits and value for money delivered by using natural infrastructure.
The shaded boxes highlight the benefits of each natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events(e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

E. Enabling and driving scaling – key learnings from the case studies

When assessing the learnings from these case studies, key success factors were common to all. These success factors set up the projects to be successful – and to deliver not only financial benefits but also measurable resilience, environmental, social and/or cultural benefits.

Principle 1: Taiao – credible ambition and outcomes through valuing the natural world

From the outset, the projects and schemes recognised and responded to the inherent value of the natural assets and the ecosystem services it provides.

The projects and schemes were deliberately designed to embed, maintain and enhance the natural world from the outset. For example, the Tangaroa Stream flood resilience scheme and the Queensland Reef Credit scheme both recognised the value of the ecosystem services provided by natural infrastructure.

Principle 2: People – there are opportunities for community and tangata whenua co-creation

From the outset, the projects and schemes recognised that nature is a system, and to address the imbalance a system-level response is required. For example, Kaipara Moana, Kirimoko Park, and Christchurch City Council all recognised that solutions are needed at a community level. Furthermore, community engagement is high, such that they have committed to a 'Kirimoko Code' which includes a range of environmental requirements and incentives.

A second success factor was strong leadership provided by key people driving design and implementation. For example, Auckland Airport opting for an innovative solution to its stormwater management.

Finally, significant opportunities for tangata whenua and community co-creation helped ensure landowners and residents buy-in. For example, the Tangaroa Stream flood resilience scheme had extensive co-creation with tangata whenua Manukorihi (Hapū). Integrating the clear vision of Manukorihi ensured multiple benefits were realised, including to revive the stream, to improve the water quality, to improve flood resilience, and to improve biodiversity, and restore mahinga kai for the area.

Principle 3: Strategic alignment – there is alignment with the infrastructure priorities New Zealanders need

All projects and schemes had long-term visions, which were aligned with organisational strategic plans. For example, Christchurch City Council knew the area in south-west Christchurch was planned for urban development and had the vision to include nature-based solutions to flood resilience into their plans.

Principle 4: Value for money – there are direct and indirect benefits and outcomes from the investment

A comparison with traditional infrastructure approaches was able to demonstrate direct financial and non-financial benefits and outcomes. For example, the Kirimoko Park subdivision, using a Water Sensitive Design approach resulted in not only improved flood resilience, but a better financial business case (due to reduced capital expenditure, reduced operating and maintenance costs and an extended asset design life).

The projects also demonstrate that having an ambition to go beyond "minimum compliance" could still achieve a return on investment and/or result in reduced costs. For example, Tangaroa Stream flood resilience scheme, by using a natural infrastructure solution coupled with iwi/Māori co-design, the consenting process was smooth and efficient, saving on potential consenting and compliance costs.

Principle 5: Deliverability – the solution achieves positive intergenerational multiple outcomes.

All projects had solid and established governance structures to sustain the ambition.

The projects were also designed and structured to deliberately deliver multiple outcomes. For example, Christchurch City Council's natural infrastructure approach has used the Sparks Rd wetland to provide 17ha of greenspace, provide 90,000 new wetland plants, restore 600m of waterways, and provide 1.7km of walking tracks for the community.

F. Case Studies

Case Study 1: Kaipara Moana Remediation

Project name	Kaipara Moana Remediation
Project region/location	Auckland/Northland
Network infrastructure category	Water and waste
Economic sector relevancy	Bioeconomy and Blue Economy
Project owner	KMR Joint Committee (KMR Board)
Iwi/Māori involved	Ngā Maunga Whakahii o Kaipara, Te Uri o Hau and Te Rūnanga o Ngāti Whātua
Other entities involved	Ministry for the Environment, Northland Regional Council, and Auckland Council
Project start date	February 2021
Project completion date	2031
Project financial value	$200 million
Project lifetime	10 years
Natural Infrastructure Implemented	Wetland restoration, Riparian planting, Forest regeneration and Erosion prevention.
Access to investment funds	$100million crown funding (Deed of Funding). $10million from Northland Regional Council and Auckland Council each. $80million from stakeholders and philanthropy (often in-kind)

CONTEXT

The Kaipara is the Southern Hemisphere's largest natural harbour and a place of global significance[1].

Many vulnerable farming communities are in the region and are exposed to extreme weather. They were particularly impacted following Cyclone Gabrielle and the Auckland Anniversary Day floods (2023) leading to significant loss of valuable soils.

The impacts of declining land productivity are not only reflected as lower farm incomes but also lower demand on the services offered by downstream industries, and subsequently lower profits along the whole supply chain.[2]

Soil erosion is a widespread problem in Aotearoa New Zealand, with an initial analysis suggesting its impact on productivity could be at least $300 million per year [3].

1 https://kmr.org.nz/

2 https://www.nzares.org.nz/doc/2020/Papers/Soliman%20Walsh%202020%20Eros_Prod_analysis_13Aug20.pdf

3 Erosion is costing NZ up to $300m a year | RNZ News

Decades of deforestation and land-use intensification have degraded the catchment. Today, less than 10% of original native forest and 5% of wetlands remain, leading to a seven-fold increase in average annual soil erosion and associated sediment washing into the Moana (700,000 tonnes a year).

Half the catchment is considered erosion-prone, and one eighth, highly erodible. The significant impacts of sedimentation on the Kaipara Moana are well-documented, with studies showing that valued species and habitats are smothered, leading to ecological issues.

The Kaipara has unique economic value that is nationally important – 98% of the North Island west coast snapper hatches in the Kaipara 'nursery'. Snapper is Aotearoa New Zealand's top commercial inshore fisheries catch, creating export revenue of around $35million and contributing ca. $69million to the economy, including 579 jobs per year[4].

The harbour holds deep environmental value, with some of the rarest ecosystems in Aotearoa New Zealand, including sand-dune seagrass, freshwater and estuarine wetland ecosystems. It is home to many taonga species such as the critically endangered Māui dolphin.

The evidence shows that the harbour and the 6000km of surrounding catchment, annually contributes $69million[5] to Aotearoa New Zealand's economy and has significant cultural and recreational values.

PROJECT DESIGN

As the largest national harbour restoration project in Aotearoa New Zealand, KMR aims, in the long-term, to halve sediment flows from the land into the moana.

KMR intends to achieve this through investing in natural infrastructure projects within the catchment which align with this intended outcome. These projects include protection and restoration of wetlands, reforestation and regeneration of native forests on erosion-prone land, fencing near streams and rivers for stabilisation, and more.

Project financial value

$200million

Natural infrastructure implemented

Wetland restoration, Riparian planting, Forest regeneration and Erosion prevention.

PROJECT FUTURE STATE OUTCOMES

KMR is protecting vulnerable communities previously impacted by Cyclone Gabrielle and the Auckland anniversary floods by delivering significant soil conservation, land stabilisation, water quality improvements and flood attenuation, driving nature-based resilience in the area.

KMR is securing economic prosperity for the region through support to land-owners - fencing off marginal areas and planting natives to improve water quality, farm infrastructure, land management systems and productivity.

KMR ultimately aims to achieve these outcomes through its main target: halving the amount of sediment flowing into the harbour. The snapper fishery and the economic

4 https://kmr.org.nz/the-kaipara-moana/
5 https://kmr.org.nz/the-kaipara-moana/

Pictured: Kaipara Wetland

outcomes it delivers is at risk from the sediment losses from the land, and so water quality improvements protect this industry for the future.

This restoration aims to protect many social and cultural taonga within the catchment. While KMR's focus is on reducing sediment, wider benefits include helping valued bird and ocean species to thrive, reducing climate change risks and increasing resilience to storms and other extreme weather.

PROJECT/ASSET ACCOUNTABILITY

Project owner

KMR Joint Committee (KMR Board)

Iwi/Māori involved

Ngā Maunga Whakahii o Kaipara, Te Uri o Hau and Te Rūnanga o Ngāti Whātua

Other entities involved

Ministry for the Environment, Northland Regional Council, and Auckland Council

PROJECT TIMEFRAMES

Project start date

February 2021

Project completion date

2031

Project lifetime

10 years

STAKEHOLDER ENGAGEMENT

KMR has contracted projects with 917 landowners/groups with 108 more projects in development. This has created employment opportunities for a wide range of local businesses, and supported training and mentoring for 247 people, many from local iwi and hapū.

MEASURED FINANCIAL BENEFITS

An independent Benefit Case Study from March 2025[6] evaluated the cost/benefits of KMR delivery. This study estimated that KMR will produce a return of $3.94 per $1 invested, which will be primarily returned to the local and national economies.

Improved economic prosperity and Return-on-Investment

The net present value of the current investments was estimated to be $316million, expected to grow to $423million by 2031, with $195million from environmental benefits, $121million from economic gains, and $107million from wellbeing outcomes.

The payback period for these investments was estimated to be 3.63 years (for benefits to permanently outweigh costs).

Improved flood resilience

The project will deliver $11million in value due to prevention of harm to people, property and infrastructure from floodplain restoration.

Improved employment

From an employment perspective, the project has provided 424,000 hours of new work for 272 people, which at full scale could provide up to 712 FTE.

6 Economic-Impacts-Kaipara-Moana-Remediation-v2.pdf

Pictured: Wairoa River, Kaipara

Improved on-farm productivity

Independent analysis of a typical farm system, acting with KMR support, highlighted the economic benefits of retiring unproductive areas on farm: improving grazing efficiency ($12,800/yr in increased pasture income) giving a benefit-to-cost ratio of 22% and payback period of 4.5 years.

MEASURED ENVIRONMENTAL, SOCIAL AND CULTURAL BENEFITS

- To date, the project has invested over $28million and planted 2.78million trees/plants in over 1,544ha, as well as delivered/contracted 1,065km of fencing. This is protecting:
- 1,533km of river- and streambanks (up to 16,220km if the project is fully scaled)
- 49km coastline (>800km if the project is fully scaled)
- 297ha wetlands (up to 29,742ha if the project is fully scaled)
- 325ha remnant forest
- 440ha highly erodible land.

Across the project, KMR has supported native afforestation/regeneration projects, projected to store ca. 160,000tCO2e over the next 50 years, as well as reducing soil loss from the project areas by an estimated 70%.

By the end of 2029, >6,500ha of riparian, wetland, coastal margins and erodible land are projected to be protected through KMR projects. Scientific modelling estimates that sediment loss along protected margins will reduce 70-84%, and other contaminants up to 60%.

KMR also expects an estimated 6% reduction in sediment flows from the land into the Kaipara Harbour. The project is projected to plant 14.9million trees/plants by 2031.

Improved recreational and social amenity

Estimates of the environmental and wellbeing benefits, calculated according to a 'willingness-to-pay' measure, included $22million in value of additional fish caught for recreational fishing due to improved water quality.

Improved cultural amenity

The project will realise $106million in benefits (based on a willingness to pay model) of being able to protect and promote Māori culture and practice.

ACCESS TO INVESTMENT FUNDS

- $100million crown funding (Deed of Funding).
- $10million from Northland Regional Council and Auckland Council each.
- $80million from stakeholders and philanthropy (often in-kind).

CASE STUDY 1

Case study 1: Alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

Case Study 1: Value for money - delivering fiscal, economic and wellbeing benefits through natural infrastructure

The shaded boxes highlight the benefits of this natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events (e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

Case study 2: Tangaroa Stream flood resilience scheme

Project name	Tangaroa Stream, Waitara Flood Resilience Scheme
Project region/location	Taranaki
Network infrastructure category	Water and waste
Economic sector relevancy	Towns & Cities
Project owner	New Plymouth District Council
Iwi/Māori involved	Manukorihi Hapū
Other entities involved	Beca, Morphum Environmental.
Project start date	2022
Project completion date	2025
Project financial value	$5.8 million
Project lifetime	100+ years - Intergenerational
Natural Infrastructure Implemented	Stream restoration (daylighting), wetland restoration, riparian planting.
Access to investment funds	The project is co-funded by NPDC and the Ministry for the Environment (MfE) Freshwater Improvement Fund for $1.8million.

CONTEXT

The Taranaki region is prone to high rainfall and subsequent flooding. Significant events have been recorded in the past, including the large Waitara River flooding the local community[1].

Whilst improved flood resilience is in place Waitara remains a priority focus due to significant and ongoing issues with stormwater and flooding, which are exacerbated by increasingly severe weather events overloading natural and built drainage systems in the town [2].

In 2019, New Plymouth District Council (NPDC) established the Waitara Stormwater upgrades programme, which included the essential Tangaroa Stream Restoration Project (Project). The Project will reconnect the Tangaroa Stream to the Waitara River, improving its ability to drain stormwater from heavy rainfall more quickly. The strategic objective for the Project was increased flood resilience for the wider waitara community.

Part of the stream is currently cut off from the river, preventing fish passage, and a significant 164m section, through Owae Marae, is diverted through underground pipes.

Serving as a natural boundary for Manukorihi Pā - the site of Owae Marae - Tangaroa Stream was once an essential food source that supported the success of mana whenua for generations.

Upstream development in the 2000's resulted in silt and weeds choking the stream, diminishing its flow, impacting mahinga kai and leading to widespread flooding during periods of heavy rain.

As part of the Project, the 164m section of existing

1 You & your river / Taranaki Regional Council

2 https://www.npdc.govt.nz/council/reports-and-publications/reports/preliminary-community-climate-change-risk-assessment/Preliminary Community Climate Change Risk Assessment

stormwater pipe was planned for 'daylighting' which would improve drainage ability as well as channel maintenance. Early concept designs for the stream daylighting focussed on a traditional engineered approach, involving a relatively geometric channel, with steep battered banks to tie in to surrounding ground levels, and an engineered cascade. This cascade required pipe removal, extensive earthworks and significant tree removal.

While some consideration was given to natural elements such as rock riffles, it was the application of mātauranga Māori and local knowledge that were the drivers for a fully naturalised stream system which would bring benefits beyond the engineered option.

PROJECT DESIGN

Key aspects of the design process for daylighting the stream adjacent to the Manukorihi Pā included guidance by wairua, from kaumatua (elders) and mātauranga.

The co-design team developed design principles focused on an approach of 'letting the awa speak', ecological enrichment, and tau (providing a place for peace and reflection). This approach centred on restoring the mana of the waterway by minimising soil disturbance and impact to significant tree species, while enhancing natural character and delivering positive cultural, social and ecological outcomes.

The work daylighted 164m of stream and restored stream banks along its length.

The design provides for nature, by allowing the stream to re-establish its connection with the whenua, soil, rākau (flora) and flow through an ecologically enriched landscape.

Project financial value

$5.8million.

Natural infrastructure implemented

Stream restoration (daylighting), wetland restoration, riparian planting.

PROJECT FUTURE STATE OUTCOMES

The strategic objective for the Project was increased flood resilience for wider Waitara community, particularly utilities, land and property upstream and downstream of the Tangaroa Stream. This includes schools, housing, community facilities, and the marae.

When Manukorihi (Hapū) began discussing the restoration of their awa with NPDC, their moemoeā (vision) was Te Whakaora o Tangaroa (to revive or resuscitate the Tangaroa) with the objectives of wātea (clear), pai (naturally good) and rere (flow), which speak to clear, clean and running wai (water). This included bringing watercress, tuna and kokopu back, restoring mahinga kai for the area, and restoring the wairua of the awa.

PROJECT/ASSET ACCOUNTABILITY

Project owner

NPDC

Iwi/Māori involved

Manukorihi Hapū

Pictured: Tangaroa River

Other entities involved

Beca, Morphum Environmental.

PROJECT TIMEFRAMES

Project start date

2022

Project completion date

2025

Project lifetime

100+ years - Intergenerational

STAKEHOLDER ENGAGEMENT

The Manukorihi Hapū Project Lead discussed the project frequently with wider hapū at the Marae and their kōrero was woven into the co-design process.

Co-design between Beca, Manukorihi and Morphum environmental was the founda-tion of the work, as well as key involvement from NPDC.

Manukorihi Hapū have close relationships with three local schools and considered opportunities for weaving in nature education by creating clear pathways for tamariki and Rangatahi through the site.

Clear kōrero from Hapū was the vision for the awa which drove the nature-based solu-tion – a solution which put the awa and the taiao first.

MEASURED FINANCIAL BENEFITS

The nature-based/mātauranga Māori approach achieved the strategic flood resiliency aim at a lower overall cost than the traditional approach.

Improved flood resilience for private and public assets

The Project supports improved resilience for approximately 60 properties, an intermediate school, a high school, the Owae Marae, the Waitara Community Pool and the public roads through this portion of the community.

Avoided/reduced CAPEX

The nature-based solution is estimated to have saved $400,000 in CAPEX, almost 7% of the total budget by taking a less intrusive, more natural approach to daylighting, with less earthworks, less soil disturbance, and less impact to taonga.

Avoided/reduced consenting and/or compliance costs

By having the project framed from the outset as a co-designed naturalised system, the consenting process was smooth and efficient.

MEASURED ENVIRONMENTAL, SOCIAL AND CULTURAL BENEFITS

The mātauranga Māori approach initiated by Hapū also facilitated cultural, social and ecological outcomes – with less risk of disturbance to taonga, reduced impact on soil quality and tree cover.

Pictured: Tangaroa

Environmental benefits

Ecological areas including forest wetland and stream edge wetland incorporate regional plant and tree species that have been grown in a local nursery.

Local rocks and woody debris sourced from site has been used to create habitats for taonga fauna throughout the area.

Works were completed in June 2025 and have successfully weathered their first wet season.

Since March 2024, weed management has been undertaken by Hapū of the 1.5ha site clearing weeds from the wetland and channel.

Watercress is now re-establishing along the stream within the Marae, and kokopu have been spotted. Water quality has been measured but likely to be impacted by the next stages of the resiliency scheme in the upper catchment being implemented.

Cultural and social benefits

The design provides for people; Hapū and manuhiri, to sit near the awa and listen to it speaking; hearing the sound of the water as it cascades over the rocks and echoes among the trees near the seating area.

Hapū wanted to encourage access through the site along the awa benefiting the public, tamariki from the two adjacent schools, and kohanga reo which provides opportunities for nature connection and education.

ACCESS TO INVESTMENT FUNDS

The project is co-funded by NPDC and the Ministry for the Environment (MfE) Freshwater Improvement Fund for $1.8million.

Case study 2: Alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

Case Study 2: Value for money - delivering fiscal, economic and wellbeing benefits through natural infrastructure

The shaded boxes highlight the benefits of this natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events (e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

Case Study 3: Queensland Reef Credit Scheme

Project name	Queensland Reef Credit Scheme
Project region/location	Australia
Network infrastructure category	Water and waste
Economic sector relevancy	Bioeconomy, Blue Economy and tourism
Project owner	The scheme is managed by an independent, not-for profit administrator of voluntary nature markets called Eco-Markets Australia. Eco-Markets Australia is Australia's first independent administrator of voluntary environmental markets. It operates crediting schemes that measure and verify environmental improvements, allowing landholders to earn tradable credits for actions like water quality enhancement and biodiversity restoration. The ENVOMARK Value Nature framework emphasizes integrity, transparency, and scientific rigor ensuring that every ENVOMARK credit issued represents an environmental outcome that has already happened. The Queensland Government does not play a regulatory role in the scheme but maintains its focus on regulating and overseeing minimum water quality standards.
Iwi/Māori involved	Manukorihi Hapū
Other entities involved	Queensland Government, Terrain NRM, NQ Dry Tropics, GreenCollarAU, Winrock International provided assistance in establishing the Reef Credit Scheme. Reef Credit Scheme Project Proponents include GreenCollarAU, Agriprove, and RegenAqua. Reef Credit Scheme Approved Verifiers include GHD, RSM Australia, Anthesis, DNV GM Business Assurance, ERM Australia.
Project start date	Circa 2017, conceptualised earlier.
Project completion date	The first Reef Credits under the Nitrogen Use Efficiency Methodology were issued and sold in 2020. Nitrogen Use Efficiency Projects have a 10-year project lifespan with annual credit issuance. Gully Remediation Projects have a 25-year project lifespan with credit issuance based on rainfall events. Grazing Land Management Projects have a 25-year project lifespan with credit issuance based on rainfall events. Macro Algal Bioremediation Projects have a 15-year project lifespan with quarterly credit issuance, based on a calendar year.
Project financial value	Seed funding was provided by the Queensland Government Major Integrated Projects Initiative.
Project lifetime	Ongoing

CASE STUDY 3

Natural Infrastructure Implemented	Landowners have implemented several approved natural infrastructure approaches: • Grazing Land Management: This enhances ground cover to prevent sediment runoff, leveraging natural vegetation as protective infrastructure • Gully Rehabilitation: Repairs eroding gullies through earthworks, re-seeding, and fencing, restoring natural landforms to trap sediment • Managed Fertiliser Application: Improves nutrient use efficiency to reduce nitrogen runoff, indirectly supporting soil health and natural vegetation cover • Wastewater Algal Bioremediation: Uses live algae (micro/macro) to absorb DIN from wastewater, harnessing natural biological processes for water treatment.
Access to investment funds	Not applicable

CONTEXT

The Great Barrier Reef (Reef) is an internationally significant site, a World Heritage area and a national icon.

It represents an AU$95billion asset, provides 77,000 jobs and contributes AU$9billion to Australia's economy[1] .

However, human impact is threatening this valuable ecosystem, and the Reef's outlook has been listed as "critical". Climate change, poor water quality from land-based run-off, coastal development and fishing are the primary causes of the Reef's decline, but major storms, a crown-of-thorns starfish outbreak and marine debris have also put pressure on the Reef [2].

One of the key issues is poor water quality. Several attempts have been made by public and private organisations to improve water quality, with variable success; however, the health of the reef continues to decline. Although minimum standards for water quality and monitoring are mandatory under government regulation, more is needed to support the health of the reef.

One contributing factor is that the Reef represents a public asset and is under government control (both Federal and State level), whilst land along the Reef catchments is under private ownership.

1 https://www.barrierreef.org/uploads/GBRValue-FullReport-Oct25.pdf
2 https://www2.gbrmpa.gov.au/learn/threats-great-barrier-reef

Pictured: Great Barrier Reef

CASE STUDY 3

A global first, the ENVOMARK[3] Reef Credit Scheme is a market-led mechanism that deliv-ers measurable water quality outcomes for the Reef. It works in a similar way to Carbon Credits and seeks to finance improved land management practices which lead to water qual-ity improvements.

The program was conceived around 2017 following a feasibility study funded by the Queensland government, which showed that a market-led mechanism to incentivise water quality improvements across catchments to the Reef was viable and addressed an urgent need.

The scheme is supported by an extensive Queensland Government environmental policy framework aimed at protecting the Reef. The policy framework included a 2050 Long-Term Sustainability Plan[4] and the Reef 2050 Water Quality Improvement Plan[5] which set catch-ment-specific targets for reducing pollutants such as dissolved inorganic nitrogen (DIN) and fine sediment flowing into the reef from the surrounding catchments.

PROJECT DESIGN

Farmers and landholders in the Reef regions can earn an additional and diversified income stream by generating Reef Credits.

On the supply side, Reef Credits are generated through land management actions that reduce nutrient or sediment run-off flowing into the Reef. When landholders implement projects on their land that meet approved Reef Credit methodologies (that demonstrate a reduction in nutrients or sediments) the landowner receives credit.

Reef Credits are tradable units that represent a quantifiable volume of nutrient, pesticide or sediment[6]. One Reef Credit equates to preventing 1 kg of nitrogen or 538 kg of fine sediment from entering the Reef.

On the demand side, corporates, private investors and philanthropic organisations can invest directly to protect the Reef.

The ENVOMARK Reef Credit is recognised by the Australian Government's Reef Trust as a verified scheme.

Project Financial Value

Seed funding was provided by the Queensland Government Major Integrated Projects Initiative.

Natural infrastructure implemented

Landowners have implemented several approved natural infrastructure approaches:

- Grazing Land Management: This enhances ground cover to prevent sediment runoff, leveraging natural vegetation as protective infrastructure
- Gully Rehabilitation: Repairs eroding gullies through earthworks, re-seeding, and fencing, restoring natural landforms to trap sediment
- Managed Fertiliser Application: Improves nutrient use efficiency to reduce nitrogen runoff, indirectly supporting soil health and natural vegetation cover
- Wastewater Algal Bioremediation: Uses live algae (micro/macro) to absorb DIN from wastewater, harnessing natural biological processes for water treatment.

PROJECT FUTURE STATE OUTCOMES

The scheme was designed as a voluntary measure to incentivise the actions above and beyond existing mandatory water quality regulations for agricultural producers.

It aims to incentivise improved land management practices and provide additional revenue streams for farmers. It provides an opportunity to generate income to pay for, and obtain finance to, implement pollution prevention activity they would not otherwise have financial incentive to undertake.

GreenCollarAU[7] is the organisation that works with farmers, graziers, traditional owners and other land managers to identify and create commercial opportunities through nature-based projects. They aim to generate more than 6 million Reef Credits by 2030[8] .

The State targets that the scheme contributes to:

- a 60% reduction in Dissolved Inorganic Nitrogen

3 https://eco-markets.org.au/reef-credits/
4 Reef 2050 Long-Term Sustainability Plan 2021-25 - DCCEEW
5 Reef 2050 Water Quality Improvement Plan 2017-2022
6 https://www2.gbrmpa.gov.au/learn/threats-great-barrier-reef
7 About Us - GreenCollar
8 What are Reef Credits and how are they generated? - GreenCollar

and 25% reduction in fine sediment levels compared to 2009

- a 90% adoption rate of best management practices for sediment, nutrient, and pesti-cide management in sugarcane, horticulture, cropping and grazing lands within priority catchments
- adoption of best management practices to reduce pesticide runoff [9].

PROJECT/ASSET ACCOUNTABILITY

Project owner

The scheme is managed by an independent, not-for profit administrator of voluntary nature markets called Eco-Markets Australia.

Eco-Markets Australia is Australia's first independent administrator of voluntary environmental markets. It operates crediting schemes that measure and verify environmental improvements, allowing landholders to earn tradable credits for actions like water quality enhancement and biodiversity restoration.

The ENVOMARK Value Nature[10] framework emphasizes integrity, transparency, and scientific rigor ensuring that every ENVOMARK credit issued represents an environmental outcome that has already happened.

The Queensland Government does not play a regulatory role in the scheme but maintains its focus on regulating and overseeing minimum water quality standards.

Other entities involved

Queensland Government, Terrain NRM, NQ Dry Tropics, GreenCollarAU, Winrock International provided assistance in establishing the Reef Credit Scheme.

Reef Credit Scheme Project Proponents include GreenCollarAU, Agriprove, and RegenAqua.

Reef Credit Scheme Approved Verifiers include GHD, RSM Australia, Anthesis, DNV GM Business Assurance, ERM Australia.

PROJECT TIMEFRAMES

Project start date

Circa 2017[11] , conceptualised earlier.

Project lifetime

Ongoing

9 Reef 2050 Water Quality Improvement Plan 2017-2022
10 EMA - Environmental Markets Australia - Nature. Valued.
11 https://eco-markets.org.au/governance-and-development/

Pictured: Cane Farm, Queensland

STAKEHOLDER ENGAGEMENT

As required by the Reef Credit Standard, each project undertakes a stakeholder assessment to identify parties that may be impacted by the project. A plan is then developed for communications based on their level of interest and involvement with the project. Key stakeholders may include:

- Farmers and Landowners
- Local & State Government
- Native Title Bodies
- Natural Resource Management & Landcare groups
- Environmental Service Providers
- Project Proponents/Brokers
- Corporates
- Neighbours.

MEASURED BENEFITS

The private sector has acted as a key buyer of Reef Credits, committing to purchasing millions of dollars' worth of credits to build market confidence and provide a reliable stream of income for participating landowners.

To date, four water quality improvement methodologies have been accepted under the Reef Credit Scheme[12] , and one is currently under development. Two examples of the accepted methodologies are:

- Accounting for the reduction in fine sediment run-off through gully rehabilitation through engineered interventions, revegetation or improved grazing management
- Accounting for the reduction in nutrient run-off through managed fertilizer application, which targets dissolved inorganic nitrogen loss through more efficient soil and nutrient management practices from agriculture, including sugarcane, bananas, grains and fodder.

The first Reef Credits were generated in the Tully River Catchment, south of Cairns, by a local cane farmer. The project generated 3,125 Reef Credits between January 2018 and December 2019 under the approved method for reduction in nutrient run-off through managed fertilizer application.

These Reef Credits were purchased by HSBC and the Queensland government in October 2020.

The Reef Credit Scheme has delivered a positive return-on-investment of between 5 and 10 times the initial investment.

EcoMarkets Australia and the scheme have delivered a positive return on investment.

In the five years the scheme has been running, the costs of setting up EcoMarkets Australia and the scheme have already been met.

Revenue has exceeded expectations given the volume of Credits sold, and with a further six years of Credit issuance still within the system, 5 and 10 times returns on investment are expected.

The original public funding seems to be contributing to environmental improvements on the land that could surpass the scale of the original investment.

Importantly, this model provides an alternative approach to the linear grant funding pathway, attracting corporate investment into environmental restoration. There are plans for a revolving fund that support projects with upfront investment further scaling the market to attract interest from a wider investment market.

ACCESS TO INVESTMENT FUNDS

Not applicable

12 https://eco-markets.org.au/methodologies/

Case study 3: Alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

Case Study 3: Value for money - delivering fiscal, economic and wellbeing benefits through natural infrastructure

The shaded boxes highlight the benefits of this natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events (e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

Case study 4: South-West Christchurch, Resilient Urban Development

Project name	South-West Christchurch, Resilient Urban Development
Project region/location	South-West Christchurch - covering 8,000ha of land in two catchments: • 5,300ha upper Heathcote River/ Ōpawaho • 2,700ha upper Halswell River/Hurutini.
Network infrastructure category	Surface water management network (integrated with open space network and urban development).
Economic sector relevancy	Towns and cities
Project owner	Christchurch City Council (CCC)
Iwi/Māori involved	The development of the SWAP was undertaken in consultation with the Ngāi Tūāhuriri Rūnanga and Taumutu Rūnanga, with the section on tangata whenua values being co-written with runanga representatives. Consultation with the local runanga occurs on each stormwater management facility, either undertaken by the CCC or developer.
Other entities involved	The SWAP was developed in consultation with the local community and key stakeholders including partner organisations such as Canterbury Regional Council and New Zealand Transport Agency.
Project start date	1999
Project completion date	Ongoing with expectations the full stormwater management scheme may be completed by early 2030's.
Project financial value	Implementation of the CCC's South-West Christchurch Stormwater Management Plan (SWSMP) saw its capital investment close to $160million between 2014-2025 for the de-velopment of a planned naturalised stormwater network across the upper catchments of Heathcote River/ Ōpawaho and Halswell River/Hurutini. This is in addition to facilities es-tablished by the land developers and then vested in Council. The SWSMP is 83% complete (as at end of 2025, with some final facilities either under construction or in the design phase). Upon full completion in the early 2030's the scheme is estimated to have a total capital value of over $500 million.
Project lifetime	100+ years
Natural Infrastructure Implemented	Wetland restoration, riparian planting, floodplain reconnection.
Access to investment funds	Not Applicable

CONTEXT

Christchurch City Council (CCC) has long understood the purpose of mitigating the effects of urbanised stormwater to manage flooding, improve resilience, and to realise the benefits associated with improved surface and groundwater quality.

In planning for city development in the 1990s, CCC prepared a unique and integrated strategy for implementing stormwater infrastructure alongside urban growth and renewal. The direction, set over 25 years ago, continues to be realised across Christchurch today.

Noting that future generations could expect to have to fund a significant programme of pipe replacement and rehabilitation, the CCC transitioned from a utilitarian view of waterways to a 'six values approach' through its Waterways and Wetlands Natural Asset Management Strategy [1] (1999) and Waterways, Wetlands and Drainage Guide [2] (2003).

This nature-based approach was applied in the development and implementation of the South-West Christchurch Area Plan (SWAP) in 2009 [3]. SWAP is a 30-year plan to accom-modate over 12,000 new houses and 200ha of industrial development, making it one of the South Island's largest urban growth areas.

SWAP provides a long-term framework for land use planning and public expenditure to ensure urban growth is integrated with the natural environment and nature can continue to provide intrinsic value and services to the area.

Since 2009, new urban neighbourhoods have been developed around an extensive blue-green space network built on the existing natural values, providing recreation opportuni-ties and facilitating ease of movement across the area.

The uniqueness of the area is enhanced through restored habitats, recognition of tangata whenua values, and the incorporation of landscape features and European heritage into urban development and public open space.

SWAP is a tangible example of the CCC's decades long commitment to urban devel-opment that integrated nature-based solutions to improve resilience and provide for a multi-valued approach to city planning.

PROJECT DESIGN

South-West Christchurch is characterised by an extensive network of waterways and floodplains.

From the outset of SWAP's development, regard was given to the sensitivity of the water environment from the effects of current and future land-use activities. Without good management, urbanisation would likely increase flood risk and pollution.

1 Waterways and wetlands natural asset management plan
2 Waterways, Wetlands and Drainage Guide: Christchurch City Council
3 South-West Area Plan : Christchurch City Council

Pictured: Te Kuru Stormwater facility.

SWAP's (and the supporting South-West Christchurch Stormwater Management Plan), goal was to create a well-designed, maintained and naturalised stormwater network. It sought to replicate and restore the natural environment, protect and improve water quality and quantity, improve resilience to flood risks, and maintain and improve natural habitats. This approach was distinct from the more traditional approach of pipes, concrete channels, boxed drains and pumping stations.

The CCC's commitment began with its approval to strategically acquire land (through a $50million fund) to implement the scheme, well ahead of urban enablement. This led to the development of a naturalised stormwater network connected across the two catchments, utilising a variety of stormwater mitigation facilities including soil adsorption, sedimentation and detention basins, wet ponds, swales, wetlands, and incorporating esplanade margins.

This system not only serviced new growth areas (some 12,000 new homes) it also retrofitted existing urban areas where no water quality treatment facilities existed.

These areas were previously often impacted during storm events and heavy rainfall. Urbanisation had also significantly altered natural habitats and reduced biodiversity.

CCC's 'whole of systems' approach was to establish a network of large and small habitats, connected by ecological corridors, working towards its SWAP goal to improve indigenous species diversity.

Project financial value

Implementation of the CCC's South-West Christchurch Stormwater Management Plan[4] (SWSMP) saw its capital investment close to $160million between 2014-2025 for the development of a planned naturalised stormwater network across the upper catchments of Heathcote River/ Ōpawaho and Halswell River/Hurutini. This is in addition to facilities established by the land developers and then vested in Council.

The SWSMP is 83% complete (as at end of 2025, with some final facilities either under construction or in the design phase). Upon full completion in the early 2030's the scheme is estimated to have a total capital value of over $500million.

CONDITIONS BEFORE PROJECT START

Existing surface water and groundwater quantity was identified as a major issue within South-West Christchurch due to existing flood issues in both the Heathcote and Halswell river catchments.

The sensitivities and effects of inundation of Henderson's Basin on private landowners was of particular concern. The older urban parts of the Heathcote and Halswell catchments did not have any form of water quantity or quality mitigation.

Riparian vegetation throughout the study area had been reduced and highly modified (i.e. planted gardens, exotic trees and grasses), with little native vegetation remaining and of poor quality. All waterways in the project area had been modified and affected to some degree by rural or urban land use.

Local streams were like other modified lowland streams in Canterbury and Aotearoa New Zealand having limited

ecological value on a regional or national scale. However, several localities were assessed as having high ecological values relative to waterways within the modified environment [5].

PROJECT FUTURE STATE OUTCOMES

The vision of SWAP is "...South-West Christchurch is a unique and prosperous environment, where nature and people interact and thrive."

The vision is supported by 13 goals including to:

- Create safe and well-designed residential neighbourhoods providing a balanced range of housing
- Provide a high-quality naturalised water environment
- Establish a variety of indigenous forest and wetland habitats, connected by ecological corridor
- Incorporate local landscape features into urban development and public open space to maintain landscape character
- Develop a diverse, connected and attractive public open space network that encourages use and enjoyment

4 Stormwater management plans : Christchurch City Council
5 EOS Ecology Ltd et al. 2005

- Actively protect and restore values significant to tangata whenua, both historic and contemporary
- Conserve and protect European and other emerging cultural heritage values.

Realising the vision has become 'business-as-usual' for the Council and the land development community.

PROJECT/ASSET ACCOUNTABILITY

Project owner

Christchurch City Council (CCC)

Iwi/Māori involved

The development of the SWAP was undertaken in consultation with the Ngāi Tūāhuriri Rūnanga and Taumutu Rūnanga, with the section on tangata whenua values being co-written with runanga representatives.

Consultation with the local runanga occurs on each stormwater management facility, either undertaken by the CCC or developer.

Other entities involved

The SWAP was developed in consultation with the local community and key stakeholders including partner organisations such as Canterbury Regional Council and New Zealand Transport Agency.

PROJECT TIMEFRAMES

Project start date

1999

Project completion date

Ongoing with expectations the full stormwater management scheme may be completed by early 2030's.

Project lifetime

100+ years.

STAKEHOLDER ENGAGEMENT

The preliminary stormwater management scheme was identified and included as part of the consultation programme on the SWAP in August 2007.

MEASURED FINANCIAL BENEFITS

Reduced capital and operating expenditure through use of natural infrastructure

Using natural infrastructure has resulted in a reduced rate of pipe installation resulting in lower capital and operating expenditure.

- The assessed capital expenditure of installing pipework to manage water across the city was determined to be twice as expensive as a naturalised system, with full replacement costs at $500 to $1,300 per metre every 150 years, with asset values depreciating over time.
- In comparison, replacement of naturalised systems may never be needed, with intermittent development costs of $30 to $1,000 per metre, with asset values appreciating over time.

To provide a sense of scale, a high-level estimate of avoided pipework capital costs, by favouring a naturalised system, has been calculated to be approximately $14 million to date.

Reduced operating and maintenance costs through use of natural infrastructure

The benefits of a community-wide scheme have been cost effective and more efficient in terms of operating and monitoring costs.

Small and disparate facilities would have required individual monitoring and maintenance requirements, which are difficult and expensive to run.

The community-wide scheme also simplified land development processes for both developers and Council and provided clear expectations for design and delivery.

MEASURED ENVIRONMENTAL, CULTURAL AND SOCIAL BENEFITS

Improved flood resilience allowing for economic growth and urban development

The stormwater management scheme provided communal facilities for all new developments and retrofitted some of the existing unmitigated development with treatment and detention facilities.

Despite the urban expansion of the area, with significant increase in impervious surfaces, the scheme has ensured the one in 50-year flood risk (2 per cent chance in any one year) did not exceed pre-1991 levels.

The diagram below demonstrates that in

Due to the use of natural infrastructure the flood risk has reduced, meaning that the land has been able to be developed to accommodate city growth, whilst also providing improved protection of hundreds of properties in the downstream river.

This helps reduce insurance premiums for home and business owners [6].

Council assets such as roads and utilities are less disrupted through inundation and remain in service more consistently.

Improved extent and condition of natural assets and improved biodiversity

The new urban areas that have been established within the SWAP include major new features such as Te Kuru Wetlands.

Te Kura is a high flood ponding area which was historically farmed. It has been transformed into 110ha of greenspace, significant wetland and forest planting, and 1.5km of stream restoration.

It is now a vibrant ecological area with extensive walking and cycling tracks, native planting and diverse birdlife.

Sparks Rd wetland has contributed 17ha of greenspace, with 90,000 wetland plants, 600m of waterway restoration and 1.7km of walking tracks.

Cox Quaifes has contributed 12ha of greenspace, 240m of waterway restoration and 1.5km of walking tracks.

In total, across the Eastman Wetland, Sutherlands and Hoon Hay Basins between 600,000 – 650,000 plants have been established, the total number of tree species being in the region of 100,000 – 110,000 (comprising 30,000 – 35,000 Tall (noble) trees (>12m) and 70,000-75,000 small trees/tall shrubs (>5m)). Species planted aligning with the Christchurch Ōtautahi Indigenous Ecosystems Plant Lists[7] .

Research and monitoring of birdlife within the South-West Christchurch is planned to be undertaken in early 2026[8] .

Ecological benefits - improved water quality and reduced contaminant loading

Research and monitoring into the ecological benefits have been undertaken but it is recognised a more comprehensive evaluation of these benefits is needed.

Annual water quality monitoring for the Ōpawaho Heathcote River catchment shows no declining or increasing trends in invertebrate community health at three Cashmere Stream sites from 2013 to 2019.

This is consistent with previous years (Instream 2018) and shows that changes from rural to urban land use in the catchment has not impacted negatively on aquatic ecosystem health.

Without the scheme, predictions were that further urbanisation could have significantly increased contaminant loads into the waterways.

Pictured: Freshwater Crayfish

While a statistically significant change in inanga abundance in the Cashmere Stream[9] has not been able to be demonstrated between survey rounds, this is more reflective of the lack of comparable baseline data upstream.

However, in 2021, 45 inanga were identified across eight monitoring sites. In comparison, 405 inanga were recorded during the 2024 survey at just one monitoring site. This shows the restoration and fish barrier remediation efforts have almost certainly resulted in an increase in inanga.

Societal value and recreational benefits.

In addition to the stormwater network investment, the Council and developers have expanded the parks (local and regional) and recreation network providing societal benefits.

ACCESS TO INVESTMENT FUNDS

Not applicable

6 Treasury data shows insurers honing in on flood-risk properties | RNZ News
7 https://ccc.govt.nz/environment/land/ecosystem-map/
8 https://smartview.ccc.govt.nz/apps/waterquality/
9 Cashmere Stream Restoration: Follow-up Ecological Survey 2024" undertaken by Instream Consulting Ltd

Case study 4: Alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

Case Study 4: Value for money - delivering fiscal, economic and wellbeing benefits through natural infrastructure

The shaded boxes highlight the benefits of this natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events (e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

Case study 5: Auckland Airport, Innovative Stormwater Project

Project name	Improved Contaminant reduction and space saving with an innovative Coupled Wetland Biofilter (CWB)"
Project region/location	Auckland
Network infrastructure category	Water and waste, ports and airports
Economic sector relevancy	Towns and cities
Project owner	Auckland Airport Limited
Iwi/Māori involved	Auckland Airport's iwi partners provided cultural and environmental guidance at various stages of the CWB project. A cultural marker has been installed adjacent to the CWB in recognition of the archaeological findings and the cultural narrative these inform.
Other entities involved	None
Project start date	2022 with physical works commencing in October 2023.
Project completion date	Construction finished July 2025.
Project financial value	The CWB is part of Auckland Airport's $465 million northern airfield expansion which opened in 2025.
Project lifetime	This is an enduring asset.
Natural Infrastructure Implemented	Nature-based stormwater treatment system, combining a wetland with native plants, and a raingarden (acting as a biofilter).
Access to investment funds	This was privately funded by Auckland Airport.

CONTEXT

Auckland Airport's Master Plan 2025[1] sets out the blueprint for development at Aotearoa New Zealand's largest airport to 2047.

Stormwater management is critical to this plan, including boosting resilience to extreme weather and treating water flowing from the airport into the Manukau Harbour.

Auckland Airport takes a holistic approach to stormwater upgrades. Although the current RMA consents held by Auckland Airport focus on the need to remove total suspended solids (TSS), Auckland Airport seeks solutions which support improved resilience in the future and go beyond consent requirements for stormwater treatment in alignment with best-in-class environmental management standards.

For this project, the assessment of options for the treatment of airside stormwater runoff included two critical drivers:

- The ability to meet (or exceed) treatment requirements
- The ability to retain existing land for aeronautical use.

As a result, Auckland Airport built the Coupled Wetland Biofilter (CWB), the first-of-its kind in Aotearoa New Zealand.

1 https://corporate.aucklandairport.co.nz/content/dam/aia/files/corporate/futureakl/akl-master-plan-2025.pdf

CASE STUDY 5

PROJECT DESIGN

The CWB is a nature-based solution that provides additional contaminant removal as well as supporting improved flood resilience and climate change resilience for the airport. Although the current stormwater discharge permit held by Auckland Airport focuses on removal of total suspended solids (TSS), Auckland Airport sought a solution which was future-proofed and went beyond traditional stormwater treatment practices at the airport.

The CWB treats stormwater by removing sediment and contaminants in three stages. It consists of a sediment forebay, slowing the flow and trapping heavier debris; a wetland, where 20,000 native plants help filter out finer sediments and contaminants; and, during periods of high-water flow, a raingarden (acting as a biofilter) which provides final filtration through soil.

The CWB has a bypass for rainfall events exceeding the two-year annual return interval but ensures first flush contaminants are always treated; providing resilience and continuity for the system against extreme weather events while also managing stormwater quality.

The design considers future climate conditions, including sea-level rise, potential saltwater intrusion, and changing rainfall patterns.

Measures have been taken to minimise the potential for the CWB to attract birds and increase bird-strike risk. These include bird-proof netting of the CWB itself and careful selection of plant and grass species in surrounding landscaping.

Project financial value

The CWB is part of Auckland Airport's $465 million northern airfield expansion which opened in 2025.

Natural infrastructure implemented

Nature-based stormwater treatment system, combining a wetland with native plants, and a raingarden (acting as a biofilter).

Project future state outcomes

The CWB can currently treat stormwater from 56ha with built in capacity to serve 106ha in the future. This is an enabler for Auckland Airport to deliver on the Master Plan 2025 and expand the airfield and other aeronautical assets.

Compared to a traditional stormwater retention pond, the CWB requires a third of the land to treat the same volume of stormwater, freeing up valuable space for aeronautical activities.

The treatment provided by the CWB will help support replacement of stormwater consents essential to the ongoing operation of Auckland Airport and will inform future stormwater management options.

PROJECT/ASSET ACCOUNTABILITY

Project owner

Auckland Airport Limited

Pictured: Auckland Airport

Iwi/Māori involved

Auckland Airport's iwi partners provided cultural and environmental guidance at various stages of the CWB project.

A cultural marker has been installed adjacent to the CWB in recognition of the archaeological findings and the cultural narrative these inform.

Other entities involved

None

PROJECT TIMEFAMES

Project start date

2022 with physical works commencing in October 2023.

Project completion date

Construction finished July 2025.

Project lifetime

This is an enduring asset.

STAKEHOLDER ENGAGEMENT

Delivering the CWB required strong collaboration across Auckland Airport teams and external partners. The project was shaped by input from technical experts including engineering, ecological, and archaeological experts.

The support of Auckland Council as regulator was also critical given this was new technology for Aotearoa New Zealand.

MEASURED ECONOMIC BENEFITS

As the CWB requires a third of the land area to treat stormwater, more land is available for economic activities.

Compared to a traditional pond, the CWB requires a third of the land to treat the same volume of stormwater.

Whilst establishment and operational costs are more expensive than a traditional pond of the same size, three traditional ponds would have been required to meet treatment requirements.

Using the CWB enables Auckland Airport to retain the more valuable future use of the land to flexibly support airport expansion as per the Master Plan 2025 and subsequent economic growth, whilst also delivering a nature-based solution that provides enhanced stormwater treatment.

Improved flood resilience

The CWB is part of a stormwater network that as a whole provides greater flood resilience for the Airport.

Improved asset design life and reduced maintenance costs

The natural infrastructure design provides a treatment solution which minimises long term maintenance requirements, including replacement of media typically associated with proprietary treatment devices.

MEASURED ENVIRONMENTAL, SOCIAL AND CULTURAL BENEFITS

Improved stormwater quality

The CWB is designed to achieve more than 80% removal of total suspended solids and provides enhanced treatment for total nitrogen, total phosphorous and heavy metals, prior to discharge into the Manukau Harbour. A monitoring programme is be-ing implemented as the CWB comes into operation.

Improved biodiversity

The CWB also benefits local biodiversity with around 20,000 native plants within the wetland and 2,600 within the raingarden.

The CWB's performance will be closely monitored, including across seasonal weather cycles, to identify opportunities for improvement and to inform the potential imple-mentation of the design more broadly at the airport, including at existing stormwater ponds and for new treatment devices.

CASE STUDY 5

Case study5: Alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

Case Study 5: Value for money - delivering fiscal, economic and wellbeing benefits through natural infrastructure

The shaded boxes highlight the benefits of this natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events (e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

Case study 6: Kirimoko Park, Residential Development

Project name	Kirimoko Park, Residential Development
Project region/location	Wanaka
Network infrastructure category	Land transport, water and waste
Economic sector relevancy	Towns and cities
Project owner	Meridian Land Development Consultants, Southern Land Consultants, Southern Ventures
Iwi/Māori involved	None
Other entities involved	• National Science Challenges – Building Better Homes, Towns and Cities, • Manaaki Whenua • Earth Sciences NZ (formerly NIWA) • Koru Environmental • Batstone Associates • AR Associates
Project start date	2014
Project completion date	2016
Project financial value	Not publicly available
Project lifetime	Ongoing
Natural Infrastructure Implemented	Raingardens, natural stormwater basins and swales
Access to investment funds	Private development

CONTEXT

Kirimoko Park used water sensitive design (WSD)[1] practices, with these forming an integral part of the urban landscape.

WSD is an approach whereby stormwater management is seen as an attractive asset, including visible water and garden features, showcasing stormwater, and its management, as a strategic asset to developments.

In this instance, led by a private developer's vision, a three-stage master-planned development incorporated WSD as part of plans to provide a regenerative, resilient residential subdivision for both people and the environment.

At Kirimoko Park, which covers nearly 12ha virtually all primary and secondary stormwater flows are managed on the surface, through swales, raingardens, detention / infiltration basins and fords, with very little or no hard infrastructure, such as piping[2]

1 https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=666

2 https://www.landcareresearch.co.nz/discover-our-research/environment/sustainable-society-and-policy/activating-water-sensitive-urban-design-for-healthy-resilient-communities/research-outputs

PROJECT DESIGN

The approach was to achieve overall integration of stormwater design with urban architecture and landscape design across the development.

Stormwater design principles included minimisation of earthworks and maintaining existing natural drainage patterns and hydrology. This was primarily achieved by allowing the road network to follow the natural contour of the land, thereby limiting earthworks to the formation of road corridors rather than comprehensive re-contouring of the land. The use of pipes was avoided wherever possible.

Slowing stormwater runoff was encouraged thereby promoting biofiltration and infiltration and promotion of dispersed flow patterns as well as avoidance of fast and concentrated discharges. This included making use of roads, footpaths, car parking areas and other urban design elements to foster stormwater infiltration, slowdown of runoff and retention of water.

Conversely, the development made use of stormwater design elements to fulfil other urban design and engineering functions such as the use of raingardens as landscape elements or fords as traffic calming measures.

Stormwater was also used for the protection and enhancement of remnant and newly planted areas thereby maximising the visibility of stormwater treatment as an asset adding amenity value to the subdivision.

The design used plants that perform well in Wanaka's environment, including many native species consistent with the natural character and biodiversity of the area.

Project financial value

Not publicly available

Natural infrastructure implemented

Raingardens, natural stormwater basins and swales

Project future state outcomes

Stormwater management is seen as an asset and a positive amenity to the subdivision having been integrated into its design and landscape architecture.

Outcomes sought included increased waterway health, contaminant removal, urban summer cooling, flood risk reduction, and groundwater recharge.

Project future state outcomes

Stormwater management is seen as an asset and a positive amenity to the subdivision having been integrated into its design and landscape architecture.

Outcomes sought included increased waterway health, contaminant removal, urban summer cooling, flood risk reduction, and groundwater recharge.

PROJECT/ASSET ACCOUNTABILITY

Project owner

Meridian Land Development Consultants, Southern Land Consultants, Southern Ventures

Iwi/Māori involved

Pictured: Kirimoko Park Subdivision

CASE STUDY 6

None

Other entities involved

National Science Challenges – Building Better Homes, Towns and Cities, Manaaki Whenua, Earth Sciences NZ (formerly NIWA), Koru Environmental, Batstone Associates, AR Associates

PROJECT TIMEFRAMES

Project start date

2014

Project completion date

2016

Project lifetime

Ongoing

STAKEHOLDER ENGAGEMENT

Community signed up to the 'Kirimoko Code' which includes a range of environmental requirements and incentives.

In view of the rapid growth in Wanaka, there is strong community interest in addressing how development can be managed to retain the high natural values of Lake Wanaka and the surrounding landscape.

MEASURED FINANCIAL BENEFITS

This development project was the subject of a case study[3] for the National Science Challenge where financial and non-financial benefits were assessed using an innovative tool, 'More than Water'. See Figure 1 overleaf.

Using the 'More than Water' assessment tool[4] - Stage 2 'as constructed' was assessed as delivering markedly better outcomes than 'business as usual'.

Using the WSD approach meant eight of the cost criteria were assessed as being delivered at a high level by Stage 2, with all but one of these considered to be based on highly reliable assessments by the research team and development team.

These include:

- Private development yield
- Public infrastructure delivery
- Avoided hard infrastructure/pipes costs
- Avoided costs of future proofing
- Avoided environmental remediation costs
- Water quality cost effectiveness
- Hydrology cost effectiveness.

In contrast the 'business as usual' was assessed as delivering none of the cost criteria at a high level, with the majority assessed as 'low'.

A notable anomaly was housing affordability, which was assessed as 'medium' under 'business as usual', compared with 'low' under Stage 2. The reliability of the assessment of housing affordability was judged to be 'high'.

Reduced capital expenditure costs

The development approach translated into significant construction cost savings for the project, as well as environmental, social and economic benefits over and above traditional infrastructure.

Using a WSD approach meant the design was 22% more cost effective than a traditional approach to stormwater management. Cost savings because a WSD approach was used included:

- Reduced pavement costs because of narrower streets
- Rationalized and reduced overall roading and utility service infrastructure requirements because of clustering
- Significantly reduced earthwork cuts and fills because of maintaining the existing landform where possible and the formation of roads along contours
- The use of swales for treatment as well as conveyance reduced the need for a costly piped infrastructure and kerb and channel
- The placement of WSD practices partly or wholly within private land thereby optimising land development yield and improving landscape amenity in lots.

Reduced operational costs

Actual maintenance costs of WSUD devices are difficult to obtain from Local Councils to use as comparators, in addition to the fact that WSUD devices have only been operating for around 10 years so there is no long-term

3 https://www.landcareresearch.co.nz/discover-our-research/environment/sustainable-society-and-policy/activating-water-sensitive-urban-design-for-healthy-resilient-communities/research-outputs

4 https://www.landcareresearch.co.nz/assets/Discover-Our-Research/Environment/Sustainable-society-policy/WSUD/More-than-Water-Tool-report-FINAL.pdf

data, and costs are commercially sensitive.

Maintenance frequency is a key determining factor in long-term maintenance costs. For Kirimoko Park, this has been assessed compared to average dataset values for Aotearoa New Zealand that could be obtained, showing:

- Reduced mowing frequency for swales
- Reduced trimming of rain gardens
- Reduced frequency of device cleaning of debris and gross pollutants.

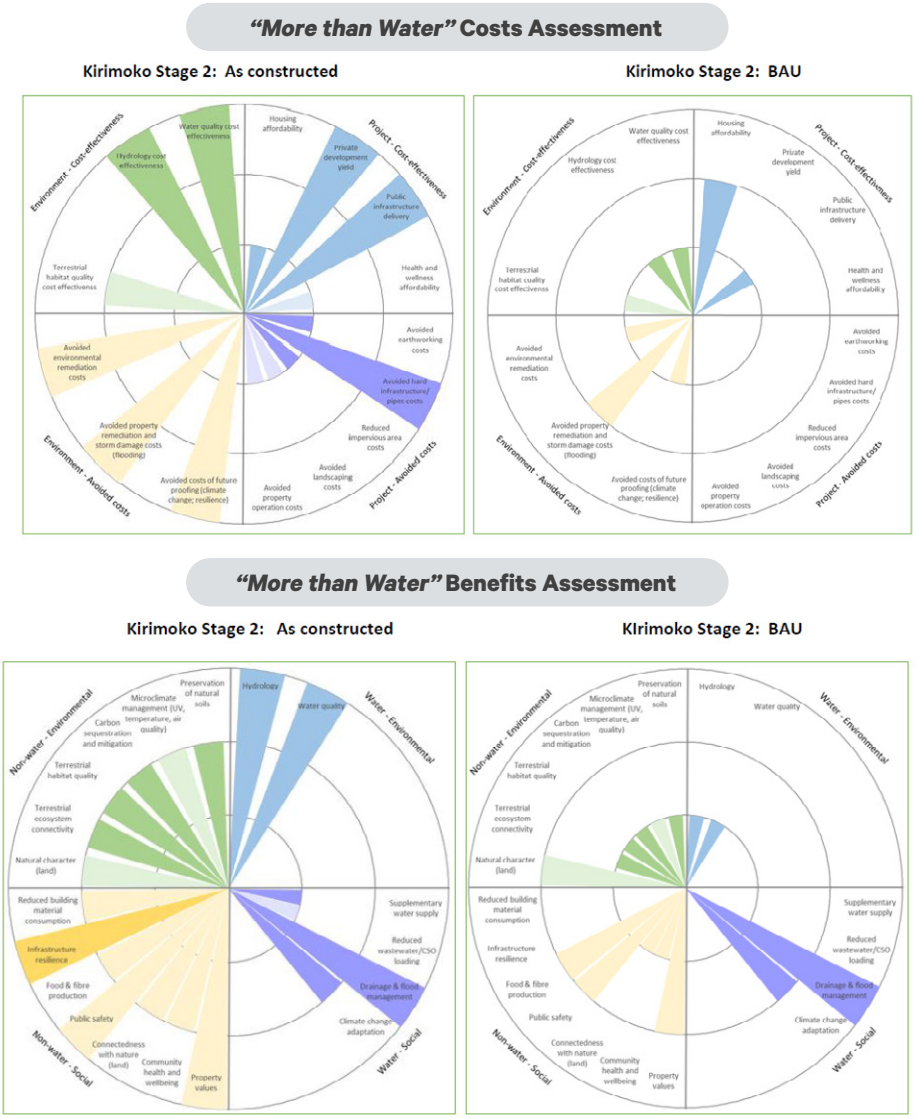
MEASURED ENVIRONMENTAL, SOCIAL AND CULTURAL BENEFITS

Using the 'More than Water' tool[5] six benefits were assessed by the research team and development team as being delivered at a high level by Stage 2.

Four criteria were assessed and were able to provide measurable improvements to:

- Hydrology
- Water quality
- Drainage and flood management
- Infrastructure resilience.

In contrast, should the developer have opted for a 'business as usual' traditional infrastructure approach, the 'More than Water' tool assessed it would only have delivered on one benefit: drainage and flood management.



5 https://www.landcareresearch.co.nz/assets/Discover-Our-Research/Environment/Sustainable-society-policy/WSUD/More-than-Water-Tool-report-FINAL.pdf

CASE STUDY 6

Case study 6: Alignment with the Infrastructure Strategy's five key objectives

Enabling a net-zero carbon emissions Aotearoa	Supporting towns and regions to flourish	Building attractive and inclusive cities	Strengthening resilience to shocks and stresses	Moving to a circular economy
• Moving to a low emissions energy sector • Reducing emissions produced by infrastructure	• Accessing safe and reliable infrastructure • Securing and integrating freight and supply chains and services • Use of technology to improve regional advantage	• Taking a long-term approach to infrastructure in our cities • Integrating land-use regulation and infrastructure • Easing pressure on infrastructure networks	• A coordinated approach to critical infrastructure investment • A planned approach to adapting climate change • Improving information and tools for resilience	• Setting a national direction for waste • Managing pressure on landfill and waste recover facilities • Developing waste-to-energy for the waste we produce

Case Study 6: Value for money - delivering fiscal, economic and wellbeing benefits through natural infrastructure

The shaded boxes highlight the benefits of this natural infrastructure solution.

Benefit Domain	FINANCIAL	RISK & RESILIENCE		ENVIRONMENTAL			SOCIAL	CULTURAL
Benefit Typology	Financial opportunities through reduced costs and improved asset values	Disruptions to a systemically important supply chain (major trade, food security or mahinga kai)	Disruptions to, or failure of, critical infrastructure	Biodiversity loss and ecosystem collapse (incl pest or disease incursion)	Severe weather events (e.g. flooding & wildfire)	Natural resource shortages (e.g. caused by drought)	Changes in social and recreational amenity	Changes in cultural amenity
Natural Infrastructure Benefits - Nature's Contributions to People (NCP)	Avoided/reduced CAPEX	Improved/reduced service disruption ("loss of function")	Improved/ maintained availability of insurance	Increased/ maintained abundance and diversity of native species	Reduced emissions/ Improved emissions mitigation; increased nature-based carbon storage permanence & sequestration	Improved/ maintained groundwater and/ or surface water quality and/or quantity and/ or recharge and storage	Improved access and recreational use of the natural environment	Expanded/ maintained cultural/ spiritual settings & learning/inspiration opportunities. Supporting identities.
	Avoided/reduced OPEX	Improved/ maintained primary sector productivity/ outputs	Improved/ maintained insurance premiums	Improved/ maintained presence of endangered/ threatened species	Reduced/avoided surface runoff and associated erosion/ slips (incl climate adaptation)	Improved/ maintained marine water quality or marine flow regime	Improved/ maintained livelihood opportunities	Increased/ maintained cultural property/land value
	Avoided/reduced consenting and/or compliance costs	Increased/ maintained food security	Improved/ maintained asset protection and resilience (incl climate change resilience)	Improved/ maintained habitat (incl aquatic) protection/ restoration	Improved/ maintained surface water flows and/ or flood protection and/or stability - inland or coastal (incl climate adaptation)	Improved/ maintained Material NCP (e.g. Energy, food, materials, medicinal, biochemical & genetic resources)	Improved/ maintained tourism opportunities	Expanded/ maintained mahinga kai
	Increased/ maintained property/land value	Improved resilience of operations and supply chains		Improved/ maintained Regulating NCP (e.g. pollination, seed dispersal, air-soil-water quality, water flows, natural pest control etc)		Improved/ maintained biomass	Improved/ maintained community engagement and wellbeing (including physical and psychological experiences)	
	Improved/ maintained asset design life	Reduced loss of useable land due to improved resilience or integrity		Improved/reduced use of High-Impact Commodities				
	Improved/new revenue streams/ investment due to the provision of Ecosystem Services to benefiting parties			Improved/ maintained terrestrial habitat extent				
	New and improved products, services and/or brand value			Improved/ maintained aquatic habitat condition				
	Improved/ maintained Return on Investment							

Contact us

For questions or additional information on the Natural Infrastructure Plan, contact The Aotearoa Circle.

E: info@theaotearoacircle.nz

W: www.theaotearoacircle.nz

Acknowledgements

The Project Lead for the case studies was **Genevieve Smith**, Principal – Sustainability & Climate, Beca.

To the organisations who submitted potential case studies for the long-list – thank you.

For the selected case studies, The Aotearoa Circle would like to acknowledge the following individuals, who were instrumental in providing the data required to facilitate the selected case studies financial evaluation:

Kaipara Moana Remediation, Kaipara

- Justine Daw
- Lisette Rawson.

Tangaroa Stream flood resilience scheme, New Plymouth

- Kelly Armfield (New Plymouth District Council)
- Geoff White (Manukorihi Hapū).

Queensland Reef Credit Scheme, Australia

- Amy Bassnet (Eco Markets Australia)
- Goslik Schepers (Eco Markets Australia)
- Anjali Nelson (GreenCollarAU)
- Charlotte Fladgate (GreenCollarAU).

South-West Christchurch Resilient Urban Development, Christchurch

- Sarah Oliver (Christchurch City Council)
- Hannah Lewthwaite (Christchurch City Council)
- Peter Christensen (Christchurch City Council).

Auckland Airport, Auckland

- Andrea Marshall (Auckland Airport)
- Joy Morse (Auckland Airport).

Kirimoko Park residential subdivision, Wanaka

- Sue Ira (Koru Environmental)
- Robyn Simcock (Manaaki Whenua - Landcare Research)
- Jonathan Moores (NIWA)
- Chris Batstone (Batstone Associates).

Program Delivery Lead:

- Erica Miles (Nine West Consulting)

To these individuals and their teams – thank you.

The Natural Infrastructure Plan, including its associated separate parts, have been prepared by The Aotearoa Circle in collaboration and consultation with Circle Partners and other key stakeholders to stimulate discussion, improve understanding and support consideration of nature as critical national infrastructure. The plan reflects the views at the time of publication and is intended for general information purposes only.

While reasonable care has been taken in the preparation of this document, The Aotearoa Circle makes no representations or warranties, express or implied, as to the accuracy, completeness, or currency of the information. Readers are urged to seek their own independent professional advice on specific matters before acting on any information contained in this Plan.

4 March 2026

The Aotearoa Circle

The Aotearoa Circle

Mā te Kaitiakitanga ko te Tōnuitanga
Prosperity Through Guardianship

Private Bag 5902, Wellington
info@theaotearoacircle.nz
Join us at www.theaotearoacircle.nz