Takutai Kāpiti.

TAKUTAI KĀPITI COASTAL HAZARD ADAPTATION PROJECT

REPORT OF THE INDEPENDENT COASTAL ADVISORY PANEL

6 JUNE 2024

REPORT INFORMATION

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Hei hura i te kahu o te po.

I tupu ko te pū

Ko te weu, Ko te rito Ko te take

Ko te pukenga

Ko te wānanga

Tēnā rukutia ki te toi rangi

Ki te toi nuku

Ki te te toi o te ora,

He oranga taiao, hei oranga tangata

Tūturu ki a Rongo whakamaua kia tina, tina, hui e tāiki e

PREFACE

One of the most significant global challenges recognised in recent years has been the impact of climate change and rising sea levels on coastal communities. Recognising this concern, the Kāpiti Coast District Council has taken action by creating the Takutai Kāpiti Coastal Advisory Panel ("**CAP**").

CAP was formed to make recommendations to the Council regarding the long-term implications of sea level rise on our coastal community, projecting a century ahead as required by the New Zealand Coastal Policy Statement 2010. While complete accuracy over such a long timeframe is unattainable, future decisions can be informed by identifying thresholds where current management is no longer delivering desired outcomes, trigger points at which changes can be made in advance of crossing a threshold, and signals for early warning of a trigger point.

The primary goal when the Council formed the CAP was for it to actively engage with and listen to the community, ensuring that their perspectives were incorporated into the report provided to the Council. CAP was tasked with gathering community input and subsequently reporting to the Council based on these insights. In a diverse community like Kāpiti, opinions vary widely, ranging from those advocating for minimal Council intervention in safeguarding assets like roading and sewerage to others urging for more proactive policy development to enhance protection for both community and personal assets.

One of the foremost concerns we heard revolves around the projected rise in sea levels and its potential impact on private homes. It is understandable that these concerns weigh heavily, as a family's home often represents their most significant asset. However, it is not solely about safeguarding personal homes; the accessibility of homes and services through roads and sewerage systems is equally crucial. In essence, the threat of coastal inundation resulting from sea level rise poses significant risks to individuals and communities alike.

During our engagement with the community, the CAP encountered differing viewpoints, including some who disputed the scientific consensus and downplayed the risks posed to property and well-being. These dissenting voices often challenged the scientific basis; however, we have focussed on reaching out to the community through various channels to understand their concerns. Our core responsibility has, I believe, remained intact—to gather community input comprehensively and reflect their perspectives in our report to the Council. Now, it's up to the Council to review our findings and use as a basis to get wide agreement on appropriate measures.

I want to express my gratitude to the CAP members for their dedication to this task, as well as to the Technical Advisory Group for their invaluable support throughout this intricate process.

Rt Hon James Bolger, ONZ, PC
Chair, Takutai Kāpiti Coastal Advisory Panel

EXECUTIVE SUMMARY

This report presents the evaluation process and recommendations of the independent Coastal Advisory Panel (the "**CAP**" or "**Panel**"), which was formed to develop coastal adaptation options and make recommendations for Kāpiti Coast District Council (the "**Council**") to consider.

The Takutai Kāpiti Coastal Hazards Adaptation Report (the "**Report**") covers the coastal area extending from Ōtaki to Paekākāriki. It considers coastal erosion, coastal flooding, and the social, local and national frameworks for response, with particular focus on the impacts of sea level rise on coastal hazards affecting the Kāpiti Coast.

The intent of this report is to initiate a planned response to changes in coastal hazards out to the year 2130.

The vision of this Report is:

> *Coastal communities, businesses, and critical infrastructure in the Kāpiti District from Ōtaki to Paekākāriki can become resilient to coastal hazard risks (erosion, accretion, inundation) exacerbated by sea level rise and climate change.*

There are, and likely always will be, differing perspectives on the topic of climate change and the effects of sea level rise both internationally and within our local community. Given the significant amount of scientific data relating to sea level and changes on the New Zealand coastline the prevailing view of climate change scientists is that sea level rise will continue for at least 100 years into the future. In some communities, coastal effects are becoming more obvious than others where factors such as vertical land movement and accretion are involved.

While future amounts and the rate of sea level rise remain subject to deep uncertainty, the community should prepare for a range of what may occur, rather than reacting only after damage has been done.

The Kāpiti Coast has an extensive coastal boundary making it imperative that there is a plan in place to facilitate adaptation if or when specific scenarios start to materialise. Our view is that the Council must have an effective adaptation plan in place rather than allow damage to occur due to a lack of preparation and planning.

The Kāpiti community has also expressed a strong desire to maintain access to the beach for activities such as walking, boating, fishing and general enjoyment including the collection of kai. There has been a notable concern that birdlife and shellfish are protected. A long history of Māori occupation with multiple sites of significance to mana whenua and iwi also need to be protected in coastal adaptation areas.

This leads to some concerns within parts of the community that the process of creating an adaptation plan may have more negative consequences than the alternative of maintaining the status quo and waiting until a significant event occurs which impacts on housing and/or infrastructure.

To alleviate these concerns, we propose potential "pathways" or alternatives (based on community feedback and taking account of the technical data we have had access to) using the Dynamic Adaptive Pathways Planning ("**DAPP**") method recommended by the Ministry for the Environment. DAPP is a way to acknowledge the uncertainty of climate change and natural hazard risks, while ensuring communities have the opportunity to adapt and avoid unnecessary loss and damage. The process used for selection of pathways we are recommending is described in this report.

The insurance industry undertakes its own research to monitor risk and to decide whether it will or will not insure certain properties or certain areas. They have also made it clear that where communities have an adaptation plan in place to mitigate or reduce risk, this is likely to reduce any impact on insurance premiums. Without an adaptation plan, insurance premiums may be higher. Community feedback has been clear that people want to be able to get insurance and have concerns over the value of their homes decreasing.

The New Zealand Coastal Policy Statement 2010 ("**NZCPS**") requires decision-makers to take a precautionary approach when planning for and making any resource management decisions in the coastal environment. It also requires a 100-year perspective to be used for planning.

While that 100-year context is covered here, "time" is not used as the primary factor in determining when it is appropriate to change from one adaptation action to another. Rather, we use the DAPP method and consider when changes to conditions signal the need to move from one adaptation pathway to another.

Defining signals, triggers and thresholds for when adaptation actions are implemented should be the next phase of coastal adaptation planning. The Council has indicated that they will consult with each specific community to determine signals, triggers, and thresholds applicable to those communities. We have provided some potential thresholds for consideration.

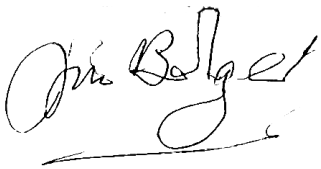
Future costs of adaptation will be significant. Local Government response needs much better coordination with Central Government. Legislation to replace the Resource Management Act is expected to develop and set up a framework for more integrated future responses.

As well as the dynamic adaptive pathway short-listed recommendations we have also made a number of other recommendations to Council in Section 12 under the following themes:

- Imperative for putting a Kāpiti Coastal Adaptation Plan in place
- Ensuring the Takutai Kāpiti process, including consultation, is ongoing
- Revisiting the DAPP approach and reviewing pathways at least every 10 years
- Integration of Takutai Kāpiti with a coastal groundwater investigation and integration with the GWRC plan, Whaitua Kāpiti freshwater catchment study
- Need for regular ongoing monitoring and reporting of coastal changes
- Implementation Action Plans need to be developed prior to trigger points being reached
- Working with communities in each Management Unit on an anticipatory signals, triggers, and thresholds approach
- Preparing for longer term developments that may be required, including planning for retreat
- Further assessment by Council is needed on the prioritisation of, economic costs, benefits, and funding mechanisms for the short-term actions for the 20 Management Units.

The following report captures both the evaluation process and recommendations of the Takutai Kāpiti Coastal Advisory Panel, which was formed to develop coastal adaptation options and make recommendations for Kāpiti Coast District Council consideration.

TAKUTAI KĀPITI COASTAL ADVISORY PANEL MEMBERS



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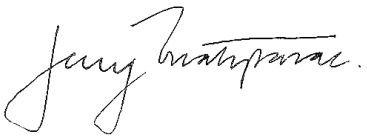

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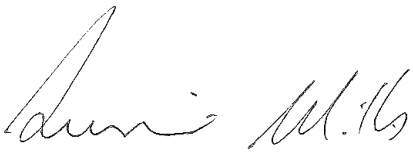

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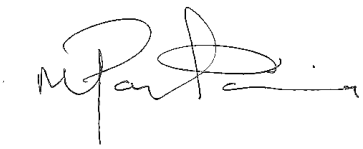

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GLOSSARY

Term	Definition
Adaptation Actions	The specific measure taken to reduce or eliminate long-term risk associated with the hazard(s).
Adaptation Area	Five defined areas within the Kāpiti District where adaptation pathways for coastal hazards will be developed by the CAP and consolidated into the Coastal Hazards Adaptation Recommendations Report. The five Adaptation Areas are: Northern Kāpiti; Central Kāpiti; Raumati; Paekākāriki; and Queen Elizabeth Park.
Adaptation Options	Overview term used to group adaptation actions which have similar objectives and outcomes. In line with the MfE (2017) *Coastal Hazards Guidance,* Options in this report are termed as: Enhance, Accommodate, Protect, Retreat, Avoid.
CAP	Coastal Advisory Panel
Criteria	A principle, value, or objective by which something can be judged or decided against in a MCDA process. These can be social, cultural, environmental, technical.
DAPP	Dynamic Adaptive Planning Pathways – An approach to planning for sea level rise in the future.
Hazard	Any atmospheric, earth or water related occurrence, the action of which adversely affects or may adversely affect human life, property, social, cultural, economic activities, or other aspects of the environment. A hazard is characterized by its timing, location, scale, intensity, and probability.
Long-term	50 to 100 years from the present day
Medium-term	30 to 50 years from the present day to align with the life of a building being not less than 50 years, as defined in the Building Act.
MCDA	Multiple Criteria Decision Analysis used as a decision tool to inform assessment of the DAPP process.
Management Unit	Mapped sub-areas within the five Adaptation Areas used for pathway development, assessment and recommendations
Objectives	Goals defined by the CAP for use in the MCDA process and to develop the recommended adaptation pathways based on collective values.
Pathways	A sequence of actions which reduce or eliminate the risk to the hazard(s) over the short, medium, and long term that are the outputs from the DAPP process.
Preferred Adaptation Actions and Pathways	A sequence of actions which CAP has identified as having the most alignment with their values based on scoring in the MCDA analysis, economic analysis, and community feedback.

Term	Definition
Relative Sea Level Rise	The combined effect of sea level rise and changes to the local elevation of the land surface (i.e., vertical land movement).
Risk Assessment	A systematic approach for identifying the consequences of exposure to hazards, based on the likelihood of an event multiplied by a loss due to its consequences.
ROA	Real Options Analysis is an economic assessment technique that can help evaluate policy pathways and quantify the investment risk associated with uncertain future outcomes.
Scoring	Quantitatively assessing the expected performance of each adaptation pathway against the MCDA criteria.
Sea Level Rise	An increase in the level of the ocean due to the effects of climate change.
Signals	Derived indicator values, monitoring changes in physical, social, cultural, economic, and risk attributes, which provide early warning to signal that a trigger (decision point) is approaching in the near to medium term and should prompt thinking and initial engagement processes on the next steps or any changes to the trigger.
Short-term	0-30 years from the present day to align with Long Term Planning timeframes set under the Local Government Act.
TAG	Technical Advisory Group
Thresholds	When agreed objectives, community values, risk exposure, or levels of service are no longer being met or start to fail, requiring an alternative adaptation action or pathway to be in place before this occurs. The adaptation threshold is not tied to a particular time – rather it will be a bracketed time window derived using the scenarios in the DAPP processes tolerance for the hazard has been exceeded.
Triggers	A derived indicator value(s), which when reached, provides sufficient lead time to cover community engagement, consenting, construction and funding arrangements, to ensure a new pathway or adaptation action can be implemented before the adaptation threshold is reached. The trigger is not tied to a particular time – rather it will be a bracketed time window derived using the scenarios in the DAPP process.
Values	Something considered, either personally or collectively, as being important or beneficial to quality of life.
Weighting	Assigned relatively for each of the criteria to reflect their relative importance to the decision for the objective of the strategy.

A

PART A

Overview and Background

1. INTRODUCTION

The independent Coastal Advisory Panel (the "**CAP**" or "**Panel**") was formed to develop coastal dynamic adaptive pathways and make recommendations for further consideration, community consultation and decision making by Kāpiti Coast District Council ("**the Council**"). The focus of this report is the impact of coastal erosion and coastal inundation, as influenced by sea-level rise, on the Kāpiti Coast.

1.1 PURPOSE OF THIS REPORT

The purpose of this report is to:

- Describe the formation of the CAP, their Terms of Reference and scope;
- Summarise the science and policy context relevant to this work;
- Provide an overview of the purpose and process of developing the Recommendations Report;
- Outline the process adopted by the CAP for identifying and assessing options for responding to coastal hazards risks on the Kāpiti Coast;
- Identify preferred dynamic adaptive pathways for each management unit; and
- Present CAP's recommendations.

It is proposed that our recommendations, including any potential costs, legislative requirements, and benefits associated with the options, contribute to a planning process that will guide development of the Operative Kapiti Coast District Plan 2021 ("**District Plan**") provisions to manage coastal issues.

Our recommendations will provide input into dealing with the wider District implications of sea-level rise.

1.2 BACKGROUND TO THE COASTAL ADVISORY PANEL

There is a long history of coastal erosion issues on the Kāpiti Coast, including severe coastal erosion in Paekākāriki and Raumati in 1968. As a coastal district, Kāpiti continues to face significant environmental challenges from our changing climate and associated relative sea level rise ("**RSLR**").

Over the years, the Council has commissioned a number of consultant reports on coastal hazard issues, however, mapped coastal hazard management areas and associated policies were not considered sufficiently robust to be incorporated in the Proposed District Plan ("**PDP**") notified in 2012, and several coastal hazard provisions were withdrawn from the PDP in 2014. As a result, these issues are not yet adequately addressed in the District Plan.

In March 2016, the North Otaki Beach Residents Group ("**NOBRG**") filed applications for declarations in the Environment Court regarding coastal matters. Coastal Ratepayers United ("**CRU**") joined as a party to those proceedings. The Council negotiated with NOBRG and provided a settlement agreement to the Environment Court in June 2016

CRU did not sign the settlement agreement and filed their own application for two declarations in the Environment Court in July 2016. A hearing was held in November 2016 and a final decision was issued by the Environment Court in July 2017. CRU appealed to the High Court against the Environment Court's decision, alleging a number of errors. A hearing for the appeal was held on 13 November 2017 and the High Court issued its decision 16 days later, dismissing CRU's appeal on all grounds.

In the High Court, the Council indicated that a plan change could be commenced within 18 to 24 months (from November 2017) to address coastal hazards.

During this time, CRU had also submitted on and then appealed some coastal matters in PDP. The Council entered into Environment Court mediation with CRU (and other parties including DOC and GWRC) and a settlement agreement was reached with CRU on identical terms to the earlier settlement agreement entered into with NOBRG. The terms of the settlement agreements include commitments around:

- The Council engaging with the community early in the process of addressing coastal hazards;
- The Council evaluating an appropriate range of options for coastal hazards; and
- Any coastal hazards plan change being of sufficient scope so that the community could submit on the full range of provisions provided in the then district plan (including provisions introduced through the current PDP process).

In May 2019, the Council declared a climate emergency on the Kāpiti Coast. This declaration was in response to calls from residents, businesses, and citizen groups that Council must take stronger action on climate change.

In June 2019, Greater Wellington Regional Council (GWRC) released 'Preparing coastal communities for climate change'. This report was overseen by the Wellington Region Climate Change Working Group "Subgroup on Community-Led Coastal Adaptation", including members representing the Council and Kāpiti Iwi and Hapū. The report assessed a range of vulnerability criteria and identified priority areas within Districts for coastal adaptation planning.

It is within this context that the Takutai Kāpiti community-led coastal adaptation project (Takutai Kāpiti project) began to take shape.

1.3 RECOMMENDATIONS DEVELOPMENT PROCESS

The project has been developed in four phases, shown in the figure below.

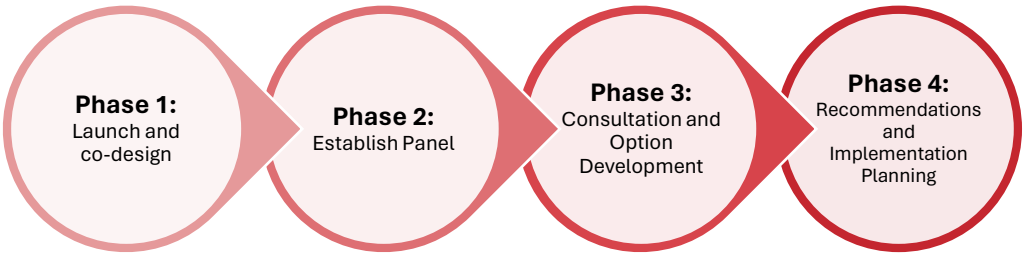

Figure 1: Phases of the Takutai Kāpiti project

Phase One involved launching and co-designing the project and community-led process. A Co-Design Working Group ("**Working Group**") made up of representatives of CRU, NOBRG and Tangata Whenua was formed in 2019 to develop and recommend to the Council elected members, a preferred approach for the Takutai Kāpiti project for the district.

In March 2020, the District Council and the ART Confederation[1] agreed a scope that set out Ngā Hapū o Ōtaki,[2] Ātiawa ki Whakarongotai and Ngāti Toa Rangatira involvement in the co-design process, as part of a dedicated ART Confederation Coastal Advisory Group ("**ARTCAG**").

On 8 March 2020, the Takutai Kāpiti: Climate Change and Our Coast Summit 2020 launched the Takutai Kāpiti: Our Community-led coastal adaptation project ("**Takutai Kāpiti project**") through a conference and community event held in Otaki.

On 10 December 2020, the Working Group presented their report to Council which outlined their recommendations for the establishment of a Community Assessment Panel for the project.

Phase Two commenced with the establishment of the Panel consisting of iwi, community and other key stakeholder/ agency representatives to consider the District's response to the impacts of climate change on the coast. The Panel's name was proposed to be changed

[1] The Art Confederation is comprised of Ātiawa ki Whakarongotai, Ngāti Raukawa ki te tonga and Ngāti Toa Rangatira.

[2] Ngāti Raukawa ki te Tonga is represented by Ngā Hapū o Ōtaki as the Mandated Iwi Organisation in this district.

from Community Assessment Panel to Coastal Adaptation Panel in response to community feedback which suggested that the previous title was unclear about the panels purpose. In December 2021, the Panel was renamed the Coastal Advisory Panel to recognise CAP's role in advising the Council.

The panel's terms of references are contained in **Appendix 1**.

To assist CAP with its objectives and outcomes, it received support from the Council's Takutai Kāpiti Project Team and a Technical Advisory Group which was established to provide scientific advice and data on sea level rise and coastal inundation, planning and regulatory advice, and natural character, ecological, social, and economic assessments.

Phase Three comprised substantive collation of information, consultation with the wider community and assessment of options relating to coastal adaptation plans. The process undertaken and dynamic adaptive pathways developed and considered are presented in the following parts of this report. A summary list of Coastal Advisory Panel Meetings with links to the minutes of each meeting is contained in **Appendix 2**.

Phase Four is the predominant purpose of this report: providing recommendations to Council to facilitate coastal adaptation and associated implementation planning. This phase is the culmination of the process to date to arrive at a set of recommendations to ensure coastal communities, businesses and critical infrastructure in the Kāpiti District can become resilient to the effects of coastal hazards.

We anticipate the Council engaging with the District's communities on our Report and developing an implementation plan for the ongoing coastal adaptation plan it adopts.

1.4 OBJECTIVES AND OUTPUTS

The CAP's objectives, as set out in the Terms of Reference, were to:

- Facilitate engagement with the broader community, affected persons, and other stakeholders in relation to coastal hazard risks and associated coastal hazard response options.
- Develop coastal hazard response options through consideration of the practicality, affordability, scientific, cultural, and social values (technical expertise provided externally) of a range of options, based upon agreed trigger points.
- Determine, in consultation with the wider community, the preferred option(s).
- Prepare a report detailing the evaluation process and recommendations of the Panel.

1.5 REPORT STRUCTURE

Part A: Overview

Introduces the Recommendations Report and provides background material relevant to the work of the Assessment Panels.

Part B: Option Development and Assessment Process

Details the process CAP undertook to develop their recommendations, principally through a series of workshops and associated meetings, site visits and technical sessions.

Part C: Recommendations

Presents recommendations for how the communities of Kāpiti District should respond to coastal hazards as a basis for the Council to develop wide agreement on a coastal adaptation plan.

Part D: Appendices

Provides links to access the supporting material and reports developed and used by CAP in forming their recommendations.

2. BACKGROUND AND CONTEXT

The Kāpiti Coast is not alone in facing coastal hazards exacerbated by climate change. A significant amount of work is happening internationally and across New Zealand to better understand coastal hazard risk and provide coastal communities options for adapting to coastal hazards. There are, and likely always will be, differing perspectives on the topic of climate change and the effects of sea level rise both internationally and within our local community. However, one message is clear: our coastal communities will be more resilient if we prepare ourselves for adverse changes before they occur, rather than reacting only after damage has been done.

CAP's work has been informed by and sits within a larger framework of policy and science direction. The following sub-sections summarise global, national, and local information, guidance and direction which is relevant to CAP's process and recommendations.

Much like the coastal environment itself, the policy and science contexts are dynamic – evolving as new and improved information becomes available, and the consequences of climate change unfold in real time.

2.1 GLOBAL CONTEXT

The Intergovernmental Panel on Climate Change ("**IPCC**") is the United Nations body that provides governments with regular assessments of climate change, its implication and potential future risks as well as adaptation and mitigation options. These are comprehensive peer reviewed reports that cover the physical scientific basis for climate change (Working Group I), the impacts adaptation and vulnerability aspects of climate change (Working Group II), and options for mitigating climate change (Working Group III).

The IPPC's Sixth, and most recent, Assessment Report states climate change is already affecting many weather and climate extremes in every region across the globe, resulting in widespread adverse impacts and related losses and damages to nature and people.[3] Global mean sea level increased by 0.20 m between 1901 and 2018.[4] This is because most of the heating due to increasing greenhouse gas concentrations is going into the oceans and, as they warm, the water expands and raises sea level. Warming is also leading to melting of glaciers and of the ice sheets in Greenland and Antarctica which increases the amount of water in the ocean and raises sea level.

[3] Climate Change 2021: The Physical Science Basis – Summary for Policymakers. IPCC.

[4] Ibid.

IPCC Working Group I showed that thermal expansion and the loss of glaciers and ice sheets have contributed to an increasing rate of sea-level rise over the last 25 years.[5] Loss of ice sheets and glacier mass has played the dominant role since 2006.[6] Future sea level has larger relative uncertainties than future temperature. These uncertainties come from limited data on the response of ice sheets, although this area of science is developing rapidly. Current ranges for future sea-level increase significantly beyond about 2050, reflecting the potential for changes in ocean circulation to modify thermal expansion, and the uncertainty of rates of ice-sheet loss over the longer-term.

Uncertainty over the long-term means it was very important for CAP to consider a range of sea-level rise scenarios, and not ignore the potential for more extreme scenarios. It is essential that adaptation planning is dynamic and allows the community to be ready for a wide range of possible futures. In this context, DAPP (described further in Section 8 of this report) is a useful tool because it helps us to keep our options open moving forward and avoid adaptation actions which are not appropriate for the reality of sea-level rise.

2.2 NATIONAL SCIENCE CONTEXT

2.2.1 New Zealand sea level rise

Tide gauges on the New Zealand coastline have been used to record long term trends since 1900 and data for six sites are available at Stats NZ.[7] From 1993, satellite data has been providing more comprehensive global coverage of the oceans[8] and has shown that New Zealand is in a region where sea level has been variable but has increased over the last 30 years by more than the global average. This data has a spatial resolution of about 25 km and is measured relative to a stable ellipsoid representing the Earth's surface.

More recently, satellite data have also recorded vertical land movement which is additional to satellite sea level data when considering changes relative to the coastline. Analysis for New Zealand has produced data for land movement along the New Zealand coastline with a high spatial resolution of about 2 km.[9] For the Kāpiti region vertical land movement has been dropping it by rates around 1 mm/yr.

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5 Ibid.

6 Ibid.

7 Stats NZ. Coastal sea-level rise. https://www.stats.govt.nz/indicators/coastal-sea-level-rise (2022).

8 Copernicus. Sea level gridded data from satellite observations for the global ocean from 1993 to present. https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-sea-level-global (2024).

9 Levy, R. & Naish, T. NZ SeaRise. *https://www.searise.nz/* (2020).

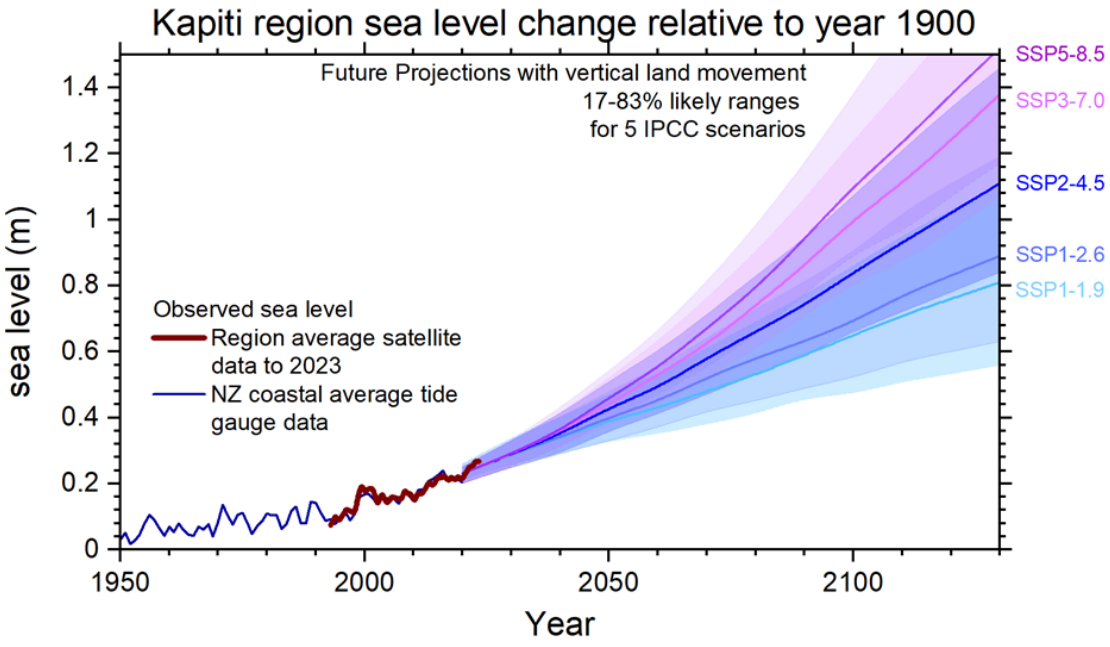

Figure 2: Changes in sea level from NZ tide gauge data and regional satellite data are shown relative to the IPCC global average for 1900. Tide gauge data are annual averages across the five longest running sites[2]. Satellite data over 1993 – 2023 are from Copernicus[9] and averaged over the ocean 100 km out from the New Zealand coastline. Coloured bands are mid-range and 17-83% likely ranges for five scenarios used in the IPCC report and adjusted for regional variations in sea level as well as vertical land movement for Kāpiti as given by the NZ SeaRise project[4] and recommended by Ministry for the Environment. Values shown here are relative to the global average sea level for 1900 as used in the IPCC Summary for Policymakers.

Future projections of sea level shown in Figure 2 are based on a set of scenarios used widely in climate science for future greenhouse gas concentrations. These include two that stay below, or close to, global average warmings of 1.5°C and 2.0°C, and one that leads to warming by more than 4°C this century with that increasing well into the 2200's. These projections are shown as extensions to observed sea level rise around New Zealand in Figure 2.

Note that even though the two lowest IPCC scenarios have global mean temperatures stop increasing during this century, sea level could continue rising beyond 2300.

Use of the uppermost IPCC scenario has been criticised on the basis that it ignores climate mitigation policies that many countries are actively following.[10] However, that criticism was related to the socio-economic context and the authors of that critique have said it does not apply for sea level rise where a potential for crossing thresholds in the stability of ice sheets. This was recognised more than forty years ago.[11]

Several recent studies of Antarctic ice sheets have indicated they are close to, or have crossed, thresholds for sustainability.[12, 13, 14] However, the range of expert opinion also includes views that they are still stable.[15] For these reasons, the uncertainty ranges for sea level are quite different to those for temperature and it is widely recognised that the higher Shared Socio-economic Pathways (SSP) scenario remains relevant for coastal planning, due to the deep uncertainties that can apply.[16, 17] Recognition of a need to consider long term risks is also reflected in the New Zealand Coastal Policy Statement's Policy 3 requiring a precautionary approach.[18]

2.2.2 Coastal erosion and storm wave power

The Carley *et al*[19] coastal hazard assessment for Kāpiti noted that NZ was in a region where there was evidence for a trend of increasing storm wave height and risk of coastal erosion. This has been extended by a more recent and highly cited study of 'wave power' or the

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10 Hausfather, Z. & Peters, G. P. Emissions – the 'business as usual' story is misleading. Nature 577, 618-620 (2020).

11 Mercer, J. H. West Antarctic ice sheet and CO2 greenhouse effect: a threat of disaster. Nature 271, 321-325 (1978).

12 DeConto, R. M. & Pollard, D. Contribution of Antarctica to past and future sea-level rise. Nature 531, 591-597 (2016).

13 Scambos, T. A. et al. How much, how fast?: A science review and outlook for research on the instability of Antarctica's Thwaites Glacier in the 21st century. Global and Planetary Change 153, 16-34 (2017).

14 Naughten, K. A., Holland, P. R. & De Rydt, J. Unavoidable future increase in West Antarctic ice-shelf melting over the twenty-first century. Nature Climate Change 13, 1222-1228 (2023).

15 Golledge, N. R. & Lowry, D. P. Is the marine ice cliff hypothesis collapsing? Science 372, 1266-1267 (2021).

16 McKay, D. I. A. et al. Exceeding 1.5°C global warming could trigger multiple climate tipping points. Science 377, 1171, eabn7950 (2022).

17 Ministry for the Environment. Coastal hazards and climate change guidance, Ministry for the Environment, Manatū Mō Te Taiao, PO Box 10362, Wellington 6143, New Zealand, https://environment.govt.nz/news/updated-guidance-on-coastal-climate-change-released/ (2024).

18 Department of Conservation. New Zealand Coastal Policy Statement Department of Conservation, Wellington, http://www.doc.govt.nz/publications/conservation/marine-and-coastal/new-zealand-coastal-policy-statement/new-zealand-coastal-policy-statement-2010/ (2010).

19 Carley, J. T., Komar, P. D., Kench, P. S. & Davies, R. B. Coastal Erosion Hazard Assessment for the Kāpiti Coast: Review of the Science and Assessments Undertaken for the Proposed Kāpiti Coast District Plan 2012, Kāpiti Coast District Council, https://www.kapiticoast.govt.nz/media/uyuabrwn/1316-13-kcdc-app-1-6-sp-14-1253.pdf (2014).

transfer of wind energy to wave energy.[20] This is largest in the southern ocean across a range of latitudes including most of NZ and has had an increasing trend for over 60 years.

Coastal erosion is an increasing impact of climate change caused by the combination of more wave power together with rise in sea level. The effects of this on sandy beaches can be estimated with a widely used 'Bruun rule'[21] to estimate upward and landward movement of the beach profile. While that has been criticised, in some cases it can be applied with different levels of detail and used effectively to identify areas that need further analysis.[22] New methods that identify risks in more detail are still being developed.[23]

Volume 1 of the Jacobs report (**Appendix 3)** summarises the history of coastal erosion in Kāpiti and the evidence for vulnerability to storm events. Google Earth is also becoming used to monitor coastal erosion where fixed reference points can be identified along the shoreline. This shows there was significant retreat of the sand dune in north Paraparaumu occurring between 2016 and 2023. Tools for doing this systematically are becoming developed and reported in science literature.

2.2.3 Groundwater response to sea level rise

This report has not been able to consider any detailed analysis of groundwater response to sea level rise on low lying land in Kāpiti. But the extent to which that can increase the extent and frequency of coastal flooding cannot be ignored. The IPCC Working Group I Fifth Assessment report identified the Wellington region as an area where a 0.5 m rise in sea level would make coastal flooding 1,000 times more frequent.[24] This is because a rise in groundwater reduces the volume of ground that is available to hold rainwater.

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[20] Reguero, B. G., Losada, I. J. & Méndez, F. J. A recent increase in global wave power as a consequence of oceanic warming. Nature Communications 10, Article 205 (2019).

[21] Bruun, P. Sea-Level Rise as a Cause of Shore Erosion. Journal of the Waterways and Harbors Division 88 (1962).

[22] Todd, D. Coastal Erosion and Sea Water Inundation Assessment Technical Report, Waimakariri District Council, https://openmaps.waimakariri.govt.nz/HazardsReports/CoastalErosionandSeaWaterInundation.pdf (2018).

[23] Shand, T. et al. in Australasian Ports and Coasts Conference, 2015 (Auckland, 2015).

[24] Church, J. A. et al. in Working Group I Contribution to the IPCC Fifth Assessment Report (AR5), Climate Change 2013: The Physical Science Basis (eds. Stocker, T. et al.) (Cambridge University Press, 2013).

Preliminary indications of how some parts of Kāpiti might be affected are shown in Figure 3 using land elevation data taken in 2021.

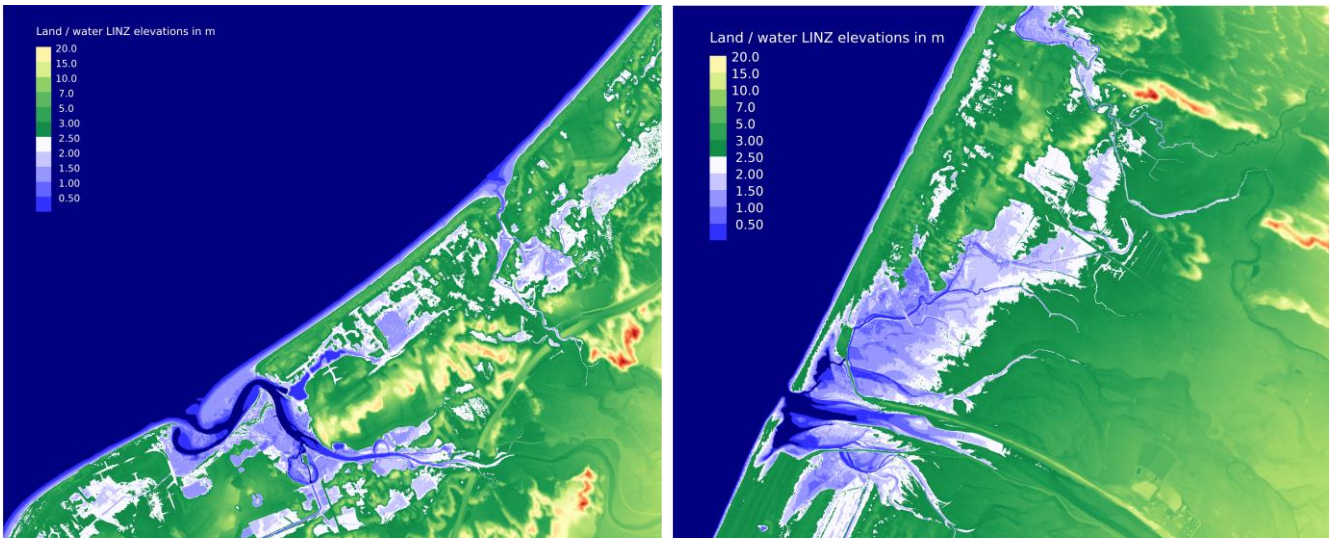

Figure 3: Colour images of land elevation for the north of Paraparaumu and Waikanae Beach (left) and the Otaki coastal area (right), using LiDAR data taken in March 2021 and available at https://data.linz.govt.nz/data/.

While this figure may indicate some areas at risk it is effectively a 'bathtub' approach for considering how rise in sea level affects groundwater. More detailed studies of groundwater are now being carried out in several coastal parts of New Zealand. For example, studies done recently for South Dunedin have shown that 'bathtub' models to consider the effects of sea level rise on groundwater significantly underestimate the extent to which water can emerge above ground level[25].

Figure 4 is a schematic diagram and reflects what has been found for Dunedin, that groundwater levels can be closest to the surface well back from the beach. This means that the first effect of a rise in sea level can be an increase in flood extent 1 – 2 km back from the beach followed by an increasing extent of groundwater inundation.

[25] Cox, S. C., Ettema, M. H. J., Chambers, L. A., Easterbrook-Clarke, L. H. & Stevenson, N. I. Dunedin groundwater monitoring, spatial observations and forecast conditions under sea-level rise GNS, https://shop.gns.cri.nz/sr_2023-43-pdf/ (2023).

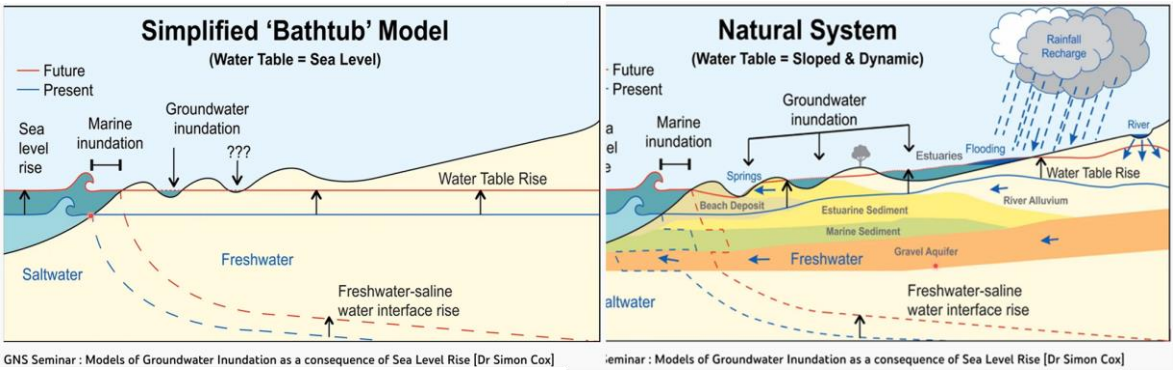

Figure 4: This shows the difference between a 'bathtub' view of groundwater response to sea level rise and one that takes into account the groundwater variation with land height. Taken from Cox.[26]

Lagoons and streams near the coastline provide a rough indication of groundwater levels. Links to sea level can also be seen by tidal cycles in groundwater data that are available at GWRC for several wells in Kāpiti up to 3 km back from the beach. Recent events have also shown signs of the water table being close to ground level or going above it in rain events. This was seen to the north of Waikanae starting in December 2021 and was eventually resolved by restoring a land drainage system.

Emergence of the water table in rain events depends on soil porosity and this is less for sandy soils than for clay soils, so can be expected over large parts of the Kāpiti coastal area. Extension of Kāpiti groundwater monitoring to have a more specific focus on identifying the areas at risk from sea level rise could follow what is being done in Dunedin and elsewhere in New Zealand.

2.3 NATIONAL POLICY CONTEXT

2.3.1 New Zealand Coastal Policy Statement 2010

The New Zealand Coastal Policy Statement ("**NZCPS**") is a national policy document that provides guidance and direction for managing New Zealand's coastal environment under the Resource Management Act 1991 ("**RMA**"). It sets out objectives and policies to achieve sustainable management of coastal resources, including directions for considering and planning for coastal hazards risks and taking account of climate change.

[26] Cox, S., Ettema, M., Mager, S., Glassey, P., Hornblow, S., and Yeo, S., 2020: Dunedin groundwater monitoring and spatial observations. GNS Science Report 2020/11, GNS Lower Hutt New Zealand. 86 pp.

Councils are required to give effect to the NZCPS in their policy statements, regional plans and district plans.[27] They must also have regard to the NZCPS in resource consenting.[28]

Objective 5 sets the direction for managing coastal hazards:

> *To ensure that coastal hazard risks taking account of climate change, are managed by:*
>
> - *Locating new development away from areas prone to such risks;*
> - *Considering responses, including managed retreat, for existing development in this situation; and*
> - *Protecting or restoring natural defences to coastal hazards*

This objective seeks to ensure that the management of coastal hazards is risk based and takes account of climate change. It requires proactive management to address coastal hazard risks.[29]

> ***Policy 3: Precautionary approach***
>
> *(1) Adopt a precautionary approach towards proposed activities whose effects on the coastal environment are uncertain, unknown, or little understood, but potentially significantly adverse.*
>
> *(2) In particular, adopt a precautionary approach to use and management*
>
> *(a) avoidable social and economic loss and harm to communities does not occur;*
>
> *(b) natural adjustments for coastal processes, natural defences, ecosystems, habitat and species are allowed to occur; and*
>
> *(c) the natural character, public access, amenity and other values of the coastal environment meet the needs of future generations.*

The precautionary approach requires a forward-thinking, risk management approach and is appropriate where full information on effects is not available, particularly when the effects are potentially significant, or decisions are effectively irreversible. An integrated and precautionary approach is desirable to limit the scale of damage from climate change.[30]

The NZCPS provide clear direction for councils to manage coastal hazards and climate change risks to avoid increasing the risk of adverse effects.[31] Councils are to encourage

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27 Sections 62(3), 67(3)(b) and 75(3)(b) of the RMA.

28 Sections 168(3) and 171(1) of the RMA.

29 *NZCPS 2010 Guidance Note: Coastal Hazards – Objective 5 and Policies 24, 25, 26 & 27.*

30 *NZCPS 2010 Guidance Note: Policy 3 - Precautionary approach.*.

31 NZCPS, Policy 25.

redevelopment and consider managed retreat to minimise risk, and they are discouraged from relying on hard protection structures.

The risk from coastal hazards over at least 100 years must be identified.[32] The NZCPS does not specify which climate change scenario or SLR projections to use, or the thresholds for applying different planning responses. However, it does require identification of areas "potentially affected", "taking into account national guidance and the best available information on the likely effects of climate change on the region or district".

The NZCPS also includes strategies for assessing a range of options for reducing coastal hazard risk to protect significant existing development.[33] The opportunity to avoid the risks from coastal hazards may have already passed for these areas so local authorities are encouraged to consider a wide range of risk-reduction strategies.

2.3.2 National Adaptation Plan

The Climate Change Response Act requires the government to prepare a National Adaptation Plan that looks at the impacts of climate change on New Zealand now and into the future and sets out how we can adapt.

Aotearoa New Zealand's first National Adaptation Plan was released in 2022. It contains strategies, policies and actions that will help New Zealanders adapt to the changing climate and its effects.[34] The intent is to reduce the potential harm of climate change, as well as seize the opportunities that arise. The goals of the National Adaptation Plan are:

- Reduce vulnerability to the impacts of climate change
- Enhance adaptive capacity and consider climate change in decisions at all levels
- Strengthen resilience to climate change.

The National Adaptation Plan states that Councils should use their existing powers now to drive climate-resilient development in the right places. They should use the climate scenarios recommended by the National Adaptation Plan when making and changing policy statements and plans.

This national adaptation plan is the first in a series. Every six years, He Pou a Rangi – Climate Change Commission will prepare a national climate change risk assessment. This will

[32] NZCPS, Policy 24.

[33] NZCPS, Polic 27.

[34] Aotearoa New Zealand's first national adaptation plan. Ministry for the Environment.

identify the climate risks that need to be addressed most urgently. New national adaptation plans that respond to those risks will be developed in consultation with all New Zealanders.

This process recognises that adaptation is a process of assessing risk, planning, implementing, evaluating and adjusting as necessary, as depicted in Figure 5.

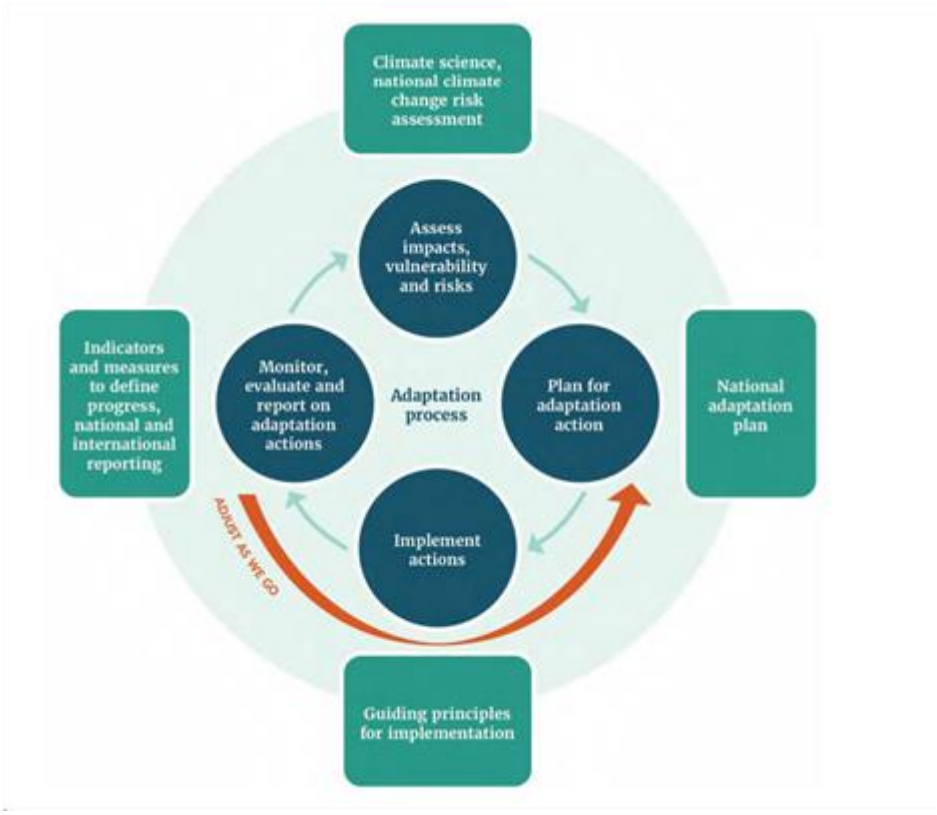

Figure 5: Aotearoa New Zealand's adaptation process over time (Source: Aotearoa New Zealand's First National Adaptation Plan).

The first plan focuses on getting the foundations right. It sets out what the Government will do to enable better risk-informed decisions, drive climate-resilient development in the right locations, help communities assess adaptation options (including managed retreat) and embed climate resilience into all of the Government's work.

The National Adaptation Plan recognises that the most appropriate adaptation options will differ for every community and recommends a place-based and risk-based approach should be adopted to ensure adaptation options meet the specific needs and circumstances of the community.[35]

[35] Ibid.

The CAP dynamic adaptive pathway development process described in this report aligns with this recommendation. CAP have used place-based risk assessments and worked with communities to understand the key values and inform decisions about which adaptation options are suitable for each adaptation area along the Kāpiti Coast.

2.3.3 Ministry for the Environment Guidance

The Ministry for the Environment ("**MfE**") provides guidance on coastal hazards and climate change, including the findings and projections of the Assessment Reports produced by the Intergovernmental Panel on Climate Change ("**IPCC**").

The decision-making framework developed for and adopted by CAP was developed in accordance with MfE's 2017 guidance document, titled Coastal Hazards and Climate Change: Guidance for Local Government.

The 2017 guidance was structured around an iterative 10-step planning framework and five key questions. It included four sea level rise scenarios to cover a range of possible futures derived from the IPCC's Fifth Assessment Report and a 2014 study by Kopp et al[36].

The key message of the 2017 guidance was the introduction of the Dynamic Adaptive Pathways Planning, known as "DAPP". This planning approach identifies ways forward despite uncertainty, while remaining responsive to change if needed.

MfE updated their guidance in 2024 to reflect the IPCC's Sixth Assessment Report (discussed above)[37]. The 2024 guidance fundamentally enhances the direction of the previous guidance and clarifies requirements for local government. The updates cover:

- Advances in sea-level rise science and updated global projections from the IPCC's Sixth Assessment Report.
- New relative sea-level rise projections and vertical land movement estimates from the NZ SeaRise Programme.
- Advances in knowledge relating to the types of coastal hazards (such as sea-level rise, storms, flooding, or rising groundwater) and how they interact with each other.
- Updated guidance on carrying out risk assessments and adaptive pathways planning.

The 2024 guidance retains the 10-step decision cycle grouped around five main questions. This adaptative planning strategy allows for:

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[36] *Preparing for coastal change: A summary of coastal hazards and climate change guidance for local government.* Ministry for the Environment. 2017.

[37] *Coastal hazards and climate change guidance.* Ministry for the Environment. 2024.

- Adjusting pathways as new information emerges;
- Transparent future actions for communities; and
- Participatory decision making.

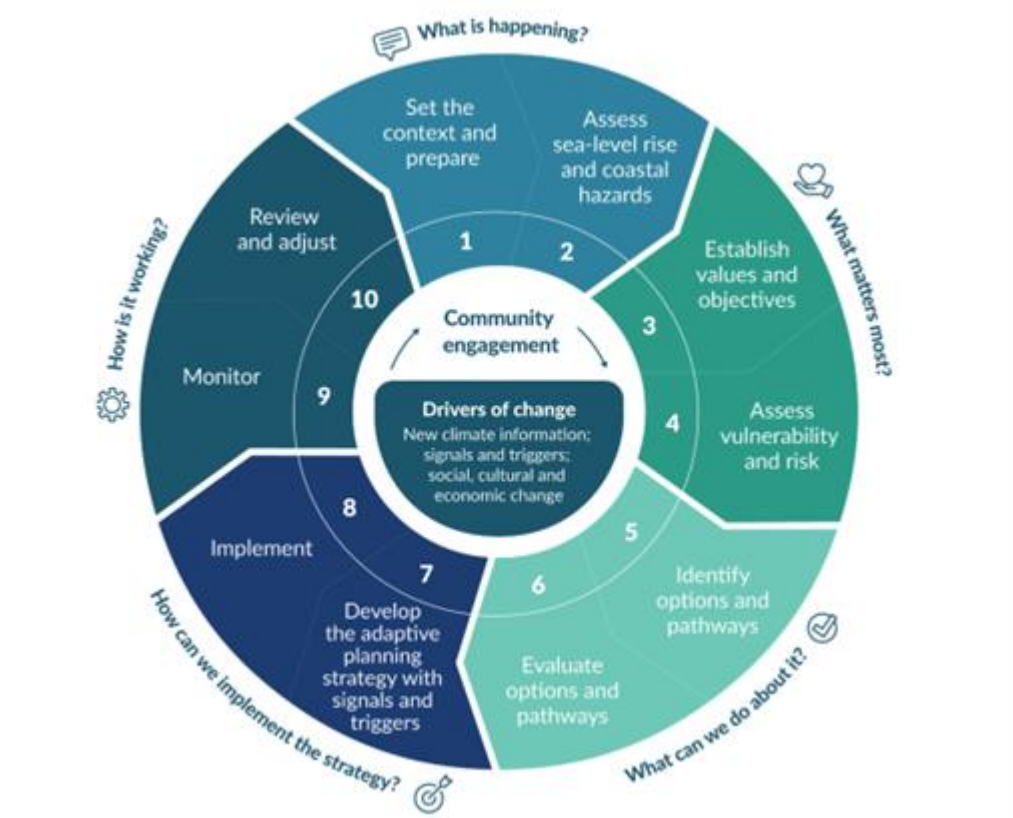

Figure 6: **10-step decision cycle, grouped around five questions (Source: MfE (2024), adapted from Max Oulton (University of Waikato) and UN-Habitat (2014)).**

CAP's approach, outlined in Part B, was developed in accordance with the 2017 guidance and remains consistent with the 2024 guidance.

2.3.4 Insurance Council New Zealand ("ICNZ")

The Insurance Council of New Zealand ("**ICNZ**") is a representative body which represents about 95% of the New Zealand general insurance market, including about a trillion dollars worth of New Zealand property and liabilities.

New Zealand has experienced more than 150 severe weather events and natural disasters since ICNZ began keeping records in 1968. The costs of these events has increased

significantly in recent years, with weather events costing $3.75 billion in 2024, compared to the previous all-time highest annual total of $359.4 million in 2022.[38]

The insurance industry undertakes research to measure risk and inform their decision on what types of risk and locations it will insure. Traditionally, risk has been assessed by looking backwards, however, it increasingly requires more forward-looking predictive models that include climate change. Insurers are beginning to look at more detailed data to form more precise understanding of risk and impacts on their business sustainability over the long-term, and underwrite accordingly.

If, over time, risks are not addressed and allowed to become greater, they are not sustainable. Increasing risk will mean increasing premiums changed, and in extreme cases, cover for some may not be viable.

Nationwide, we are already seeing evidence of insurance premiums responding to severe weather events. Price monitoring data provided to Treasury showed average premium increases of 23 percent between September 2022 and July 2023, and more than 30 percent in some regions.[39]

In 2021, ICNZ released a paper calling for local government across New Zealand to take a "*proactive, coordinated, and long-term view when it comes to managing the real and significant impacts of climate change…"*.[40] This includes:

- Planned action and investments for adaptation and mitigation to reduce the extent of future climate change and its impacts.
- Grappling with the full impacts of climate change now head on despite the uncertainty, noting that the potential impacts stretch across generations, with the economic, social and environmental impacts being too significant to ignore and only increasing if no action is taken.
- Adopting a holistic and flexible approach when working through these matters, leveraging a risk management framework and an adaptive pathways approach.

The ICNZ also note that property damage from coastal erosion and "actions by the sea" excluded from the majority of home insurance policies in Australia. Local government action to manage the impact of climate change risks is critical to ensuring the same thing does not happen in New Zealand.[41]

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38 Cost of Natural Disaster Table (NZ) and ICNZ 2021 media release.

39 RNZ article: *How homeowners are respodning to huge insurance premium hikes*, 10 April 2024.

40 *ICNZ's views on climate change and the role of local government*. ICNZ. 5 March 2021.

41 Ibid.

Where communities have adaptation plans and pathways to mitigate risk, this reduces uncertainty for insurers and may translate positively to insurance premiums.

The Takutai Kāpiti project has sought to initiate adaptation planning in a manner consistent with the ICNZ's recommended approach. CAP acknowledge the uncertainty in considering future climate change scenarios and the DAPP process is an appropriate method to navigate this context.

2.3.5 An Evolving and Dynamic Future

Although it is confronting, we must not shy away from the reality that the impacts of climate change are being felt, now. The risk of social, economic, and environmental harm only increases if no action is taken and become more costly to address later.

While it is imperative for our coastal community to start adapting now, it is equally important that we map out a pathway which is agile, and transformational to meets the needs that emerge as the uncertainties of climate change become reality. In addition, there needs to be room to consider new solutions or ways to address coastal erosion and inundation that may be developed after the first steps in an adaptive pathway are implemented.

Grappling with the complexities associated with climate change, the uncertainties around what its full impacts will be and when those impacts will occur over a long-time frame, requires ongoing attention. While the pathways identified in this report recommend a first step, the preferred pathways should be revisited regularly to ensure they remain the most appropriate options for each management unity. These reviews should undertaken as part of an ongoing conversation with coastal communities, where recent monitoring and research is shared and community objectives are reaffirmed.

2.4 REGIONAL POLICY CONTEXT

2.4.1 Greater Wellington Regional Policy Statement

The Regional Policy Statement ("**RPS**") sets out the framework and priorities for resource management in the Wellington region. The RPS must give effect to the NZCPS.

The current RPS was made operative in 2013 and seeks to:[42]

- Reduce the risks and consequences to people, communities, their businesses, property and infrastructure from natural hazards and climate change effects;[43]

[42] Regional policy Statement for the Wellington Region.

[43] Objective 19 of the RPS.

- Ensure that communities are more resilient to and better prepared for natural hazards, including the impacts of climate change;[44] and
- Ensure that hazard mitigation measures, structural works and other activities do not increase the risk and consequences of natural hazard events.[45]

Greater Wellington Regional Council ("**GWRC**") are currently proposing changes to the RPS to respond to the climate emergency, enable urban development, protect waterways, and strengthen existing provisions for indigenous biodiversity.[46] These changes are called Plan Change 1 or "PC1". GWRC have consulted on the changes and are close to finishing the hearings process, however at the time of drafting this report the provisions have not been finalised.

The Council will need to ensure their District Plan gives effect to the new RPS when it is finalised.

PC1 proposes to insert a new chapter into the RPS on climate change and amends the natural hazards chapter.[47] These changes respond to the climate emergency, declared by GWRC in 2019, and to the IPCC's Sixth Assessment Report. The changes introduce provisions to reduce the impacts of climate change by increasing community resilience to climate change, improving public awareness of climate change, empowering mana whenua/tangata whenua to achieve climate resilience, and ensuring that nature-based solutions are an integral part of adaptation.

GWRC have indicated they intend to further update the RPS at the end of 2024.

2.4.2 Greater Wellington Natural Resources Plan

The purpose of the Natural Resources Plan ("**NRP**") is to promote the sustainable and integrated management of air, land, water and the coastal environment in the Wellington region. The NRP includes objectives, policies, and rules for the management of the coast and natural hazards. These provisions require GWRC to avoid inappropriate uses and development in high hazard areas and ensure that risk and residual risk, from natural hazards and adverse effects of climate change, on people, the community, the environment and infrastructure are acceptable.[48] GWRC must also give special consideration to the potential for climate change to cause or exacerbate natural hazard events over at least the

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[44] Objective 21 of the RPS.

[45] Objective 20 of the RPS.

[46] *Regional Policy Statement (RPS) Proposed Change 1 (PC1)*.

[47] Further information on PC1 and the notification process is available on GWRC's website: *Regional Policy Statement (RPS) and Proposed Change 1 (PC1).*

[48] Objective O15 and O16 of the Operative NRP.

next 100 years, including as a result of coastal erosion, coastal inundation and sea level rise.[49]

GWRC is currently progressing Plan Change 1 to the NRP. This plan change is predominantly focussed on freshwater matters and does not seek changes to the natural hazards and climate change provisions discussed above.

GWRC have indicated they intend to further update the NRP at the end of 2024.

2.4.3 Greater Wellington Climate Change Assessment

In 2017, GRWRC, the Council and the other territorial authorities across the Wellington region established the Wellington Region Climate Change Working Group ("**WRCCWG**"). The purpose of this group was to enable a regional response to climate change issues. A sub- group of the WRCCWG was also established to focus on climate change and coastal hazards for the region. As a first-step the sub-group sought a high-level, region-wide assessment of the vulnerability of coastal communities to sea level rise and coastal hazards. Identifying the coastal communities most at risk was intended to assist in designing a process for working with the affected communities to develop long-term adaptive strategies.

The resulting report considered coastal inundation, coastal erosion, and tsunami and found that sea level rise impacts will be the most significant in the highly populated settlements along the region's coast[50]. For the Kāpiti District, Paraparaumu and Raumati were considered the most vulnerable. It was also noted that existing seawalls along the Kāpiti Coast mitigated risks to communities at Paekākāriki, Paraparaumu and Raumati.

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[49] Policy P28 of the Operative NRP.

[50] *Preparing Coastal Communities for Climate Change: Assessing coastal vulnerability to climate change, sea level rise and natural hazards*. Prepared by Mitchell Daysh Limited. June 2019.

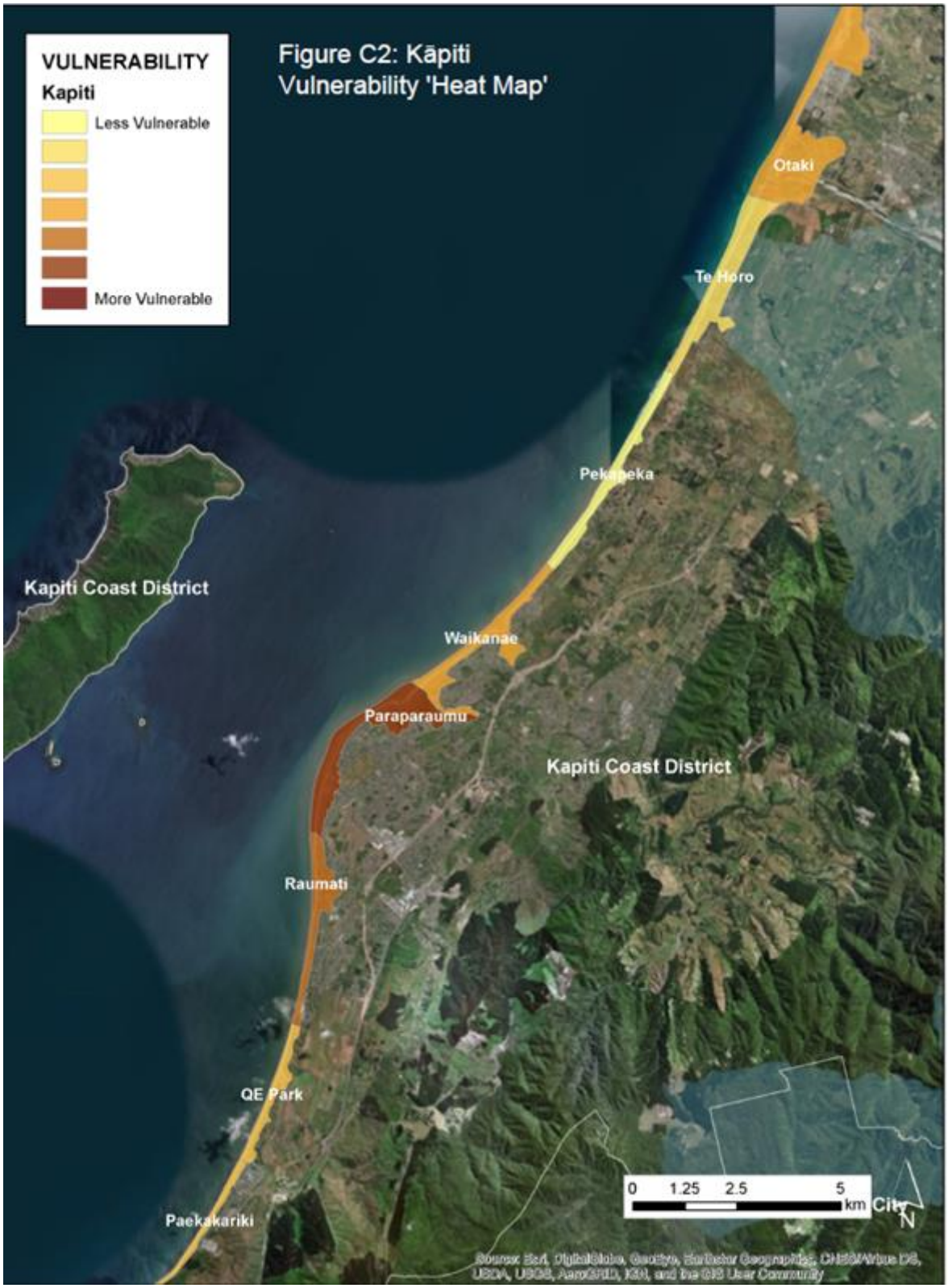

Figure 7: Vulnerability 'Heat Map for Kāpiti Coast (Source: Mitchell Daysh, 2019).

2.5 LOCAL POLICY CONTEXT

2.5.1 Te Ātiawa ki Whakarongotai

We acknowledge and thank Te Ātiawa ki Whakarongotai for their participation and sharing of mātauranga with CAP throughout the Takutai Kāpiti project.

We recognise Whakarongotai o te moana Whakarongotai o te wā, which is a Kaitiakitanga Plan prepared by Ātiawa ki Whakarongotai Charitable Trust[51]. This plan identifies the key kaupapa, huanga and tikanga (values, objectives, and policies) of Te Ātiawa ki Whakarongotai that guide their kaitiakitanga as mana whenua. While the plan is primarily internally focused, it also informs other entities, like CAP, of the values and policies of the iwi, and in particular, helps provide insight and detail regarding specific key concepts and values within the environmental statutory framework.

The Plan acknowledges that climate change poses an unprecedented threat to the well-being and survival of people on planet earth, and identifies ways to address climate change risk.

We thank Te Ātiawa ki Whakarongotai for their support through the Takutai Kāpiti project. We are especially grateful for the sharing of mātauranga and the collective wisdom shared through the MCDA scoring process for the te ao Māori criteria in the CAA, RAA and PAA.

2.5.2 Ngā Hapū o Ōtaki

Ngā Hapū o Ōtaki serves the whānau of the five hapū of Ōtaki, Ngāti Kapu, Ngāti Pare, Ngāti Maiotaki, Ngāti Koroki and Ngāti Huia, and the 3 marae in the rohe of Ōtaki.

We recognise the Ōtaki River and Catchment Iwi Management Plan 2000 prepared by Ngā Hapū o Ōtaki. The plan establishes a vision for the exercise of kaitiakitanga in respect of the Ōtaki River and its tributaries and provides policy to guide the fulfilment of that vision.

We extend our gratitude to Ngā Hapū o Ōtaki for their manaakitanga and sharing of mātauranga to inform the Takutai Kāpiti project. Our first district-wide session was held in Ōtaki with a lot of support from Ngā Hapū o Ōtaki.

In particular, we acknowledge Dr Aroha Spinks who has been closely involved in the preparation and meetings for the NAA and providing advice to CAP. We thank Dr Spinks for her contribution in terms of her knowledge, coordination of hapū, and coordination of the MCDA scoring session for te ao Māori criteria.

[51] *Whakarongotai o te moana Whakarongotai o te wā – Kaitiakitanga Plan for Te Ātiawa ki Whakarongotai*.

2.5.3 Ngāti Toa Rangatira

Te Rūnanga o Toa Rangatira was established in 1990. It is the mandated iwi authority for Ngāti Toa Rangatira, and the administrative body of iwi estates and assets.

The rohe of Ngāti Toa extends from the Whangaehu River south along the ranges to Turakirae. It then crosses Raukawa Moana (Cook Strait) to Marlborough and Nelson. This is encapsulated in the tribal pepeha: Mai i Miria te Kakara ki Whitireia, whakawhiti te moana Raukawa, ki Wairau, ki Whakatū.[52]

Schedule 1of the Ngati Toa Rangatira Claims Settlement Act 2014 identifies statutory areas and coastal statutory areas of Ngati Toa Rangatira.[53] Along the Kāpiti Coast, these include, Queen Elizabeth Park, Cook Strait and Kapukapuariki Rocks.

The Council, as a consent authority, must have regard to these statutory acknowledgements.

2.5.4 Operative Kapiti Coast District Plan 2021

The Operative Kapiti Coast District Plan 2021 ("**Operative District Plan**") was made operative in 2021. When this plan was notified in 2012 (referred to as the Proposed District Plan ("**PDP**"), it included coastal hazard provisions. Because the Council formally withdrew coastal hazard provisions from the PDP in 2014 and 2017, there are some provisions relating to coastal hazards in the District Plan 1999 that have been retained in the Operative District Plan, and still apply in relation to development along the coast.

Operative District Plan provisions which relate to natural hazards seek to ensure that urban development delivers resilient communities, does not increase risks to life or property damage from natural hazard events, delivers urban environments that are resilient to the current and future effects of climate change[54]. They seek to avoid exposure of people and communities to increased levels of risk from natural hazards by adopting a risk based and precautionary approach.[55]

The Coastal Environment chapter, including the 1999 provisions, discourage the development of buildings and significant infrastructure in areas which may be prone to

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52 https://www.govt.nz/assets/Documents/OTS/Ngati-Toa-Rangatira/Ngati-Toa-Rangatira-Attachments-7-Dec-2012.pdf

53 Schedule 1 of the Ngati Toa Rangatira Claims Settlement Act 2014, and shown in the Deed of Settlement attachments.

54 Objective DO-O3 of the District Plan.

55 Policies NH-P2 and NH-P4 of the District Plan.

coastal erosions or the effects of sea level rise, and ensure that adverse effects of natural hazards are avoided or mitigated in areas prone to natural hazards[56].

While these provisions for the management of coastal natural hazards are not as detailed as the direction set by the NZCPS and the RPS, they still demonstrate a clear preference to improve the resilience of people and communities in Kāpiti by avoiding increasing risk to communities and the need to consider the potential effects of climate change and sea level rise.

2.5.5 Long Term Plan and Annual Plan

Long Term Plans, often referred to as the "LTP", are a key planning tool for councils. LTPs outline the council's priorities for the next 10 or more years, all things the council does and how they fit together. They show what will be done over the 10 year period, why the council is doing these things and their costs. LTPs are reviewed every three years and this provides an opportunity for public participation in council decision-making.

The annual plan outlines the specific plans and budget to deliver on the LTP in a particular year. Councils prepare an annual plan in each of the two years between LTP reviews, and set out in them what the council plans to do in the next 12 months to move towards achieving its goals. These plans are adopted before the start of the financial year in July, following a submission process.

For the adaptive pathways identified in this report to be implemented, the Council will need to make provision for the first step of the preferred pathway in their LTP. The 10+ year outlook and three year review cycle of LTPs fits well with the DAPP process. It enables the Council and Kāpiti Coast communities and iwi to consider what pathways are appropriate for the next 10 years. This ensures that Kāpiti is not "locked in" to the pathways identified in this report, and allows flexibility to amend the preferred approach as required to meet the desired outcomes of affected communities while keeping the long-term goal of resilience to natural hazards in sight.

It is noted that at the time of drafting this report the Council were consulting on the 2024-2034 LTP. There will be opportunities for Kāpiti's communities to comment and provide feedback to the Council each time they update their LTP.

[56] Policy C.9.1.2-4 and Objective C.15.1.1.0 of the District Plan 1999 Provisions.

2.5.6 Local Government Act

Councils are required to establish consultative processes around their policy-making activities which reflect the intent and the purpose of the Local Government Act 2002 ("**LGA**").

There have been many opportunities for the Kāpiti community to engage through the CAP community consultation processes to date – and we recognise that it will be over to the Council once we provide this report to decide what further consultation might be needed.

2.6 WHAT ARE DYNAMIC ADAPTIVE PATHWAYS?

Rather than prescribing a single, final solution for addressing coastal erosion and inundation, CAP have identified preferred "pathways". These pathways are like a roadmap that shows several different ways for getting to where a community wants to be in the future. While the community can start planning where they want to go now, they still have the ability to change routes for getting there, or even the whole direction, as conditions change (or don't change in the way that was expected).

The pathways we developed include short-term, medium-term, and long-term adaptation actions that are tailored for each area in the Kāpiti district. Climate change is likely to have different implications for each of these areas, along with there being a difference in the protections already in place for them, so it is important to focus on each area separately to plan the best possible options for the unique needs of that area. The recommended pathways in this report have been developed for further discussion with the communities they relate to.

While the NZCPS requires councils to look ahead 100 years, rather than prescribing a single 100-year solution, DAPP enables informed and sensible decisions to be made over time. After the short-term action is implemented, future options are left for future decisions. This ensures that councils and communities are not "locked in" to any one pathway, and that adaptation options can be reviewed or changed in future.

For example, a pathway for a community may begin with "dune restoration and enhancement" and then if a certain trigger is activated then it will move to a more "protective" method such as the construction of a seawall or beyond that option to raising the level of houses. If the triggers are not activated, then the community in the example given will continue as it is, maintaining and enhancing the dune systems that are already in place.

2.7 PROJECT GOVERNANCE

As recorded in the Terms of Reference (**Appendix 1**), CAP's purpose is to develop coastal adaptation options and make recommendations for the Council's consideration.

A key objective of the CAP in achieving this purpose was to facilitate engagement with the broader community, affected persons and other stakeholders.

To assist CAP with its objectives and outcomes, it received support from the Council's Takutai Kāpiti Project Team and a Technical Advisory Group ("**TAG**") which was established to provide scientific data on sea level rise and coastal inundation, social and economic impact assessments, and the effects of changing groundwater levels.

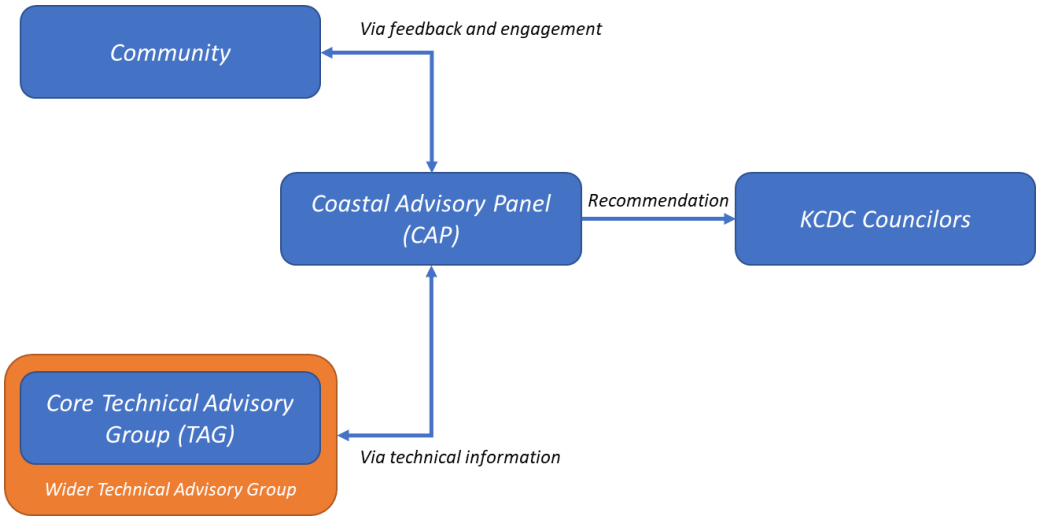


Figure 8: Relationship structure for the development of the Coastal Hazards Adaptation Recommendations Report (Source: Jacobs, 2022).

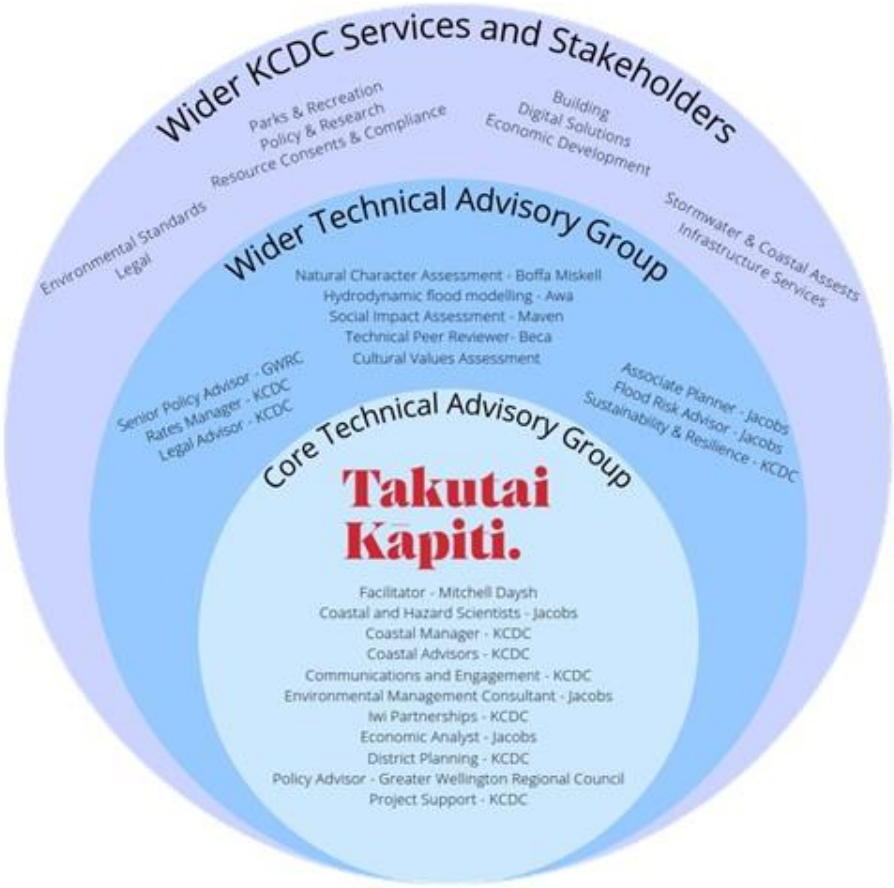


Figure 9: Overview of TAG members and wider TAG structure (Source: Jacobs, 2022)

2.7.1 Evolution of the Terms of Reference

As noted in Section 1.2 and 1.3 of this Report, a Co-Design Working Group ("Working Group") was established to create a set of recommendations for how the community-led process should be designed.

The Working Group consisted of representatives from Tiriti Partners, GWRC, Coastal Ratepayers United, North Ōtaki Beach Residents Group, Waikanae Estuary Care Group, and the Council staff. Those with a responsibility for climate change from the Council and GWRC, and one representative each from the Ōtaki, Waikanae, Paraparaumu/Raumati, and Paekākāriki Community Boards attended the Working Group meetings in the role of observers.

The Working Group objective was to discuss, agree, and finalise recommendations for the Council's elected members on the preferred process for Phase Two for the Takutai Kāpiti project. These recommendations were summarised and presented to Council on 10 December 2020.

Following initial feedback from the community, the Panel was renamed the Coastal Advisory Panel to recognise CAP's role in advising the Council.

Once CAP began meeting, we took into account the recommendations of the Working Group and finalised their ToR on 21 March 2022.

The panel's terms of references are contained in **Appendix 1**.

B

PART B

Adaptive Pathway Development and Assessment

3. INTRODUCTION

Part B of this report summarises the decision-making framework and key information utilised by CAP to develop adaptive pathways for the Kāpiti Coast. CAP largely followed the decision-making framework recommended by Jacobs in 2022, with some variations to respond to the needs of the community as these became apparent through the process.

4. CAP ESTABLISHMENT AND EARLY MEETINGS

The history and evolution of CAP is summarised in Sections 1.2 and 1.3 of this Report.

CAP began officially meeting in late 2021, with an inaugural meeting on 29 September 2021. These early meetings and workshops included foundational presentations on relevant science, regulatory frameworks, and assessment methodologies, which would be used throughout CAP's work programme. Presentations covered topics such as modelling of the effects of SLR on groundwater, the DAPP process, and the Hazard Susceptibility and Vulnerability Report. Presentations also provided CAP an understanding of how their work related to, and fit in with, other climate change and adaptation workstream occurring in New Zealand, including the National Adaptation Plan.

A key outcome of these early meetings was the formal agreement of the CAP's Terms of Reference ("**ToR**") which are attached in full as **Appendix 1**.

While the Panel held a number of informal pop-up sessions at markets and libraries, the Panel's public engagement work formally began with a launch meeting on 23 July 2022 in Paraparaumu. The event was well attended, highlighting the importance and public interest in adaptation planning in Kāpiti.

5. OVERVIEW OF CAP WORK PROGRAMME

From 2022 through to mid-2024, CAP have worked through a structured decision-making process, completed through a series of workshops and community engagement opportunities.

Agendas, minutes, and presentations from CAP's meetings are available on the Council's website.[57] Supporting information and reports are also publicly available.[58]

[57] *Coastal Advisory Panel – Work.*

[58] *Takutai Kāpiti Documents*.

5.1 DECISION MAKING PROCESS

CAP's decision-making process broadly followed three key phases, as recommended by Jacobs:[59]

1. Defining and confirming;
2. Assessment of pathways for adaptation area, which was repeated for each adaptation area; and
3. Synthesis and recommendations to Council.

It is important to note that the CAP has not completed Phase 3 of the decision making process shown in Figure 10 because these steps were outside the scope of the Terms of Reference. Phase 3 is the responsibility of the Council as a further stage of work.

[59] Refer **Appendix 6**.

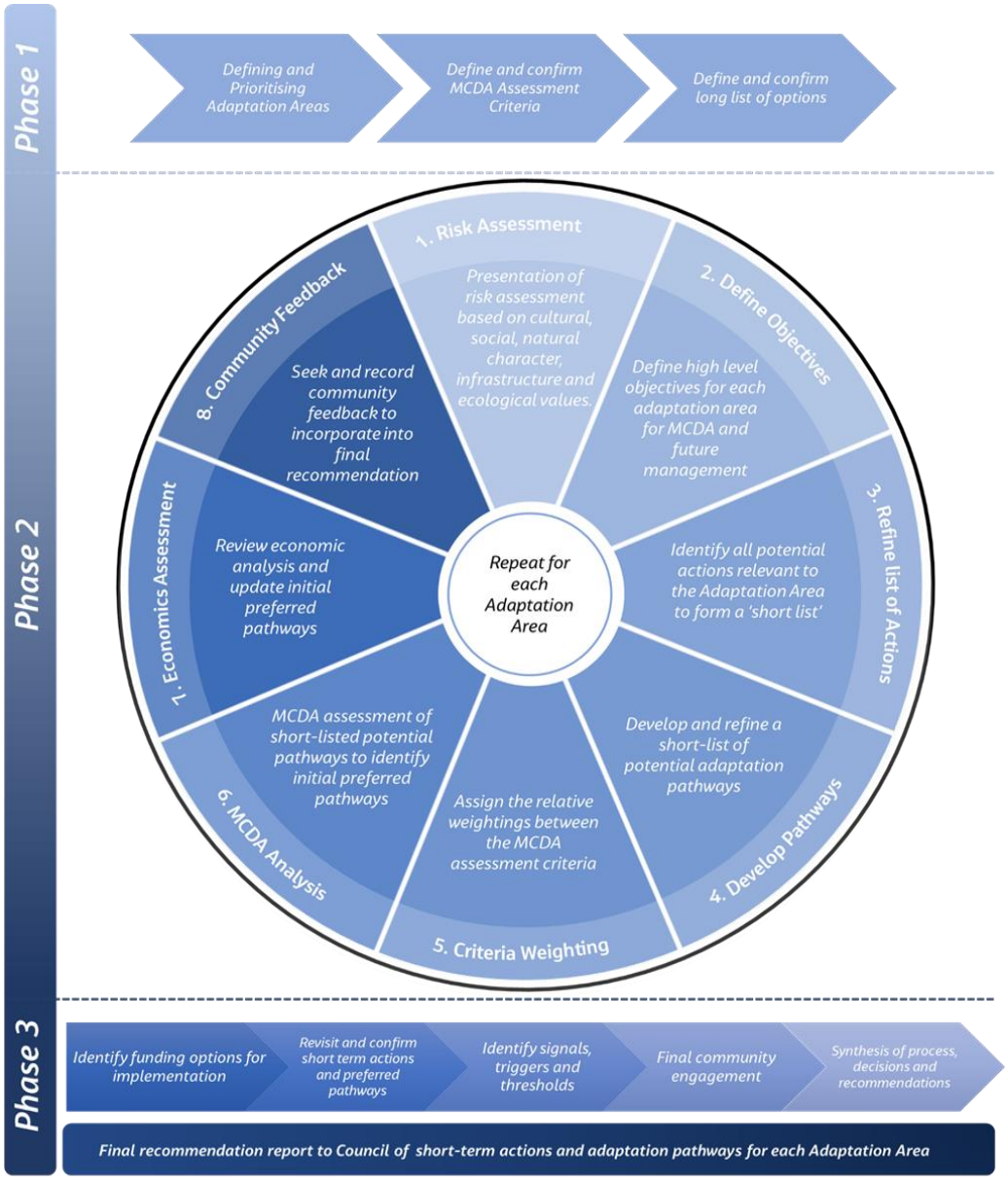


Figure 10: Overview of decision-making framework for the CAPs Report. (Source: Jacobs, 2022).

The process undertaken by CAP to date covers steps 3-6 of MfE's recommended 10-step decision cycle as shown in Figure 11 below. It is noted that Steps 1 and 2 have been completed prior to CAP, through a significant body of work undertaken by Greater Wellington Regional Council with the District Council's as discussed in Section 2.3 of this report. CAP anticipate the Council will continue through the 10-step cycle in consultation with the Kāpiti community.

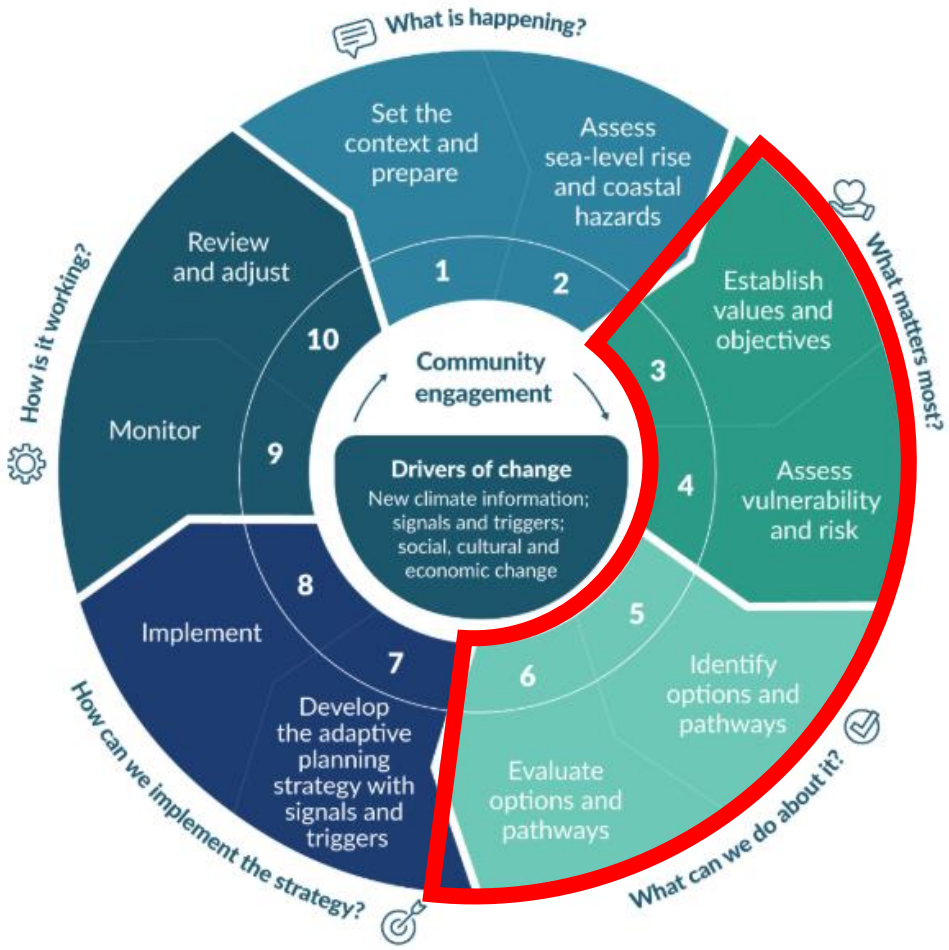
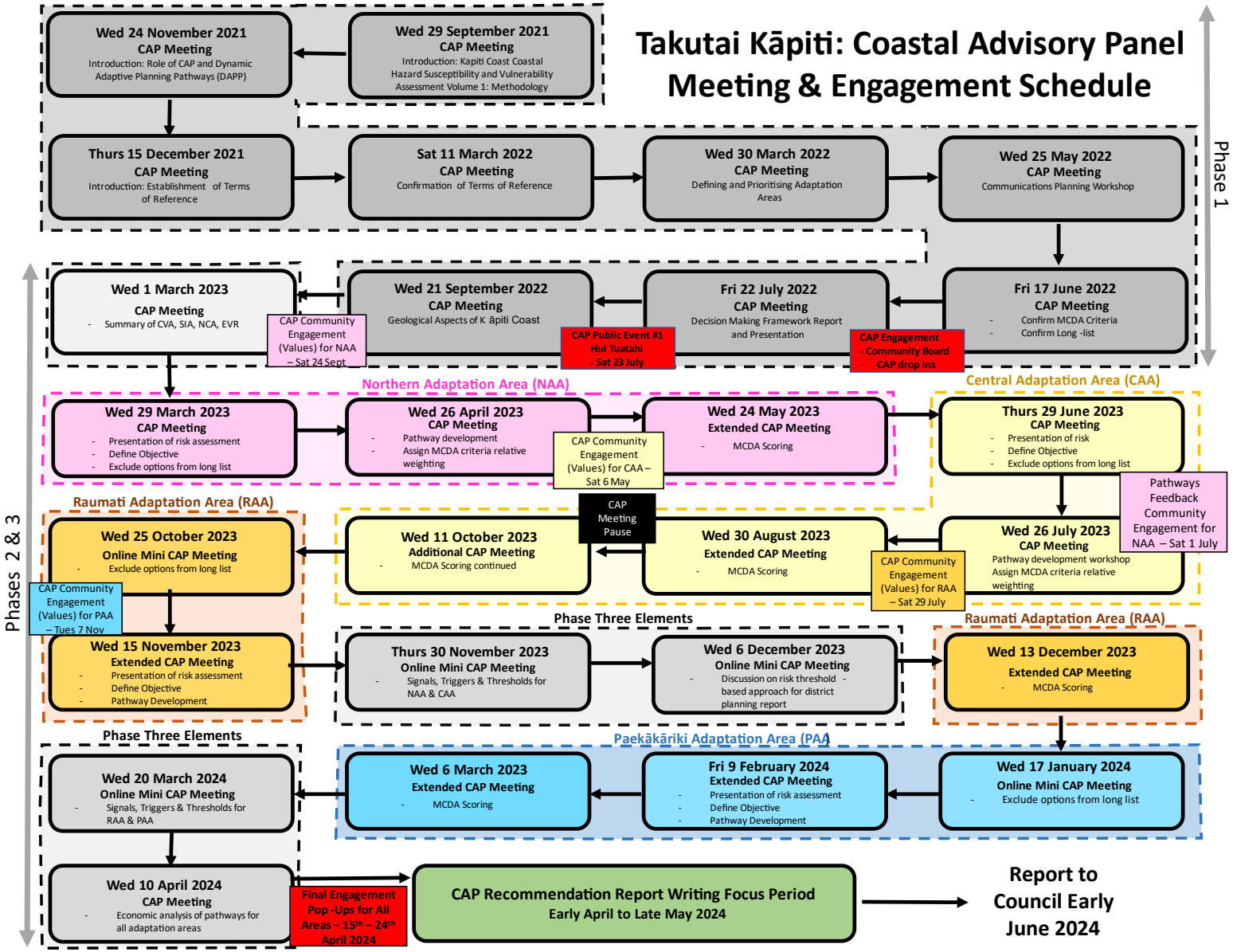


Figure 11: Ten-step decision cycle (Source: MfE, 2024).

5.2 SCHEDULE

Phase One (defining and confirming) was undertaken in 2022 with Phases Two and Three spanning 2023 and 2024. The key CAP meetings and community engagement points are shown in the image below.


Takutai Kāpiti: Coastal Advisory Panel Meeting & Engagement Schedule
Phase 1
Phases 2 & 3
Wed 24 November 2021
CAP Meeting
Introduction: Role of CAP and Dynamic Adaptive Planning Pathways (DAPP)
Wed 29 September 2021
CAP Meeting
Introduction: Kapiti Coast Coastal Hazard Susceptibility and Vulnerability Assessment Volume 1: Methodology
Thurs 15 December 2021
CAP Meeting
Introduction: Establishment of Terms of Reference
Sat 11 March 2022
CAP Meeting
Confirmation of Terms of Reference
Wed 30 March 2022
CAP Meeting
Defining and Prioritising Adaptation Areas
Wed 25 May 2022
CAP Meeting
Communications Planning Workshop
Fri 17 June 2022
CAP Meeting
- Confirm MCDA Criteria
- Confirm Long -list
CAP Engagement - Community Board - CAP drop ins
Fri 22 July 2022
CAP Meeting
Decision Making Framework Report and Presentation
CAP Public Event #1 Hui Tuatahi - Sat 23 July
Wed 21 September 2022
CAP Meeting
Geological Aspects of K āpiti Coast
CAP Community Engagement (Values) for NAA – Sat 24 Sept
Wed 1 March 2023
CAP Meeting
- Summary of CVA, SIA, NCA, EVR
Northern Adaptation Area (NAA)
Wed 29 March 2023
CAP Meeting
- Presentation of risk assessment
- Define Objective
- Exclude options from long list
Wed 26 April 2023
CAP Meeting
- Pathway development
- Assign MCDA criteria relative weighting
CAP Community Engagement (Values) for CAA – Sat 6 May
Wed 24 May 2023
Extended CAP Meeting
- MCDA Scoring
Central Adaptation Area (CAA)
Thurs 29 June 2023
CAP Meeting
- Presentation of risk
- Define Objective
- Exclude options from long list
Pathways Feedback Community Engagement for NAA – Sat 1 July
Wed 26 July 2023
CAP Meeting
Pathway development workshop
Assign MCDA criteria relative weighting
CAP Community Engagement (Values) for RAA – Sat 29 July
Wed 30 August 2023
Extended CAP Meeting
- MCDA Scoring
CAP Meeting Pause
Wed 11 October 2023
Additional CAP Meeting
- MCDA Scoring continued
Raumati Adaptation Area (RAA)
Wed 25 October 2023
Online Mini CAP Meeting
- Exclude options from long list
CAP Community Engagement (Values) for PAA – Tues 7 Nov
Wed 15 November 2023
Extended CAP Meeting
- Presentation of risk assessment
- Define Objective
- Pathway Development
Phase Three Elements
Thurs 30 November 2023
Online Mini CAP Meeting
- Signals, Triggers & Thresholds for NAA & CAA
Wed 6 December 2023
Online Mini CAP Meeting
- Discussion on risk threshold based approach for district planning report
Raumati Adaptation Area (RAA)
Wed 13 December 2023
Extended CAP Meeting
- MCDA Scoring
Paekākāriki Adaptation Area (PAA)
Wed 17 January 2024
Online Mini CAP Meeting
- Exclude options from long list
Fri 9 February 2024
Extended CAP Meeting
- Presentation of risk assessment
- Define Objective
- Pathway Development
Wed 6 March 2023
Extended CAP Meeting
- MCDA Scoring
Phase Three Elements
Wed 20 March 2024
Online Mini CAP Meeting
- Signals, Triggers & Thresholds for RAA & PAA
Wed 10 April 2024
CAP Meeting
- Economic analysis of pathways for all adaptation areas
Final Engagement Pop -Ups for All Areas – 15th – 24th April 2024
CAP Recommendation Report Writing Focus Period
Early April to Late May 2024
Report to Council Early June 2024

6. IDENTIFYING AND DEFINING ADAPTATION AREAS

CAP defined areas of similar coastal morphologies, processes, hazard exposure and current management practices so that preferred adaptive pathways could then be developed for each area with common characteristics.

Jacobs recommended a list of potential adaptation areas based on the following factors:[60]

- Similarities in the susceptibility and vulnerability to coastal hazards;
- Similarities in local processes occurring (e.g., sediment supply, sediment transport);
- Density of population and infrastructure;
- Present day coastal management practices (e.g., structured/non-structured);
- Limit of coastal influence on flooding and groundwater levels; and
- Common river catchments.

Five adaptation areas were identified by Jacobs and agreed to by CAP on 30 March 2022:

- Northern Adaptation Area ("**NAA**");
- Central Adaptation Area ("**CAA**");
- Raumati Adaptation Area ("**RAA**");
- Paekākāriki Adaptation Area ("**PAA**"); and
- Queen Elizabeth Park.

While RAA and PAA have similar features, being located to the south and having seawall structures in place, they have been assessed separately as they are split by the Queen Elizabeth Park area.

As the Queen Elizabeth Park is managed by GWRC, currently under a managed retreat strategy, CAP have not developed adaptive pathways for this adaptation area.

The five adaptation areas are shown in Figure 12, below.

[60] Refer **Appendix 6**.

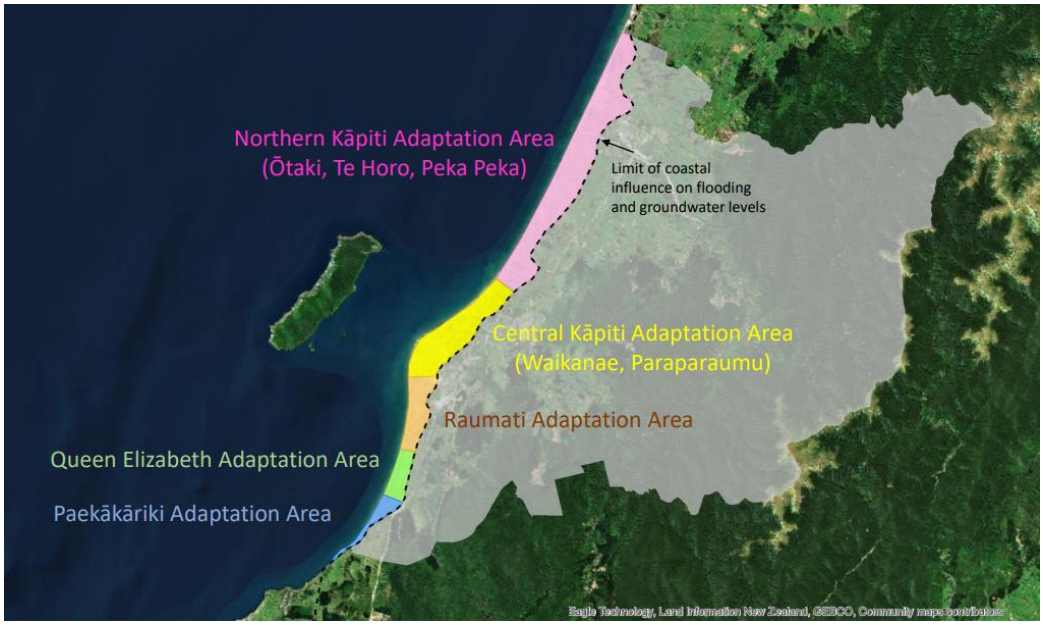


Figure 12: Takutai Kāpiti Adaptation Areas (source: Jacobs, 2022).

CAP confirmed that we would develop adaptive pathways sequentially, starting with the NAA and working south.[61] CAP therefore undertook all tasks described in Phase 2 for one adaptation area before working through all tasks for the next adaptation area.

Adaptive pathways for Kāpiti Island were not developed in the Takutai Kāpiti process, however, Kāpiti Island was taken into account in the Central Kāpiti Adaptation Area to ensure that any adaptation actions and pathways identified would not have a negative impact on the Island.

7. COMMUNITY ENGAGEMENT

The Takutai Kāpiti project has been a topic of great public interest, with a wide-range of perspectives held across the community.

CAP have been mindful of the importance of this work, and have sought opportunities to hear and understand these different perspectives. We have used a wide range of engagement methods since 2022, to hear from residents, mana whenua and interested parties along the Kāpiti Coast. Our engagement started with more informal community meetings and pop-ups in early 2022, and progressed to more formal feedback engagements through 2022 and 2023. We have also presented at a number of Community Board meetings

[61] *Minutes: Takutai Kāpiti Coastal Advisory Panel Meeting #5*. 30 March 2022; and *Minutes: Takutai Kāpiti Panel Meeting #6*. 25 May 2022.

across the district throughout the Takutai Kāpiti project. At the beginning of 2024, we have held a number of pop-up sessions to seek feedback on our work so far.

Many of these engagements have been supported by the Council, including:

- Takutai Kāpiti newsletters;
- Articles, public notices and surveys in the newspaper;
- Emails and letters to ratepayers;
- Features within Everything Kāpiti newsletter;
- Facebook posts and ads;
- Instagram reels, posts and ads;
- The Council's 'Have Your Say' survey platform;
- Antenno
- Community engagement pop ups including at:
    - Libraries
    - Community markets
    - Coastlands Shopping Centre
    - Ōtaki Expo
- A district-wide public information event at Paraparaumu Beach Community Centre on 23 July 2022;
- Rangatahi session in Ōtaki on 31 August 2022;
- Community engagement workshop at Ōtaki Rotary Club on 24 September 2022 – for Northern Adaptation Area;
- Community engagement workshop at Otaihanga Boating Club on 6 May 2023 – for Central Adaptation Area;
- Series of Ngā Hapū o Ōtaki wananga;
- Community feedback session at Ōtaki Baptist Church on 1 July 2023 – for Northern Adaptation Area;
- Community engagement workshop at Raumati Bowling Club on 29 July 2023 – for Raumati Adaptation Area;
- Community engagement workshop at St Peter's Village Hall on 7 November 2023 – for Paekākāriki Adaptation Area; and
- Presentations to Community Board meetings.

We have also undertaken an additional round of consultation, seeking feedback from the community on the preferred pathways and optional thresholds. This has primarily been

through community events and an online survey, which ran from 15 April 2024 to 9 May 2024.

This feedback is documented in the report "*District-Wide Engagement on the Coastal Advisory Panel's Draft Recommendations: Summary of Community Feedback*" attached as **Appendix 15**.

This summary report provides an overview of the 1,442 individual pieces of feedback from the community on the CAP's top three preferred adaptation pathways for each Adaptation Area and their Management Units, the CAP's optional thresholds, and their proposed approach for managing coastal hazards in the Operative Kapiti Coast District Plan 2021.

The summary report has been used by the CAP for consideration of the adaptation pathway recommendations in this report to Council and may inform further engagement with communities on adaptation planning after Takutai Kāpiti.

We acknowledge that despite these efforts, many in the community have not yet had an opportunity to input into the development of adaptive pathways. A key recommendation of this report is that the Takutai Kāpiti project must be an ongoing conversation with the community.

8. SUPPORTING INFORMATION AND DECISION-MAKING TOOLS

This section sets out at a high level the methodology used by CAP and the types of information provided to CAP to inform their decision making.

The Decision Making Framework Report indicates that technical information would be presented to CAP in three 'volumes'. Volumes 1 and 2, and a later Addendum to these reports produced in February 2024, comprising a district wide hazards susceptibility and vulnerability assessment (**Appendices 3-5**). Volumes 1 and 2 have been peer reviewed by both Beca and GWRC.

In addition, the CAP received a collection of other subject-matter reports prepared by a number of expert consultants. Together, these reports make up 'Volume 3' of the technical advice for the Takutai Kāpiti project:

- Decision Making Framework Report, prepared by Jacobs (**Appendix 6**);
- Coastal Risk-Based Planning Report and Planning Framework Relevant to Coastal Hazards memo, prepared by Jacobs (**Appendix 7**);
- Risk Matrices and Overviews for each Adaptation Area, prepared by TAG (**Appendices 8A-8D**);

- Cultural Values Assessments, prepared on behalf of Ngā Hapū o Ōtaki and Te Ātiawa ki Whakarongotai (**Appendices 9A and 9B**);
- Ecological Values Review Report, prepared by the Council and peer reviewed by Astrid.Ecology (**Appendix 10**);
- Social Impact Assessment, prepared by Maven (**Appendix 11**);
- Kāpiti Coast Natural Character Evaluation, prepared by Boffa Miskell (**Appendix 12**);
- Economic Analysis of Short-listed Pathways, prepared by Jacobs (**Appendix 13**).

Additional technical information and advice was provided to CAP by the TAG through meeting presentations.

Full copies of each report identified above are attached as appendices to this report and all meeting presentations are available on the Takutai Kāpiti project website.[62]

8.1 DISTRICT HAZARDS

The Council engaged Jacobs to assess the Kāpiti District for coastal hazards, from Ōtaki in the north to Paekākāriki in the south. The assessment updates previous coastal hazard assessments of the Kāpiti Coast District shoreline. It identifies areas susceptible to current and future coastal erosion and inundation under various potential magnitudes of sea-level rise over 30, 50, and 100 years. It identifies Council infrastructure, community services and private property vulnerable to those hazards.

Volume 1 sets out the methodology which Jacobs used, and Volume 2 comprises two documents:

1. The results of the assessment; and
2. The appendices, including maps.

Jacobs also provided an addendum to these reports in February 2024 to confirm CAP's approach remained consistent with updated SLR scenarios recommended for use by the IPCC and MfE. In response to a KCDC request for clarification on use of SLR scenarios, MfE recommended that the upper scenario SSP5-8.5 be included to follow the precautionary approach of NZCPS Policy 3, and that the best information for this including vertical land movement is provided by NZSearise[4]

Volumes 1 and 2, and the addendum are attached as **Appendices 3 and 4**.

[62] *Coastal Advisory Panel – Work*.

8.2 DECISION MAKING FRAMEWORK REPORT

The purpose of the Decision Making Framework Report, prepared by Jacobs, is to set out the tasks and process that CAP would follow in order to produce their coastal hazard adaptation recommendations.

The proposed process was developed to ensure CAP's process aligned with MfE's guidance and provided an overview of a number of decision-making tools that CAP would use along the way.

This report is attached as **Appendix 6.**

8.3 PLANNING AND REGULATORY ADVICE

Jacobs provided a memorandum to CAP in June 2022 summarising the relevant resource management planning instruments. Jacobs updated the memo in November 2023 to reflect changes to the planning framework since they provided their first memo.

Given CAP's recommendations are intended to help inform the Council's future District Plan reviews, the purpose of the memo was to ensure the CAP had a good understanding of the requirements of the Resource Management Act 1991 ("**RMA**") and other documents that give effect to the RMA.

The 2023 Coastal Risk-Based Planning report is attached as **Appendix 7**.

8.4 RISK MARTICES AND OVERVIEWS

Risk matrices and overviews were presented to CAP for each adaptation area to demonstrate how different scenarios could affect risk, levels of service, maintenance, and the viability of the community. The risk matrices and overviews also provided a 'baseline case' for testing potential pathways during the MCDA assessment compared to the "doing nothing" option.

The risk matrices and overviews prepared by TAG considered the potential consequences of two different sea level rise scenarios over a 100-year timeframe on five domains:

- Built Environment;
- Ecology;
- Natural Character;
- Human; and
- Cultural.

Risk assessments for each adaptation area are included in **Appendices 8A – 8D.**

8.5 CULTURAL VALUES ASSESSMENTS

Two cultural values assessments ("**CVA**") were undertaken as part of the Takutai Kāpiti project.

In 2023, Dr Aroha Spinks, Lindsay Poutama and Moira Poutama completed a Cultural Values Assessment Report (CVA) that represented Ngā Hapū o Ōtaki and Ngāti Toa Rangatira perspectives. The project began as a desktop exercise and initial engagement with the ART Confederation. Each iwi organisation recommended different approaches and provided representatives to give further guidance. Ātiawa ki Whakarongotai requested to complete their own values assessment, and this was supported with the addition of agreed text placed into the draft Report. Ngā Hapū o Ōtaki sent the draft report to hapū members for comment and collated those, as well as members having the opportunity to provide further feedback during wānanga (workshops). Ngāti Toa Rangatira provided verbal guidance at the beginning, endorsed further engagement with Ngāti Haumia representatives during the Draft Report feedback stage. Ngāti Haumia provided additional information after reviewing the draft report.

This report representing Ngā Hapū o Ōtaki and Ngāti Toa Rangatira perspectives is attached in full as **Appendix 9A**.

A CVA on behalf Te Ātiawa ki Whakarongotai has been prepared. However, it has not been approved for public release because it contains culturally sensitive information. It is therefore not appended to this report, but its key findings are reflected in the MCDA scoring process.

8.6 ECOLOGICAL VALUES REVIEW REPORT

The Council prepared an Ecological Values Review which outlined the national, regional and local guidance, provided a desktop review of available data sources from The Council and GWRC, and included existing sites of significance along the coast. This report has been peer reviewed by independent expert ecologist, Dr Astrid Dijkgraaf.

The review recognises that the Kāpiti Coast comprises a wide variety of different habitats and flora and fauna and that coastal hazards will impact the Kāpiti Coast District through erosion or inundation, with consequential effects on flora and fauna along the coast. This review brings together the current state of knowledge of the species present and their distribution in the coastal zone which was considered by CAP when making their recommendations for adaptive pathways in each adaptation area.

The review is attached as **Appendix 10.**

8.7 SOCIAL IMPACT ASSESSMENT

Maven provided a Social Impact Assessment ("**SIA**") which explores community values and analyses the community's perception of coastal hazards under the current approach to managing hazards.

SIA is an iterative process informed by on-going engagement with project proponents and other stakeholders, particularly the impacted community. To prepare their report, Maven undertook semi-structured interviews with 35 people, a desktop review of relevant studies, reports, and demographic and social issue data, then reviewed their key findings.

The findings of this report, and complimented by CAP's own engagement with the communities of the Kāpiti Coast, are reflected in the MCDA scoring process.

The SIA is attached as **Appendix 11.**

8.8 NATURAL CHARACTER EVALUATION

Boffa Miskell worked with GWRC, The Council, Jacobs and NIWA to provide an assessment of the natural character of the Kāpiti Coast, including Kāpiti Island.[63] They define natural character as:

> *"…the natural characteristic and qualities of the coastal environment".*

The degree or level of natural character within an environment was assessed depending on the extent to which the natural elements, patterns and processes occur, and the nature and extent of modification to the ecosystems and landscape/seascape. Natural character is typically highest where there is least modification, however, this varies due to the wider context and may be perceived differently by different parts of the community.

The NZCPS sets out the importance of preserving the natural character of the coastal environment[64] and the findings of this report are reflected in the development of pathways and the MCDA scoring process.

This report is attached as **Appendix 12.**

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[63] Kāpiti Island and the coastal marine area out to 12 nautical miles is outside the scope of CAP's work programme.

[64] For example, through Objective 2 and Policy 15 of the NZCPS 2010.

8.9 LONG-LIST OF ADAPTATION OPTIONS AND ACTIONS

Options is the broader term used to identify the general approach to adaptation, and overarches a number of 'actions' which all have similar objectives/outcomes. **Actions** is the term used to define the measure that is required to execute the Option.

The five 'options' considered by CAP are:

- **Enhance – "We maintain and improve what we are already doing"**
  Enhancement builds on the current actions that are underway along the Kāpiti Coast, and utilises the existing environment to provide protection.
- **Accommodate – "We adapt where we are and learn to live with the hazard"**
  Accommodating as an option looks at adapting our current assets and infrastructure where they currently are in order to become more resilient to the hazard.
- **Protect – "We keep the hazard away"**
  Protection uses soft or hard engineering options in order to slow the retreat, hold the line, or retreat the line (e.g., setting back future protection structures from their current position).
- **Retreat – "We move away from the hazard"**
  This option looks to move assets, infrastructure, or communities to safer ground which has a lower risk profile.
- **Avoid – "We avoid developing in places we know will be at risk in the future"**
  Using Avoid as an option utilises land use and infrastructure planning tools to ensure new or extension of existing assets, infrastructure, or services are not located in areas at risk from coastal hazards. It also involves controlling activities that could exacerbate the exposure to hazards by adversely impacting current natural buffers or protection structures.

For each adaptation area, the TAG would prepare a 'long-list' of adaptation options and actions. CAP would then iteratively refine this list to exclude actions that were not considered appropriate in a management unit, or to modify an action to suit the unique scenario presented by a management unit.

Reasons to exclude an action from the long-list included:

- The action would not provide for the adaptation area's objective;
- The action does not have a good track record of success in the type of environment it would be applied to;
- There would be insufficient or limited space to implement the action;
- It is not a practical solution; or

- The action would result in limited benefits.

Appendices 8A-8D include the long-list for each adaptation area. These are important reference documents as they demonstrate the unique modifications considered for each adaptation area.

8.10 DEVELOP DYNAMIC ADAPTIVE PATHWAYS

From the long-list of actions identified for each adaptation area, we 'mapped-out' potential pathways. Each pathway includes a short-term action, a medium-term action, and long-term action.

This process usually began with the TAG providing guidance or recommendations regarding combinations of actions into pathways. We chose to focus on the pathways we considered most sensible, and modified, amended or removed pathways as appropriate for each adaptation area. We were very mindful to clearly link selected actions to reflect the objective and community values established earlier in the process.

In addition to the actions identified for each pathways, we determined that, at all times, all pathways would include the "AVOID" option through land use planning.

This process resulted in the identification of a number of potential pathways for responding to coastal inundation and coastal erosion in each adaptation area. These are summarised for each adaptation area in Section 9 below.

8.11 MULTIPLE CRITERIA DECISIONS ANALYSIS ("MCDA")

Multiple Criteria Decision Analysis ("**MCDA**") is a decision-making process used to aide in assessing the pathways and options that came about during the DAPP process.

The adaptation options differ in how they benefit different criteria. An option that may be beneficial in one criterion may be detrimental for another criterion, so the MCDA tool helps by providing a way to form the list of options in order of preference, from most preferred to least preferred.

There are three key steps in the MCDA process:

1. Decision Criteria: Develop a set of district-wide criteria to score potential adaptation options.
2. Weighting: Assign weights for each of the criterion to reflect their relative importance to the adaptation area.
3. Weighted Scoring: Combine the weights and scores for each pathway to derive an overall value.

There are five impact criteria (ecology, landscape, te ao Māori values, community social and economic wellbeing, public access and recreation) which are based on values and what is important to the community. There are also three technical criteria which relate to consenting and policy risk, effective management of coastal erosion risk, and effective management of coastal inundation risks.[65]

These criteria specifically did not include any economic or cost-based criteria to ensure that the initial assessment pf adaptive pathways focussed on the best outcomes from a community values perspective without the bias of cost considerations.[66]

Relative weightings are applied to each assessment criteria to determine the relative importance of that criteria to achieving the objectives for the Adaptation Area.

All criteria are weighted on a scale of 1 to 3:

3 – Critical

2 – Very important

1 – Important

These weightings reflect that while all criteria are important, they may not have equal importance for defining an adaptive pathway.

Information and advice for each of the MCDA criteria was provided to CAP by TAG and experts to help inform CAP's scoring decisions.

Ngā Hapū o Ōtaki scored each of the pathways identified by CAP for the NAA. The approach agreed with Te Ātiawa ki Whakarongotai is that they scored the three pathways that scored highest under the other MCDA criteria.

Table 1 describes and provides guidance for the scoring of each criterion.

[65] *Minutes: Takutai Kāpiti Panel Meeting: Phase One Workshop*. 22 July 2022.

[66] *Phase One Workshop: Confirming MCDA Criteria and Longlist*. Jacobs. 22 July 2022.

Table 1: MCDA Scoring Guidance

	#	Criteria	Description	Scoring Guide				
				5. Highly Desirable	4. Desirable	3. Neutral	2. Undesirable	1. Highly Undesirable
Impact Criteria	1.	Ecology	• Impact or enhancement on indigenous biodiversity values and habitat; and ecosystem functioning within the coastal environment and surroundings. • Ability to protect the natural adaptive capacity of the ecosystem.	Highly likely to provide for enhancement and increase of ecological habitats and values	Likely to provide for some enhancement and increase of ecological habitats and values	Little change likely to ecological habitats and values present	Some reduction in ecological habitats or values. Likely to be limited to the footprint of the options or short term.	Highly likely there will be a reduction in ecological habitat and values, which could be for larger footprint than existing protection and long-lasting
	2.	Landscape	• Impact on the natural character of coastal environment and surroundings. • Aesthetic outcomes of implementing the option and the meaning of this to the community. • Ability to protect the natural adaptive capacity of natural character.	Positive impact or enhancement of the natural character of the coast, and aesthetic outcomes which align with community expectations.	Likely to provide some increase to the natural character of the coastal environment and aesthetic outcomes mostly align with the community expectations.	Little change likely to the present-day natural character and aesthetics of the coastal environment.	Slight negative impact on natural character and aesthetic outcomes. Aesthetic outcomes do not align with some of the community.	Highly likely to have a negative impact on the natural character of the coastal environment. Aesthetic outcomes do not align with community expectations.
	3.	Te ao Māori values	• Impacts on or enhancement of the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga. • Maintains access to, and enables the carrying out of customary activities, such as mahinga kai.	Highly likely to have a positive impact or enhancement on the identified Māori cultural values in the area	Likely to have some positive impact to identified Māori cultural values identified in the area	Little change likely to Māori cultural values identified in the area.	Likely small negative impact to identified Māori cultural values in the area	Likely large negative impact to identified Māori cultural values in the area
	4.	Community Social and Economic Wellbeing	• Health and safety of the community • Certainty around future of community • Social cohesion within the community • Maintain the insurability of personal assets.	Highly likely to provide for all factors which contribute to community social and economic wellbeing.	Likely to provide for most factors which contribute to community social and economic wellbeing.	Little change from the present-day community social and economic wellbeing.	Only likely to provide for some factors which contribute to community social and economic wellbeing.	Unlikely to provide for any factors which contribute to community social and economic wellbeing.
	5.	Public Access and Recreation	• Wider community/district use of the coastal environment • Opportunities for recreation • Public access to the coastal environment	Highly likely to increase and enhance recreational opportunities and public access to the coastal environment.	Likely to have an increase in recreational opportunities and public access to the coastal environment.	Little change to recreational opportunities and public access from the present day.	Likely to restrict some recreational opportunities and public access to the coastal environment.	Highly likely there will be large restrictions or total loss of public access and recreational opportunities in the coastal environment.
Technical Criteria	6.	Regulatory consenting and policy risk	• Regulatory consenting and policy risks of implementing an option including: - Consenting requirements; - District plan changes; and - Consistency with statutory framework. - Carbon footprint associated with the pathway.	Low to no risk - Consents are not required or can be easily obtained. No plan change required. Not contrary to statutory framework.	Low risk - Consent or plan change is required but unlikely to be challenged. Not contrary to statutory framework.	Some risk – Requires resource consenting or plan change which could be challenged but is aligned with the current statutory framework.	High risk - Consenting or plan change required which is likely to be challenged. Some elements which are contrary to current statutory framework.	Very high risk - Requires resource consenting or plan change which is highly likely to be challenged by multiple parties, and is contrary to current statutory framework
	7.	Effectively manages the risks of coastal erosion	• Effectively manages the risks of Coastal Erosion. • Proportionate to the nature and scale of the risk over time. • Avoids the exacerbation of risk in other areas. • Approaches are supported by best practice and a robust consideration of the science/Mātauranga	Highly likely to provide for all the factors listed which manage the risk of coastal erosion.	Likely to provide for most of the factors listed which manage the risk of coastal erosion.	Likely to provide for some of the factors listed to manage the risks of coastal erosion.	Only likely to provide for one of the factors listed which manage the risk of coastal erosion.	Unlikely to provide for any of the listed factors which manage the risk of coastal erosion.
	8.	Effectively manages the risks of coastal inundation	• Effectively manages the risks of Coastal Flooding. • Proportionate to the nature and scale of the risk over time. • Avoids the exacerbation of risk in other areas. • Approaches are supported by best practice and a robust consideration of the science/Mātauranga	Highly likely to provide for all the factors listed which manage the risk of coastal flooding.	Likely to provide for most of the factors listed which manage the risk of coastal flooding.	Likely to provide for some of the factors listed to manage the risks of coastal flooding.	Only likely to provide for one of the factors listed which manage the risk of coastal flooding.	Unlikely to provide for any of the listed factors which manage the risk of coastal flooding.

Each of the pathways we identified were scored against the weighted MCDA criteria. The three pathways which scored the highest for each adaptation area are shown in Section 9 below. The full MCDA matrix for each adaptation area is included in **Appendices 8A- 8D.**

8.12 ECONOMIC ANALYSIS OF SHORT-LISTED PATHWAYS

The economic assessment introduces economic costs and benefits into the assessment of pathways. As mentioned above, pathways were developed without considering the financial aspect. This allowed us CAP to explore all options from a core values perspective (i.e. their ability to achieve the community's objective), ensuring that pathways are not discounted from a funding perspective early on.

A Real Options Assessment ("**ROA**") approach was taken for the economic assessment. This technique considers:

- The flexibility over the timing of the capital investment;
- The flexibility to adjust the investment as it progresses over time, i.e., allowing a project to adapt, expand or scale-back in response to unfolding events; and
- The value of waiting for more information before an expensive and possibly irreversible investment is undertaken, and whether an alternative investment might suffice in the meantime.

The economic assessment looks at the following metrics for the three pathways for each adaptation area that were highest ranked under the MCDA assessment:

- **Pathway Costs** - This is a total cost estimate (Capital and Operational) for the design, construction, and maintenance of all elements in the full 100-year time-frame for each pathway.
- **'Cost + Loss'** – This includes the pathway costs and a residual loss calculation which reflects there may still be impacts due to uncertainties in climate science and engineering design. A lower 'Cost + Loss' value represents a more desirable adaptation pathway.
- **Value for Money ("VFM")** – This compares the total cost estimate for each 100-year pathway against its MCDA results (the weighted scores) to provide the cost of each MCDA point. A lower 'VFM' value represents a more desirable adaptation pathway.
- **Damages Avoided** – This is the difference between the losses from a "baseline" pathway which has no future adaptation actions than the current management approach over a 100-year timeframe, and the top three ranked adaptation pathways. A higher 'damages avoided' value represents a more desirable pathway.

- **Number of Properties Still Exposed in 2130** – This is a non-economic metric which demonstrates the effectiveness of the adaptation pathway to reduce the hazard risk, and provide context to the residual losses and the "Damages Avoided" metric. This metric is only in relation to property, not infrastructure or other values (social, ecological, cultural, landscape).
- **Benefit Cost Ration ("BCR")** - This is a traditional cost benefit analysis metric that provides a ratio between the total discounted benefits and total costs of a pathway. From an economic perspective, a 'Cost Benefit Ratio' greater than 1 is a desirable pathway as the benefits outweigh the costs.

This approach complements MCDA and the application of the DAPP approach by and provides an opportunity to change the preferred pathway.

The economic assessment makes no assumption or distinction of where the costs or losses from any of the adaptation pathways lie between private landowners or Council. The Economic Assessment is attached at **Appendix 13**.

We have recommended further work is undertaken by Council regarding the costs and benefits and funding approaches relating to just the short-term actions for each adaptation area, as part of the next stage of the project. We consider this information is essential to inform and initiate implementation of those short term actions identified in the pathways through the ongoing Long Term Planning processes, which are reviewed every three years.

9. ADAPTATION AREA ASSESSMENT PROCESS

For each of the four adaptation areas, CAP undertook Phase 2 of the decision-making process described in Section 5 of this report. The following section summarises the findings and key decisions made by CAP for each of the following steps:

Figure 13: CAP Decision making process for each adaptation area

Information regarding pathways development for each adaptation area is compiled into information packages, attached to this report as **Appendices 8A-8D**.

9.1 NORTHERN ADAPTATION AREA ("NAA")

The NAA spans from the northern boundary of the Kāpiti District (which is a little south of the Waikawa Beach settlement) to Pharazyn Reserve on Paetawa Road. It encompasses Ōtaki, Te Horo and Peka Peka Beach. The open coast at Ōtaki Beach is mostly sandy beach backed by sand dunes which act as a 30–80 m wide buffer between the beach and Marine Parade. Te Horo Beach is a sand and gravel beach with a low gravel ridge behind the beach, while Peka Peka Beach is a sandy beach backed by vegetated sand dunes. While sediment supply from the four large rivers to the north (Whanganui, Whangaehu, Rangitikei and Manawatu Rivers) to these beach areas has historically resulted in shoreline growth, recent observations indicate that these processes are changing. Storm events and changes to wave action, which are expected to be exacerbated by climate change and sea level rise, mean that the northern beaches are at risk of erosion.

CAP identified 8 management units in the NAA, as shown in the figure below.

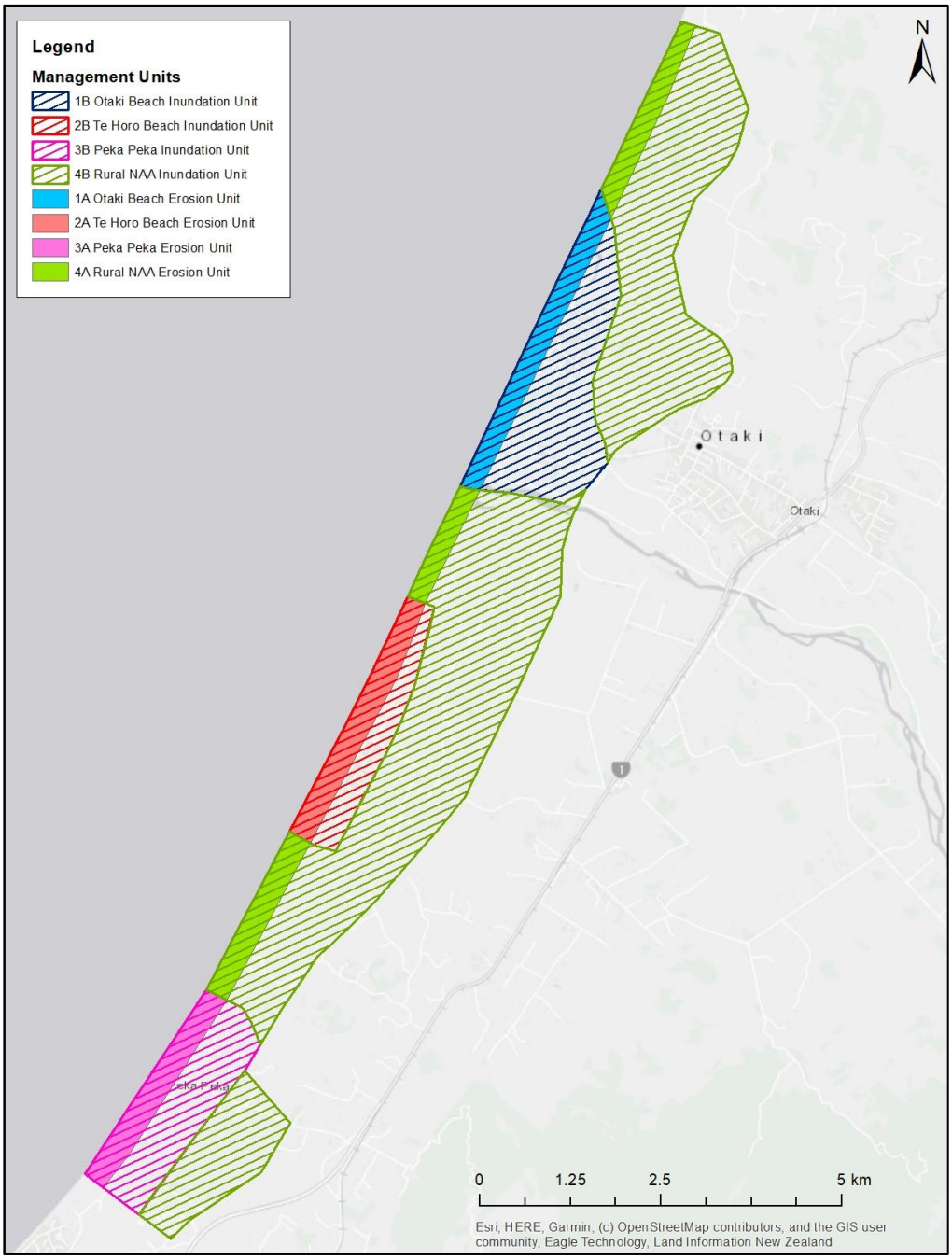

Figure 14: Northern Adaptation Area Management Units

In 2022 and 2023, CAP undertook a series of community meetings and surveys to understand what community members appreciate about their coastal community and environment. These values are summarised in **Appendix 8A**.

Based on the values identified by the NAA community, the objective agreed by the CAP is:

"Secure long-term coastline resilience through nature-based adaptation solutions, where possible, that:

- *maintains safe access to the beach;*
- *maintains food basket values (mahinga kai);*
- *provides flexibility for the community to respond to increasing sea level rise risks over time."*

CAP have identified preferred adaptive pathways for each of the management units within the NAA which are intended to achieve the objective.

All pathways were assessed against the MCDA criteria and the top-three scoring pathways were then assessed against economic criteria.

The following assumptions are incorporated into all economic assessments:

1. Multi Criteria Decision Making Analysis score determined by the CAP.
2. Cost + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.
3. Value for Money – How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway.
4. Damages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathway.

Each sub-section below summarises the pathways identified for each section and the assessment results of the top three pathways. While we have considered the option of specifying only one preferred pathway for each management unit, we think this is unnecessary and potentially misleading. This is because many of the management units start with the same "short term action" and the MfE guidance that recommends the DAPP approach is underpinned by the need to not necessarily "lock" in future actions in the medium and longer terms, given the significant uncertainties at play. Instead, our approach is intended to be truly adaptive in order to make the best move at the "short to medium term" and "medium to short term" transition points when all the relevant information is available at that time.

The DAPP "metro" maps included after each table below illustrate this important concept. A "signal" provides an early warning that a decision point is approaching. The "trigger" indicates that it is time to make a decision to change the management approach. At the

"Transfer Point", the community may decide to continue on the existing pathway or switch to another.

The "threshold" demonstrates that the existing adaptation action is no longer delivering the outcome desired by the community. A new adaptation action should be implemented before the threshold is reached.

The setting of signals, triggers and thresholds is discussed further in Section 10 of this report.

Further information regarding the identification and assessment of pathways for the NAA is included in **Appendix 8A**.

9.1.1 Management Unit 1A: Ōtaki Beach

The following table summarises the pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [3]	→	Enhance [3]	→	Renourishment [10]
PW-2	Enhance [3]	→	Renourishment [10]	→	Renourishment [10]
PW-3	Enhance [3]	→	Renourishment [10]	→	Hard Engineering Protection
PW-4	Enhance [3]	→	Renourishment [10]	→	Retreat [8]
PW-5	Enhance [3]	→	Enhance [3]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	22.4						31
PW-5	87	1	16.7	17.2	1	198	1	11.8	1=	0
PW-4	74	2	17.5	18.1	2	245	2	11.8	1=	0
PW-1	69	3	20.0	20.6	3	298	3	11.8	1=	1

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

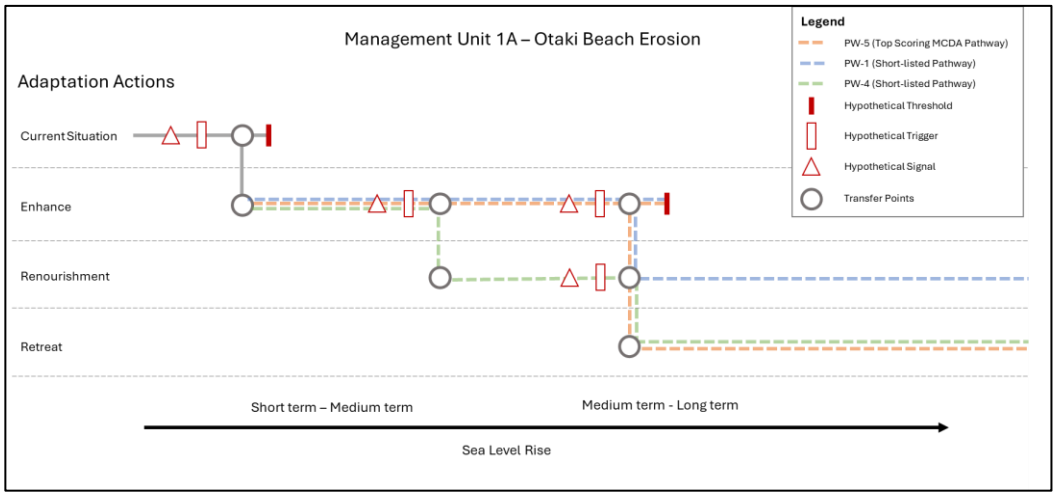

Figure 15: Pathways for Management Unit 1A

9.1.2 Management Unit 1B: Ōtaki Beach river / inlets

The following table summarises the pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [2]	→	Accommodate [5, 6]	→	Additional Hard Protection [12, 13, 15]
PW-2	Enhance [2]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]
PW-3	Enhance [2]	→	Accommodate [5, 6]	→	Retreat [8]
PW-4	Accommodate [5, 6]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	46.1						547
PW-3	83	1	741.0	757.4	2	9125	2	22.8	3	21
PW-2	62	2=	761.4	777.7	3	12543	3	22.9	2	21
PW-1	62	2=	75.0	91.1	1	1470	1	23.1	1	64

The following figure shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

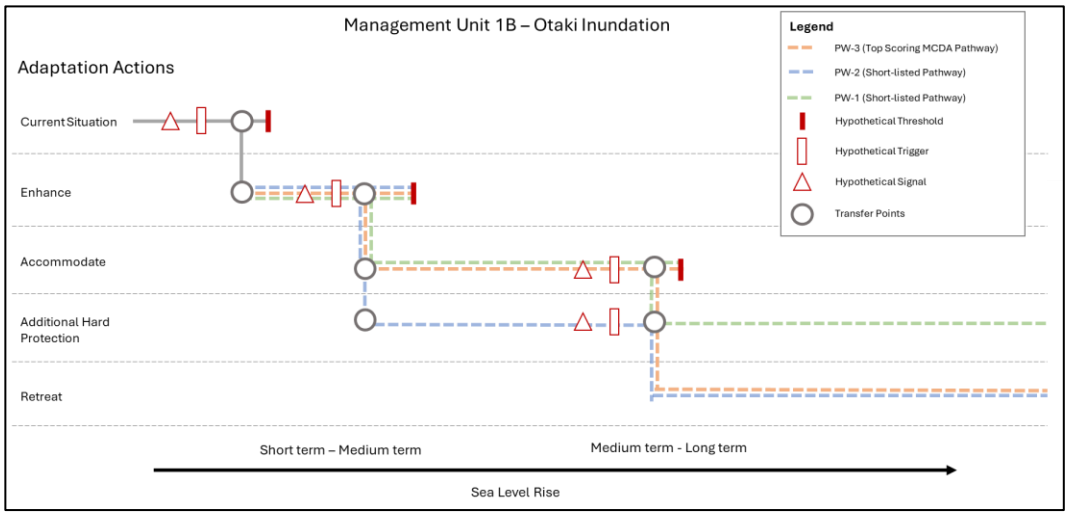

Figure 16: Pathways for Management Unit 1B

9.1.3 Management Unit 2A: Te Horo Beach Open Coast

The following table summarises the pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [2]	→	Accommodate [5, 6]	→	Additional Hard Protection [12, 13, 15]
PW-2	Enhance [2]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]
PW-3	Enhance [2]	→	Accommodate [5, 6]	→	Retreat [8]
PW-4	Accommodate [5, 6]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	22.5						18
PW-5	87	1	18.6	18.6	3	214	1	12.5	1=	0
PW-4	74	2	16.7	16.7	1	226	2	12.5	1=	0
PW-1	69	3	17.7	17.7	2	257	3	12.4	2	1

The following figure shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

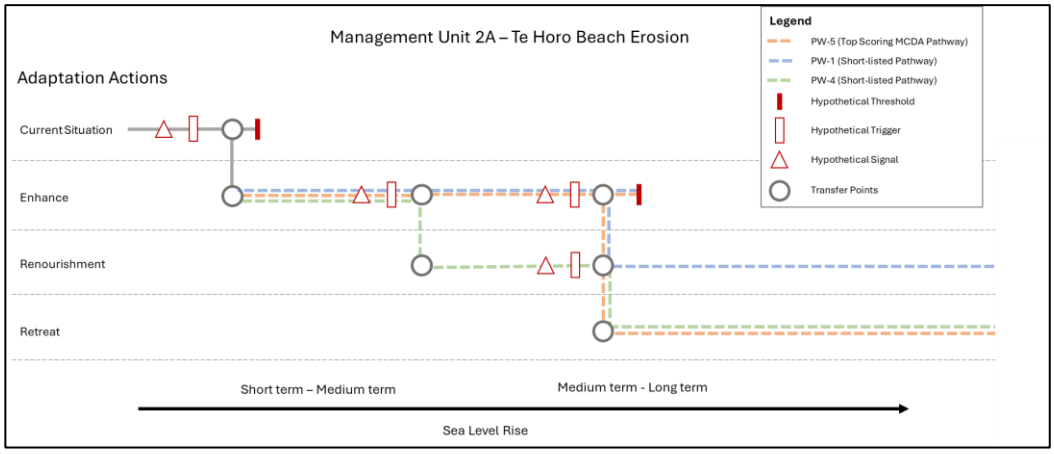

Figure 17: Pathways for Management Unit 2A

9.1.4 Management Unit 2B: Te Horo Beach river / inlets

The following table summarises the pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [2]	→	Accommodate [5, 7]	→	Additional Hard Protection [12, 13, 15]
PW-2	Enhance [2]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]
PW-3	Enhance [2]	→	Accommodate [5, 7]	→	Retreat [8]
PW-4	Accommodate [5, 7]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	9.2						43
PW-3	83	1	83.8	84.4	2	1017	2	1.69	3	4
PW-2	64	2=	86.3	86.6	3	1353	3	2.0	1	4
PW-1	64	2=	20.4	21.0	1	328	1	1.73	2	8

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

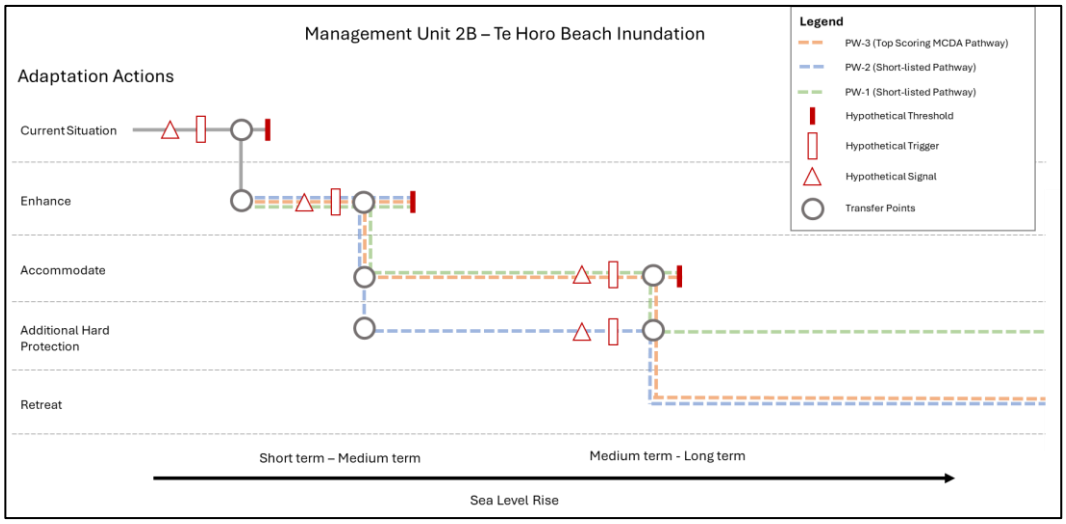

Figure 18: Pathways for Management Unit 2B

9.1.5 Management Unit 3A: Peka Peka Beach – Open Coast

The following table summarises the pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [3]	→	Enhance [3]	→	Soft Engineering Protection [9, 10]
PW-2	Enhance [3]	→	Soft Engineering Protection [9, 10]	→	Soft Engineering Protection [9, 10]
PW-3	Enhance [3]	→	Soft Engineering Protection [9, 10]	→	Hard Engineering Protection [11]
PW-4	Enhance [3]	→	Soft Engineering Protection [9, 10]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	13.1						34
PW-5	87	1	73.6	73.6	3	846	2	3.0	1=	0
PW-4	74	2	67.3	67.3	2	909	3	3.0	1=	0
PW-1	69	3	19.2	20.1	1	291	1	2.2	3	15

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

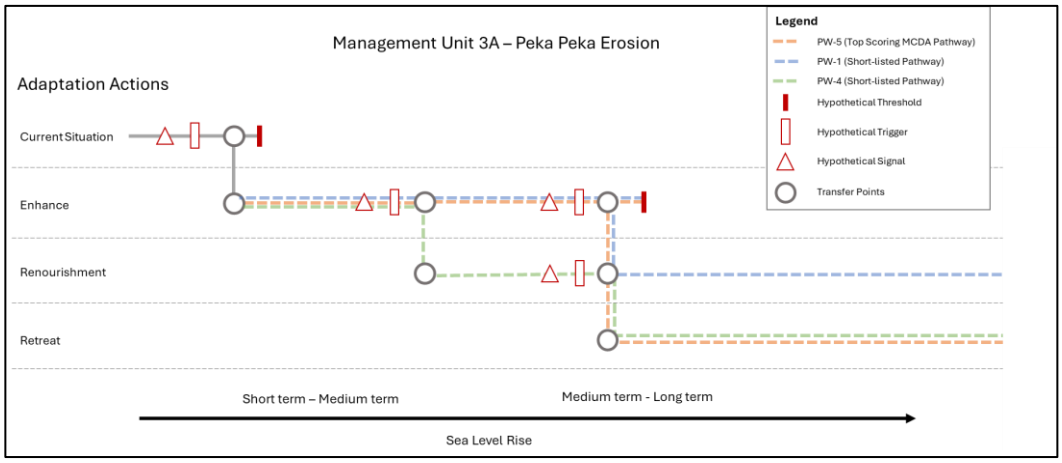

Figure 19: Pathways for Management Unit 3A

9.1.6 Management Unit 3B: Peka Peka Beach Rivers / Inlets

The following table summarises the pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [2]	→	Accommodate [5, 7]	→	Additional Hard Protection [12, 13, 15]
PW-2	Enhance [2]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]
PW-3	Enhance [2]	→	Accommodate [5, 7]	→	Retreat [8]
PW-4	Accommodate [5, 7]	→	Additional Hard Protection [12, 13, 15]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	7.6						37
PW-3	85	1	90.4	90.5	3	1065	2	0.48	2=	10
PW-2	66	2	84.7	84.9	2	1286	3	0.48	2=	10
PW-1	64	3	9.9	10.1	1	158	1	0.50	1	8

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

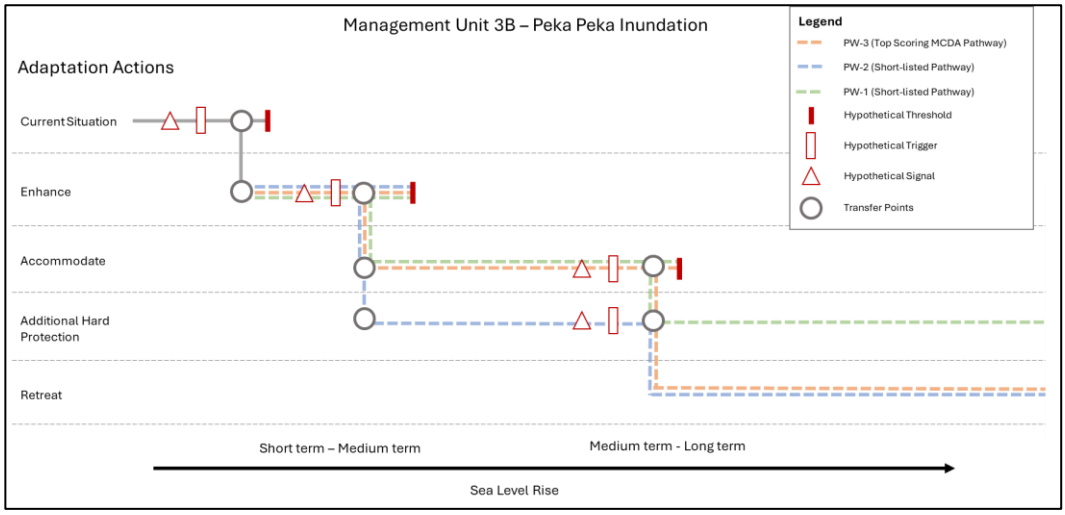

Figure 20: Pathways for Management Unit 3B

9.1.7 Management Unit 4A: Northern Rural

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1]	→	Enhance [3]	→	Enhance [3]
PW-2	Status Quo [1]	→	Enhance [3]	→	Soft Engineering Protection [9, 10]
PW-3	Enhance [3]	→	Enhance [3]	→	Soft Engineering Protection [9, 10]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	34.1						7
PW-1	72	1	20.0	24.2	1	336	1	19.8	1=	2
PW-2	60	2	26.7	30.9	3	515	3	19.8	1=	2
PW-3	50	3	20.5	24.7	2	494	2	19.8	1=	2

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

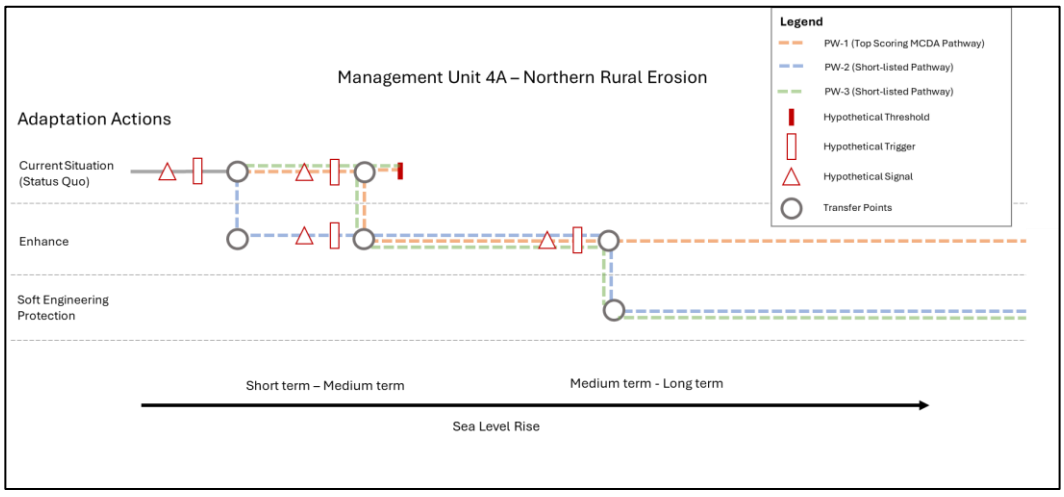

Figure 21: Pathways for Management Unit 4A

9.1.8 Management Unit 4B: Northern Rural Rivers / Inlets

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8A.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1]	→	Enhance [2]	→	Accommodate [5, 7]
PW-2	Accommodate [5, 7]	→	Accommodate [5, 7]	→	Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	7.5						14
PW-1	69	1	8.7	9.2	1	131	1	0.2	2	3
PW-2	64	2	40.0	40.2	2	628	2	0.3	1	3

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

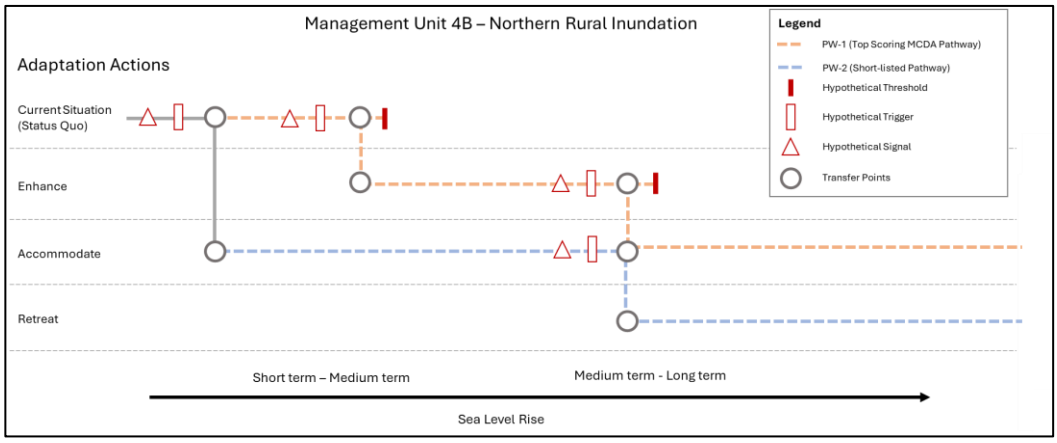

Figure 22: Pathways for Management Unit 4B

9.2 CENTRAL ADAPTATION AREA ("CAA")

The CAA includes Waikanae Beach, Paraparaumu and Otaihanga. The coastline here consists of a flat sandy beach, backed by vegetated dunes. Waikanae Beach is at the northern end of the wave shadow created by Kāpiti Island. Waikanae Beach is susceptible to flooding from storm tides through the Waikanae Estuary and Waimeha Stream which provide pathways for flooding from the sea.

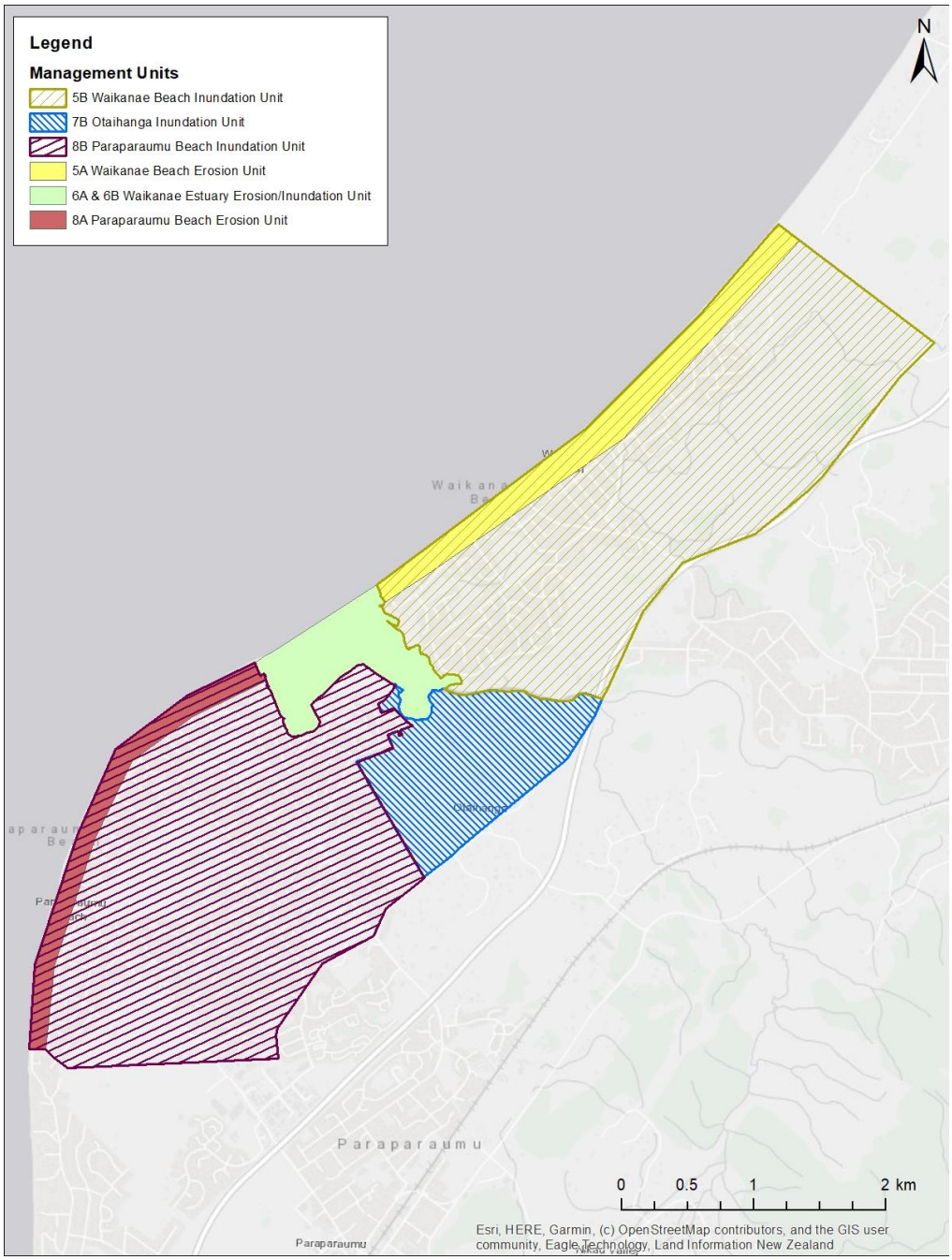

Figure 23: Central Adaptation Area Management Units

In 2022 and 2023, CAP undertook a series of community meetings and surveys to understand what community members appreciate about their coastal community and environment. These values are summarised in **Appendix 8B**.

Based on the values identified by the CAA community, the objective agreed by the CAP is:[67]

> *"Plan and implement sensible adaptation solutions that recognise the natural and relaxed coastal community feel as the coastline evolves over time by:*
>
> - *protecting the mana of the coast, dunes, biodiversity, and river and wetland areas;*
> - *utilising natural solutions where practical; and*
> - *adapting our public recreation assets and services;*
> - *keeping the community informed and involved about the types of solutions and associated costs."*

CAP have identified preferred adaptive pathways for each of the management units within the CAA which are intended to achieve the objective. All pathways were assessed against the MCDA criteria and the top-three scoring pathways were then assessed against economic criteria.

The following assumptions are incorporated into all economic assessments:

1. Multi Criteria Decision Making Analysis score determined by the CAP.
2. Cost + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.
3. Value for Money – How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway.
4. Damages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathway.

Each sub-section below summarises the pathways identified for each section and the assessment results of the top three pathways. While we have considered the option of specifying only one preferred pathway for each management unit, we think this is unnecessary and potentially misleading. This is because many of the management units

[67] *Minutes: CAP Meeting – Central Adaptation Area: Risk Assessments, Objectives, and Options*. 29 June 2023. https://www.kapiticoast.govt.nz/media/li2fy1z3/finalised-minutes-cap-meeting-29-june-2023.pdf.

start with the same “short term action” and the MfE guidance that recommends the DAPP approach is underpinned by the need to not necessarily “lock” in future actions in the medium and longer terms, given the significant uncertainties at play. Instead, our approach is intended to be truly adaptive in order to make the best move at the “short to medium term” and “medium to short term” transition points when all the relevant information is available at that time.

The DAPP “metro” maps included after each table below illustrate this important concept. A “signal” provides an early warning that a decision point is approaching. The “trigger” indicates that it is time to make a decision to change the management approach. At the “Transfer Point”, the community may decide to continue on the existing pathway or switch to another.

The “threshold” demonstrates that the existing adaptation action is no longer delivering the outcome desired by the community. A new adaptation action should be implemented before the threshold is reached.

The setting of signals, triggers and thresholds is discussed further in Section 10 of this report.

Further information regarding the identification and assessment of pathways for the CAA is included in **Appendix 8B**.

9.2.1 Management Unit 5A: Waikanae Beach

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8B.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [3, 4]	→	Protect – Soft Engineering [10]	→	Protect – Soft Engineering [9]
PW-2	Enhance [3, 4] & Protect – Soft Engineering [10]	→	Enhance [3, 4] & Protect – Soft Engineering [9]	→	Protect – Hard Engineering [11]
PW-3	Enhance [3, 4] & Protect – Soft Engineering [10]	→	Enhance [3, 4] & Protect – Soft Engineering [9]	→	Protect – Hard Engineering [14]
PW-4	Enhance [3, 4] & Protect – Soft Engineering [10]	→	Enhance [3, 4] & Protect – Soft Engineering [9]	→	Retreat[8]
PW-5	Enhance [3, 4] & Protect – Soft Engineering [10]	→	Protect – Hard Engineering [11]	→	Retreat[8]
PW-6	Enhance [3, 4] & Protect – Soft Engineering [10]	→	Protect – Hard Engineering [14]	→	Retreat[8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	40.3						102
PW-1	71	1	22.0	22.1	1	311	1	30.2	1=	0
PW-6	64	2	70.8	70.8	2	1106	2	30.2	1=	0
PW-2	60	3	71.2	71.2	3	1187	3	30.2	1=	0

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

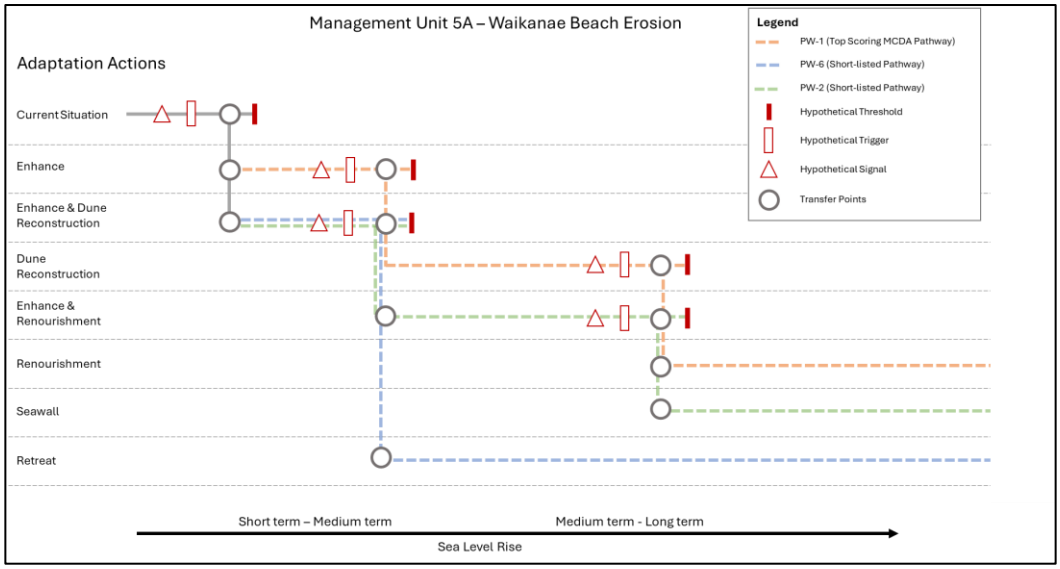

Figure 24: Pathways for Management Unit 5A

9.2.2 Management Unit 5B: Waikanae Beach river / inlets

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8B.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo[1] and Enhance[4]	→	Status Quo[1] and Enhance[4]	→	Enhance[2, 3, 4]
PW-2	Status Quo[1] and Enhance[4]	→	Enhance[2, 3, 4]	→	Additional Hard Protection[12, 13, 15]
PW-3	Enhance[2, 3, 4]	→	Enhance[2, 3, 4]	→	Accommodate[5, 7]
PW-4	Enhance[2, 3, 4]	→	Accommodate[5, 7]	→	Retreat[8]
PW-5	Enhance[2, 3, 4]	→	Additional Hard Protection[12, 13, 15]	→	Retreat[8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	17.5						524
PW-5	62	1	935.4	938.5	3	15137	3	7.5	1=	68
PW-3	59	2	58.2	61.3	1	1040	1	7.5	1=	68
PW-4	57	3	357.9	361.2	2	6336	2	7.3	3	68

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

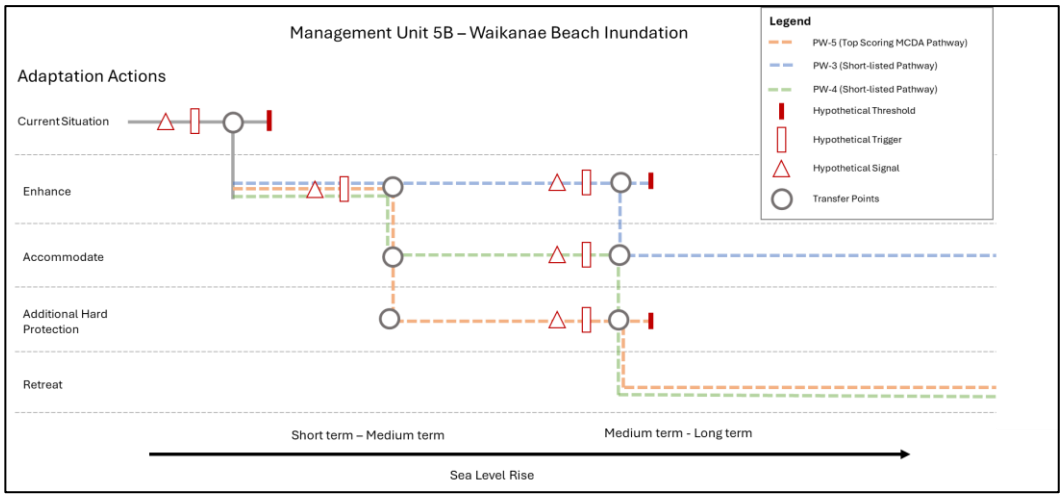

Figure 25: Pathways for Management Unit 5B

9.2.3 Management Unit 6A and 6B: Waikanae Estuary

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8B.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo[1] and Enhance[4]	→	Enhance[3, 4]	→	Enhance[3, 4]
PW-2	Status Quo[1] and Enhance[4]	→	Enhance[3, 4]	→	Protect[11]
PW-3	Enhance[3, 4]	→	Enhance[3, 4]	→	Protect[11]
PW-4	Enhance[3, 4]	→	Protect[11]	→	Protect[11]
PW-5	Enhance[3, 4]	→	Retreat[8]	→	Retreat[8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	10.0				NA	NA	0
PW-5	86	1	11.6	11.6	1	134	1	NA	NA	0
PW-3	78	2	14.4	14.4	3	184	2	NA	NA	0
PW-1	61	3	12.0	12.0	2	196	3	NA	NA	0

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

Figure 26: Pathways for Management Unit 6A and 6B

9.2.4 Management Unit 7B: Otaihanga

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8B.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1] and Enhance [4]	→	Enhance [3, 4]	→	Additional Hard Protection [12, 13, 15]
PW-2	Enhance [3, 4]	→	Enhance [3, 4]	→	Accommodate [5, 7]
PW-3	Enhance [3, 4]	→	Accommodate [5, 7]	→	Retreat [8]
PW-4	Additional Hard Protection [12, 13, 15]	→	Enhance [3, 4]	→	Retreat [8]
PW-5	Enhance [3, 4]	→	Additional Hard Protection [12, 13, 15]	→	Additional Hard Protection [12, 13, 15]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($’000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	14.6						83
PW-2	65	1	16.6	21.3	1	327	1	3.0	3	0
PW-4	56	2	181.6	182.5	3	3259	3	6.7	1	0
PW-5	50	3	30.4	33.3	2	666	2	4.7	2	12

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

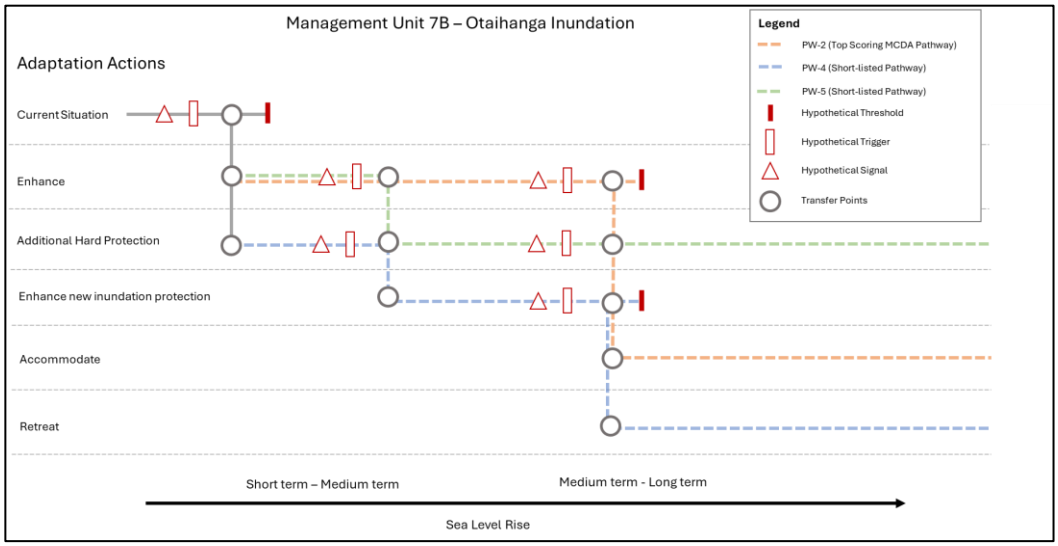

Figure 27: Pathways for Management Unit 7B

9.2.5 Management Unit 8A: Paraparaumu Beach Erosion

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8B.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Enhance [3, 4]		Protect – Soft Engineering [10]		Protect – Soft Engineering [9]
PW-2	Enhance [3, 4] & Protect – Soft Engineering [10]		Enhance [3, 4] & Protect – Soft Engineering [9]		Protect – Hard Engineering [11]
PW-3	Enhance [3, 4] & Protect – Soft Engineering [10]		Enhance [3, 4] & Protect – Soft Engineering [9]		Detached Breakwater[14] (Protect – Hard Engineering)
PW-4	Enhance [3, 4] & Protect – Soft Engineering [10]		Protect – Hard Engineering [11]		Retreat[8]
PW-5	Protect – Hard Engineering [11]		Protect – Hard Engineering [11]		Retreat[8]
PW-6	Enhance [3, 4] & Protect – Soft Engineering [10]		Retreat[8]		Retreat[8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			10.0	31.8						108
PW-1	68	1	19.8	19.8	1	292	1	21.7	1=	1
PW-6	64	2	20.6	20.6	2	324	2	21.7	1=	0
PW-2	60	3	66.7	66.8	3	1113	3	21.7	1=	1

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

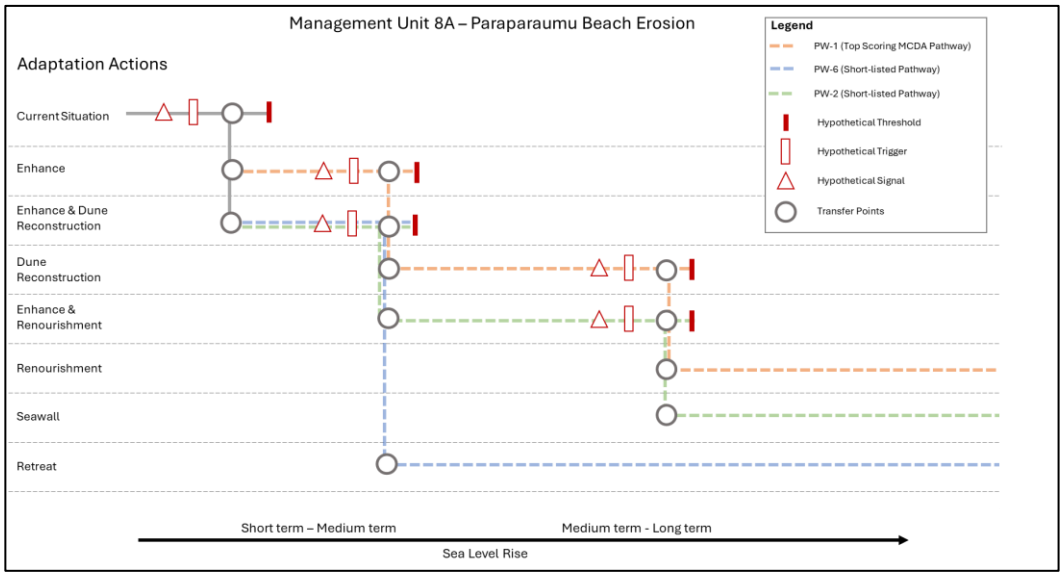

Figure 28: Pathways for Management Unit 8A

9.2.6 Management Unit 8B: Paraparaumu Beach Inundation

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8B.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1] and Enhance [4]		Status Quo [1] and Enhance [4]		Enhance [2, 3, 4]
PW-2	Status Quo [1] and Enhance [4]		Enhance [2, 3, 4]		Additional Hard Protection [12, 13, 15]
PW-3	Enhance [2, 3, 4]		Enhance [2, 3, 4]		Accommodate [5, 7]
PW-4	Enhance [2, 3, 4]		Accommodate [5, 7]		Retreat [8]
PW-5	Enhance [2, 3, 4]		Additional Hard Protection [12, 13, 15]		Retreat [8]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	15.7						484
PW-3	62	1	53.4	56.3	1	908	1	5.9	3	84
PW-4	57	2	824.2	827.0	3	14509	2	6.0	1=	84
PW-5	56	3	824.0	826.7	2	14763	3	6.0	1=	84

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

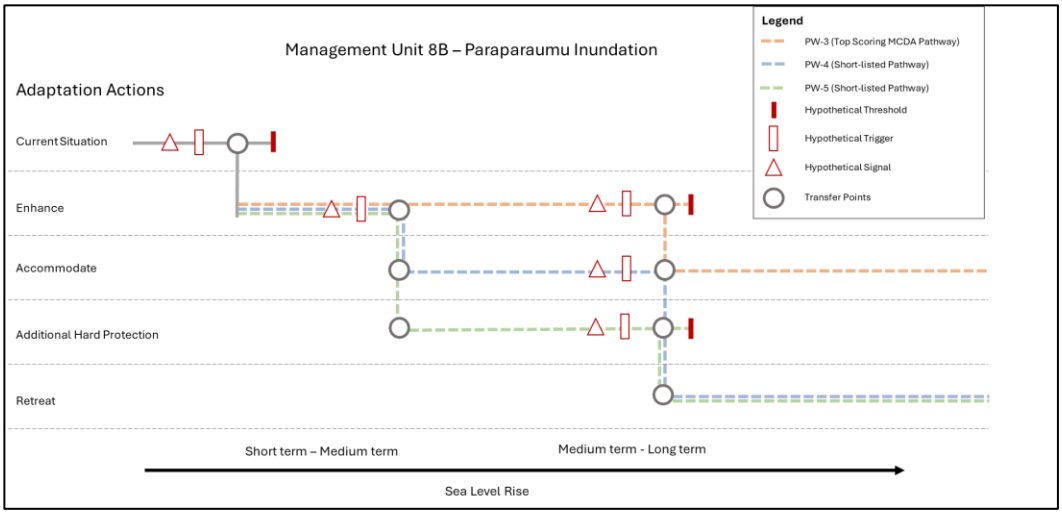

Figure 29: Pathways for Management Unit 8B

9.3 RAUMATI ADAPTATION AREA ("RAA")

Raumati coastal processes are influenced by the shape of the coast at Paraparaumu which extends west of the rest of the shoreline in a large delta shape. This acts as a natural barrier to longshore sediment transport, reducing the sediment supply to the Raumati shoreline. As result, the beach has experienced periodic large-scale erosion in significant storms. People have responded by building a near continuous line of ad hoc public and private coastal protection structures (seawalls) since at least 1955.

Three management units are identified for the RAA as shown in the figure below.

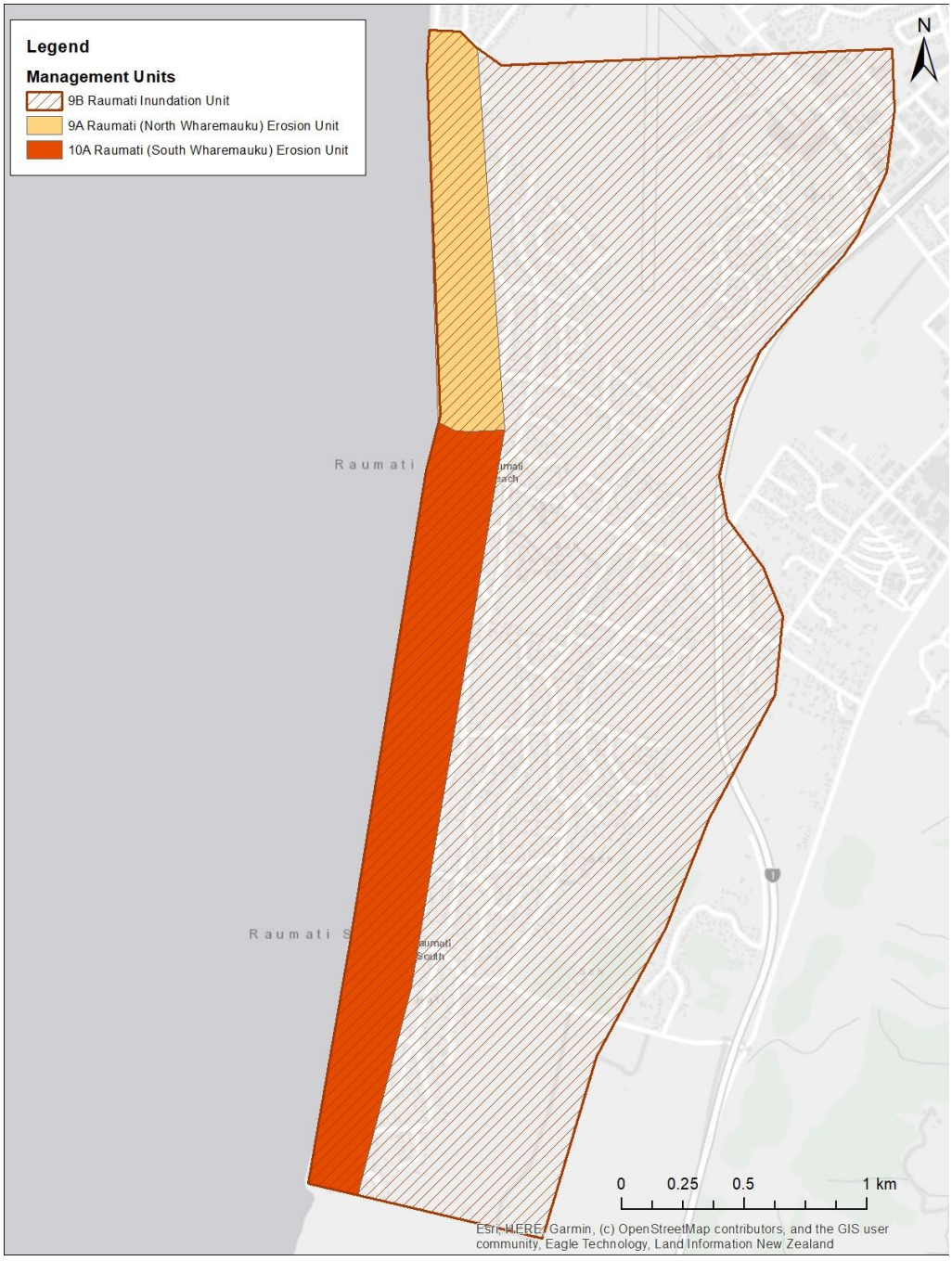

Figure 30: Raumati Adaptation Area Management Units

In 2022 and 2023, CAP undertook a series of community meetings and surveys to understand what community members appreciate about their coastal community and environment.

Based on the values identified by the RAA community, the objective agreed by the CAP is:

"Develop and implement responses to coastal hazards that protects our whole community so we can stay in place for the long term while:

- *Continuing to enjoy access to our coastline;*
- *Maintaining and enhancing our natural environment and recreation spaces;*
- *Maintaining and enhancing our public sea wall and other essential infrastructure for as long as practical; and*
- *Keeping the community informed and involved about the types of solutions and associated costs."*

CAP have identified preferred adaptive pathways for each of the management units within the RAA which are intended to achieve the objective.

All pathways were assessed against the MCDA criteria and the top-three scoring pathways were then assessed against economic criteria.

The following assumptions are incorporated into all economic assessments:

1. Multi Criteria Decision Making Analysis score determined by the CAP.
2. Cost + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.
3. Value for Money – How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway.
4. Damages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathway.

Each sub-section below summarises the pathways identified for each section and the assessment results of the top three pathways. While we have considered the option of specifying only one preferred pathway for each management unit, we think this is unnecessary and potentially misleading. This is because many of the management units start with the same "short term action" and the MfE guidance that recommends the DAPP approach is underpinned by the need to not necessarily "lock" in future actions in the medium and longer terms, given the significant uncertainties at play. Instead, our approach is intended to be truly adaptive in order to make the best move at the "short to medium term" and "medium to short term" transition points when all the relevant information is available at that time.

The DAPP "metro" maps included after each table below illustrate this important concept. A "signal" provides an early warning that a decision point is approaching. The "trigger" indicates that it is time to make a decision to change the management approach. At the "Transfer Point", the community may decide to continue on the existing pathway or switch to another.

The "threshold" demonstrates that the existing adaptation action is no longer delivering the outcome desired by the community. A new adaptation action should be implemented before the threshold is reached.

The setting of signals, triggers and thresholds is discussed further in Section 10 of this report.

Further information regarding the identification and assessment of pathways for the RAA is included in **Appendix 8C**.

9.3.1 Management Unit 9A: Raumati North Erosion

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8C.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1] and Enhance [4]	→	Enhance [2, 4]	→	Retreat & Protect [9]
PW-2	Enhance [2, 4]	→	Protect – Hard Engineering [12]	→	Retreat & Protect [9]
PW-3	Enhance [2, 4]	→	Retreat & Protect [9]	→	Protect – Hard Engineering [12]
PW-4	Enhance [2, 4]	→	Retreat & Protect [9, 11]	→	Protect – Soft Engineering [10]
PW-5	Protect – Hard Engineering [12]	→	Protect – Hard Engineering [12]	→	Protect – Hard Engineering [12]
PW-6	Protect – Hard Engineering [12]	→	Retreat & Protect [9]	→	Protect – Hard Engineering [12]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			18.0	188.7						204
PW-4	53	1	269.6	337.6	2	6371	2	102.7	2	4
PW-2	52	2=	272.4	339.5	3	6529	3	103.6	1	14
PW-6	52	2=	254.5	325.5	1	6260	1	99.7	3	14

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

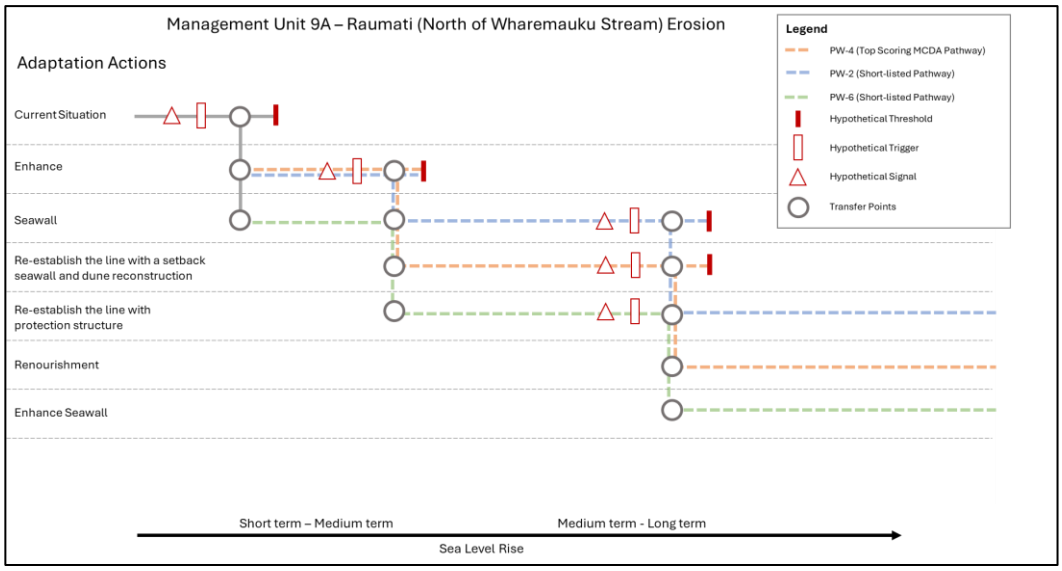

Figure 31: Pathways for Management Unit 9A

9.3.2 Management Unit 9B: Raumati North Inundation

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8C.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo[1] and Enhance [4]	→	Enhance [3, 4]	→	Additional Hard Protection [13, 14, 15]
PW-2	Status Quo[1] and Enhance [4]	→	Enhance [3, 4]	→	Accommodate [5, 7]
PW-3	Status Quo[1] and Enhance [4]	→	Additional Hard Protection [13, 14, 15]	→	Enhance [3]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	8.0						106
PW-2	55	1	16.2	16.6	2	302	2	0.6	1=	29
PW-1	54	2	19.7	20.1	3	373	3	0.6	1=	34
PW-3	51	3	7.7	8.4	1	165	1	0.3	3	48

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

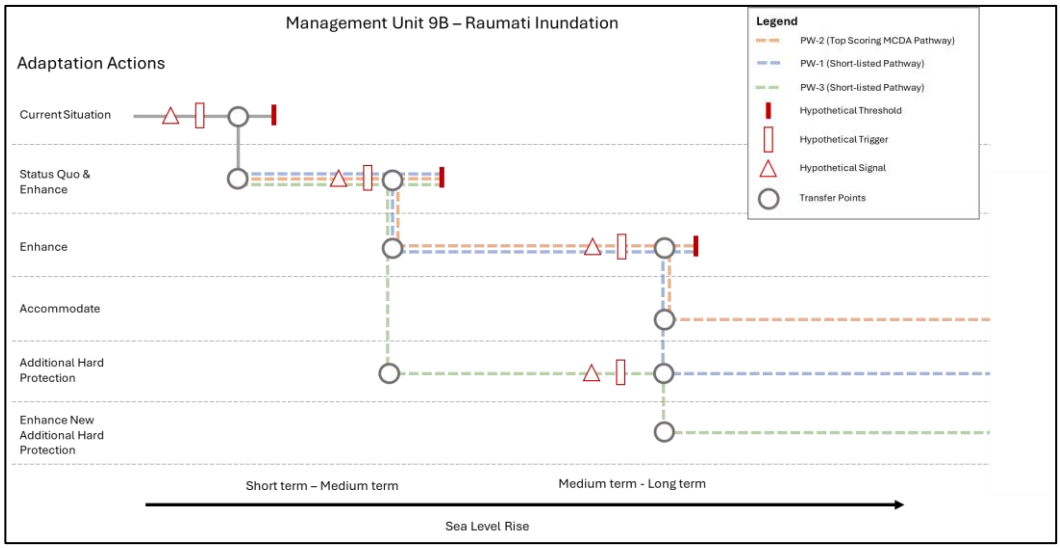

Figure 32: Pathways for Management Unit 9B

9.3.3 Management Unit 10A: Raumati South Erosion

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8C.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1] and Enhance [4]	→	Enhance [2, 4]	→	Protect – Hard Engineering [12]
PW-2	Status Quo [1] and Enhance [4]	→	Enhance [2, 4]	→	Retreat & Protect [9, 11]
PW-3	Status Quo [1] and Enhance [4]	→	Protect – Hard Engineering [12]	→	Protect – Hard Engineering [12]
PW-4	Status Quo [1] and Enhance [4]	→	Retreat & Protect [9]	→	Protect – Hard Engineering [12]
PW-5	Status Quo [1] and Enhance [4]	→	Protect – Soft Engineering [11, 12]	→	Protect – Soft Engineering [10]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			8.4	377.4						548
PW-2	57	1	422.4	561.5	1	9850	1	229.9	1	7
PW-5	53	2	437.8	579.4	3	10933	2	227.4	2	7
PW-4	52	3	431.8	574.4	2	11046	3	226.4	3	7

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

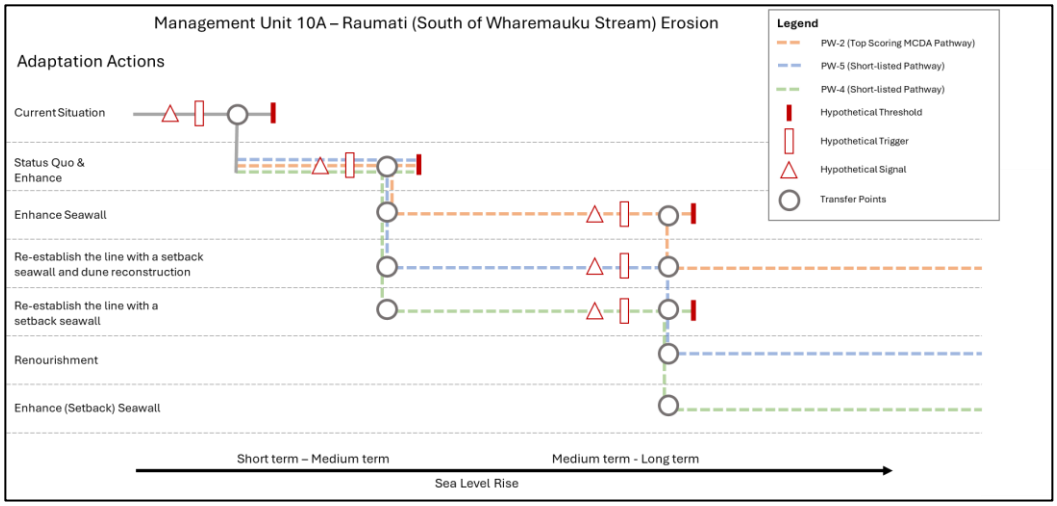

Figure 33: Pathways for Management Unit 10A

9.4 PAEKĀKĀRIKI ADAPTATION AREA ("PAA")

Paekākāriki is at the southern end of a coastal plain which narrows to less than 200m wide at the base of the coastal escarpment and Paekākāriki Hill. Coastal processes in Paekākāriki are influenced by the shape of the coast at Paraparaumu, which extends west of the rest of the shoreline in a large delta shape. This acts as a natural barrier to longshore sediment transport, reducing the sediment supply to the Paekākāriki shoreline. As a result, the beach has experienced periodic large-scale erosion in significant storms. South of The Parade, there is only a small buffer between properties and the shoreline.

There are three management units in the PAA, as shown in figure below.

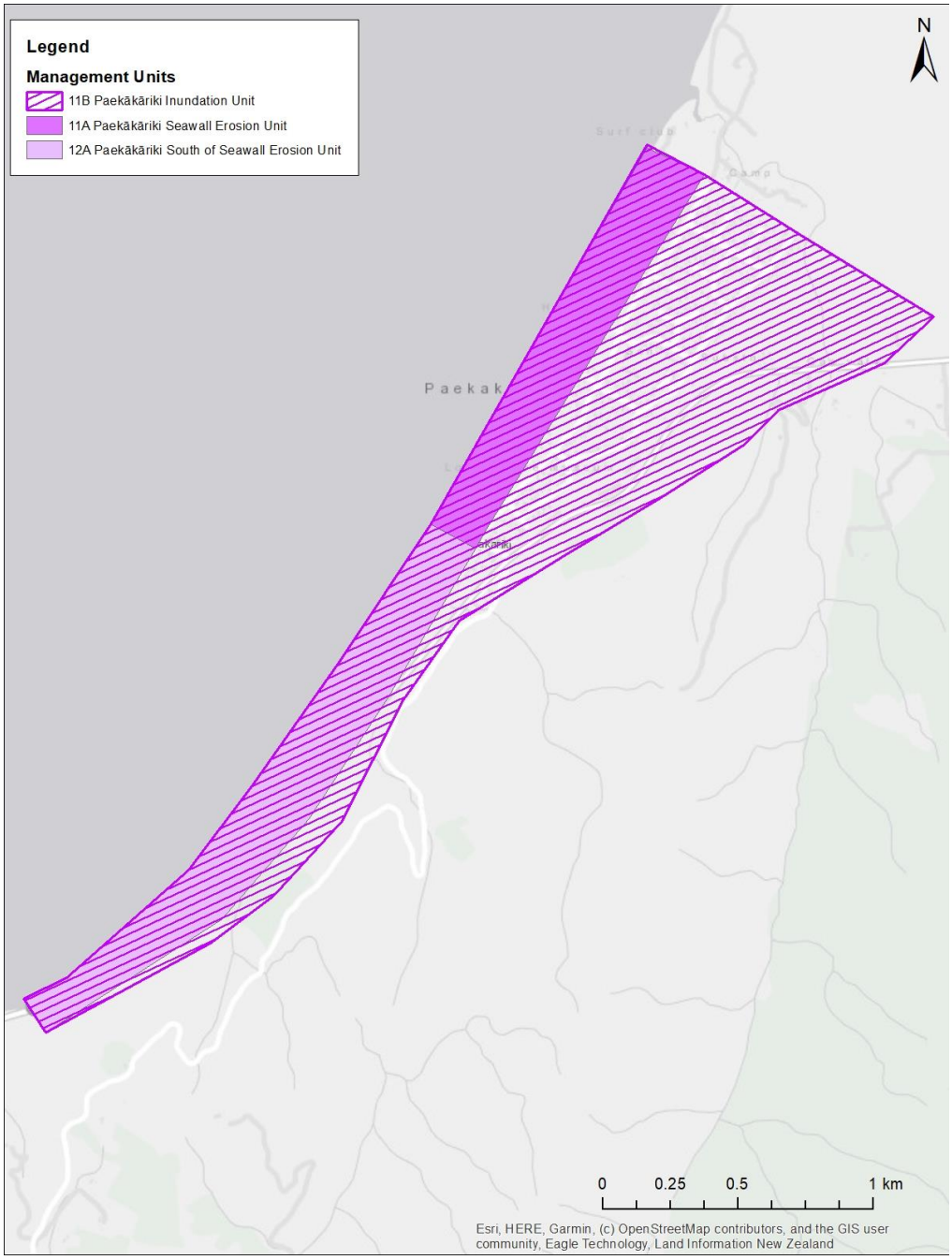

Figure 34: Paekākāriki Adaptation Area Management Units

In 2022 and 2023, CAP undertook a series of community meetings and surveys to understand what community members appreciate about their coastal community and environment.

Based on the values identified by the PAA community, the objective agreed by the CAP is:

"Protecting our unique community for as long as feasible from coastal hazards by maintaining essential infrastructure and ensuring that:

- *we continue to enjoy beach access for recreation and public use;*
- *our natural coastal environment is maintained;*
- *we are kept informed about coastal hazards, consulted on adaptation options; and*

  we can increase our resilience to protect our properties, maintain our unique lifestyle, and keep our community safe."

CAP have identified preferred adaptive pathways for each of the management units within the PAA which are intended to achieve the objective.

All pathways were assessed against the MCDA criteria and the top-three scoring pathways were then assessed against economic criteria.

The following assumptions are incorporated into all economic assessments:

1. Multi Criteria Decision Making Analysis score determined by the CAP.
2. Cost + Loss is equal to the cost estimate (operational and capital costs) for the full 100 year pathway + residual losses due to events that exceed a 1 in 100 year chance of occurrence.
3. Value for Money – How much it costs to 'purchase' each MCDA point based on the MCDA score and total cost estimate (operational and capital) of each 100 year pathway.
4. Damages avoided - The difference between the losses from a baseline pathway of no additional future adaptation actions or effort from the current management practices over the full 100 year time frame and adaptation pathway.

Each sub-section below summarises the pathways identified for each section and the assessment results of the top three pathways. While we have considered the option of specifying only one preferred pathway for each management unit, we think this is unnecessary and potentially misleading. This is because many of the management units start with the same "short term action" and the MfE guidance that recommends the DAPP approach is underpinned by the need to not necessarily "lock" in future actions in the medium and longer terms, given the significant uncertainties at play. Instead, our approach is intended to be truly adaptive in order to make the best move at the "short to medium term" and "medium to short term" transition points when all the relevant information is available at that time.

The DAPP "metro" maps included after each table below illustrate this important concept. A "signal" provides an early warning that a decision point is approaching. The "trigger" indicates that it is time to make a decision to change the management approach. At the "Transfer Point", the community may decide to continue on the existing pathway or switch to another.

The "threshold" demonstrates that the existing adaptation action is no longer delivering the outcome desired by the community. A new adaptation action should be implemented before the threshold is reached.

The setting of signals, triggers and thresholds is discussed further in Section 10 of this report.

Further information regarding the identification and assessment of pathways for the PAA is included in **Appendix 8D**.

9.4.1 Management Unit 11A: Paekākāriki Seawall

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8D.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo[1] and Enhance[4]	→	Protect – Hard Engineering[13]	→	Retreat & Protect[10]
PW-2	Status Quo[1] and Enhance[4]	→	Protect – Hard Engineering[13]	→	Protect – Hard Engineering[2]
PW-3	Status Quo[1] and Enhance[4]	→	Retreat & Protect[10]	→	Protect – Hard Engineering[2]
PW-4	Status Quo[1] and Enhance[4]	→	Retreat & Protect[10, 12]	→	Protect – Soft Engineering[11]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			8.4	53.0						151
PW-1	63	1=	200.1	206.4	1	3276	1	38.3	2	30
PW-3	63	1=	194.3	208.1	2	3302	2	30.9	3	30
PW-4	58	3	269.9	275.3	3	4746	3	39.2	1	1

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

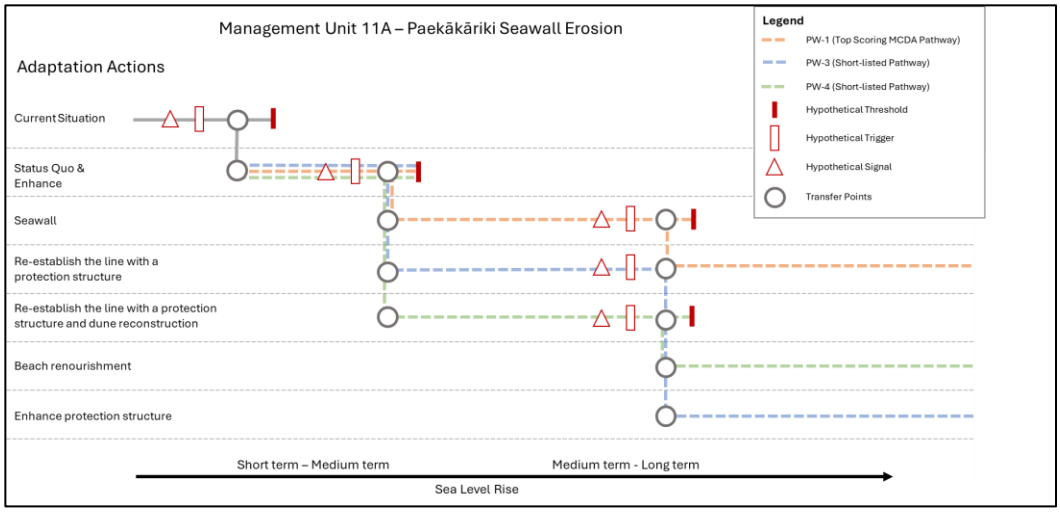

Figure 35: Pathways for Management Unit 11A

9.4.2 Management Unit 12A: Paekākāriki South

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8D.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo[1] and Enhance[4]	→	Enhance [2, 4]	→	Re-establish the line with protection structure[10]
PW-2	Enhance [2, 4]	→	Protect – Hard Engineering [13]	→	Re-establish the line with protection structure[10]
PW-3	Enhance [2, 4]	→	Re-establish the line with protection structure[10]	→	Enhance seawall [2]
PW-4	Enhance [2, 4]	→	Re-establish the line with protection structure & Dune reconstruction [10, 12]	→	Protect – Soft Engineering [10]
PW-5	Protect – Hard Engineering [13]	→	Enhance seawall [2]	→	Enhance seawall [2]
PW-6	Status Quo[1] and Enhance[4]	→	Enhance [2, 4]	→	Protect – Hard Engineering [13]
PW-7	Status Quo[1] and Enhance[4]	→	Protect – Hard Engineering [13]	→	Enhance seawall [2]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. "Pathway 0" refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of properties still exposed 2130
PW-0			8.4	97.1						59
PW-3	63	1	135.1	168.9	2	2681	1	54.3	2	0
PW-4	61	2	133.9	167.9	1	2753	2	54.1	3	1
PW-2	54	3	143.7	177.5	3	3286	3	54.4	1	0

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

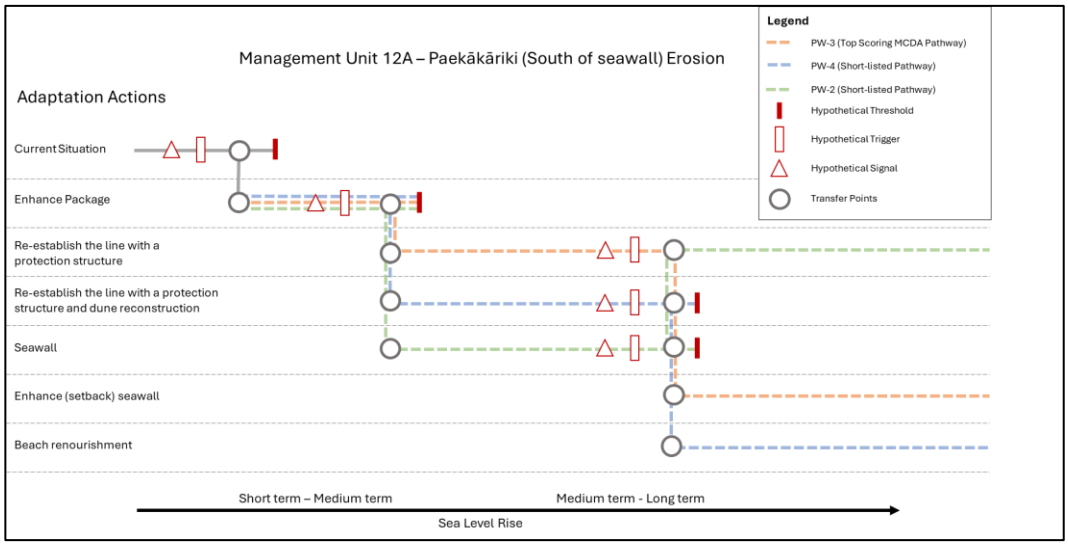

Figure 36: Pathways for Management Unit 12A

9.4.3 Management Unit 11B: Paekākāriki Inundation

The following table summarises the various pathways identified for this management unit. The number after each adaptation action refers to a specific action identified in the long-list of pathway options included in **Appendix 8D.**

Pathway	Short Term	→	Medium Term	→	Long Term
PW-1	Status Quo [1] and Enhance [4]	→	Enhance [3, 4]	→	Additional Hard Protection [14, 15]
PW-2	Status Quo [1] and Enhance [4]	→	Enhance [3, 4]	→	Accommodate [6, 8]
PW-3	Status Quo [1] and Enhance [4]	→	Additional Hard Protection [14, 15]	→	Enhance [3]
PW-4	Status Quo [1] and Enhance [4]	→	Additional Hard Protection [14, 15]	→	Enhance [3]
PW-5	Status Quo [1] and Enhance [4]	→	Accommodate [6, 8]	→	Additional Hard Protection [14, 15]

The following table highlights which pathways scored highest in the MCDA assessment and the results of the economic assessment. “Pathway 0” refers to the baseline scenario, where no action is taken.

Pathway	MCDA Score	MCDA Ranking	Pathway total PV cost ($m)	Cost + Loss ($m)	Cost + Loss Ranking	VFM ($'000/ point)	VFM Ranking	Damages avoided ($m)	Damages avoided ranking	Number of buildings still exposed 2130
PW-0			6.9	7.0						5
PW-2	59	1	7.9	7.9	1	134	1	21,458	1	2
PW-1	51	2	10.3	10.3	2	202	2	10,425	2	4
PW-3	46	3	10.3	10.4	3	225	3	14,267	3	3

The figure below shows how the preferred pathways could be implemented in relation to hypothetical signals, triggers and thresholds.

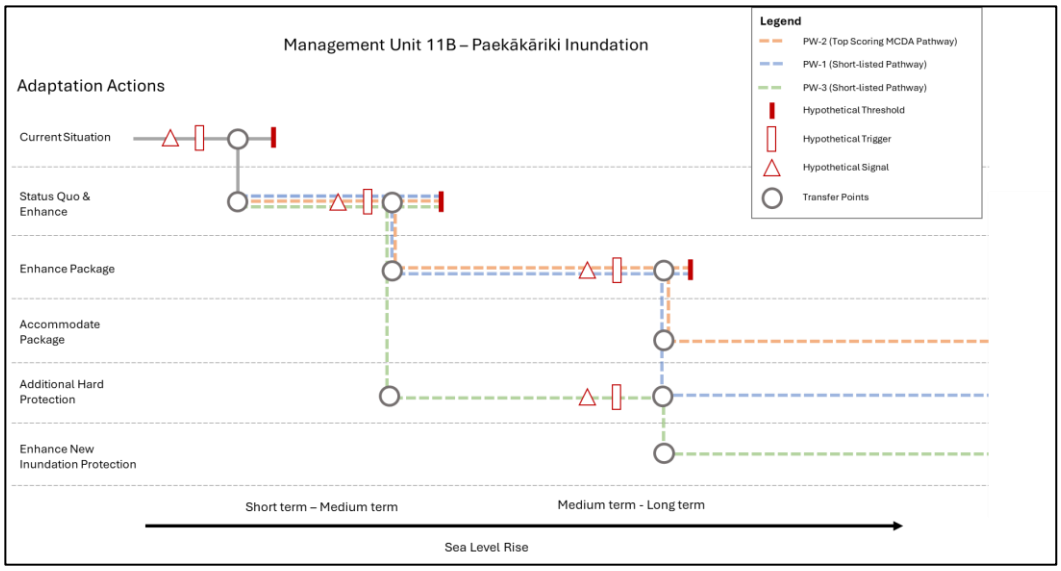

Figure 37: Pathways for Management Unit 11B

9.5 QUEEN ELIZABETH PARK ADAPTATION AREA

Queen Elizabeth Park (**"QEP"**) is a large, relatively flat coastal park characterised by a diverse range of sand dune and wetland habitats. It holds great significance Te Ātiawa ki Whakarongotai and Ngāti Toa Rangatira who maintain strong connections with the park. Community stewardship of the park is also high with many recreation, heritage and conservation groups involved in the park. It includes some 3.5km of coastline, located between Raumati and Paekākāriki.

The whole park is classified as recreation reserve, owned by the Crown (the Department of Conservation) and managed by Greater Wellington with parcels of Ngāti Toa Rangatira-owned land at the southern end. The park is visited by many Kāpiti Coast residents on a daily basis and is a regional summer beach destination for others. Its location on State Highway 1 with a park entry at Mackay's Crossing entry make it a popular highway short stopping place.

The park is controlled and managed by the GWRC under the Toitū Te Whenua Parks Network Plan 2020-2030.[68] Currently GWRC is using the Toitū Te Whenua Parks Network Plan as a basis for developing a more detailed master plan for QEP, which will include natural hazard management for fire, flooding, erosion and tsunami. This process is being called *Te Mahere Toitū Te Whenua* (the plan for Toitū Te Whenua) and will involve extensive mana whenua partner, public and stakeholder engagement.

The QEP Coastal Erosion Plan 2019 has been developed to manage coastal hazards in conjunction with mana whenua partners and others.[69] This plan focuses on the coastal edge from the park's southern entrance at Wellington Road in Paekākāriki to an area approximately 900 metres of the Wainui Stream mouth. The plan includes a strategic retreat approach to coastal hazards, with tracks, facilities and infrastructure are being relocated inland and foredunes restored.

CAP have therefore not developed adaptation pathways for Queen Elizabeth Park.

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[68] Toitū Te Whenua Parks Networks Plan 2020-2030.

[69] Queen Elizabeth Park Coastal Erosion Plan 2019.

C

PART C

Recommendations

10. SIGNALS, TRIGGERS AND THRESHOLDS

In order to know *when* to implement the next option in an adaptive pathway, the Kāpiti community needs to identify:

Signals that will provide an **early warning** that a decision point is approaching and should prompt thinking and initial engagement processes on the next steps or any changes to the trigger.

Triggers indicate that it is time to **change the management approach**. It allows sufficient time to ensure a new pathway or adaptation action can be implemented before the threshold is reached.

Threshold is when the management approach is no longer delivering the desired outcome. An alternative adaptation action or pathway needs to be in place before the trheshold is met.

CAP have considered, at a high level, some optional thresholds to inform the Council's and coastal community's design of signals, triggers and thresholds regime for each specific management unit. A critical part of the DAPP approach is that signals, triggers and thresholds are independent to the pathways and are not timeframes, rather they are observable changes in the world around us.

The signals, triggers and thresholds could be:

- Physical responses;
- Social/cultural factors; or
- Economic factors.

The first step is to identify thresholds which are based on the impact of an event. We have sought to recommend thresholds which respond to community values, risk exposure and agreed levels of service, however, we recognise that consultation with the community to

determine thresholds and the associated signals and triggers is essential. CAP have therefore developed a set of 'optional thresholds' for the Council to take to the community.

These thresholds relate to matters such as:

- The frequency of coastal flooding;
- Risk to drinking water and wastewater infrastructure;
- Disruptions to public road access;
- The cost of insurance for dwellings or their ability to obtain insurance;
- The size of dune systems; and
- The abundance of mahinga kai and shore bird habitat.

The complete set of optional thresholds developed by CAP are included as **Appendix 14.**

It remains up to Kāpiti's coastal communities in each management unit to determine the quantitative parameters of the thresholds.

11. FUNDING OPTIONS AND IMPLEMENTATION

While CAP have received and considered some economic analysis in identifying preferred pathways over a 100-year timeframe. We have not assessed the detailed cost of delivery, timing or funding options for the short-term actions which the community will need to deal with to confirm for the next 10-20 years.

We understand that this work is to occur in preparation for consultation on LTP 2027, in three years from now. In the interim, we anticipate the Council will set up a post CAP work programme to investigate in more detail both the timing and prioritisation of implementing the short-term actions across the twenty management units that have been assessed, along with further consultation with those communities regarding funding and their preferred signals, triggers and thresholds.

12. RECOMMENDATIONS OF THE COASTAL ADVISORY PANEL

In addition to **recommending the short-listed dynamic adaptive pathways**, CAP recommend the following.

Imperative for putting a Kāpiti Coastal Adaptation Plan in place

Having a coastal adaptation plan is imperative as it serves as a blueprint for addressing the multifaceted challenges posed by climate change and coastal hazards. It is essential for fostering sustainable development and ensuring the long-term viability of coastal regions in the face of ongoing environmental change.

Ensuring the Takutai Kāpiti process, including consultation, is ongoing

The community have been highly engaged through Takutai Kāpiti. A common thread through all feedback we have received is that transparency and clear communication are highly valued.

We recommend the Council utilise a variety of methods to engage across demographics within the region. We highly valued the feedback received from high school students and see many opportunities for including younger people and a greater diversity of community members in the conversation.

While we understand there are a range of possible future consultation methods available to the Council might chose to use, we recommend that the Council follow the Special Consultative Process to consult with the community on this report.

Revisiting the DAPP approach and reviewing pathways at least every 10 years

The DAPP approach is a cycle. For its effective implementation, it is essential that the process is revisited, and the pathways are reviewed on a regular basis. In this way, the Council can ensure the pathways, signals, triggers and thresholds remain relevant in light of evolving circumstances, new data, innovative new solutions and changing community objectives.

Regular reviews (we recommend every 10 years) provide opportunities for engagement, fostering transparency, accountability, and ownership of the planning process, ultimately enhancing the plan's impact and ensuring its continued alignment with the community's needs and aspirations.

Integration of Takutai Kāpiti with the GWRC plan, Whaitua Kāpiti freshwater catchment study and its coastal groundwater investigation

GWRC have established a team known as the Whaitua Kāpiti Committee which includes community members, mana whenua, the Council representations and and GWRC representatives. They will give recommendations on how to manage Kāpiti's freshwater resources, which will form the basis for new regulations and programmes of action to protect and restore freshwater across Kāpiti.

Where this work provides insights into groundwater and coastal inundation risks, these findings should be assimilated with the adaptive coastal pathways recommended by CAP, in areas where the coastal adaptation areas overlap with rivers, streams and groundwater.

Need for formal regular ongoing monitoring

By continuously observing and analysing changes in coastal conditions, the Council can effectively respond to potential threats, thereby safeguarding lives, infrastructure, and ecosystems. Monitoring allows for early warning sign to be noticed, effective planning, and the implementation of adaptive measures to minimize the impact of hazards on coastal communities, ensuring their resilience and sustainability in the face of evolving environmental challenges.

Establishing monitoring which aligns with the communities selected thresholds, triggers and signals will also be key to the success of implementing the adaptive pathways.

Implement Action Plans need to be developed prior to trigger points being activated

We recommend the Council take an anticipatory approach to signals, triggers, and thresholds. The Council should develop action plans which are ready for implementation when a trigger is activated.

Working with communities in each Management Unit on an anticipatory signals, triggers and thresholds approach

As discussed in the signals. triggers and threshold section of this report (Section 10), CAP has developed some optional thresholds for future consideration. However, it is important that these thresholds and the associated signals and triggers are discussed at a community level for each management unit and we see this best completed by Council in the next stage of the project.

Preparing for future developments that may be required, including planning for retreat

In developing pathways, CAP have assumed that the "avoid" option forms part of all pathways at all times. This means that no new development should occur in areas at risk from coastal hazards.

A number of our pathways also identify retreat as an option. When the time is right, the Council should start planning on how to accommodate the growth of the district away from coastal hazards and anticipate the potential need for whole communities to be relocated should critical infrastructure failure be imminent.

Further assessment by Council is needed on the prioritisation of, economic costs, benefits and funding mechanisms for the short-term actions for the 20 Management Units

In order to inform community consultation through the next LTP, in 2027, the Council should look further at the economic costs, benefits, and funding mechanisms for the short-term actions defined in the twenty management units, recognising that in terms of relative hazard s and risks some of these management units will require more urgent planning than others – hence the need for Councils to prioritise it's response over the coming years. This is essential for turning implementation of these adaptation plans into a tangible reality for community members to know and understand the potential impacts on them.

Further, as agreed at the CAP meeting held on 6th December 2023 CAP endorses the following planning approach:

- Use of a risk-based approach similar to that adopted by Porirua City Council and Wellington City Council in their recent District Plan reviews.
- Coastal hazards planning rules and provisions will constrain subdivision, use and development according to levels of risk.
- Risk areas will be mapped based on the best available information including relevant national and regional direction (NZCPS & RPS) and the most up to date IPCC information and relevant national guidance.

Note: The mapping, planning provisions and rules will be developed by Council district planners after Takutai Kapiti in partnership with mana whenua and consultation with the community

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