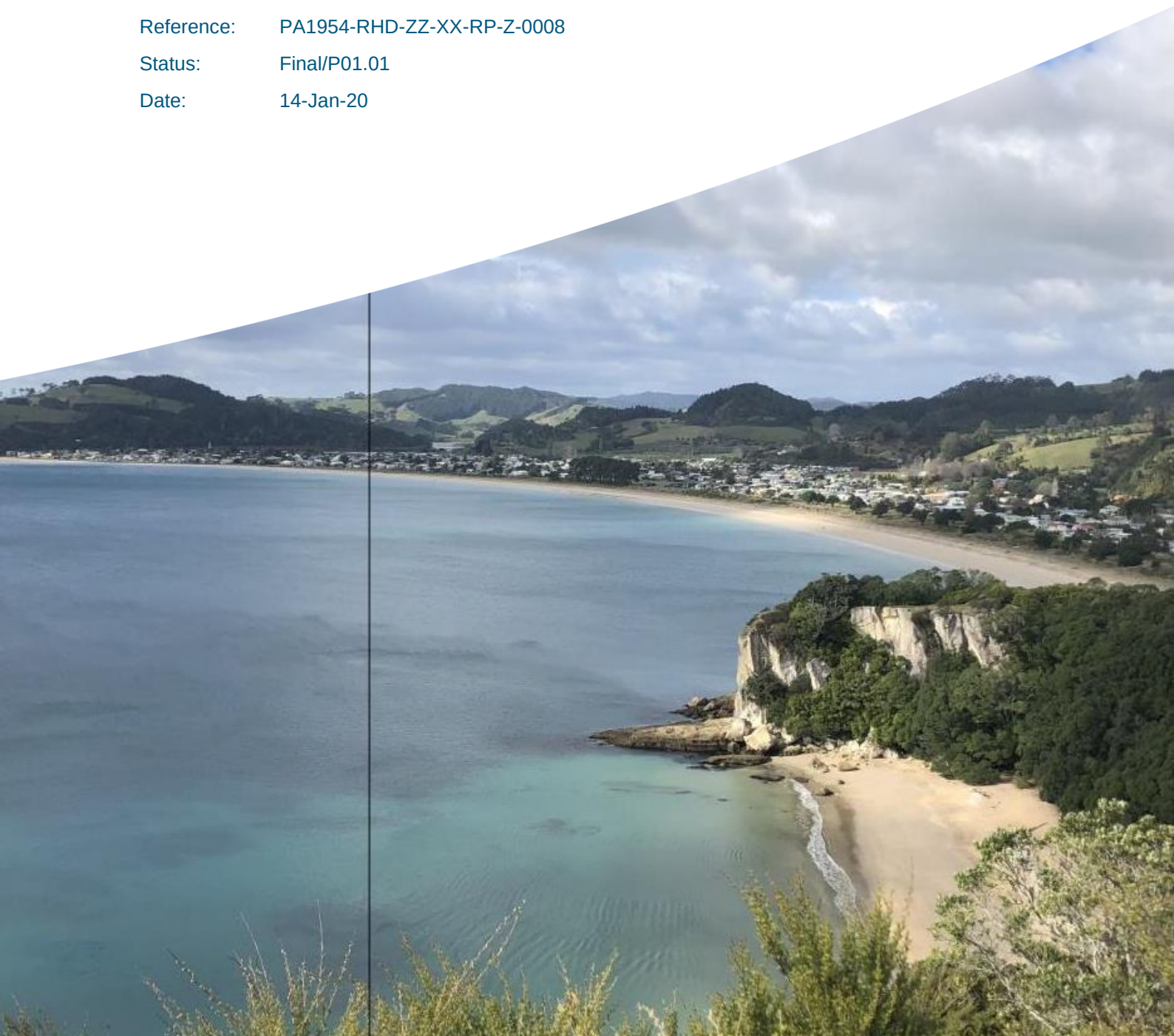
REPORT

Te Ara Tapātai o Hinekirikiri, Tīkapa Moana-Te Tara-o-Te Ika-a-Māui - Thames-Coromandel Shoreline Management Plans

Scoping Report

Client:	Thames Coromandel District Council
Reference:	PA1954-RHD-ZZ-XX-RP-Z-0008
Status:	Final/P01.01
Date:	14-Jan-20



HASKONING AUSTRALIA PTY LTD.

Level 14
56 Berry Street
NSW 2060 North Sydney
Water
Trade register number: ACN153656252

+61 2 8854 5000 **T**
+61 2 9929 0960 **F**
project.admin.australia@rhdhv.com **E**
royalhaskoningdhv.com **W**

Document title:	Te Ara Tapātai o Hinekirikiri, Tīkapa Moana-Te Tara-o-Te Ika-a-Māui - Thames-Coromandel Shoreline Management Plans
Document short title:	Scoping Report
Reference:	PA1954-RHD-ZZ-XX-RP-Z-0008
Status:	P01.01/Final
Date:	14-Jan-20
Project name:	Thames Coromandel SMPs
Project number:	PA1954
Author(s):	RHDHV, CMC and Tataki
Drafted by:	Sian John, Tom FitzGerald, Nick Lewis, Jarrod Walker
Checked by:	Sian John
Date / initials:	14/01/2020 SAJ
Approved by:	Amon Martin
Date / initials:	14/01/2020 AM

Classification
Confidential

MANAGEMENT SYSTEM CERTIFICATION DNV·GL ISO 9001 = ISO 14001 ISO 45001

Disclaimer

No part of these specifications/printed matter may be reproduced and/or published by print, photocopy, microfilm or by any other means, without the prior written permission of Haskoning Australia PTY Ltd.; nor may they be used, without such permission, for any purposes other than that for which they were produced. Haskoning Australia PTY Ltd. accepts no responsibility or liability for these specifications/printed matter to any party other than the persons by whom it was commissioned and as concluded under that Appointment. The integrated QHSE management system of Haskoning Australia PTY Ltd. has been certified in accordance with ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018.

Table of Contents

Appendices

Disclaimer
No part of these specifications/printed matter may be reproduced and/or published by print, photocopy, microfilm or by any other means, without the prior written permission of Haskoning Australia PTY Ltd.; nor may they be used, without such permission, for any purposes other than that for which they were produced. Haskoning Australia PTY Ltd. accepts no responsibility or liability for these specifications/printed matter to any party other than the persons by whom it was commissioned and as concluded under that Appointment. The integrated QHSE management system of Haskoning Australia PTY Ltd. has been certified in accordance with ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018.

Glossary of Terms & Acronyms

Term / Acronym	Definition
Acceptable risk	Section 10 of the TCDC Proposed District Plan states that acceptable risk is generally permitted, allowing people to manage the risk themselves; i.e. it is likely or possible, but the consequences would be insignificant, it is unlikely but the consequences could be minor, or it is rare but the consequences could be moderate or major. The Australian Geological Society (AGS) define acceptable risk as 'minor' risk, where the cost of further reducing risk would be disproportionate in terms of the benefits gained, e.g. for residential housing beyond coastal setback zones. "*A risk for which, for the purposes of life or work, we are prepared to accept as it is, with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable." (AGS, 2007)*
Adaptation	Change in the way a feature, such as a habitat or a community, functions. The Ministry for Environment's guidance on coastal hazards and climate change (MfE, 2017) defines adaptation as a response strategy to anticipate and cope with impacts that cannot be (or are not) avoided under different scenarios of climate change (after Denton *et al*., 2014). The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC, 2014c, annex II). Adaptation can be categorised as either: • *incremental* – actions where the central aim is to maintain the essence and integrity of a system or process at a given scale, or, • *transformational* – actions that changes the fundamental attributes of a system in response to climate and its effects.
Anthropogenic	Impacts that originate from humans.
Arohatanga	Principles of care, respect, love, compassion.
ATL	Advance the Line. A policy decision to build new defences seaward of the existing defence line where land reclamation is considered.
Atua	Māori god(s).
Beach nourishment	Supplementing the natural volume of sediment on a beach, using material from elsewhere. Also known as beach replenishment/recharge/feeding.
Benefits	The service that a feature provides. In other words, why people value or use a feature. For example, a nature reserve, as well as helping to preserve biodiversity and meet national legislation, will also provide a recreation function.
Berm crest	A nearly horizontal plateau on the beach face or backshore, formed by the deposition of beach material by wave action or by means of a mechanical plant as part of a beach nourishment scheme.
Brackish water	Freshwater mixed with seawater.
Breaker zone	The zone within which waves approaching the coastline start breaking, typically in water depths of between 5m and 10m.
CD	Chart Datum (0 m above sea level).
CES	Communications and Engagement Strategy.
CHA	Coastal Hazard Assessment.
Climate change	Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes or trends in the mean and/or the variability of its properties, and that persists for an extended period, typically decades to centuries. Climate change includes natural internal climate processes or external climate forces, such as variations in solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use (MfE, 2017).

CMC	Coastal Management Collective.
Coastal compartment	A length of coastline defined for the purpose of assessing all issues and interactions to examine and develop management scenarios. Developed in response to "what the coast is telling us" and based on coastal processes – coastal form and function; not necessarily administrative boundaries. Referred to as 'Coastal Cells' in TCDC's Coastal Hazards Policy 2017.
Coastal environment	The TCDC Proposed District Plan (under development since 2012) includes a Coastal Environment Line, developed in consultation with the local community. This supersedes the maps included in the Waikato RPS.
Coastal flooding	Coastal flooding occurs in areas that lie on the coast of a sea, ocean, or other large body of open water. It is typically the result of extreme tidal conditions caused by severe weather. Storm surge — produced when high winds from hurricanes and other storms push water onshore — is the leading cause of coastal flooding.
Coastal hazards	Physical processes that expose a coastal area to the risk of loss of life, the degradation of environmental and cultural assets, and/or property damage. They are a subset of *natural hazards* covering tidal or coastal storm inundation, rising sea level, tsunami or meteorological tsunami inundation, coastal erosion (shorelines or cliffs), rise in groundwater levels from storm tides and SLR (plus associated liquefaction), and salinisation of surface fresh waters and groundwater aquifers. Herein, taken to be – in short – coastal inundation and coastal erosion, incorporating SLR and storm events.
Coastal Marine Area (CMA)	As defined in Section 2 of the RMA 1991, CMA means the foreshore, seabed, coastal water and the air space above the water - (a) of which the seaward boundary is the outer limits of the territorial sea; (b) of which the landward boundary is the line of mean high water springs, except that where that line crosses a river, the landward boundary at that point shall be whichever is the lesser of (i) one kilometre upstream from the mouth of the river; or (ii) the point upstream that is calculated by multiplying the width of the river mouth by five.
Coastal squeeze	Narrowing of the intertidal zone as sea level rises and natural retreat is prevented by natural or man-made barriers (such as resistant cliffs or a seawall).
Community	A group of individuals with a shared interest (community of interest) or shared location (community of place). In this document can be taken to mean 'coastal community.
Community Action Plans	For the delivery of the intent of SMPs at a local level. Referred to in the MfE guidance (MfE, 2017) as Implementation Plans.
Consequence	The outcome of an event that may result from a hazard. It may be expressed quantitatively (e.g. monetary value, disruption period or environmental effect), by category (e.g., high, medium, low) or descriptively.
CCEL	Current Coastal Erosion Line; which identifies the current erosion risk.
D	flow depth.
Dynamic Adaptive Pathways Planning (DAPP)	DAPP is defined in Chapter 9 (and Appendix G) of the MfE guidance (MfE, 2017) as a series of actions over time (pathways) to achieve a set of predefined objectives under uncertain and changing conditions. An analytical planning framework. The DAPP approach is built on the notion that decisions are made over time in dynamic interaction with the system itself and cannot be considered independently or predetermined. The 10-step decision cycle used in the MfE guidance incorporates these components and suggest that it should be used for assessing and planning for risks over long timeframes where change is central (i.e. applicable at project or strategy level). It is most useful when there is high uncertainty in the future and when near-term decisions have the potential to create a path dependency and lock-in.
DOC	Department of Conservation.
Downdrift	The direction of the nett longshore transport of beach material.
Ebb-tide	Period when tide level is falling. Often taken to mean the ebb current that occurs during this period.

Ecosystem	The combined physical and biological components of an environment. An area within the natural environment in which physical (abiotic) factors of the environment, such as rocks and soil, function together along with interdependent (biotic) organisms, such as plants and animals, within the same habitat.
ENSO	El Nino Southern Oscillation.
Enhance (improve)	The value of a feature increases.
Environment	Defined in the RMA 1991 as including: (a) ecosystems and their constituent parts, including people and communities; (b) all natural and physical resources; (c) amenity values; and (d) the social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) or which are affected by those matters.
Exposure	The presence of people, livelihoods, ecosystems, environmental functions, services and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected by natural hazards and climate change (MfE, 2017).
Feature	Something tangible that provides a service to society in one form or another or, more simply, benefits certain aspects of society by its very existence. Usually this will be of a specific geographical location and specific to the SMP.
Fetch	Distance over which the wind acts to produce waves, also called fetch length (the greater the fetch, the larger the wind-driven waves will be).
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Fluvial flooding	Fluvial, or riverine, flooding occurs when excessive rainfall over an extended period of time causes a river to exceed its capacity. There are two main types of riverine flooding: 'overbank flooding occurs when water flows over the edges of a river or stream; and 'flash flooding', characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice.
Foreshore	As defined in Section 2 of the RMA 1991, any land covered and uncovered by the flow and ebb of the tide at mean spring tides and, in relation to any such land that forms part of the bed of a river, does not include any area that is not part of the CMA.
FCPL	The Future Coastal Protection Line defines the area potentially at risk from erosion over the next 100 years, should sea level rise as projected.
Geomorphology/ Morphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
GIS	Geographic Information System. A database of information that is geographically orientated, usually with an associated visual system.
Groyne	Narrow, roughly shore-normal structure built to reduce longshore currents, and/or to trap and retain beach material. Most groynes are of timber or rock, and extend from a seawall, or the backshore, well onto the foreshore and rarely even further offshore.
Hapu	Tribe or subtribe.
HDC	Hauraki District Council.
Hold the Line (HTL)	A policy decision to maintain or upgrade the level of protection provided by defences or natural coastline.
ICNZ	Insurance Council of New Zealand.
Integrated	An approach that tries to take all issues and interests into account. In taking this approach, managing one issue adds value to the way another is dealt with.
IPO	Interdecadal Pacific Oscillation.
IPCC	Intergovernmental Panel on Climate Change.
IMP	Iwi Management Plans.

Intolerable risk	Risk which cannot be justified. Risk reduction is essential, e.g. for residential housing in a Primary Hazard Zone; tolerable risk is within a range that a community can live with, so as to secure certain net benefits. According to Section 10 of TCDC's Proposed District Plan intolerable risk is generally not provided for. The activity needs to be relocated or redesigned to lower the risk. It is either almost certain to occur and would have major or catastrophic consequences or is likely to occur and would have catastrophic consequences.
Iwi	Group of people descended from a common ancestor and associated with a distinct territory.
Kaitiaki	A person or being whom is a guardian.
Kaitiakitanga	Practicing, undertaking the role of guardianship.
LIM	Land Information Memoranda.
Likelihood	The probability or chance of a hazard or event occurring. Likelihood is usually described quantitatively as a ratio (e.g. 1 in 10), percentage (e.g. 10%) or a value between 0 and 1 (e.g. 0.1), or qualitatively using defined and agreed terms, such as unlikely, virtually certain, about as likely as not.
Maintain	That the value of a feature is not allowed to deteriorate.
Managed Realignment (MR)	A policy decision to manage the coastal processes to realign the 'natural' coastline configuration, either seaward or landward, in order to create a future sustainable shoreline position.
Management Area	A collection of Policy Units that are interdependent and should therefore be managed collectively.
Mean High Water Springs (MHWS)	The average of all high waters observed over a sufficiently long period. MHSW tide applies to a high-tide water level as well as the line that marks the landward boundary of the CMA (MfE, 2017).
Mean Sea Level (MSL)	The average (mean) level of the sea relative to a vertical datum over a defined epoch, usually of several years to decades. The baseline MSL for IPCC sea-level rise projections is the average over the period 1986–2005 (MfE, 2017).
Ministry for Environment. (MfE)	MfE guidance refers to *Coastal Hazards and Climate Change: Guidance for Local Government (and Appendices)* 2017.
Manu Whenua	Iwi with authority associated with possession and occupation of tribal land.
Mana motuhake	To have autonomy, self-government and self-determination.
Manaakitanga	The process of showing respect, generosity and care for others.
Mātauranga	Maori knowledge upon which environment practise are based upon.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Modelling and Decision Support Framework (MDSF)	Mapping linked computer tool used in the evaluation of assets at risk from flooding or erosion.
Natural asset / coastal asset	Natural coast protection assets include beaches and sand dunes, saltmarsh and mudflats, and mangroves.
Natural hazard	Means any atmospheric, earth or water-related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding), the action of which adversely affects or may adversely affect human life, property, social and economic activities or other aspects of the environment (Resource Management Act 1991, Section 2 (adapted)). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its timing, location and scale, intensity and probability.
NIWA	National Institute of Water and Atmospheric Research.
No Active Intervention (NAI)	A policy decision to not to invest in providing or maintaining defences or natural coastline.

NZCPS	New Zealand Coastal Policy Statement 2010.
NZTA	New Zealand Transport Agency.
Objective	A desired state to be achieved in the future. An objective is set, through engagement with key parties, to encourage the resolution of the issue or range of issues.
Offshore zone	The zone beyond the nearshore zone where sediment motion induced by waves alone effectively ceases and where the influence of the seabed on wave action has become small in comparison with the effect of wind.
ORRAA	Ocean Risk and Resilience Action Alliance.
Papatūānuku	The earth mother.
PDP	Thames Coromandel Proposed District Plan.
Pluvial flooding	A pluvial, or surface water, flood is caused when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can occur in areas that lie above coastal and river floodplains. There are two common types of pluvial flooding: Intense rain saturates an urban drainage system and the system becomes overwhelmed. Run-off or flowing water from rain falling on hillsides that are unable to absorb the water. Pluvial flooding often occurs in combination with coastal and fluvial flooding and, although typically only a few centimetres deep, can cause significant property damage.
Policy	In this context, "policy" refers to the generic shoreline management options (No Active Intervention, Hold the Existing Line of Defence, Managed Realignment, Retreat or Advance the Existing Line of Defence, and Hold the Retired Line).
Policy Units	Sections of coastline for which a certain coastal defence management policy has been defined. These can be grouped into Management Areas for management purposes.
Present Value (PV)	The value of a stream of benefits or costs when discounted back to the present day.
Primary Hazard Zones (PHZs)	Established via the Waikato RPS and reflected in the PDP. No PHZs have been defined to date by TCDC; however, SMPs could inform them. The Thames Coromandel PDP refers to the Current Coastal Erosion Line (CCEL).
Probabilistic approach	A probabilistic approach to coastal hazard assessment allows each input parameter to randomly vary according to probability distribution functions. Randomly sampled parameters are repeatedly combined in a Monte-Carlo simulation. This contrasts to a 'deterministic approach' where each input variable is assigned a single value (e.g. a SLR projection).
Pūkenga	Expert.
Ranginui	The sky father.
Residual Hazard Zones (RHZs)	Established via the Waikato RPS and reflected in the PDP. No RHZs have been defined to date by TCDC; however, SMPs could inform them. The PDP refers to the Future Coastal Protection Line (FCPL).
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management (from the Sendai Framework for Disaster Risk Reduction).
Residual risk	Refers to the risk that remains even with a structural defence in place; specifically in the event of a failure or greater than design event occurring.
RHDHV	Royal HaskoningDHV; RHDHV Consortium – RHDHV, the Coastal Management Collective (CMC), EMM Consulting and Tātaki
Risk	Effect of uncertainty on objectives (AS/NZS ISO 31000:2009, Risk management standard). Risk is often expressed in terms of a combination of consequences of an event (including changes in circumstances) and the associated likelihood of occurrence: that is, the product of 'likelihood' and 'consequences', or 'the effect of uncertainty on objectives'. In this Project we take a consequence-driven view of risk in order to build robust DAPPs.

Risk management	Plans, actions or policies to reduce the *likelihood* and/or *consequences* of risks or to respond to *consequences* (ISO 31000:2009, Risk management standard).
RMA	Resource Management Act 1991.
RNC2	Resilience to Nature's Challenges 2; the second round of funding and projects under this theme emanating from the National Science Challenges.
S	flow speed.
Scenario	Plausible descriptions of how the future might unfold in terms of interacting factors, including human behaviour, policy choices, land- use change, global population trends, economic conditions, technological advances, international competition and cooperation (MfE 2017).
Seiching	A wave that is oscillating in lakes, bays or gulfs from a few minutes to a few hours as a result of seismic or atmospheric disturbances.
Setback	Prescribed distance landward of a coastal feature (e.g. the line of existing defences).
SLR	Sea level rise.
Shoreline Management Plan (SMP)	A non-statutory plan, which provides a large-scale assessment of the risks associated with coastal processes and presents a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. The MfE guidance (MfE, 2017) refers to Adaptive Planning Strategies, with supporting Implementation Plans.
Stop banks	Defences for coastal inundation.
Storm surge	A rise of sea elevation caused by water piling up against a coast under the force of strong onshore winds such as those accompanying a hurricane or other intense storm. Reduced atmospheric pressure may contribute to rise.
Sustain	Refers to some function of a feature. A feature may change, but the function is not allowed to fail.
Swell (waves)	Remotely wind-generated waves. Swell characteristically exhibits a more regular and longer period and has longer crests than locally generated waves.
Taiao	The natural environment.
Tangaroa	God of the ocean, rivers and streams.
Tāwhitimātea	God of wind, weather and climate.
TCDC	Thames Coromandel District Council.
Te Ao Maori	The Maori world view – the way in which Māori understand and view the relationship with the natural environment.
Tiaki	To protect.
Tidal prism	The volume of water within an estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	The periodic rise and fall in the level of the water in oceans and seas. The result of gravitational attraction of the Sun and Moon.
Tikanga	Māori customary practice, values, protocols.
Tino rangatiratanga	Self-determination and governance.
Tolerable risk	Risk that is within a range that a community can live with, so as to secure certain net benefits. It is a range of risk that is not regarded as negligible or as something to ignore, but rather as something to be kept under review and reduced if possible. According to Section 10 of TCDC's Proposed District Plan tolerable risk generally requires a resource consent to mitigate the risk to life and property, including nei ghbouring properties
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
TWG	Technical Working Group.
Updrift	The direction opposite to that of the predominant longshore movement of beach material.

Vulnerability	The predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including exposure, sensitivity or susceptibility to harm or damage, and lack of capacity to cope and adapt (adaptive capacity) (adapted from IPCC, 2014c, annex II).
Wāhi tapu	Sacred place, sacred site.
Waikato RPS	Waikato Regional Council Regional Policy Statement.
Wairuatanga	The spiritual dimension.
Water table	The upper surface of groundwater; below this level, the soil is saturated with water.
Wave direction	Mean direction of wave energy propagation relative to true North.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.
Whakapapa	Relationships with the environment, ancestral lineage and descent through genealogy.
Whakakotahitanga	consensus, respect for individual differences and participatory inclusion for decision-making.
Whānaungatanga	Family connections and the practice of meeting and getting to know people.
With Present Management (WPM)	The WPM scenario essentially describes the current regime of management which exists for a given frontage. WPM scenario assumes that defences will be maintained in their present position and other management practices, e.g. beach re-nourishment, will continue as at present.
WRC	Waikato Regional Council.

Executive Summary

Introduction

Thames Coromandel District Council (TCDC) has commissioned the preparation of Shoreline Management Plans (SMPs) – Te Ara Tapātai o Hinekirikiri, Tīkapa Moana-Te Tara-o-Te Ika-a-Māui – for the District. The purpose of SMPs is to manage coastal hazards and coastal assets. They will identify flood and erosion risk and resolve how to manage this risk through the Council's adoption and implementation of coastal management policies and Community Action Plans. SMPs are intended to provide a 'route map' for decision makers to move sustainably from the present towards the future.

Coastal hazards mean coastal erosion and coastal inundation. SMPs do not assess fluvial (river), pluvial (surface/storm water) or groundwater flooding although, where possible, the interaction between coastal flooding and fluvial/pluvial flooding will be examined. TCDC's Current Coastal Erosion Lines and Future Coastal Protection Lines will be reviewed as part of this project and refined or updated as necessary based on the more detailed coastal hazard assessment work to be undertaken.

In line with the Department of Conservation's (DOC's) *New Zealand Coastal Policy Statement 2010* and the Ministry for the Environment's *Coastal Hazards and Climate Change – Guidance for Local Government 2017*, for coastal resilience, the Thames-Coromandel SMPs will consider:

1. What is happening?
2. What matters most?
3. What can we do about it?
4. How do we get it done?
5. Is it working?

This report presents the outcomes of the Scoping phase of the project (Phase 1). Questions 1 to 4 above will be addressed by April 2022. Key milestones ahead include the production of a Coastal Hazard Report at the end of Year 1 (April 2020), reports on Vulnerability and Risk Acceptance and Asset Condition Pathways at the end of Year 2 (April 2021), and Community Action Plans and SMPs in Year 3.

The final output from the project will be non-statutory policy documents (SMPs) that form an important part of the strategy for coastal hazard management for TCDC in line with *the Thames Coromandel Coastal Management Strategy* (June 2018) and *Coastal Hazards Policy* (August 2018). Appropriate policies and, from these, asset management and action plans will be derived for different, unique stretches of the Coromandel shoreline (Coastal Compartments and, within these, Management Areas') based on Iwi and community values; that reflect the need to respond and adapt to change. The intent of the SMPs can be secured by TCDC, their Iwi partners and their project partners – Waikato Regional Council (WRC) – through the adoption and recognition SMPs in their planning policy.

Approach to Scoping

1. Data collation, review and gap analysis.
2. Description of the strategic and policy background for the development of SMPs; and the objectives for SMPs.
3. Review of coastal asset information held by TCDC.
4. Initial engagement with Iwi.
5. Initial stakeholder and community engagement – eight events across the District and meetings with WRC, DOC and the NZ Transport Agency (NZTA).
6. Information dissemination and the establishment of the TCDC SMP webpage.
7. Consideration of an appropriate approach to 'project governance' for the SMP process and the preparation of the Communication and Engagement Strategy.
8. Description of the geomorphology and coastal hazards of the Coromandel coast.
9. Development of a methodology for coastal hazard and risk assessment.
10. First pass, desk-top 'risk assessment' to enable the identification of the areas at greatest risk from coastal hazards.
11. Development of the proposed approach to the next phase(s) of the process.

Coastal Compartments

To assist in the process of shoreline management planning, the coast has then been divided into Coastal Compartments largely based on coastal character and processes. These are zones within which relatively unique coastal process interactions/landforms and community values can be captured. That is, the Thames coast, Coromandel coast, Colville and Northern bays / Moehau, the Northwest bays, Whangapoua harbour and coast, Mercury Bay / Te-Whitianga-a-Kupe, Te Whanganui-A-Hei, Tairua-Pauanui, Ōpoutere-Onemana, Whangamatā and the East coast islands.

Within Coastal Compartments, Management Areas have been defined where there is the need to consider a combination of Policy Units (that could be interdependent) together to capture the "intent of management" and/or where Policy Units should be managed collectively.

Project governance

Bespoke and inclusive governance arrangements are recommended for the Thames Coromandel SMPs and are proposed to include Iwi/hapū, WRC, Community Boards and key stakeholders such as the NZTA and DOC. For stakeholder and community collaboration, it is proposed that 'Coastal Panels' are established for different Coastal Compartments (or combinations of compartments). Further details of proposed specific roles to be fulfilled on and by these panels will be provided in a report to Council on project governance in the new year, for approval.

It is proposed that Coastal Panels will consider a number of different future scenarios regarding how the coast and communities may change and work through viable solutions for coastal management. Any recommendations arising from the Coastal Panels, and Community Action Plans, will need adoption by Council.

Engagement

A 'living' Communication and Engagement Strategy has been developed that sets out the proposed approach for communicating and engaging with the diverse communities across the Coromandel Peninsula during the next three years. That is:

- Our Coast newsletters/e-newsletters, media and social media.
- SMP webpage development.
- Fact sheets.
- A District-wide summer survey.
- Citizen science initiatives.
- Workshops and Coastal Panels.
- Drop-in sessions, public meetings and events.

A stakeholder mapping exercise has begun and will be completed in conjunction with the finalisation of the project governance framework early next year.

Continued kanohi ki te kanohi (face to face) conversations with Iwi are proposed, to provide information/background on the scope of the SMPs. This opportunity will be used to further our understanding of how Iwi would like to be engaged and what processes Iwi are involved in that potentially could assist in the delivery of SMPs.

Risk assessment

Based on the definition of Coastal Compartments and Management Areas, a 'first pass', desktop risk assessment for the Coromandel Peninsula has been undertaken. In line with best practice, the assessment focussed on coastal character, processes and foreseeable hazards, but has given some regard to settlements and infrastructure. It is acknowledged that the latter and environmental and cultural values at a local level will be fundamental to the assessment as it progresses.

Next steps

A data interrogation report will be produced early in Phase 2 that sets out what effort and approach is required for the assessment of coastal hazards in the different locations around the Coromandel shoreline. Where appropriate information is not already available (e.g. for Mercury Bay and Thames township), further detailed investigation will be undertaken.

A prioritisation workshop will be held to focus the project on the areas at the highest risk and/or with the earliest predicted onset of potential hazards. This will be based on review of the first pass risk assessment.

The outputs from the assessment of coastal hazards across the District will be a Coastal Hazard Report and a set of mapping layers that will inform the next step in the risk management process 'What can we do about it?'.

The environmental baseline will also be characterised in Phase 2 and the output from this work will be included in a Coastal Environment chapter of the SMPs. The development of an integrated GIS and digital data-based asset management system will continue.

Information on asset condition is available for TCDC's existing coastal assets, but further information is required on natural assets (e.g. sand dunes and wetlands) and third-party assets. Therefore, it is proposed that gap filling regarding extent and location, and role and service level requirements, occurs as part of the next phase of the project. An initial report will also be prepared on the Legalisation of Coastal Assets and Asset Service Limits. TCDC's Coastal Asset Management Plan will be able to be updated based on this work.

In addition, during Phase 2, a piece of work will be undertaken to examine potential issues relating to coastal management and insurance, and recommendations will be provided on next steps. The actions of insurers will influence the decisions individuals will take regarding the desire to defend and the timescale over which they desire to defend. To that end they will also influence proposed shoreline management policies.

Proposals for Iwi and community engagement going forward are covered above. Further to this, discussions with key stakeholders (e.g. WTC, NZTA, DOC etc.) will continue, particularly regarding opportunities for joint working/initiatives, data sharing and funding.

Recommendations

It is proposed that SMPs are developed for different, unique stretches of the Coromandel shoreline; albeit an SMP may combine more than one Coastal Compartment, where appropriate. Coastal Compartments will be subdivided into Management Areas, within which relevant shoreline management policies will be derived for Policy Units. These SMPs will be guided by a set of overarching core principles and guidelines to provide consistency in the approach being taken to the management of coastal hazards; but may not necessarily follow existing institutional or government boundaries.

Each SMP will:

1. Identify what is at stake and why it is important.
2. Set specific objectives for the management of the coastal environment based on the unique characteristics and value of its shoreline.
3. Consider a number of different future scenarios regarding how the coast and communities may change.

4. Be action-oriented and clearly link the actions of today with those for the future.
5. Work through viable solutions for coastal management and plot a course towards these solutions, but in a manner that enables a change of course if necessary.

It is recommended that, for the assessment of vulnerability and risk, Coastal Panels are formed for each SMP. The proposal is that Coastal Panels, informed by Iwi, natural hazard and coastal science experts, would test options and develop proposals for SMP policy and Community Action Plans, that would be considered by the Council Members.

We recommend that a Technical Working Group (TWG) is established to oversee and guide the development of the SMPs. The TWG should consist of appropriate TCDC and WRC officers and Iwi.

It is recommended that TCDC continues its dialogue with Iwi to develop and strengthen relationships and to explore future possible co-governance arrangements with the new Council. The project needs to understand how Iwi would like to be engaged and what processes Iwi are involved in that potentially could assist in the delivery of SMPs.

1 Introduction

1.1 Background

Royal HaskoningDHV (RHDHV), the Coastal Management Collective (CMC), Tātaki[1] and EMM Consulting, the 'RHDHV Consortium', were commissioned in April 2019 to prepare Shoreline Management Plans (SMPs) – Te Ara Tapātai o Hinekirikiri, Tīkapa Moana-Te Tara-o-Te Ika-a-Māui – for the Thames-Coromandel District. The purpose of SMPs is to manage coastal hazards[2] and to deliver, in part, the *Thames Coromandel Coastal Management Strategy*; adopted by Thames Coromandel District Council (TCDC) in June 2018. The strategy establishes the need for coastal climate adaptation and describes goals, objectives and actions to support the sustainable management of natural and physical coastal resources, now and for future generations. In August 2018, Council also approved the *Thames Coromandel Coastal Hazards Policy* that set out the objectives for risk management, levels of service and emergency events at the coast.

The Thames-Coromandel SMPs will consider all 'coastal assets', be they man-made or natural, irrespective of their ownership. Their development will provide an opportunity for TCDC to examine the interaction between the way the coast behaves, and is likely to evolve, and the way the coast is used. They will provide a large-scale assessment of the risks associated with coastal change and present a policy framework to address these risks to people and the developed, cultural and natural environment in a sustainable manner. Addressing more immediate issues but considering them in the longer-term context of how we are likely to need to adapt. That is, they will identify flood and erosion risk and resolve how to manage this risk through the adoption by the Council of management policies. These SMP policies will be implemented through Community Action Plans.

The process will involve taking account of the aspirations and concerns of TCDC's diverse communities and working with stakeholders to identify risks, so that decisions being made now contribute to a longer-term vision for the whole area. Wholesale changes to existing coastal management practices may not be appropriate in the short-term, but SMPs are intended to provide a 'route map' for decision makers to move from the present towards the future.

The initial Scoping Phase of this work, with a duration of six months, began in April 2019 and focused on data and policy review, the definition of 'coastal compartments' and method development. The phases of the process proposed to be adopted for this project are summarised in **Figure 1.1**.

The study area for the project is the entire Thames-Coromandel District shoreline (see **Figure 1.2**); defined in the southwest by the Waihou River (the border with Hauraki District Council (HDC)) and to the southeast by the Otahu River (the border with the Western Bay of Plenty District Council). This incorporates the Wards of Thames, Coromandel-Colville, Mercury Bay, Tairua/Pauanui and Whangamata.

[1] *Jarrod Walker, previously with Streamlined*
[2] *not coastal resources*

YEAR ONE	
April to Sept 2019	Oct 2019 to March 2020

PHASE ONE	PHASE TWO
Scoping	**Hazard Assessment**

Deliverables	Deliverables
1. Scoping Report 2. Communication & Engagement Strategy 3. Coastal Hazard Assessment Methodology	1. Coastal Hazard Report 2. Coastal Environment Report 3. Asset Service Limits Reports

YEAR TWO	
April to Sept 2020	Oct 2020 to March 2021

PHASE THREE	PHASE FOUR
Vulnerability & Risk Assessment	**Evaluation of Options**

Deliverables	Deliverables
1. Report on Values & Objectives 2. Report on Vulnerability & Risk Acceptance	1. Draft Community Action Plans 2. Draft SMPs (for some areas) 3 Asset Pathways Report

YEAR THREE	
April to Dec 2021	Jan 2021 to March 2022

PHASE FIVE	PHASE SIX
Finalise SMP Action Plans & Asset Legalisation	**Adoption of SMPs**

Deliverables	Deliverables
1. Community Action Plans 2. DRAFT SMPs 3. Asset Consents 4. LIM Inputs	Adopted SMPs

COMMUNITY & STAKEHOLDER ENGAGEMENT

Figure 1.1 SMP - Phases 1 to 6

Figure 2.2 Study area

Figure 1.2 provides an indication of the area that is considered to represent the coastal zone for the purposes of this exercise. Offshore the study area is bounded by Chart Datum (CD). Inland it includes the area of coastal inundation (based on a 100-year event); i.e. exposure to coastal hazards. However, where the extent of coastal inundation 'up river' encounters flood defences (managed by Waikato Regional Council (WRC)) this will be the boundary for the SMPs (e.g. for the Waihou River the project boundary will be Kopu Bridge). The scope of the SMPs does not include fluvial (river), pluvial (surface/storm water) or groundwater flooding but does include the interaction between coastal and fluvial/pluvial/groundwater flooding where possible.

Further precision regarding the study area (i.e. the zone of coastal inundation) will be provided as the project progresses and coastal hazards are examined in detail for different coastal compartments (see **Section 5.1**).

1.2 Shoreline Management Planning

The outputs from the project will be policy documents (SMPs) and Community Action Plans that form an important part of the strategy for flood and coastal defence for TCDC, based on the Department of Conservation's (DOC's) *New Zealand Coastal Policy Statement (NZCPS) 2010* and the Ministry for the Environment's (MfE's) *Coastal Hazards and Climate Change – Guidance for Local Government 2017*.

A simple way to describe how to go about adapting to coastal change is set out in the MfE's guidance and seeks to answer five key questions. For the SMPs this has been summarised as (see **Figure 1.3**):

1. What is happening? This includes providing the context (baseline) for the SMPs as well as considering the implications of sea-level rise and hazard assessments based on different potential change scenarios.
2. What matters most? Answering this question will seek to determine community values and objectives and expectations in terms of asset service delivery. It will be informed by risk and vulnerability assessments.
3. What can we do about it? Identifying and evaluating relevant coastal management units and management options.
4. How do we get it done? The development of dynamic adaptive planning pathways (DAPPs) and Community Action Plans.
5. Is it working? Monitoring and regular review, including possible adjustments.

The project has adopted the logical sequence encapsulated by these key questions and, where possible, seeks to provide for efficiencies.

Coastal adaptation issues are complex, ambiguous and often contested. Coastal environments are different and different communities place different values on them. Effective management of the coast must be cognisant of the entire 'coastal system', e.g. where does the sand come from and where does it go to? What role does the catchment have on coastal dynamics? etc. As part of the Scoping Phase, the RHDHV Consortium has investigated the extent of these coastal systems and identified 'coastal compartments' and 'management areas' (see **Section 5.1**). These compartments will form the basis of the SMPs.

Figure 1.3 Framework for adapting to coastal change (simplification of the 10-step decision cycle in MfE, 2017)

1.3 This Report

This report sets out the findings and recommendations of Phase 1 – Scoping. It summarises existing information and identifies future engagement, assessment and other work requirements. It provides a 'route map' for the next phases of the SMP project.

Section 1 sets out the background to the project, the program for the work and describes the study area. It also introduces shoreline management planning.

Section 2 briefly sets out the approach adopted for the Scoping Phase.

Section 3 sets out the strategic context and policy background for the development of SMPs in Thames-Coromandel (further detail is provided in **Appendix 1**). It also discusses the proposed structure and objectives for the TCDC SMPs.

Section 4 covers the engagement undertaken for the Scoping phase and (in conjunction with **Appendix 2**) sets out the strategy for communication and engagement (including with Manu Whenua) going forward. It also covers the proposed governance process for the Thames-Coromandel SMPs.

Section 5 provides a summary of the geomorphology and coastal hazards that characterise the Thames-Coromandel shoreline and begins the process of compartmentalising the coast into useful management areas.

Section 6 summarises the proposed approach to the assessment of coastal hazards and risks. Full details are provided in **Appendix 3**. It also identifies proposed management areas, within coastal compartments, in **Appendix 4** and introduces the 'first pass' risk assessment undertaken for the Coromandel coast; presented in **Appendix 5**.

Section 7 provides a review of TCDC's coastal assets.

Finally, **Section 8** discusses next steps and maps out the proposed way forward. This includes the provision of an updated project methodology for Phase 2, where relevant, and recommendations.

References used are included in **Section 9**.

The Scoping Report has been drafted by RHDHV and their sub-consultants CMC and Tātaki.

2 Approach

In brief, the approach adopted for the Scoping phase was as follows:

1. Project inception. Development of a Project Plan and Program, including reporting protocols. Familiarisation and alignment of the project with TCDC's *Coastal Management Strategy* and *Coastal Hazards Policy* (both 2018).
2. Data collation, review and gap analysis. Relevant existing data, literature and assumptions were reviewed by the project team. Data gaps were identified (and where appropriate this involved "ground-truthing" through site visits) and assessment needs determined.
3. Review of the information held by TCDC on their coastal assets and the provision of recommendations on next steps.
4. Initial stakeholder and community engagement. Open community information exchange sessions were held at eight locations across the District in August 2019. These sessions introduced the team and the intent of the project and sought local knowledge and feedback on the key issues and the proposed approach through facilitated discussions. Meetings and conversations were also held with key project partners and stakeholders, including WRC, the NZ Transport Agency (NZTA) and DOC, Iwi, to facilitate their involvement in the Project and gather intelligence.

5. Information dissemination: A dedicated SMP webpage was established on the TCDC website and two SMP flyers were produced.
6. A District-wide survey, targeting the broader coastal community, has been drafted and will be undertaken during the 2019-20 summer. The survey will gather baseline information that will assist further communications and guide the development of community objectives.
7. Consideration of an appropriate project governance framework for the SMP process. This was discussed with TCDC's Elected Members, with WRC and at the community sessions. It will be developed further in conjunction with Council, Iwi and the Community Boards in the coming months.
8. Development of conceptual models to describe the key coastal processes that relate to the study area. This includes an overarching description of geomorphology of the Coromandel Peninsula and an assessment of the different characteristics and risks associated with the different coastal compartments.
9. Development of a conceptual approach to coastal hazard assessment, in line with MfE and WRC guidelines, and industry best-practice, for application to the Coromandel coastline. This describes how coastal hazards will be defined in the context of a risk-based 'dynamic adaptive pathways planning' (DAPP) approach.
10. First pass 'Risk Assessment'. Based on the data review and conceptual modelling, the risk of coastal erosion and inundation across the Thames-Coromandel Peninsula has been identified and classified. This is intended to enable the identification of the areas at greatest risk ("hotspots").
11. Development of the proposed approach to the next phase(s) of the SMP process.

3 Strategic Context

3.1 Introduction

All coastal land and waters in NZ are subject to a range of statutory and regulatory controls that regulate land and water use and provide for appropriate environmental management. **Figure 3.1** sets out some of the key natural hazards legislation and policy relevant to the production of SMPs for the Thames-Coromandel District. It does not show all relevant legislation and policy; this is detailed in **Appendix 1**. For example, it does not include the Marine and Coastal Area (Takutai Moana) Act 2011 or the Hauraki Gulf Marine Parks Act 2000 which covers the entire Coromandel Peninsula.

Appendix 1 summarises the key statutes and policy documents which affect the management of the TCDC coastline as this relates to coastal hazards. Its purpose is to inform stakeholders about the statutory and policy framework within which the project is being delivered. It highlights opportunities and constraints within which SMPs will be implemented.

It is important that the links between SMPs and existing legislation, plans & policy are explicit, so that the latter has appropriate 'weight' when coastal adaptation choices are being considered. This is a key element of our approach and requires appropriate governance mechanisms to facilitate it. The recommendations of SMPs will need reinforcement through statutory and non-statutory mechanisms like the District Plan, Regional plans, Local Government Act 2002 requirements, and policy incentives and disincentives, to facilitate sustainable adaption to coastal change.

3.2 National policy

3.2.1 The Resource Management Act 1991

The Resource Management Act 1991 (RMA) is the central piece of legislation governing management of the environment. The RMA is based on the principle of sustainable management and requires consideration of effects of activities on the environment, now and in the future, when making resource management decisions. The RMA sets out the framework for policy development at the national, regional and local level; as well as how these policies are implemented (e.g. through rules governing activities and resource consents).

Government has provided clear direction to local government regarding the management of risks from natural hazards and the effects of climate change. Amendments to the RMA in 2017 elevated the consideration of natural hazards to Part 2 (Section 6(h)) of the Act. Explicitly, this means that anyone exercising functions and powers under the Act must recognise and provide for the management of significant risks from natural hazards as a matter of national importance.

National policy on coastal hazard management and adapting to coastal change is provided by DOC and the MfE.

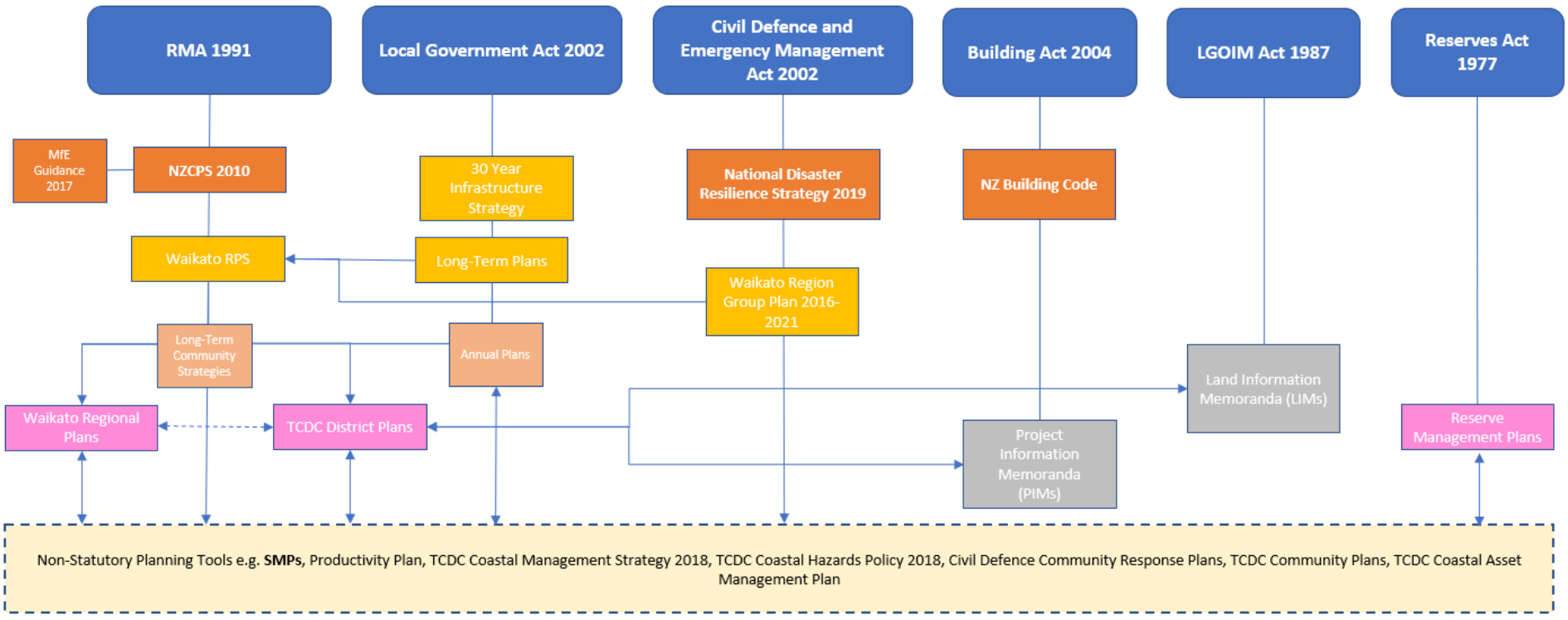


Figure 3.1 The hierarchy of the key natural (coastal) hazards legislation and policy relevant to the production of SMPs for the Thames Coromandel District

3.2.2 The NZ Coastal Policy Statement 2010

The current NZCPS came into effect in 2010 and sets clear national policy direction for managing natural coastal hazards and climate change in the coastal environment. All regional policy statements, regional plans and district plans are required to give effect to the NZCPS and 'avoid' adverse effects on outstanding landscapes and areas of outstanding natural character.

Objective 5 seeks to ensure that the management of coastal hazards is risk-based and takes account of climate change. It requires proactive management, including locating new development away from areas prone to such risks; the consideration of action/responses for existing development, including managed retreat; and protecting and restoring natural defences.

Policy 3 directs the adoption of a precautionary approach in relation to the use and management of coastal resources potentially vulnerable to the effects from climate change.

The focus of Policy 24 is on the identification of coastal hazards and assessing risk over at least 100 years, including the consideration of national guidance. Policies 25, 26 and 27 consider the avoidance of any increase in risk, discourage the use of hard protection structures, promote the use of natural defences against coastal hazards, and address the protection of existing development when avoidance is no longer an option.

3.2.3 The Ministry for the Environment's Coastal Hazards Guidance 2017

The MfE's *Coastal Hazards Guidance* (2017) supports councils to manage and adapt to the increased coastal hazard risks posed by climate change and sea-level rise. The DAPP approach promoted in the guidance differs to earlier approaches to coastal hazard management in two ways; namely in how it deals with uncertainty and risk, and by placing community engagement at the centre of decision-making processes. The MfE guidance provides advice on how best to assess the potential coastal risks from climate change, and how to help determine possible response options. The outputs from this process are a long-term strategic plan and decision-making framework for coastal areas affected by coastal hazards and climate-change effects. The MfE's 10-step process is iterative, so that responses can be reviewed and adapted as monitoring determines – for example, if new information becomes available.

3.3 Regional policy

3.3.1 Introduction

WRC has a statutory role to play under the RMA and the Civil Defence and Emergency Management Act 2002 in managing natural hazards. Under sections 30 and 62 of the RMA, regional council functions include the control of the use of land for the purpose of avoiding or mitigating natural hazards. The Regional Council is also required to prepare a Regional Policy Statement (RPS) (which all Regional and District Plans must give effect to) and a Regional Coastal Plan (which covers the entire Coastal Marine Area of the region).

3.3.2 Waikato Regional Policy Statement

The Waikato RPS (2016) requires territorial authorities to be responsible for the control of the use of land to avoid or mitigate natural hazards, except where the WRC retains control in respect of:

1. structures in *primary hazard zones* (see the final paragraph of this section); and
2. the control of the use of land in the *coastal marine area* and the beds of lakes and rivers.

Objective 3.24 (Natural hazards) of the Waikato RPS seeks to manage the effects on communities and the environment by increasing community resilience, reducing risk and enabling recovery from hazard events. Policies 4.1 and 4.2 seek to manage the effects of natural hazards by adopting an integrated and collaborative approach. Other associated policies include:

- that coastal development occurs in a way that provides for setbacks (for both new and existing development), allows for the potential of sea level rise including landward migration of coastal habitats, and avoids increasing risk in coastal area (Policy 6.2);
- that a natural hazard risk management approach be taken that ensures risk does not exceed acceptable levels, prefers use of natural features over manmade structures for defence, and uses best available information and practice (Policy 13.1);
- that subdivision, use and development are managed to reduce the risks from natural hazards to an acceptable or tolerable level (Policy 13.2).

The RPS refers to collaboration with territorial authorities to develop long term adaptive management strategies with potentially affected communities (Policy 13.1 and Method 13.1.3).

3.3.3 Regional Hazards

WRC has a particularly thorough body of work in relation to coastal hazards including:

- The Coastal Inundation Tool which identifies areas that may be subject to inundation across the region, particularly with reference to sea level rise (SLR). It is not designed to provide specific property data (for example, to inform minimum floor levels); rather provide a snapshot of potential inundation.
- The Waikato Regional Hazards Portal which is intended to improve access to hazard information, and aims to help the public, local authorities and others make informed decisions about their exposure to natural hazards. The Portal collates available spatial hazard information into a GIS viewer.

Of particular relevance here, in 2002, the WRC produced *Development Setback Lines for Coromandel beaches* which specified two lines along the coast identifying land at risk from coastal flooding and erosion under existing conditions, and in 100 years. These were recommendations provided to both Hauraki and Thames Coromandel District Councils to help them plan for future coastal development, with the aim being that buildings are set back far enough from the sea to avoid any danger from coastal erosion or flooding – thereby avoiding the need for coastal protection structures. SMPs should inform TCDC's use and the identification of these zones, with a view to identifying PHZs and RHZs as required by the Waikato RPS.

The RPS (6.2.4) makes explicit provision for regional (and district) plans to identify circumstances where existing development along the coast is to be relocated to avoid natural hazards, including the projected effects of climate change. This must be tied back into primary hazard zone identification and the development of *Long-Term Community Strategies* promoted in the RPS. These strategies need to consider and address the implications of allowing development in residual risk zones. SMPs will, therefore, contribute to the delivery of the strategies by identifying primary hazard zones for communities (based on an understanding of what intolerable risk means in each case).

3.4 District policy

3.4.1 Thames Coromandel Proposed District Plan

The *Thames Coromandel Proposed District Plan* (PDP), which has been under development since 2012, gives effect to the NZCPS, the Waikato RPS and Regional Plan and adopts a risk management approach to coastal hazards. Section 10.1.2 provides direction on the assessment of risk as *acceptable, tolerable or intolerable* and, of particular note, are two mapped 'coastal risk' lines. The Current Coastal Erosion Line (CCEL) identifies the current erosion risk; where land seaward of the CCEL is currently at risk, with a 1% chance of a coastal erosion event per year. Building seaward of the CCEL is not permitted, however, reasonable use of existing lots is provided for where the risk is tolerable (Thames Coromandel PDP 34.5.2).

The Future Coastal Protection Line (FCPL) defines the area potentially at risk from erosion in the next 100 years, should sea level rise as projected (in this case, according to the PDP, a 0.9m SLR relative to 1990 levels). The aim of this line is to avoid additional cost or risk for future generations by avoiding more intense residential use or the location of key community assets in this area. Any resource consent must demonstrate how it will deal with the future erosion risk. Both the CCEL and FCPL will be reviewed as part of this project and refined or updated as necessary based on the more detailed coastal hazard assessment work to be undertaken (see **Section 6**).

The Thames Coromandel PDP also includes rules around where one can build/undertake activities in relation to flooding risk, tsunami and flood risk defences. This can include requiring a minimum floor level for buildings in a flood plain and requiring specialist reports on identified hazards and how these can be mitigated. SMPs will help to inform appropriate floor levels in the future but will not define floor levels. This is because the analysis will not be of sufficiently high resolution (at this stage) to allow floor levels to be defined to the level of accuracy required for individual properties.

3.4.2 Thames Coromandel Long-Term Plan

The Council's latest Long-Term Plan (for 2018-2028) includes a clear focus on ensuring that Council infrastructure and assets are maintained and risk from coastal hazards and climate change are considered. TCDC has committed to test all major new infrastructure and asset renewals against a potential SLR of 1.4m by 2120 up to a rise of 1.88m by 2150 (TCDC Long-Term Plan 2018-2028, p.10).

3.4.3 Thames Coromandel Coastal Management Strategy and Hazards Policy

As stated in **Section 1.1**, the *Thames Coromandel Coastal Management Strategy 2018* and the *Thames Coromandel Coastal Hazards Policy 2018* provide the context for coastal climate adaptation, risk management, levels of service and the sustainable management of coastal resources in the Thames-Coromandel district.

3.5 Shoreline Management Plans

3.5.1 Principles

The Thames-Coromandel SMPs will be non-statutory policy documents to guide coastal adaptation. They will take account of other existing planning initiatives and legislative requirements and inform wider strategic planning. That is, as illustrated in **Figure 3.2**, by adopting a coastal 'systems-based approach' in line with overarching (National, Regional and District) policy requirements, 'asset management plans' can be derived for relevant sections of the coastline ('coastal compartments'); and reflect the need to respond and adapt to change.

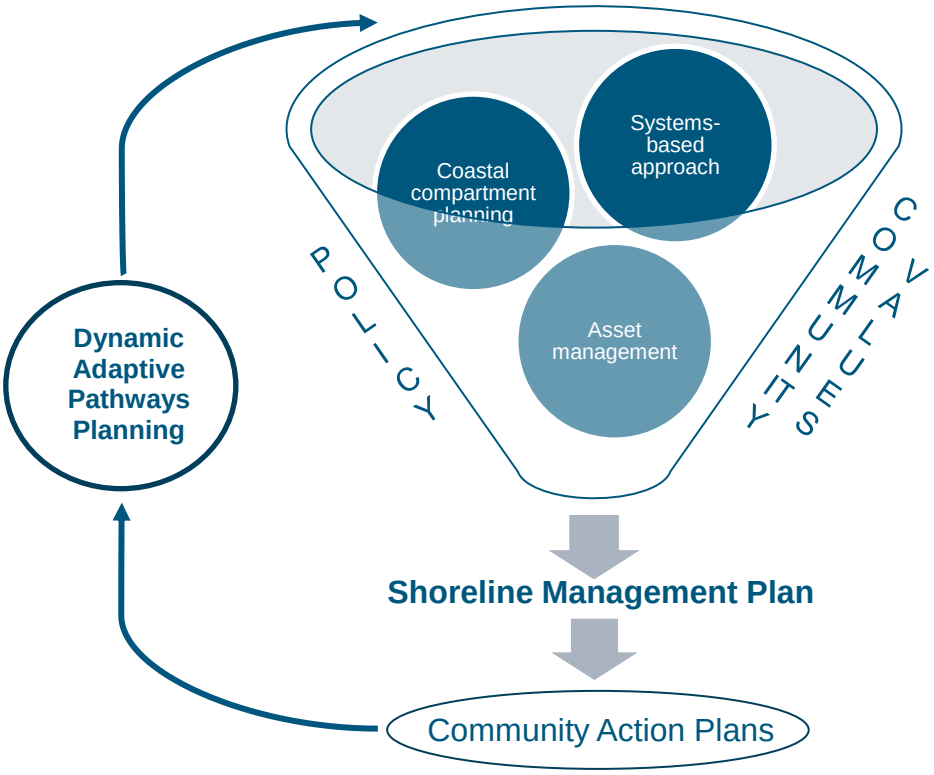


Figure 3.2 Schematic on the derivation of community based, adaptive shoreline management plans

SMPs will promote management policies for a coastline into the 22nd Century that achieve long-term objectives without committing to unsustainable defences. It is, however, recognised that, due to present day objectives, wholesale changes to existing coastal management practices may not be appropriate in the short-term. Consequently, SMPs will provide a 'route map' – proposed objectives, policy and management changes – to enable decision makers and the

community to determine where to place different coastal compartments on the risk continuum and how to move from the present situation towards the future.

In setting out an approach to management, SMPs must identify the various levels of risk, management options and associated costs. Some options will not be viable because they would lead to problems linked to sustaining defences in the future. In such areas, the SMP will highlight this challenge and attempt to resolve barriers to, and opportunities for, implementation.

3.5.2 Structure

For the Thames-Coromandel District it is recognised that, while there are coastal issues in common across the peninsula, there are locally specific issues that may work against generic solutions. Given this, it is proposed that several SMPs will be developed for different, unique stretches of the Coromandel shoreline; that is, different 'coastal compartments' (see **Section 5.1**). These SMPs will be guided by a set of overarching core principles and guidelines to provide consistency in the approach being taken to the management of coastal hazards.

The SMPs developed may combine more than one coastal compartment, where appropriate (for example, combining the East coast islands with the coastal compartments covering the adjacent coast; or combining the Ōpoutere-Onemana and Whangamatā coastal compartments), and may not necessarily follow existing institutional or government boundaries, but they will underpin coastal management decisions.

Each SMP will:

1. Identify what is at stake and why it is important.

2. Set specific objectives for the management of the coastal environment based on the unique characteristics and value of its shoreline.

3. Consider a number of different future scenarios regarding how the coast and communities may change.

4. Be action-oriented and clearly link the actions of today with those we might need to take in the future.

5. Work through viable solutions for coastal management and plot a course towards these solutions, but in a manner that enables a change of course if monitoring determines this to be necessary.

It is also relevant to reinforce the fact that SMPs will be produced for the whole of the Thames-Coromandel District and for all 'coastal assets' (see **Section 7**), be they man-made features (stop banks and rock revetments) or natural features (dune systems and mangroves), and irrespective of their ownership (i.e. TCDC and non-TCDC (NZTA, DOC, WRC etc.) assets).

3.5.3 Objectives

The high-level, generic objectives for the Thames Coromandel SMPs, that derive from the policy and principles set out above, are:

- To better understand our coastal environment, its process interactions and social, economic and cultural context, and the physical and climate changes that will affect it.
- To define and reduce the coastal flooding and erosion risks to people and the social, cultural and natural environment over the next century.
- To reduce the threat of coastal flooding and erosion to people, property and valued assets to an acceptable or tolerable level.
- To encourage the provision of sustainable flood and coastal defence measures.
- To discourage inappropriate development in areas at risk from flooding or coastal erosion.
- To produce resilient coastal communities that are prepared for change and aware of the appropriate risk reduction measures they can take, consistent with the principles of sustainable development.

Specific coastal management objectives will be set for each of the Thames-Coromandel SMPs in Year 2 of the project (Phase 3).

4 Communication and Governance

4.1 Communications and Engagement

4.1.1 Introduction

A key component of the Scoping Phase was the development of a 'living' *Communications and Engagement Strategy* (CES). This strategy – summarised in **Appendix 2** – sets out the key elements of the proposed approach for communicating and engaging with the diverse communities across the Coromandel Peninsula during the next three years.

The 2017 MfE guidance on adapting to coastal change advocates a risk and vulnerability-based approach. Central to this is the issue of how to deal with the consequences of coastal change felt by communities. Through the learnings from previous coastal hazard management projects (e.g. in Kāpiti and Christchurch), it is now firmly established that community engagement and collaboration lie at the heart of a successful step-by-step process to planning, managing, monitoring and reporting on the compounding risks facing coastal asset managers and coastal communities.

Adapting to coastal hazards, exacerbated by sea level rise, will require individuals, whanau, communities, businesses, infrastructure and utility providers, and governments to make hard choices about an uncertain future. Different interests, expectations, values and world views may result in a lack of consensus. In addition, the impacts of sea level rise and the consequences of coastal risks and solutions will not be the same for everyone. For these reasons, effective community engagement will play a central role in developing SMPs and Action Plans that can successfully allow adaptation to coastal change.

Furthermore, the NZCPS provides explicit recognition of the foundational role Manu Whenua have as Kaitiaki of the coastal environment.

4.1.2 The Strategy

Key to meeting the Project's engagement goals is consideration, and appropriate use, of scale. The Thames Coromandel District has over 400km of coast, a diverse coastal environment with direct and indirect connections between land and sea, and settlements and landscapes characterised by diverse values. A "one-size-fits-all" approach to communications and engagement will not work.

In addition, engaging with a community defined by their proximity to coastal hazards or with an active concern in coastal management could unnecessarily narrow the scope of engagement and exclude some voices. This could lead to uninformed decisions, a deficit of public support and ultimately unsuccessful SMP policy implementation. To overcome these challenges, the CES seeks to engage at multiple scales, in different places and at different times. That is, engagement in particular locations will occur in tandem with attempts to involve the wider community.

Therefore, the approach to communications and engagement for the Project will be tailored to the particular audience at the appropriate scale. Essentially, it will have two parts, working at different scales. They are:

Part A – District-wide communications, where the key methods employed will be aimed at sharing information and compiling and providing feedback, including:

- Our Coast newsletters/e-newsletters, media and social media.
- SMP webpage development.
- Fact sheets.
- A District-wide summer survey.
- Citizen science initiatives.

Part B – Place-based community engagement, where the key methods employed will aim to bring people together through:

- Deliberative dialogues, workshops and Coastal Panels (see **Section 4.2**).
- Drop-in sessions, public meetings and events.
- Targeted meetings with existing groups.

4.1.3 Scoping Outreach

As part of the Scoping process, eight community information meetings across the District were held in August 2019[3]. More than 220 people attended the meetings, which provided an introduction to SMPs, why TCDC is developing them and how communities can get involved. Community concerns, ideas and historic knowledge were brought to the table. These meetings were initial information sessions, aimed at introducing the project and gauging community interest in the coastal environment. The slides used for the presentations are available at tcdc.govt.nz/coastal. A Facebook live session was also held which, to date, has had over 2500 views (available on the TCDC Facebook page).

Community information meetings held during August 2019

- **Thames:** Thames Civic Centre - Monday, August 12, 12:30pm-1.30pm
- **Te Puru:** Te Puru Community Hall - Monday 12 August, 5:30pm-6.30pm
- **Colville:** Colville Community Hall - Tuesday 13 August, 5:30pm-6:30pm
- **Coromandel Town:** TCDC Coromandel Service Centre, 355 Kapanga Rd, Coromandel Town - Wednesday 14 August, 12:30pm-1:30pm
- **Kuaotunu:** Luke's Kitchen - Saturday 17 August, 9:30am-10:30am
- **Whitianga:** Whitianga Town Hall - Saturday, 17 August, 12:30pm-1:30pm
- **Tairua:** Tairua Country Club - Saturday 24 August, 10:30am-11.30am
- **Whangamata:** TCDC Whangamata Service Centre, 620 Port Rd, Whangamata - Saturday 24 August, 2pm-3pm

Photo: Shoreline Management Plan community meeting in Tairua, August 24, 2019

[3] *open invitations to events were published via the TCDC newsfeed and newspaper articles*

A thorough stakeholder mapping exercise has begun and will be completed in conjunction with confirmation of the project governance framework (see below) early next year. This will identify individuals, groups and organisations with an interest in the coastal environment at different scales.

4.1.4 Iwi engagement

4.1.4.1 Te Ao Maori

Māori have a deep, intimate and holistic relationship with te taiao (the environment and its resources), with a valuable knowledge base – called mātauranga Māori – developed over generations of cultural practice. The Māori world view acknowledges a natural order where all aspects of life (both human and natural) are in harmony. The interconnectedness of all elements (physically and spiritually) are expressed in the Māori world view through their whakapapa and the interdependencies of all living things. Māori beliefs, customs and values are derived from a mixture of cosmology, mythology, religion and anthropology, and are conveyed in the stories of the origins of the universe, the Atua (gods) and Māori. It is these sources of knowledge and wisdom that underpin the concepts and relationship Māori have with the environment and the coast.

4.1.4.2 Māori values

Māori values are derived from a traditional belief system based on mātauranga Māori. Values can be defined as instruments through which Māori make sense of, experience and interpret their environment. They form the basis for the Māori world view (te ao Māori) and provide the concepts, principles and lore Māori use to varying degrees in everyday life, and often to form ethics and principles. This can govern responsibilities and the relationships Māori have with the environment and the way they make decisions. Some important Māori values include: tikanga (customary practice, values, protocols); whakapapa (ancestral lineage, genealogical connections, relationships, links to ecosystems); tino rangatiratanga (self-determination); Mana Whenua (authority over land and resources); whānaungatanga (family connections); kaitiakitanga (environmental guardianship); manaakitanga (acts of giving and caring for); whakakotahitanga (consensus, respect for individual differences and participatory inclusion for decision-making); arohatanga (the notion of care, respect, love, compassion); and wairuatanga (a spiritual dimension). Māori values provide a basis for (under guidance from Iwi) what is valued and significant (i.e. taonga, wāhi tapu important habitats and species) and for prioritisation.

4.1.4.3 Kaitiakitanga

Māori tikanga (practise) is embedded in whakapapa (relationships) with the Atua (Māori gods), Papatūānuku (earth mother), Ranginui (sky father) and their children, including Tāwhitimātea (wind, weather and climate) and Tangaroa (oceans). All of whom are the progenitors of the natural world and its domains. Kaitiakitanga is based on the mātauranga Māori, which can be place based and includes Iwi/hapū ecological knowledge and pūkenga (environmental experts). Iwi, hapū and whanau of Hauraki are the kaitaiki (caretakers) and have the mana to manaaki (care for) and tiaki (protect) the physical and spiritual well-being of the taiao (environment). They are charged with the responsibility to safeguard and manage natural resources for present and future generations.

4.1.4.4 Coromandel Iwi

On 1 October 2010, the Hauraki Collective signed a framework agreement with the Crown setting out the broad parameters of a settlement of all historical Hauraki Treaty of Waitangi claims. The Hauraki Collective is made up of the following Iwi:

- Ngāi Tai ki Tāmaki;
- Ngāti Hako;
- Ngāti Hei;
- Ngāti Maru;
- Ngāti Pāoa;
- Ngāti Porou ki Hauraki;
- Ngāti Pūkenga;
- Ngāti Rahiri Tumutumu;
- Ngāti Tamaterā;
- Ngāti Tara Tokanui;
- Ngāti Whanaunga; and
- Te Patukirikiri.

The above Iwi are the Hauraki Iwi recognised by the Waitangi Tribunal. They are the Iwi involved with the Hauraki settlement process which is currently being negotiated. There are a further four Iwi who claim Mana Whenua over areas of the Thames Coromandel District, who have not been recognised by the Crown in terms of the settlement process

As a result of the history of tribal conquest and the existing claims of Manu Whenua and mana moana, tension exists between some Iwi. This requires specific acknowledgment and careful consideration as part of the project, as Iwi interactions will be based on an Iwis' claim as Manu Whenua and will dictate which Iwi groups will be prepared to work with other Iwi. In addition, the status of an Iwi's Treaty settlement claim will also have bearing on the willingness of Iwi to engage in Council projects; particularly where the project includes issues or interests relevant to Iwi that may overlap with Treaty negotiations and deeds of settlement.

Based on this understanding, during the Scoping Phase the project team collaborated with TCDC's Iwi Liaison Team to determine how best to organise hui to enable Iwi to engage in the project.

4.1.4.5 Project-based communications with Iwi

To facilitate hui, an information package was designed - consisting of a one-page information sheet and companying email - to provide Iwi with background to and advanced notice of SMPs and a pending invite to initial hui. The intention of which was to provide Iwi with background on the project and to demonstrate commitment to and the importance of Iwi's contribution to the

development of SMPs. In addition, initial hui where to provide Iwi with an opportunity to ask and raise questions where more clarification and/or certainty was sought.

The email, which was sent to representatives of all the respective Iwi groups, generated several responses from a range of Iwi. For the most part these responses were positive and expressed a willingness to engage. However, email responses were also received that raised questions regarding why Manu Whenua and Iwi were only being contacted now and not during the project planning phases; and on how SMPs relate to the Marine and Coastal Act 2011 (Takutai Moana) and harbour negotiations (natural resources redress), and other management plans.

Upon receipt of these emails, individual conversations were had with various Iwi representatives to provide an overview of the SMP Project and to communicate the Projects' commitment to undertake meaningful engagement with Iwi. These conversations were also a valuable opportunity to understand the range of issues Iwi raised in respect to the project and TCDC's engagement with Iwi (both present day and historically).

Some of the main concerns Iwi have relate to the SMPs and/or TCDC's relationship with Hauraki Iwi, specifically:

- Council has not undertaken meaningful engagement with Hauraki Iwi to date.
- Historic grievances around land confiscation and/or poor land management decisions; including the cancellation of projects or projects not delivering Māori outcomes.
- Iwi are focused on Treaty Settlements and are unsure how the SMP Project will influence those future planning processes.
- What will future governance structures and arrangements with Iwi look like?

4.1.4.6 Strategy moving forward

TCDC proposes to initiate dialogue with Iwi to develop and strengthen relationships and to explore future co-governance arrangements with the new October 2018 Council. These conversations and the resulting (relationship building and governance related) outcomes will be highly influential for subsequent Iwi engagement as part of the project.

While TCDC is undertaking the above process, the RHDHV Consortium proposes to continue to have kanohi ki te kanohi (face to face) conversations with Iwi, for the sole purpose of providing information/background on the scope of the SMPs. We will use this opportunity to further our understanding of how Iwi would like to be engaged and what processes Iwi are involved in that potentially could assist in the delivery of SMPs within the context of other plans and organisational arrangements as a consequence of Treaty settlements.

The project team need to be guided by Iwi and TCDC:

- To determine how we can best work with Iwi to deliver and take a strategic approach to SMPs and related planning processes that Iwi are central to (e.g. Waihou, Piako and the Coromandel Catchment Authority), in order to find synergies and leverage established expertise.

- Regarding how best to proceed with korero with Iwi on progressing the project. It is of central importance that Iwi feels comfortable in being actively involved and included.

4.2 Project Governance

In developing SMPs, communication and coordination between the various arms of Council, Manu Whenua, other agencies and communities will be critical, and will require appropriate project governance.

A bespoke and inclusive approach to governance needs to be developed for the Thames-Coromandel SMPs in conjunction with TCDC and WRC, Iwi/hapū, Community Boards and key stakeholders such as the NZTA and DOC. This approach was successfully trialled in the development of the *Clifton to Tangoio Coastal Hazard Strategy 2120* in the Hawkes Bay and is being implemented by WRC and HDC in the *Kaiaua 2120* project. The Hawkes Bay strategy was founded upon a strong partnership between the Hawkes Bay Regional Council, District and City councils and Manu Whenua. Key stakeholders (like Ports of Napier) were also involved and community panels were established along the coastline to improve knowledge exchange and recommend actions to decision-making authorities.

For stakeholder, Community Board and Iwi/community collaboration in the Thames-Coromandel SMPs, it is proposed that 'Coastal Panels' are established for each SMP. Further details of proposed specific roles to be fulfilled on these panels will be provided in a report to Council on project governance in the new year. Further details on the proposed constitution of, including the development of Terms of Reference, and process for the Coastal Panels are provided in **Appendix 2**. A separate process for getting Iwi membership on these panels will also need to be developed. The proposal is that Coastal Panels, informed by natural hazard and coastal science experts, would test options and develop proposals for SMP policy and Community Action Plans. That would be considered the Elected Managers.

In addition, the 'coastal activity coordination meetings' that have been initiated between TCDC and WRC, should be formalised and a joint Technical Working Group (TWG) established to ensure consistency and alignment in the development of SMPs, for example with the Regional emergency management framework, RPS direction, the Regional Coastal Plan, the PDP and Iwi liaison, and provide natural hazards and coastal science expertise.

It is proposed that Manu Whenua and WRC will each nominate one or two senior officers to sit on the TWG, who would coordinate internal resources and communications for their organisation. This group would likely meet bi-monthly, or as required, and provide advice to both the Project Partners (and elected representatives) and the Coastal Panels. It is envisaged that additional key stakeholders would be invited to join the group as required, e.g. NZTA, DOC, Hauraki District Council, Pare Hauraki and so on. The TWG and the Coastal Panels would be supported by the SMP Project Office[4].

[4] The SMP Project Office constitutes the TCDC Project Lead (Mohammed Imtiaz), Project Manager (Amon Martin), a Governance representative (Joanne Cook-Munro) and a Communications representative (Georgina Bond), alongside the RHDHV Consortium. TCDC's Coastal Engineer (once appointed) will also join this group.

The proposed project governance framework is set out in **Figure 4.1**. The TWG would oversee the SMP programme and make recommendations to the respective decision-making authorities vis-à-vis the adoption of the policy recommendations and their reflection in District and Regional Plans, as appropriate, and Iwi Management Plans.

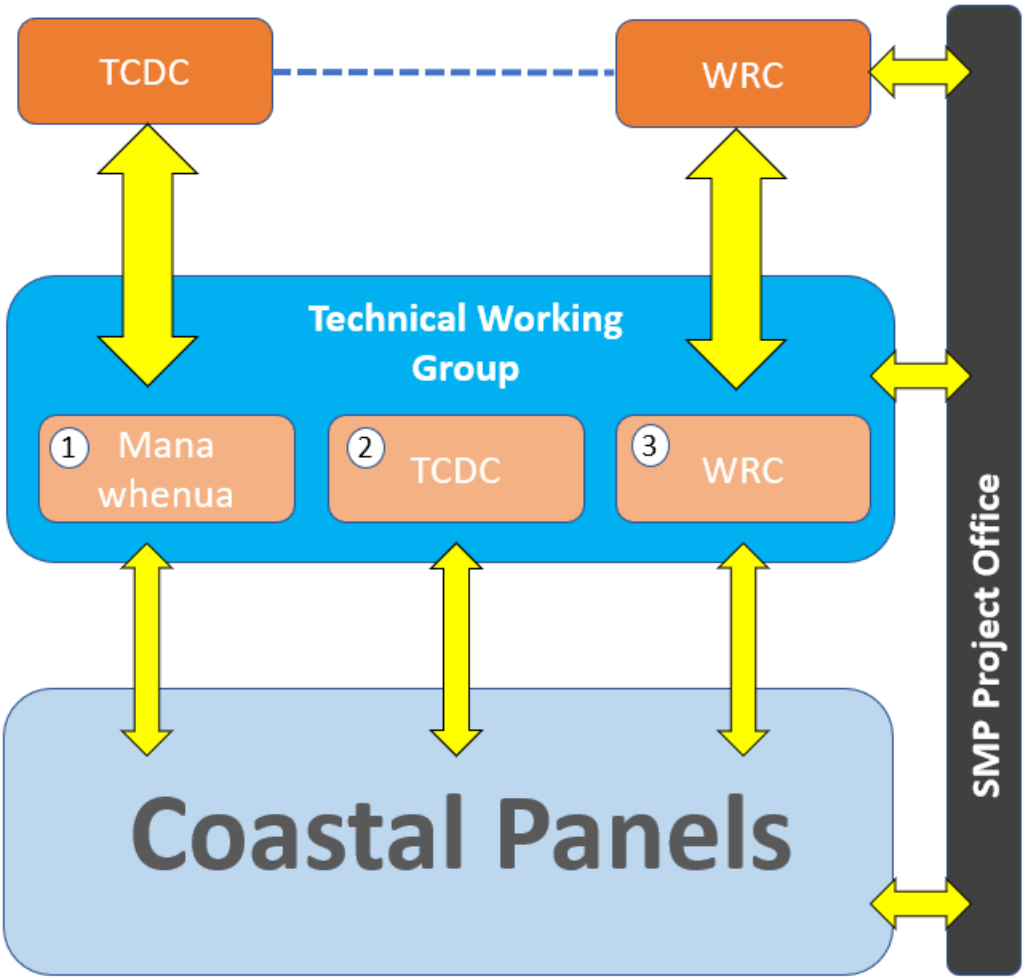


Figure 4.1 Proposed Project Governance Framework

As noted above, the proposed framework for project governance will be the subject of further reporting as suitable arrangements are confirmed with the Project Partners. It will need to be formally adopted by TCDC/Iwi (and WRC) to ensure the SMPs have the appropriate mandate and required legitimacy to stand the test of time. For TCDC it is proposed that a report is presented to Council in early 2020.

5 Conceptualisation of the coastline

5.1 Introduction

In this section the coastal processes that characterise the Thames-Coromandel SMP study area are described based on a desk-based assessment and site visits. An overview of the Coromandel Peninsula is provided in **Section 5.2** and further detail of the coastal compartments in **Sections 5.3 onwards**. Focus is placed on selected compartments where more information is available and / or where the behaviour of the coast in terms of processes and geomorphology is more critical to the development of the SMPs.

To assist in the process of shoreline management planning, the coast has then been divided up into these compartments largely based on coastal character and processes (shown in **Figure 5.1** and described in **Table 5.1**). **Coastal Compartments** are zones within which relatively unique coastal process interactions/landforms and community values can be captured.

In concept, recognising the different levels of coastal process interaction and interdependency across the Coromandel, shoreline management should be considered for the whole area. However, while it is important to recognise the broader scale interactions, this would be impractical and not fully necessary for developing and considering specific management approaches at the local level. The aim of compartmentalising the shoreline is to provide more manageable areas, within which the character of the coast (whether it be physical coastal processes or coastal features (e.g. settlements, infrastructure, assets, environment, values) or both) and its essential qualities and values are captured. The intension of this approach is to allow the main broader scale context to be captured, while enabling the process to focus on areas requiring specific management approaches.

In implementing this approach, although Coastal Compartments are fundamentally based on differences in geomorphology, they have also been identified based on other aspects, such as settlements, infrastructure and environment. This division of the coast is less based on the similarities but rather based on maintaining essential qualities and reflecting important interactions and interdependencies within each compartment.

The boundary of Coastal Compartments are typically significant features, such as a rocky headland. This typically marks the boundary of a geomorphological unit and makes management of these compartments logical.

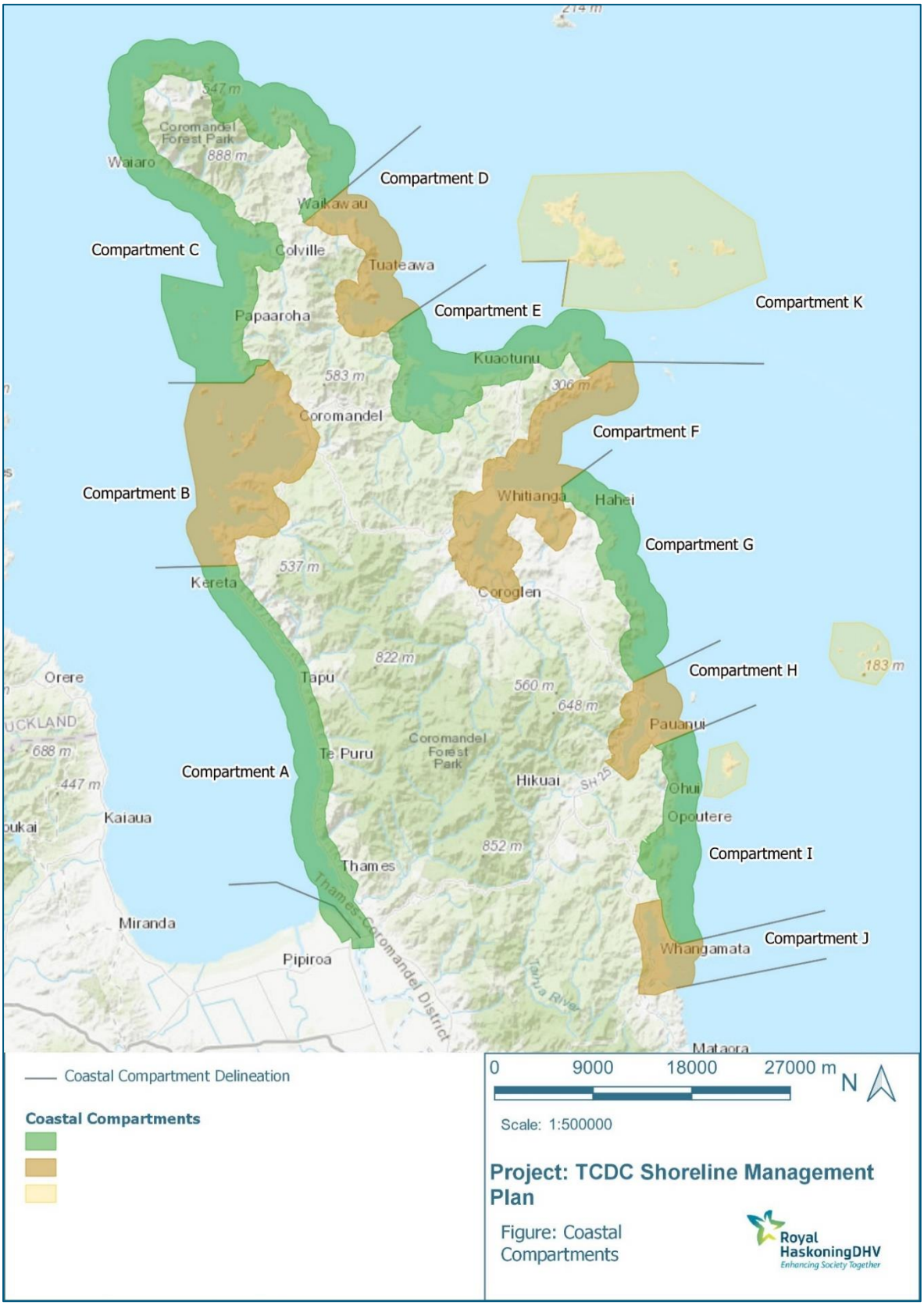


Figure 5.1 Proposed Coastal Compartments

Table 5.1 Summary description of proposed Coastal Compartments

	Coastal Compartment	Geomorphology	Coastal processes
A	Thames coast	Relatively narrow developed coastal strip opening to wide coastal plain at its southern end. Naturally constrained but erodible shoreline with shallow embayments and local fluvial deltas.	Relatively low exposure shoreline with more significant influence of tidal surge. Narrow upper beach sediment movement with increasing siltation at the southern end.
B	Coromandel coast	Enclosed sheltered bays with local remote communities at the open coast. Strongly constrained coastline with deep embayments.	Low wave exposure, with narrow upper beach areas and larger areas of siltation.
C	Colville and Northern bays / Moehau	Strongly constrained coastline with local bays and flooded valleys.	Increasing wave exposure, with locations with wider beaches but generally narrow beaches within sheltered valleys.
D	Northwest bays	Major undeveloped bay and barrier systems with low-lying plains, incised into a strongly controlled hard coastline.	Higher wave exposure, exposed to significant swell, with significant areas of beach sediment movement and spits.
E	Whangapoua harbour and coast	Major developed open coast bay system controlled locally by hard headlands.	Moderate wave exposure, exposed to swell, with significant sediment supply and movement.
F	Mercury Bay / Te-Whitianga-a-Kupe	Major developed bay system and large low-lying plains, controlled locally by hard headlands.	Relatively sheltered direct wave exposure, with significant exposure to swell. Relatively stable bay shapes with local variation.
G	Te Whanganui-A-Hei	Predominantly hard rock coastline with local open bays.	Higher wave exposure, exposed to significant swell, with significant local areas of beach sediment movement.
H	Tairua-Pauanui	Major developed bay and barrier beach systems, with large low-lying plains, controlled locally by hard headlands.	
I	Ōpoutere-Onemana	Predominantly hard rock coastline with major barrier beach and dune systems.	Higher wave exposure, exposed to significant swell, with significant sediment supply and beach movement.
J	Whangamatā	Developed barrier beach system between estuaries, influenced by nearshore islands.	Higher wave exposure, exposed to significant swell, with significant sediment supply and beach movement.
K	East coast islands	Largely undeveloped islands.	

5.2 General Character

5.2.1 Preamble

The character of the Coromandel Peninsula differs markedly between the east coast and the west coast, with the northern section of the coast (north of Coromandel around to Waikawau Bay) spanning both east and west coast environments and effectively forming a unique zone in its own right. Given this, it is convenient to describe the general character of the peninsula based on these three general geographical areas.

5.2.2 West Coast

The Firth of Thames, comprising the majority of the west coast of the peninsula, comprises a major area of muddy coast, with deep Holocene mud deposits offshore, broad intertidal mud deposits and a well-developed shelly chenier ridge plain (Healy, 2002). The southern section of the west coast, from Thames through to Kereta and on to Wilson Bay, where the main road cuts in land, consists of relatively narrow sand and gravel beaches, with some areas of exposed rock at the shoreline. These narrow beaches are fronted by wide intertidal flats.

Most of these narrow beaches along the margin have limited sediment reserves, though occasional, small stream-mouth alluvial gravel fan deltas prograde into the Firth along the Thames Coast. These numerous deltaic fans exhibit the ability to fluctuate between erosion and accretion, particularly in relation to the location of the stream mouths. The general trend of the deltaic fans has been a north-westward movement of the river channel over the last 100 years, with associated erosion to the north and accretion to the south (WRC, 2002).

The far south of this area, including Thames and the area to the south of Thames, is backed by low-lying land and generally fronted by a band of mangroves several hundred metres wide.

Further north, the shoreline, while typically exposed to the same offshore tide and wave regime, tends to be more indented, with the presence of islands and ridges running seaward, forming large bays. The largest of these being Coromandel Bay. These areas still exhibit typical west coast characteristics, being relatively sheltered in terms of wave climate, with a significant amount of fine sediments, and mangroves of saltmarsh giving way to low lying land within river valleys.

The wave climate is dominated by short-period, low amplitude wind waves (Allison, 2014), prevailing from the SE and SW. Waves are fetch-limited by the Coromandel and Hunua Ranges, and Hauraki Plains (Dravitzki, 1988). Tidal and longshore currents are generally minor, due to the low-energy regime (Allison, 2014). Rare storm surges with a northerly swell are amplified by the semi-enclosed shallow embayment of the Firth of Thames (Schneider, 2010) and can include cyclones (e.g. Drena (January 1997), Bola (March 1988)).

5.2.3 Northern Coast

Moving north from Coromandel, the wave exposure tends to increase, and the coast line is characterised typically by harder rocky shorelines with very little by way of a beach.

Within this general hard rocky character, this relatively remote section of the peninsular contains several inlets or coves. The most notable being Colville Bay, where the shoreline cuts back sufficiently to create sandy bays within the valleys of the Whangaahei and Kairaumati, around to the main muddier valley of the Umangawha, within which Colville sits. Further around the coastline there are other distinct coves such as Port Jackson and the steeper valley inlet of Port Charles.

These areas are quite distinct both in terms of coastal processes and their development.

5.2.4 East Coast

The east coast is located on the tectonically active margin of the Australian and Pacific Plates and forms the east part of the Coromandel Peninsula; an uplifted horst block feature, down-tilted to the east and composed on Tertiary volcanics overlying an indurated Jurassic sedimentary basement (Skinner, 1976). Pleistocene and late Quaternary tephra deposits also thinly mantle extensive areas of the Peninsula, largely originating from volcanic centres in the central North Island (Hogg and McCraw, 1983).

The coastline is steep and rocky and characteristically indented by embayments, typically associated with barrier beaches, and small pocket beaches which front a relatively narrow continental shelf, approximately 20-30km in width (Bradshaw *et al*., 1991). The embayments possess compartmentalised sandy littoral drift systems, some of which are quite extensive, and contain extensive Holocene dune ridge sandy barrier progradation systems. A number of small, shallow tidal estuaries also occur along the coast in drowned river valleys impounded by Holocene sandy dune ridge barrier spits (e.g. Pauanui, Matarangi), which have been in place since the late Holocene.

The typically hilly catchments and active erosion of the soft Tertiary lithologies means that these drowned river valleys have to a large extent become infilled with sediment, so that the harbours and estuaries lagoons are typically shallow and display extensive intertidal flats. The rate of such infilling has typically increased post human settlement (WRC, 2008).

Located on a lee shore in a mid-latitude zone of dominant westerly winds, the coast is sheltered from persistent waves and swells generated in the Tasman Sea (Harris, 1985; Hilton, 1990; Bradshaw, 1991); hence the term lee coast. The wave climate is primarily a mixed storm and swell wave environment; with swell waves generated by subtropical disturbances north of New Zealand and storm waves generated by onshore winds associated with local weather patterns (Pickrill and Mitchell, 1979). Predominant wave directions range from east to north (primarily from the northeast) and are dominated by low refracted swell waves of T_7‑9 s and H_0.5‑1.0 m (Healy, 2005).

Tides along the coast are essentially semi-diurnal and microtidal, with spring tide ranges typically 1.5 m on the open coast, though slightly amplified (1.62 m) in Mercury Bay (Harris, 1985; Smith, 1980).

The surfeit of sand on this coast is derived from the adjacent volcanic zone to the south, having been brought to the coast during the Pleistocene, and reworked across the shelf during the Holocene post-glacial transgression, with continuous additions from some of the larger rivers (Environment Waikato, 2002).

The beach and dune barrier systems of the eastern Coromandel have been variously classified (Healy, *et al*., 1981; Abrahamson, 1987; Bradshaw, 1991). However, as noted by Bradshaw (1991), they can essentially be subdivided into:

- Medium-large foredune barriers (e.g. Whangamatā, Pauanui, Cooks Beach and Whitianga, composed of foredune plains up to 2.8km wide, attached to the mainland at their basal ends and enclosing moderate-sized estuary systems; and
- Pocket barrier beach systems (e.g. Hot Water Beach, Kennedy Bay), which occur in small embayments, on steep rocky coasts (Bradshaw, 1991). These systems are fronted by steep-faced, medium coarse-grained pocket beaches (Healy and Dell, 1987), which tend to be more reflective than dissipative beach systems.

While onshore supply from the continental shelf has been the dominant sediment source for the major barriers, modern fluvial supply may also be a limited factor at some sites. Of particular note are Whitianga, Cooks Beach and Pauanui.

Many of the pocket beaches have very limited dune sand reserves, typically only a single dune and this sometimes is just a veneer of sand of varying thickness over pre- Holocene surfaces (Environment Waikato, 2002). However, larger sand reserves occur at Tairua, Onemana and Whangapoua beaches.

Overall, Holocene progradation along the eastern Coromandel now appears to have ceased at most beaches. Analysis of shoreline change over the last 60-100 years by Environment Waikato (2002) suggests that most eastern Coromandel beaches are in a state of dynamic equilibrium, with little trend for net shoreline advance or retreat. However, there is evidence of dune line recession at both Whiritoa and Kuaotunu beaches; pocket beaches that have historically been subject to significant sand extraction.

Changes in shoreline position tend to be on a decadal scale, with periods of erosion followed by periods of accretion. However, much greater dynamic changes can occur on shorelines adjacent to ebb tidal deltas and in close proximity to estuary entrances (e.g. the northern end of Pauanui Beach and eastern end of Cooks Beach), near stream entrances (e.g. Whiritoa and Kuaotunu west) or major stormwater outlets (e.g. Williamson Park, Whangamata). Such instability is evident at the southern and northern end of Whangamata, and at the eastern end of Cooks Beach.

Further detail on each coastal compartment is provided below.

5.3 Compartment A – Thames Coast

5.3.1 Description

The compartment lies within the Firth of Thames, to the south-eastern corner of the large, shallow semi-enclosed embayment. It has been sub-divided into three proposed Management Areas for the purpose of shoreline management planning (see **Appendix 4**). To the south there is the large flood plain bounded to the south by the Waihou River. A core part of this compartment is Thames. The township is established on relatively low-lying land, a portion of which is reclaimed. State Highway 25 (SH25) runs through the town and northward, closer to the coast, through the remainder of the compartment. The township is in part defended by stop banks.

To the north the shoreline takes on a more linear nature, generally with a steeply rising coastal slope to the rear of the road (SH25), defended for the most part by a rock revetment on the seaward side. The defence of the highway was improved following the 2018 storm event. Within this area are various communities developed over coastal fans (e.g. Waikawau, Te Mata, Tapu, Waiomu, Te Puru and Tararu) associated with the main rivers running down to the Firth.

5.3.2 Potential risks

Notable storm events include 1936, 1938, 1947 (WRC, 2002), 1951 (Schneider, 2010) and 2002 (Schneider, 2010) and 2018.

The more recent 4th January 2018 storm event was characterised by north-easterlies gusting to 120 km/h in exposed places. The combination and coincidence of King tides and peak wind/waves resulted in significant water levels within the Firth of Thames. The peak level recorded at Tararu Tide Gauge was 2.8 m RL (Tararu Vertical Datum). The previous recorded peak water level was 2.4 m RL in 1995. The largest historical water level (not recorded by tide gauge) was that during the 1938 storm of approximately 3.0 m RL.

Primarily historical coastal change has been associated with the coastal fans, which have exhibited measurable change in shoreline over the last 50 to 100 years.

Based on the ‘first pass risk assessment’ (see **Appendix 5**), the key flood risk areas within this compartment are the settlements on the coastal fans, as well as the low-lying areas of Thames. Flood risk is presented by coastal inundation as well as fluvial flooding and, to a lesser extent (less probable), tsunami hazard.

5.4 Compartment B – Coromandel Coast

5.4.1 Description

This compartment is characterised by a rocky, deeply-indented shoreline, including semi-enclosed muddy embayments and pocket beaches. The embayments exhibit broad alluvial plains that extend landward, fronted by extensive intertidal muddy zones, which typically support seagrass, intertidal mudflats, mangroves and saltmarsh.

The principal settlement in the compartment is Coromandel, characterised by the main harbour and quays (servicing aquaculture, fisheries and recreational boat use). Small remote settlements, such as Kirita and Waipapa Bays, characterise the pocket beaches.

The coastal embayment of Koputauki Bay, located to the north of Coromandel township, consists of broad alluvial flats fronted by a wide intertidal area. The Waiwhango Stream discharges into the centre of the embayment. SH25 runs across a number of the low-lying alluvial plains, before heading inland. Other roads (e.g. Rings Road/Colville Road) are located close to the shoreline in places.

5.4.2 Potential risks

Within Koputauki Bay, the alluvial flats on the true left (southern) side of the stream have demonstrated a consistent trend for erosion since at least 1909 (Environment Waikato, 2002). Over this period, erosion along the 450 m length of the foreshore has typically averaged about 0.2-0.3 m/year, with maximum shoreline retreat of 30-50 m.

The river flats are undeveloped, but the erosion now poses a serious threat to the three urupa located in the area, particularly the southernmost urupa.

The consistent trend for erosion over this lengthy period illustrates the potential for significant progressive shoreline change in alluvial environments along the western Coromandel coastline.

The compartment is at moderate risk of flooding, particularly the low-lying alluvial plains. Flood risk is presented by coastal inundation and to a lesser extent tsunami hazard.

The highway and other minor roads are at potential risk of cliff erosion.

5.5 Compartment C – Colville and Northern Bays / Moehau

5.5.1 Description

Compartment C extends around the northern section of the Coromandel Peninsula from Soahuru Bay to north of Waikawau. The compartment is a predominantly undeveloped steep and rocky coast with small relatively remote communities around Colville, Port Jackson, Port Charles, Waitete, Otautu and Sandy Bay.

The shoreline is strongly constrained by the inherent geology (rocky foreshore) with beaches formed in local bays and flooded valleys, as well as occasional pocket beaches. Increasing wave exposure lends itself to locations with some wider pocket beaches (e.g. Port Jackson) but, generally, the beaches are narrow and located within relatively sheltered valleys.

Colville and Port Charles are notable embayments located in drowned river valleys, which exhibit a muddy intertidal foreshore, sheltered from significant wave activity. The respective settlements are developed on low-lying alluvial plains.

Throughout the compartment various linking roads, which provide important access, are located close to the shoreline and/or on low-lying land. This includes the coastal road to Port Jackson, as well as the main road at Port Charles and Sandy Bay.

5.5.2 Potential risks

Based on the 'first pass' risk assessment, the compartment is at moderate risk of flooding, focussed on Colville, Port Charles and Sandy Bay. This risk is predominantly from coastal inundation, but also by fluvial flooding at Colville.

In addition, there is a risk to the link road through cliff instability.

5.6 Compartment D – Northwest Bays

5.6.1 Description

Compartment D typically comprises an undeveloped rocky coastline with a small number of isolated settlements at Kennedy Bay, Waikawau and Tuateawa.

A number of beaches are present, most notably the large barrier beach of Kennedy Bay, as well as Waikawau and Little Bay, both pocket beaches confined by distinct headlands. The barrier beach of Kennedy Bay semi encloses a drowned river valley creating a small estuary (Harataunga River Estuary), supporting alluvial plains, intertidal mudflats and mangroves.

Throughout the compartment, various linking roads, which provide important access to the isolated communities, are located close to the shoreline and/or on low-lying land. This includes the roads linking Kennedy Bay and Waikawau to the rest of the peninsula.

5.6.2 Potential risks

The compartment is at a relatively low risk of flooding generally. However, Kennedy Bay is at risk of coastal inundation and tsunami. In addition, the barrier system of Kennedy Bay is vulnerable to the spit breaching. While this breach has been repaired by human action, the spit remains vulnerable to further breaching in the future.

5.7 Compartment E – Whangapoua Harbour and Coast

5.7.1 Description

Compartment E contains the large barrier beach of Matarangi, which semi encloses the extensive Whangapoua Harbour, as well as a number of pocket beaches (e.g. Whangapoua), which are separated by rock headlands. The barrier is significantly developed landward of the dunes, by the settlement of Matarangi.

To the east of Matarangi is a straighter section of coast running through from the Matarangi Bluff head land at the eastern end of the Matarangi beach, to Kuaotuna. Eastward of here the compartment comprises higher ground around the Kauwera Point headland and the bays of Otama and Opito. Generally, Whangapoua, Rings Beach, Kuaotuna, Otama and Opito have all developed in the lee of pocket beaches, some of which exhibit small tidal inlets.

SH25, which provides a northern link between the east and west coast, passes through low lying land behind Whangapoua Harbour and along the coast east of Rings Beach and Kuaotuna. Other major roads include the road to Whangapoua, which traverses low-lying land via a causeway within Whangapoua Harbour, and a minor coastal road to Opito.

5.7.2 Potential risks

The areas at greatest risk from coastal hazards within the compartment are Whangapoua, Matarangi and Opito.

As with most large east coast estuaries, Whangapoua Harbour has exhibited significant infilling, particularly over the past century. Mangrove cover in the estuary has more than doubled, and seagrass cover more than halved, over the past 50 years (WRC, 2008).

5.8 Compartment F – Mercury Bay / Te-Whitianga-a-Kupe

5.8.1 Description

Compartment F comprises Mercury Bay, indented in a general u-shape orientated north eastward. The northern portion of the compartment includes a rocky foreshore with numerous pocket beaches. At the head of the bay is Whitianga barrier, fronted by Buffalo Beach, located between three large pocket beaches: Cooks Beach and Maramaratotara to the south, and Wharekaho to the north. The main estuary, forming a tidal inlet to the south of Buffalo Beach, includes Whitianga Harbour. Purangi River also outfalls at the east end of Cooks Beach.

The major coastal development is within low lying coastal areas and the principal settlements are at Whitianga and Cooks Beach, with smaller settlements and individual properties around Whitianga Harbour and at Ohuka and Wharekaho. Whitianga township and surrounding areas lie on a wide expanse of dunes that built up over thousands of years. The dunes along many areas of the beach have been flattened for roading, housing and recreational reserves.

Inside the estuary, there are a number of sandy beaches backed by roads and housing. Some of these beaches have experienced slow erosion over time, but the extent of this erosion has not been well recorded.

SH25, located on low lying land close to the coast, provides access to Whitianga and beyond to compartment E.

The compartment is regionally important for local recreational and tourism beach use, as well as recreational water use.

5.8.2 Potential risks

Whitianga township is surrounded by a mobile sandy beach and estuarine shoreline. Natural processes have altered the shoreline position over thousands of years and, in many locations, these natural changes threaten high value assets, including roads, reserves and private housing. Coastal erosion has been prevalent in Whitianga since at least the 1930s and has become more problematic since the late 1990s; particularly at the southern and northern ends of Buffalo Beach, and the public reserve areas at Ohuka Beach.

The coastal margins are also vulnerable to coastal flooding during storms. In major storms low atmospheric pressure, waves and onshore winds can cause water levels to overtop low lying road and reserve areas at the southern end of the Buffalo Beach and at Ohuka Beach.

The shape of Mercury Bay can cause wave reflection and a process known as 'seiching', where waves are reflected backward and forward across the Bay. This process can cause tsunami waves to increase in height when compared with waves in other areas of the open coast nearby, putting coastal development in the area at a particular risk from tsunami.

Based on available data, mangrove expansion within Whitianga Harbour has been only moderate. Sediment yield estimates (derived from SedRate and the Hicks and Shankar (2003) model) were the lowest (36 tonnes/km^2/year) and second lowest (69.3 tonnes/km^2/year) of five estuaries studied in the Coromandel. Sediment core dating was undertaken in 2007, with results suggesting considerable variability in sedimentation over time. Sedimentation rates of up to 30 mm/year were reported for the period around and prior to the 1960s, compared to rates of between 5 and 9 mm/year for the last few decades.

5.9 Compartment G – Te Whanganui-A-Hei

5.9.1 Description

Compartment G comprises a largely rocky cliff coastline intersected by a number of pocket beaches, the largest of which is Hot Water Beach. Other notable pocket beaches include those at Hahei, Otara Bay and Te Karo Bay. The coastline of the compartment is typically undeveloped with few properties, with the exception of a small settlement at Hot Water Beach and a larger settlement at Hahei.

There is little marine or transport infrastructure in the compartment.

5.9.2 Potential risks

Owing to the relatively undeveloped coastline and predominant cliffed rocky foreshore, the risks within the compartment are relatively low. The exception being Hahei, which is potentially at risk from a number of hazards (set out in **Appendix 5**).

5.10 Compartment H – Tairua and Pauanui

5.10.1 Description

Compartment H comprises Tairua (a pocket beach) and Pauanui (a large barrier beach), bound by rocky coastline to the north and south, separated by Paku Mountain. Adjacent to Paku Mountain (to the south) is the entrance to Tairua Harbour.

Tairua Harbour is a barrier enclosed river estuary, 6 km^2 in area, 51% of which is intertidal. It is sheltered from the sea by the Pauanui sand spit and Paku Mountain. Saltmarsh vegetation, grading into a freshwater swamp in Duck Creek, is ecologically significant in this location and there is an extensive area of seagrass on the intertidal flats. Saltmarsh and mangroves are present in the mouths of creeks and streams, such as Pepe Stream. The invasive weed, *Paspalum,* is also present.

The Tairua River catchment mostly consists of steep land typical of the Coromandel, often rising abruptly from the lowlands. The total catchment area is 282 km^2, almost half of which is indigenous forest (Environment Waikato, 2008).

Landward of Tairua and Pauanui beaches are significant settlements. The settlement of Pauanui is developed on the Pauanui barrier, while Tairua is developed on the tidal/alluvial flats. There are a significant number of dwellings located close to the shore, both on the estuary foreshore and the open coast. Dwellings on the open coast are typically located behind a large dune ridge.

For the main part, SH25 runs north-south along the compartment away from the coast. However, in places, SH25 and other key roads run along the low-lying foreshore of Tairua Harbour.

5.10.2 Potential risks

The low-lying land in the lee of the high foredune of Tairua beach is subject to coastal flooding from swell waves propagating through the harbour entrance and the elevation of water levels due to storm surge effects.

Snapshots of shoreline position at Pauanui suggest both decadal fluctuations and a possible long-term trend for continued net progradation (WRC, 2002). Over the period 1895 to 1995, there appears to be a very slow ongoing trend of accretion of the order of 5-10 m per century based on the average position of the entire beach. In 1944, however, the shoreline generally appears to have been in an eroded state and erosion dominated between 1967 and 1978; with accretion dominating thereafter (WRC, 2002).

Larger dynamic changes are typical of shorelines adjacent to ebb tidal deltas and in close proximity to estuary entrances. Such a pattern is evident at the northern end of Pauanui beach.

Mangrove coverage in Tairua Harbour was estimated to be 12 ha in 1983. From aerial photography dated 1995, the mangrove extent was estimated to be 38 ha, suggesting the estuary area covered by mangrove had more than tripled in just over a decade.

5.11 Compartment I – Ōpoutere to Onemana

5.11.1 Description

Compartment H comprises a relatively straight section of coast containing the settlements Onemana and Ōpoutere. Onemana is a small pocket beach which has built up a significant amount of sediment. Opoutere is a long (5km) barrier beach which is bound to the south by a large estuary (Wharekawa Harbour).

The main beaches and numerous other small pocket beaches are separated by rocky headlands and sections of steep rocky coastline.

For the main part, SH25 runs north south along the compartment away from the coast. However, in places, SH25 and other key roads run along the low-lying foreshore of Wharekawa Harbour.

5.11.2 Potential risks

The risk associated with coastal hazards in this compartment is relatively low.

5.12 Compartment J – Whangamatā

5.12.1 Description

Compartment J comprises the barrier beach of Whangamatā bound by large tidal inlets/estuaries. The compartment is bound to the north and south by rocky headlands.

The Holocene barrier system at Whangamatā is approximately 1.15 km wide and averages about 3-3.2 km length. To the north and south of the main beach are the tidal inlets of Whangamatā Harbour (to the north) and Otahu River (to the south).

Whangamatā Harbour is 4.4 km^2 in area, 90% of which is intertidal; comprising extensive sand and mudflats, supporting saltmarsh and mangroves. Whangamatā Harbour catchment covers an area of 52 km^2, the major land cover being plantation forest.

Landward of the main beach is the relatively large and densely populated settlement of Whangamatā. There are a significant number of dwellings located close to the shore, both on the estuary foreshore and the open coast. Dwellings on the open coast are typically located behind a large dune ridge.

SH25 runs behind the township and traverses low-lying land within the estuaries, marina development (Whangamatā Marina) and local roads. Whangamatā is a regionally important beach for recreation and tourism and the harbour is a regionally important for recreational water use.

5.12.2 Potential risks

The principal hazards in the compartment are inundation from both coastal and fluvial sources that impact both Whangamatā and the low-lying areas of the harbour. Whangamatā township comprises a relatively large and densely populated centre, therefore, the potential risks are significant.

Five snapshots of the average shoreline position of Whangamatā beach over the 50-year period from 1944 to 1994 show no discernible trend for net accretion or erosion (WRC, 2002). However, coastal erosion also poses a risk, with most of the beach-front properties located within erosion lines.

For the harbour, from the sediment core data, it was calculated that $0.732 \times 10_6$ tonnes of sediment have been deposited on the intertidal flats since the 1940s (Swales and Hume, 1994). In response, rapid mangrove expansion has been occurred in the upper and middle reaches of the estuary and there has been a decline in seagrass over the last 50 years (Turner and Riddle, 2001). The 10 ha decrease in mangroves between 1995 and 2007 is partly due to mangrove clearance (of at least 3.4 ha).

5.13 Compartment K – East Coast Islands

5.13.1 Description

Compartment K comprises a number of islands which are largely undeveloped, including but not limited to Slipper, Cuvier, Great Mercury, Atiu, Red Mercury and Ohene Islands. The islands typically exhibit a steep rocky foreshore, with remote pocket beaches where topography lends itself to sediment deposition.

Notable individual properties exist on the west coast of Great Mercury Island and Slipper Island. There are also a number of local roads and airstrips on these islands.

Coastal processes are typical of the east coast of the peninsula, with a high wave exposure from both refracted swell waves and local wind waves.

Sediment movement is limited and generally confined to the pocket beach compartments.

5.13.2 Potential risks

Due to the limited properties and infrastructure on these islands, few areas are at risk of flooding.

There has been little notable historical change given the rocky nature of the foreshore.

6 Coastal Hazard and Risk Assessment

6.1 Introduction

SMPs are intended to reduce the risk from 'coastal hazards' to an acceptable or tolerable level and aim to develop tailored, flexible solutions to ensure the long-term sustainability and resilience of the entire coastal area, underpinned by the gift of mātauranga Māori for the Coromandel Peninsula. Determining the nature and extent of the coastal hazards facing the District, and how they may change over time, is the first step in this process. Existing information on coastal hazards is available, such as the TCDC coastal erosion and protection lines and WRC's Coastal Inundation Tool and Regional Hazards Portal. However, this information is variously based on old predictions and methods that have since improved, does not always account for the presence of flood defences or is not sufficiently detailed, comprehensive (in terms of the suite of risks covered and its spatial extent) for shoreline management planning.

It is imperative that a detailed understanding of the extent and nature of coastal hazards is established prior to a full risk and vulnerability assessment being undertaken. To this end, Coastal Hazard Assessment (CHA) is an important foundation for the SMP Project. The outputs from the CHA will underpin the SMP process by identifying 'what is happening' from a hazard and sea level change perspective and informing a broad investigation of 'what matters most', whereupon detailed assessments of risk and vulnerability will be developed.

The MfE (2017), in Chapters 5 and 6, provides guidance on the consideration of uncertainty associated with SLR and climate change, as well as techniques for CHA (see also Ramsay *et al*., 2012). Chapter 8 specifically tackles risk and vulnerability assessments (see the shaded blue area in **Figure 6.1** below). Building on this guidance, **Appendix 3** sets out the proposed approach to CHA to be applied to the Coromandel coastline. It aims to describe how coastal hazards will be defined in the context of a risk-based 'dynamic adaptive pathways planning' approach. It provides relevant definitions and a proposed framework for first identifying and second defining hazards and hazard likelihood.

Appendix 3 was provided to WRC technical staff and Coastal Scientist Jim Dahm for peer review and has been updated based on initial feedback received.

6.2 Approach

A *probabilistic approach* is to be applied to the TCDC SMP CHA (see **Figure 6.2**). That is, the probability distribution of the severity of each type of coastal hazard will be calculated for a defined planning horizon and used to assess the fragility of assets, infrastructure and the environment to give an indication of risk. When combined with the values and objectives to be set through the community engagement processes, and a deeper understanding of the *vulnerability* of communities, socio-cultural and economic systems, this provides a more complete picture of risk[5].

[5] *Where total risk = hazard x vulnerability (or likelihood x consequence)*

Engaging and working with Iwi will also allow Iwi to provide their individual understandings and stories of the types of risks they have experienced and what taonga (e.g. wāhi tapu) are currently at risk and how Iwi can be part of the solutions to allow for their whakapapa and relationship with coastline to continue. Mātauranga Māori can inform this approach and the project will be guided by Iwi as to what extent and depth mātauranga can be incorporated into coastal hazard assessments.

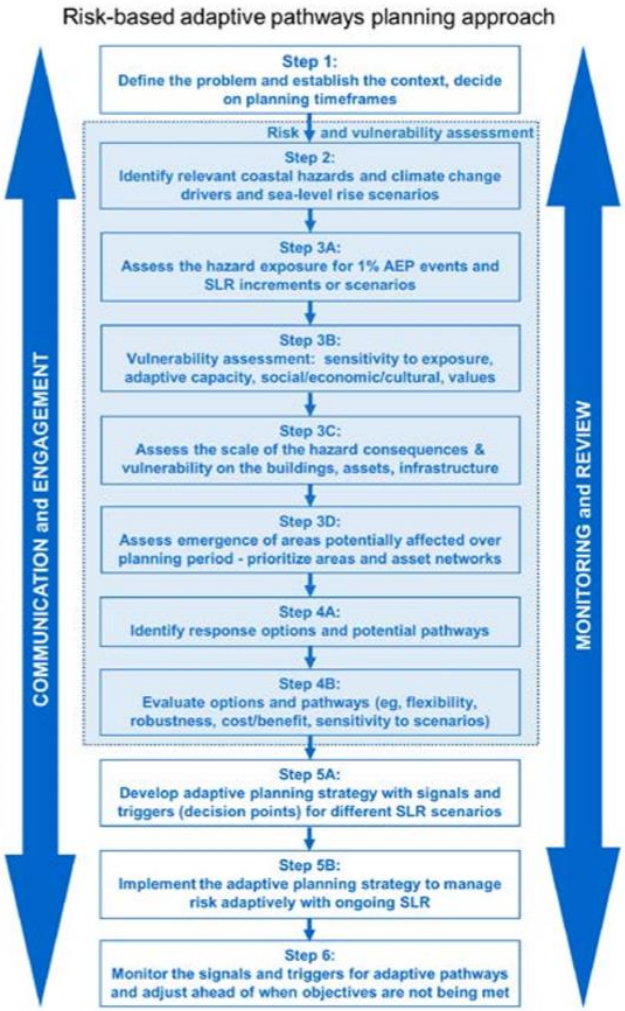


Figure 6.1 Risk-based adaptive pathways planning approach (from MfE, 2017)

Determining the probability of individual hazard types, and the consideration of collective values on a scale local enough to allow for planning decision making, is a highly resource intensive exercise and requires prioritisation to maximise outcomes. Hence the approach proposed, in line with MfE (2017) guidance, includes a prioritisation process and a staged approach, that will become progressively more detailed as risks increase.

The need to screen risks and prioritise resources is a particularly relevant consideration on the Coromandel Peninsula due to its length of coastline and relatively low-density population. Risk screening has and will be undertaken to focus resources on:

- providing detail in those locations where the likely consequences are highest; and
- particular hazards in local areas which have the greatest likelihood of occurrence.

Conversely, where no consequences or likelihood of a particular hazard exist, there will be no reason to expend resources investigating this further.

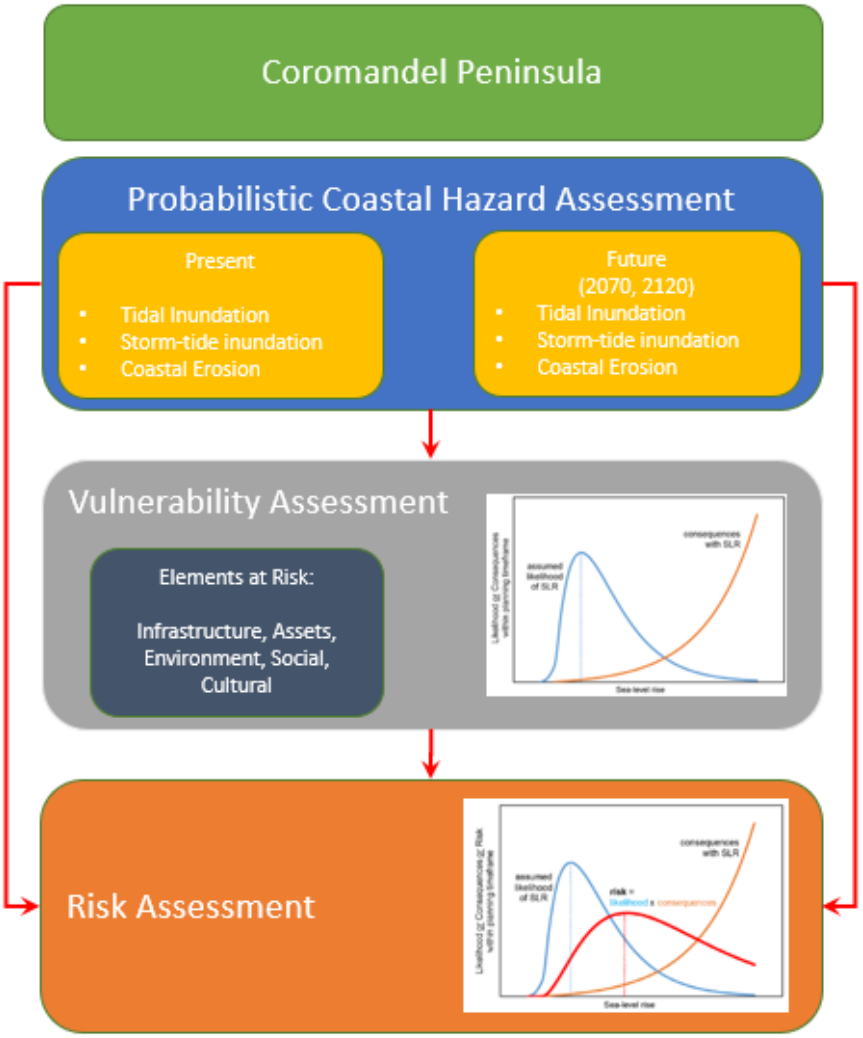


Figure 6.2 Conceptual framework for a risk-based Coastal Hazard Assessment

6.3 First Pass Risk Assessment

6.3.1 Introduction

A 'first pass', desktop risk assessment for the Coromandel Peninsula has been undertaken. In line with best practice in shoreline management planning, at this initial stage, the assessment focussed on coastal character, processes and foreseeable hazards, with only limited regard being given to settlements, infrastructure or environmental and cultural values at a local level (albeit it is acknowledged that the latter will be fundamental to the assessment as it progresses). It makes use of existing knowledge and data (including, for example WRC's coastal inundation

tool and tsunami mapping, and TCDC's CCEL and FCPL mapping) and has been undertaken on a semi-quantitative basis. It screens for areas that appear to be at significant risk.

The first pass assessment has also been influenced by the availability of information – which tends to focus on those areas where coastal hazards are particularly relevant.

This 'first pass' assessment is intended to inform the prioritisation of areas for further detailed risk assessment and help to identify those areas where the issues are complex – and potentially will require greater focus – or urgent.

6.3.2 Coastal Compartments and Management Areas

To assist with the analysis and communication of the 'first pass' risk assessment, risks have been considered on the basis of Coastal Compartments (shown in **Figure 5.1** and described in **Table 5.1**) and, within these, potential Management Areas. Coastal Compartments and Management Areas have been developed in response to "what the coast is telling us" and are shown in more detail in **Appendix 4**.

As set out in **Section 5.1**, **Coastal Compartments** are larger zones within which relatively unique coastal process interactions/landforms and community values can be captured.

Whereas **Management Areas** are 'pockets of interest' where there is the need to consider a combination of Policy Units (that could be interdependent) together to capture the "intent of management" and/or where Policy Units should be managed collectively. For example, for Compartment A (Thames) in **Figure 5.1**, the coastal road and, within this, local areas with different requirements (i.e. Policy Units), will form three different Management Areas.

Policy Units – are individual units where policy will be assessed as a sequence over time (working coherently within a Management Area).

6.3.3 Risk assessment

A risk assessment rating has been used as follows:

Green – no issues now or in the future.
Yellow – generally no existing issues, with some potential for issues to arise in the future.
Orange – minor existing issues and or some potential future issues.
Red – existing and or significant future issues.

This rating has been applied to areas in a spatial database as a means of allowing prioritisation of effort in the detailed hazard assessment stage. The rating is broken down into subcategories of hazard; for example, coastal inundation (ocean storm, fluvial or tsunami) or coastal erosion (cliff, soft sediment harbour entrances). Accordingly, effort can also be prioritised based on individual hazards and not just spatially.

Appendix 5 describes the approach taken and provides the outputs from the 'first pass' risk assessment undertaken for each Coastal Compartment and each Management Area.

The locations where detailed hazard assessment (including the assessment of asset condition) is considered to be required will be identified based on Management Areas, once the coast has been prioritised in terms of particular hazard likelihood and the associated consequences.

Specific Management Areas will then be subject to detailed investigation using the *probabilistic approach* to coastal hazard assessment outlined above. The conceptual methodologies proposed for the detailed investigations that will form this assessment are described in **Appendix 3**. This work represents **Phase 2 in Figure 1.1** and **Step 2 in Figure 1.2** (hazard and SLR assessments). Detailed assessments of Vulnerability and Risk (**Step 4 in Figure 1.2**) – 'second pass risk assessment' – will enable further investigation of short-listed risks and inform the testing of strategies in **Phase 4 (Figure 1.2)**.

Risk to the different stretches of shoreline will be assessed (in due course) in the context of the presence/absence of defences and, where they are present, the condition of the asset (see **Section 7**).

6.3.4 Prioritisation workshop

A prioritisation workshop was held in November 2019 to focus the project on the areas at the highest risk and/or with the earliest predicted onset of potential hazards. This was based on review of the first pass risk assessment. Further details are provided in **Section 8.1.1**.

7 Coastal Assets

7.1 Objective

The objective of this section is to document a review by RHDHV of TCDC's coastal asset management, in the context of the SMP Project. Specifically, the review included:

- Consideration of TCDC's coastal assets; and the definition of coastal assets.
- TCDC's current coastal asset management practice(s) and *Coastal Asset Management Plan* (2018b).
- An analysis of the extent to which the *Coastal Asset Management Plan (2018b); Coastal Management Strategy* (2018d); and the *Marine and Harbour Facilities Strategy* (2017) align with and inform the SMP process and vice versa.
- Recommendations for future actions: (1) within the SMP process; and (2) within TCDC's wider coastal management practices.

In this context it is important to recognise that both natural and man-made features are primary 'coastal assets' that have a coast protection function. In addition, natural (and man-made) coastal assets can be impacted by (and have an impact on) coastal processes (and the coast).

7.2 Background

TCDC has a significant number of coastal assets. These comprise structural assets, such as sea walls, commercial wharves and berthing facilities, public boat ramps and wharfs, buildings and amenities, as well as natural assets, such as beaches and sand dunes. Broadly they provide services to support the protection of public and private assets, tourism activities, commercial operations and essential infrastructure. TCDC's *Coastal Asset Management Plan* (2018b) acknowledges that there is (remains) a need to provide a comprehensive and reliable register of all of these coastal assets, and an understanding of their condition, the level of service provided by them (the plan includes inspections conducted in 2017 and 2018) and their legal status.

It is also important to understand the coastal assets in private (or non TCDC) ownership within the Thames Coromandel coastal area. This is essential because, as the need for adaptation becomes more pressing, a piecemeal approach to protection measures may not allow for this if there is inadequate understanding of how other coastal land owners are responding/planning to respond and the capacity of those private protection works to provide the required level of service for any given design event.

For the Scoping phase, our focus was on the way that the SMP investigations can complement the work already completed and being undertaken by TCDC.

7.3 Review of TCDC Coastal Asset Management

A review of current TCDC coastal management asset practices revealed the following key outcomes:

- TCDC are responsible for a number of public assets in the District. Notable exceptions are the State Highway 25 (SH25) (see below).
- Included within TCDC's asset management portfolio is the management of specific coastal assets (e.g. wharfs and slipways, and some revetments).
- Responsibility for the management of TCDC's 'coastal assets' lies with different parts of the Council (e.g. Reserves, Infrastructure, Stormwater) and in some cases there is ambiguity as to where responsibility lies.
- The primary purpose of TCDC's coastal asset management is to provide facilities to support recreation, tourism-related activities, commercial fishing, aquaculture and public amenities. The coastal asset activity includes wharves, wharf buildings, boat ramps and other associated assets.
- NZTA manage state-owned assets, such as the SH25. There is currently limited interaction with NZTA regarding asset management.
- WRC manage state-owned flood mitigation infrastructure, including stop banks and river training works. Of particular note are the extensive stop banks which protect the alluvial coastal plains in the south of the Firth of Thames.
- TCDC currently record their assets within a proprietary digital system named 'Asset Finda'.
- Known assets are periodically inspected. Asset inspection is largely a manual process, undertaken in the field and recorded directly into the Asset Finda system via tablets.
- Once in the Asset Finda system, selected data is transferred to TCDC's GIS database (held on an Esri ArcGIS platform) and then further selected data is uploaded to TCDC's publicly-available online 'SMART Maps' system; which is available for public viewing and download.
- Therefore, the coastal asset data collection and inspection process is largely manual, with information collected at a low resolution and scale temporally, making limited use of contemporary methods, such as remote observation technologies. Such methods are often referred to as 'smart asset management' and can include such methods as CCTV observation.
- In March 2018, TCDC prepared a *Coastal Asset Management Plan*. The plan was informed by TCDC's *Coastal Management Strategy* (2018d) and *Marine and Harbour Facilities Strategy* (2017) and is a tactical, infrastructural plan that gives effect to a range of other strategic and tactical planning documents, including TCDC's 2018-2028 Long Term Plan. The *Coastal Asset Management Plan* demonstrates how Council's goals and strategic targets will be achieved through the effective, appropriate and sustainable management of coastal assets. Comments on the Plan are provided in **Box 7.1** below.

- TCDC currently has an understanding of its own built coastal assets (e.g. wharfs and some rock revetments), but a lack of knowledge relating to 'natural' assets (e.g. sand dunes) and assets built and owned by others (e.g. stop banks). The project presents an opportunity to produce a comprehensive list of all coastal assets in the District and to co-ordinate the management of these assets.
- An ongoing initiative of TCDC, instigated in early 2019, is to undertake a stocktake of all coastal assets. This is currently being undertaken by TCDC with help from RHDHV. The methodology being adopted is to manually identify coastal assets from aerial photograph images obtained via drone survey (e.g. refer to **Figure 7.1**).
- The above process was initiated by defining 'coastal assets' and responsibilities associated with them. A summary of this advice is included below in **Box 7.2**.
- Regarding the extent to which the *Coastal Asset Management Plan* (TCDC, 2018b) *and the Marine and Harbour Facilities Strategy (2017)* align with and inform the SMP process, it is considered that these two documents do (could) align, as the plan provides the proposed management for known assets, whilst the SMP will provide the policy context. However, the *Coastal Asset Management Plan* (TCDC, 2018b) currently contains a significant gap in terms of both a register of coastal assets (particularly natural assets) and, therefore, a plan for how these coastal assets will be managed.

Box 7.1: RHDHV feedback on TCDC's *Coastal Asset Management Plan 2018*

- There is a focus on wharfs, boat ramps and some seawalls. That is, on active assets with a definable user 'demand'.
- There is a need for a comprehensive stocktake and valuation of coastal assets, not just wharfs and boats ramps.
- The plan requires updating to include wider coastal assets.
- Clarification should be provided on the 'coastal' assets managed by WRC. That is, flood defences (including stop banks) that also have a coastal defence function.
- In addition, further information is required on what function these additional assets are providing (e.g. protection from inundation, erosion/recession).
- Levels of service currently focus on the use of active assets and, therefore, need to be refined to enable level of service to be captured for wider coastal assets and functions.
- There appears to be no capital budget for coastal hazards, only OPEX (operational budget).
- The climate change section needs to discuss implications and include a robust plan for adaptation (or otherwise) based on different scenarios.
- The engagement section could to be improved, particularly for assets other than wharfs and boat ramps.
- Actions and budgets need to be defined for coastal assets.

Figure 7.1 Extract of aerial photograph obtained from the west coast drone survey

Box 7.2: Responsibility for management of 'coastal assets' - RHDHV recommendations to TCDC

- If an asset provides protection from coastal processes or offers access (physical, visual or otherwise) to the coastal zone, it is a coastal asset (e.g. the Moanataiari sea wall and sand ladders). This includes both coastal assets managed by TCDC's Infrastructure Team and Reserves Team, as well as coastal assets managed by the NZTA (such as the rock revetments that define SH25) and WRC.
- If an asset happens to be near the coast, e.g. a seat and table in a park next to a beach/estuary, but has a generic function, then it is not a coastal asset but rather a reserves asset.
- Where a structure is connected to the stormwater system it is a stormwater asset in terms of monitoring, upkeep and maintenance, replacement budget etc. (e.g. the Moanataiari stormwater pump and stormwater floodgates).
- However, where a structure discharges to/interacts with the coast or estuary, and there is an impact on an adjacent coastal asset (dune, beach, seawall, estuary bank, etc.), the management of the impact will fall to the coastal asset team and, hence, a budget allocation is required in this respect.

7.4 Recommendations

Recommendations for the improved management of coastal assets and filling data gaps are included in **Section 8.2**.

8 Next Steps and Recommendations

8.1 SMP Phase 2

What is happening?
What matters most?
What can we do about it?

8.1.1 Identification of coastal hazards

The next stage of the project will entail undertaking the Coastal Hazard Assessment based on the approach set out in **Section 6.2** and the methodology included in **Appendix 3**. Each Management Area will be subject to further investigation based on the outputs of the data gap analysis undertaken in Phase 1. That is, where relevant data and/or models (e.g. on coastal inundation and erosion) are available at the required level of detail, this information will be used for the identification and assessment of coastal hazards.

Where appropriate information is not available (e.g. for Mercury Bay and Thames township), detailed investigation using a probabilistic approach to determine 'what is happening' will be undertaken (**Phase 2 in Figure 1.1** and **Step 2 in Figure 1.3**; repeated here).

A data interrogation report will be produced early in this phase that sets out what effort and approach is required where. In addition, a prioritisation workshop, based on review of the first pass risk assessment (**Appendix 5**), was held with the SMP Project Office and others in order to focus the project on the areas at the highest risk and/or with the earliest predicted onset of potential hazards.

The work that follows will then help to refine / optimise (or change, as appropriate) the proposed Management Areas, and allow examination of the levels of service provided by (for example) public infrastructure and lifeline utilities (transport networks, storm water and drainage networks), coastal assets (public and private) and the ecosystem.

In parallel with the determination of relevant Values & Objectives (**Step 3 in Figure 1.3**; see **Section 8.1.6**), the CHA will inform a broad investigation of 'what matters most', where detailed assessments of Vulnerability & Risk will be developed – 'second pass risk assessment' (**Step 4 in Figure 1.3**).

The second pass will enable further investigation of short-listed risks, particularly with regard to the 'vulnerability' of communities, and inform the prioritisation and testing of strategies and actions; but the conceptual approach proposed first requires an analysis of 'hazard', an estimation of 'consequence' and the identification of known elements at 'risk', as well as value judgements regarding how a particular community may choose to 'live' with the risk posed by coastal hazards.

To initiate this feedback loop, the outputs from the CHA will include the spatial presentation of hazards (via GIS-based mapping layers) for areas where detailed risk analysis has been undertaken. These mapping layers will:

- Only show the hazard(s) of relevance to a Management Area.
- Present and map each hazard and the exposure of known elements (population, environment, archaeology and sites of cultural significance, property, infrastructure etc.).
- Present a hazard line or zone as a series of likelihoods and Council, partners, stakeholders and the community will be walked through how those hazards may change over time and feedback will be sought as to how that may impact known values.

The final outputs from this process will be a Coastal Hazard Report and a set of mapping layers that will inform the next step in the risk management process 'What can we do about it?'.

8.1.2 Characterisation of the coastal environment

The Thames-Coromandel coastal environmental baseline will also be characterised in Phase 2 (see **Figure 1.2**). That is, the geomorphology, geology, surface and groundwater, and ecology of the Coromandel's estuaries, harbours and coast will be described; in as far as it is relevant to the SMP process. Where appropriate, the connection between the coast and river catchment will be examined; particularly where coastal flooding, fluvial (river) flooding and pluvial (surface water) flooding have the potential to interact.

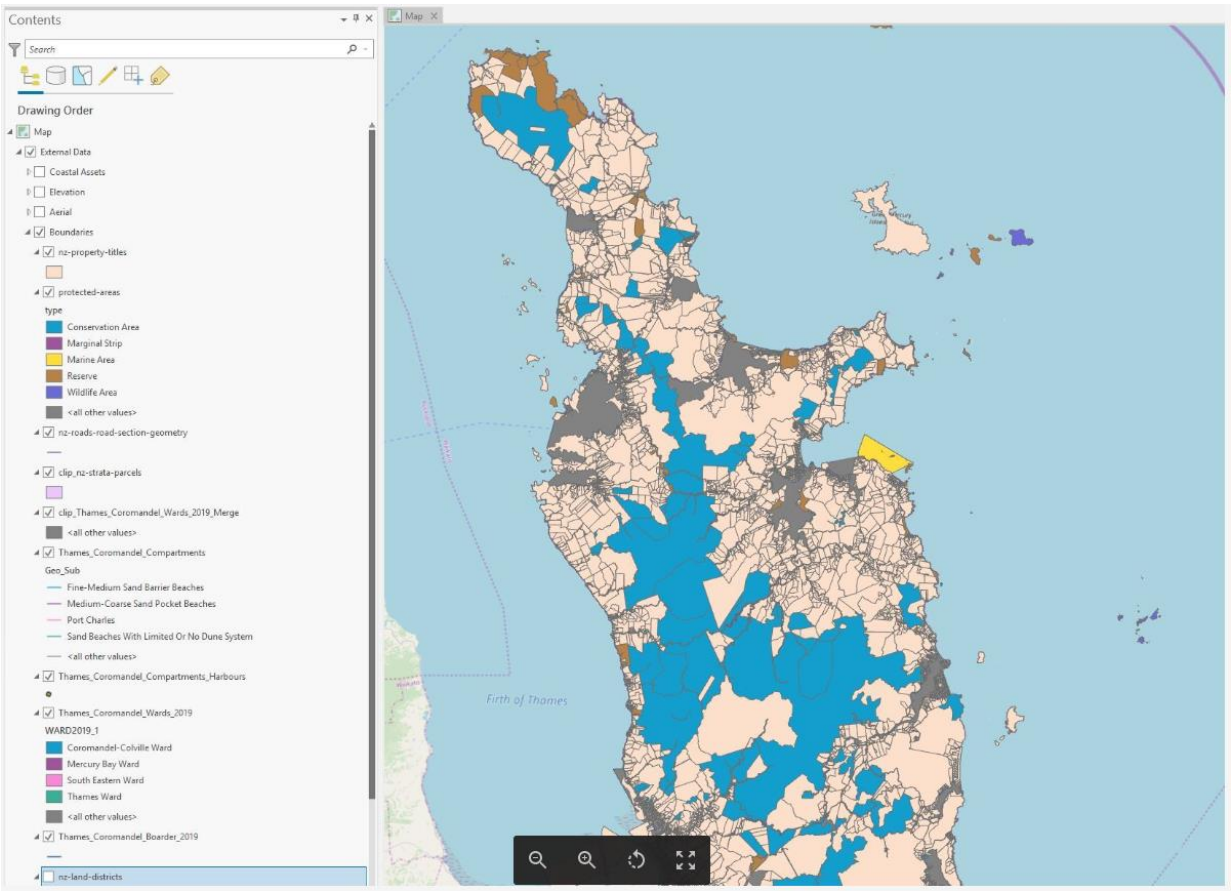
The output from this work will be a Coastal Environment chapter to be included in the SMPs, to set the scene. Its proposed structure is as follows:

- Section 1 – description of the coastal environment – coastal processes and landforms.
- Section 2 – description of the natural environment – habitat areas and distribution; estuarine/marine water quality/ecosystem health; sites of scientific and special interest.
- Section 3 – description of the built environment – marine structures (including marine farms); storm and wastewater systems; sites of cultural significance and Mana Whenua cultural indicators.

Alongside the work to be undertaken to define the baseline, we will look to establish citizen science initiatives around the coastline (e.g. CoastSnap) to monitor coastal change, enhance a sense of Iwi/community ownership and foster understanding (see the **Appendix 2**). These initiatives will play a role in the monitoring of signals and triggers to implement the DAPP approach.

8.1.3 GIS and digital database

The development of an integrated GIS and digital data-based asset management system will continue in this phase. To date data and data layers have been gathered relating to organisational boundaries and planning data (see **Figure 8.1**), infrastructure and coastal assets, setback lines, environmental information, shoreline changes (recent and historic), storm events, coastal inundation and flood risk zones, tsunami, and coastal erosion (and more). These data layers will be important for assessing risk at different scales, e.g. land use affected by coastal inundation.



C:\Users\220025\Box\PA1954 CL Thames\PA1954 CL Thames Team\PA1954 Technical Data\E07 GIS\04_Figures\19.09.25 - ArcGIS Screenshots
https://royalhaskoningdhv.box.com/s/sl8vzdnt5e2wwyi6jv1j4qhxac6g5q5c

Figure 8.1 Extract from the TCDC SMP GIS

Section 2 explains the statutory basis for existing coastal protection measures. As the risk and vulnerability assessments that form part of the SMP process are progressed, cultural, economic and funding assessments that draw on the data held in the GIS database will also support the consideration of the feasibility of options.

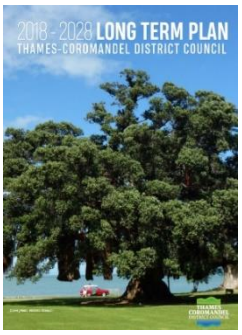
The forward plan for the development of the Project GIS database is as follows:

- Determine what data should be hosted online (some data sets are very large, hence hosting raster/image data should be avoided) and continue to structure this data, potentially adding additional fields as a template for others to add metadata to.
- Host the coastal asset data collated on ArcGIS Online (preferably TCDC's ArcGIS account).
- Continuously build the ArcGIS Online database as we collect additional data. The intension being that, in the future, it can be used by the RHDHV Consortium and/or TCDC to link to other websites, add coastal asset metadata, or to utilise other ArcGIS modules such as ArcGIS Collector, StoryMaps, iReport etc.

8.1.4 Asset condition assessment

Another element of Phase 2 was intended to be the validation of the TCDC coastal asset condition assessment. However, TCDC are only at the beginning of this process and are currently investing in defining what its suite of coastal assets are (see **Section 7**). Information on condition is available for some coastal assets, but this is not comprehensive. Therefore, it is proposed that this part of the SMP Project concentrates on filling the gaps. This will involve site visits and condition/preliminary service level assessments by RHDHV engineers.

In due course an essential requirement will be to account for the temporal and physical dimensions of SLR in determining the of 'level of service' of assets. It is noted, for example, that some assets already have proposed works and budget allocations (e.g. Whitianga Wharf Pontoon Extension) and these are driven by importance and requirements for future levels of service. To make difficult decisions, and to work within responsible financial limits, an overview of the extent to which all existing TCDC coastal assets are likely to provide a continued acceptable level of service in the future is required.



This should be linked to the 2018-2028 Long-Term Plan (TCDC, 2018a) which notes: *"Both Council and our communities are clear that we face great risk and expense from storm events and coastal inundation in this district, and it is important that we are operating with the best information to be able to respond to these risks."* The Long-Term Plan confirms that all new major infrastructure and renewals are to be tested against a projected sea level rise of 1.4m by 2120 and a rise of 1.88m by 2150. This should also apply to existing infrastructure.

Following the review of TCDC assets (and the above site visits), it is proposed that an initial report will be prepared on the legalisation of TCDC coastal assets (e.g. Resource Consents (for boat ramps, etc.) and NZTA Licenses' to Occupy, as appropriate). That is, once the extent and location of TCDC assets are confirmed, and their role and service level requirements

established, their legal status will be described. This includes identification of the authorisations attached to an asset, including any resource consents (noting that the status of some assets will be ambiguous). There will be two outputs from this step:

1. A spreadsheet of assets and links to known resource consents, alongside the identification of gaps.
2. A report on Asset Service Limits; to provide a more strategic footing.

The report on Asset Service Limits will broadly forecast when action (such as replacement, upgrade or removal) is likely to be required. This may or may not align with the design life of the asset. This information highly relevant in the context of determining 'what is happening' and 'what we can do about it' and, in due course, will be linked to the identification of critical thresholds and the evaluation of options (**Steps 5 and 6 in Figure 1.3**).

The work is also relevant because the total economic burden associated with action may or may not be spread evenly across the long-term planning period; there is a risk to TCDC and local communities both if larger assets require upgrade or renewal (as is the current focus) and if numerous minor asset upgrades or replacements cluster at particular times. Hence it will assist with programme management as part of DAPP going forward.

TCDC's *Coastal Asset Management Plan* will be able to be updated based on this work.

8.1.5 Insurance

Insurance is another issue that will influence the approach taken to the future management of the Thames-Coromandel shoreline. As recently as mid-September 2019 a new alliance between the insurance and finance sectors, governments and environmental organisations was launched to build resilience to ocean risk. The Ocean Risk and Resilience Action Alliance (ORRAA) intends to pioneer insurance and finance products that spur investment in coastal resilience, accelerate research to better understand and manage ocean risk, and inform policy, governance, and public understanding.

Significantly, the actions of insurers will influence the decisions individuals will take regarding the desire to defend and the timescale over which they desire to defend. To that end they will also influence proposed shoreline management policies.

During Phase 2, therefore, a piece of work will be undertaken to provide context on potential issues relating to insurance. That is, to set out the position that the insurance sector in NZ is in (including what is typically covered and what is not covered); how climate change (and other risks) are influencing insurance; how an SMP could influence this (positively and negatively); and how decision making by insurers (e.g. withdrawal) could influence SMP management options.

Recommendations will be provided on insurance inputs for future phases of the SMP project. For example:

- It will be important to determine to what extent TCDC's assets are likely to be underinsured and how their insurance requirements could change.

- Workshop presentations to Coastal Panels to set the insurance scene and gain feedback on insurance-related concerns/queries.
- Examination of possible funding streams from the insurance sector.
- Consideration of "insurance retreat" (or other insurance-related thresholds, e.g. re-sale and mortgage implications), with the wider SMP team, as a trigger for action in a DAPP.

8.1.6 Communications and Engagement

Communications and engagement activities for the next phase of the SMP Project are set out in **Appendix 2**. A thorough stakeholder mapping exercise has begun and will be completed in conjunction with confirmation of the project governance framework early next year. This will identify individuals, groups and organisations with an interest in the coastal environment at different scales.

It is proposed that a series of communications activities are undertaken in Phase 2. Key activities include:

- a District-wide summer survey (2019-2020);
- establishment and ongoing update of the SMP webpage;
- initiation of citizen science activities in at least two locations;
- ongoing communications and publicity via media, social media and a SMP newsletter/e-newsletter; and
- the preparation and publication of appropriate fact sheets.

The summer survey will gather baseline information that will assist further communications and guide the development of community objectives for the management of coastal hazards. That is, it is intended to elicit current understanding and further detail on the concerns and values of the broader community.

Further to this community engagement, discussions with key stakeholders (e.g. NZTA, DOC etc.[6]) will continue, particularly with regard to opportunities for joint working/initiatives, data sharing and membership of the TWG and Coastal Panels.

8.1.7 Project Governance

Elected Members were provided with a project update regarding the outcomes of the Scoping phase and proposed next steps in December 2019, following the induction of the new Council. This is to be followed by a detailed examination of the governance framework for the SMP Project by Elected Members early in the new year. This examination will require the input of Iwi partners to ensure the options are appropriate. We anticipate that Elected Members will be presented with a preferred option that has been developed by the SMP Project Office and, ideally, agreed to by the SMP Project Partners, including WRC and Iwi.

Following formal adoption of the project governance framework (including draft Terms of Reference), Expressions of Interest and invitations (as appropriate) to join the Coastal Panels

[6] *Engagement with Iwi is covered below.*

will be sought, based on the Terms of Reference and a brief 'job description'. It is recognised that a separate process will need to be developed with regard to Iwi involvement on the panels.

Membership of the Coastal Panels and other bodies proposed to be established under the project governance framework will then be confirmed through an April/May 2020 meeting of the Council.

8.2 Recommendations

8.2.1 Coastal compartments and primary hazard zones

It is proposed that SMPs are developed for different, unique stretches of the Coromandel shoreline. That is, different Coastal Compartments; albeit SMPs may combine more than one Coastal Compartment, where appropriate. These SMPs will be guided by a set of overarching core principles and guidelines to provide consistency in the approach being taken to the management of coastal hazards; but may not necessarily follow existing institutional or government boundaries.

It is also proposed that these Coastal Compartment are subdivided into Management Areas and within these Policy Units are derived, for which relevant shoreline management policies will be derived.

SMPs should inform TCDC's use and the identification of *development setback lines*, with a view to identifying primary and residual hazard zones (based on an understanding of what intolerable risk means) as required by the Waikato RPS. Both the existing CCELs and FCPLs will be reviewed as part of this project and refined or updated as necessary based.

8.2.2 Improved management of coastal assets

Recommendations for the improved management of coastal assets and filling data gaps are as follows:

1. Based on the definition of coastal assets being accepted, clarity should be provided on what are TCDC assets and what are not (i.e. NZTA, DOC, WRC etc. assets) and internal responsibility for TCDC coastal assets should be determined. Currently, a formal definition of coastal assets has not been adopted by TCDC nor a clear line of responsibly for them.

2. The coastal asset stocktake should be completed (and data for the east coast obtained). Knowledge regarding TCDC's coastal assets is essential to the successful preparation of SMPs.

3. Iwi are to be provided with the opportunity and space to deliver guidance and direction regarding the ongoing management of the taiao, taonga, wāhi tapu and associated sites of cultural significance to enable whakapapa to flourish, to empower kaitiakitanga and acknowledge Iwi's mana motuhake.

4. Ways to interact better vis-à-vis coastal assets managed by others are required. As outlined above, a number of critical coastal assets are managed by other parties (e.g.

SH25 managed by NZTA; and various stop banks and other flood defences managed by WRC).

5. A review of the *Coastal Asset Management Plan* should be undertaken in light of an envisaged increased asset stock. In particular, the natural assets and those managed by others should be included in the plan, with appropriate actions and funding assigned. Furthermore, recommendations identified as part of the preliminary review were:
    a. A comprehensive valuation of coastal assets, other than wharfs and boats ramps, is required.
    b. Further information is required on the function of coastal assets.
    c. Current information on levels of service focusses on the use of active assets, therefore levels of service need to be captured for the wider suite of coastal assets.
    d. Appropriate actions and budgets need to be defined in the context of the above.

6. More comprehensive and efficient methods of asset management (sometimes termed 'smart asset management') ought to be considered. This is particularly relevant when considering the geographical size of the Coromandel and the large number of remote assets. Smart asset management could include methods such as remote video monitoring and telemetry. There are clear opportunities to improve efficiency in TCDC's current asset management, particularly asset monitoring and inspection.

8.2.3 Project governance

It is important that the links between SMPs and existing legislation, plans & policy are explicit, so that the latter has appropriate 'weight' when coastal adaptation choices are being considered. This requires appropriate governance mechanisms to facilitate it.

For the assessment of vulnerability and risk and the evaluation of shoreline management options, we advocate the use of a deliberative process via small, site-specific 'Coastal Panels' that will augment the scientific and technical analysis of risk through a facilitated socio-political process. This process will identify values relevant to the coastal environment, translate those into objectives, overlay the coastal hazard assessment on those values, and test the viability of solutions and interventions over time against set objectives. Ultimately this will enable fair decision-making based on the best available science[7].

The proposal is that Coastal Panels, informed by Iwi, natural hazard and coastal science experts, would test options and develop proposals for SMP policy and Community Action Plans. That would be considered by the Elected Managers.

We recommend that the 'coastal activity coordination meetings' that currently occur between TCDC and WRC officers are formalised and a TWG established to oversee and guide development of the SMPs. The TWG should consist of appropriate TCDC and WRC officers and Iwi, including representatives of policy and governance, district and regional planning, and natural hazards. Draft Terms of Reference for the operation of the group will be prepared.

[7] *More information on this approach can be found in the CES.*

We also recommend that a workshop is convened with the SMP Project Office and other relevant TCDC staff as appropriate, to finalise the preferred options for project governance and identify the process for approval and implementation of the project governance framework. This should set milestones for Council reporting and align with the requirements of the Project Partners. As above, it is proposed that the framework, including further details on Coastal Panels, is presented to Council early in the new year.

8.2.4 Iwi

It is recommended that TCDC continues its dialogue with Iwi to develop and strengthen relationships and to explore future possible co-governance arrangements with the new Council. These conversations and the outcomes will have a big influence on subsequent Iwi engagement as part of the project.

In the next phase of work project-based kanohi ki te kanohi conversations with Iwi should continue, with the purpose of providing information on the scope of the SMPs and to further understand how Iwi would like to be engaged and what processes Iwi are involved in that potentially could assist in the delivery of SMPs.

The Project team need to be guided by Iwi and TCDC:

- To determine how we can best work with Iwi to approach SMPs and related planning processes that Iwi are central to.
- Regarding how best to proceed with korero with Iwi on progressing the SMP Project.

8.2.5 Funding opportunities

Engagement with key stakeholders in the next phase of the project should cover joint funding opportunities (both for the SMP process but, more significantly, the implementation of Actions Plans). Funding knowledge is a critical component of developing robust adaptive pathways.

Opportunities exist in this context however. For example:

- The NZTA are developing a community resilience programme (i.e. they want to understand how the NZTA can support safe and resilient communities?), in conjunction with other lifeline utilities, and are keen to develop (co-design) a pilot (with a territorial authority) in the Waikato Region in 2019/2020.
- NIWA resilience challenge work (RNC2 - *Adapting to New Zealand's Dynamic Coastal Hazards*) on current and future coastal hazard and risk faced by communities around NZ, which includes providing integrated scientific datasets to underpin robust decision-making, identifying hotspots of coastal risk, focusing on weaknesses identified in implementation of the MfE Guidance and (potentially) extending the vulnerability aspect of SMPs (2019-2024).
- The Insurance Council of NZ (ICNZ) are part of the newly formed ORRAA which aims to pioneer insurance and finance products that spur investment in coastal resilience.

9 References

Allison, A. (2014). *Morphodynamics on an armour-layered fan delta, Te Mata, Coromandel.* The University of Auckland, School of Environment MSc Thesis.

Australian Geomechanics Society Landslide Taskforce, Landslide Practice Note Working Group [AGS] (2007). Practice Note Guidelines for Landslide Risk Management 2007, *Australian Geomechanics*, Volume 42, No. 1, March, pp. 63-114.

DOC (2010). *New Zealand Coastal Policy Statement.* New Zealand Government, Department of Conservation, Wellington NZ: December 2010.

Dravitski, M.L. (1988). *Littoral Drift of mixed sand and gravel sediment on four gravel delta fans, Western Coromandel, New Zealand*. Earth Sciences, University of Waikato, MSc Thesis.

Gibbs, M. (2006). *Whangapoua Harbour Sediment Sources*. Technical Report 2006/42, Environment Waikato, Hamilton.

Harris, T.F.W. (1985). *North Cape to East Cape: Aspects of the Physical Oceanography*. University of Auckland, Department of Physics and Marine Laboratory, Leigh. 178p.

Healy, T. (2002). Chapter Fourteen Muddy coasts of mid-latitude oceanic islands on an active plate margin New Zealand. In: Healy, T, Y.W. and J.-A.H. (Eds.), *Proceedings in Marine Science, Muddy Coasts of the World Processes, Deposits and Function*. Elsevier, pp. 347–374.

Healy, T. (2005). New Zealand, Coastal Geomorphology and Oceanography. In Schwartz, M.L. (Ed) *Encyclopaedia of Coastal Science 2005*.

Hicks, D.M., Shankar, U. (2003). *Sediment yield from New Zealand Rivers.* NIWA Chart Miscellaneous Series No. 79, NIWA, Wellington.

Hicks, D.M., Shankar, U., McKerchar, A.I., Basher, L., Lynn, I., Page, M. and Jessen, M. (2011). Suspended sediment yields from New Zealand rivers. *Journal of Hydrology (New Zealand)* Vol. 50, No. 1, Special Issue: Sediment flux, Morphology and River management, pp. 81-142.

Hogg, A.G. and McCraw, J.D. (1983). Late Quaternary Tephras of Coromandel Peninsula, North Island, New Zealand: a Mixed Peralkaline and Calcalkaline Tephra Sequence. *NZ Journal of Geology and Geophysics*, 26, 163-187.

MfE (2017). *Coastal Hazards and Climate Change: Guidance for Local Government.* Ministry for the Environment, ME1341, Wellington NZ: December 2017.

Ramsay, D., Gibberd, B., Dahm, J. and Bell, R. (2012). *Defining coastal hazard zones for setback lines: a guide to good practice*. NIWA, Hamilton NZ.

Schneider, P. (2010). *Current and future climate change adaptation of a vulnerable coastal community on the Coromandel Peninsula, New Zealand*. Planning, Massey University, MP Thesis.

TCDC (2017). *Marine and Harbour Facilities Strategy*. TCDC: December 2017.

TCDC (2018a). *2018-2028 Long-Term Plan Thames-Coromandel District Council*. TCDC: December 2018.

TCDC (2018b). *Coastal Asset Management Plan*. TCDC: March 2018

TCDC (2018c). *Thames-Coromandel Coastal Hazards Policy*. TCDC: August 2018.

TCDC (2018d). *Thames-Coromandel Coastal Management Strategy*. TCDC: June 2018.

WRC (2016). *Waikato Regional Policy Statement*. Waikato Regional Council: May 2016.

WRC (2018). *Draft Risk Assessment Framework to support implementation of the WRPS: Natural Hazards (Chapter 13)*. Waikato Regional Council: November 2018.

WRC (2019). *Waikato Regional Policy Statement Implementation Practice Note on Natural Hazards.* Waikato Regional Council: March 2019.

A1 Appendix 1

Policy and Statutory Context

Policy and Statutory Context for the Thames-Coromandel Shoreline Management Plans

1 Purpose of Report

This technical report identifies the relevant statutory and policy documents that have been assessed in relation to the scoping phase of the Thames Coromandel Shoreline Management Plan project (the project).

The purpose of this report is to inform stakeholders about the statutory and policy framework within which the project is being considered and delivered. This report does not consider the multitude of scientific and technical reports on coastal hazards, coastal management and development, instead focussing on the relevant legislative and policy mandates and how they may influence the project.

All coastal land and waters in NZ are subject to a range of statutory and regulatory controls that regulate land and water use, and provide mechanisms for appropriate environmental management. This document summarises the key statutes and policy documents which affect the environmental management of the Thames-Coromandel District Council (TCDC) coastline as this relates to coastal hazards.

The following documents have been considered:

Document	Abbreviation	Section of this report
2.0 International Context		
Sendai Framework for Disaster Risk Reduction 2015-2030		2.1
Paris Agreement on Climate Change 2015		2.2
RAMSAR Convention on Wetlands	RAMSAR	2.3
World Heritage Convention		2.4
3.0 National Context		
Te Tiriti o Waitangi 1840		3.1
National-level policy on climate change		3.2
National-level policy on coastal hazards and risk management		3.3
Thirty Year NZ Infrastructure Plan 2015		3.4
Hauraki Gulf Marine Park Act 2000	HGMPA	3.5
Resource Management Act 1991	RMA	3.5
Civil Defence and Emergency Management Act 2002	CDEMA	3.5
Conservation Act 1987		3.5
Land Transport Management Act 2003	LTMA	3.5
Reserves Act 1977		3.5
Marine and Coastal Area (Takutai Moana) Act 2011	MACAA	3.5

Document	Abbreviation	Section of this report
Heritage NZ Pouhere Taonga Act 2014	HNZPT	3.5
Building Act 2004		3.5
Local Government Act 2002	LGA	3.5
National Planning Standards		3.6
National Environmental Standards	NES	3.7
National Policy Statements	NPS	3.8
New Zealand Coastal Policy Statement 2010	NZCPS	3.9
4.0 Regional Context		
Waikato Regional Policy Statement 2016	RPS	4.1
Waikato Regional Coastal Plan 2005	RCP	4.2
Waikato Regional Plan 2007	WRP	4.3
Zone management plans		4.4
Coastal Erosion Risk Mitigation Strategy for the Waikato Region 1999		4.5
Coastal Flooding Risk Mitigation Strategy 1999		4.6
5.0 Local Context		
Iwi Management Plans	IMP	5.1
Statutory Acknowledgement Areas		5.2
TCDC District Plans Operative 2010 & Proposed 2019	PDP	5.3
Reserve Management Plans		5.4
Local Community Plans		5.5
Marine and Harbour Facilities Strategy 2017		5.6
Long Term Plan 2018-2028	LTP	5.7
Code of Practice for Subdivision and Development 2013		5.8
Hauraki District Plan 2014		5.9
Thames Coromandel District Council Coastal Management Strategy 2018		5.10
Coastal Hazard Policy 2018		5.11
TCDC Productivity Plan 2018		5.12

2 International Context

NZ is a member state and signatory to a number of international conventions, and some of these confer certain obligations on the Crown to comply with international nature conservation legislation and biodiversity obligations. Generally, these international agreements focus on conservation efforts in relation to threatened species, nature conservation, however there are several international agreements that are important to consider in the context of the geographical study area and the nature of the project. These are the Ramsar Convention on Wetlands, the World Heritage Convention, the Paris Agreement on Climate Change, and the Sendai Framework.

2.1 Sendai Framework for Disaster Risk Reduction 2015-2030

In 2015, New Zealand signalled commitment to the Sendai Framework for Disaster Risk Reduction. This aims to be a blueprint for how nations approach risks to their development and focuses on the priorities of understanding and managing risk through a whole of society approach. Specifically, it aims for the following outcome:

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

Its four priorities for action set the global foundations for reducing risk at the coast. These priorities are (1) understanding risk including all dimensions of vulnerability, adaptive capacity, exposure of people and assets, hazard characteristics and the environment (2) strengthening risk governance to manage disaster risk (3) investing in disaster risk reduction to increase resilience (4) enhancing disaster preparedness for effective response to "build back better".

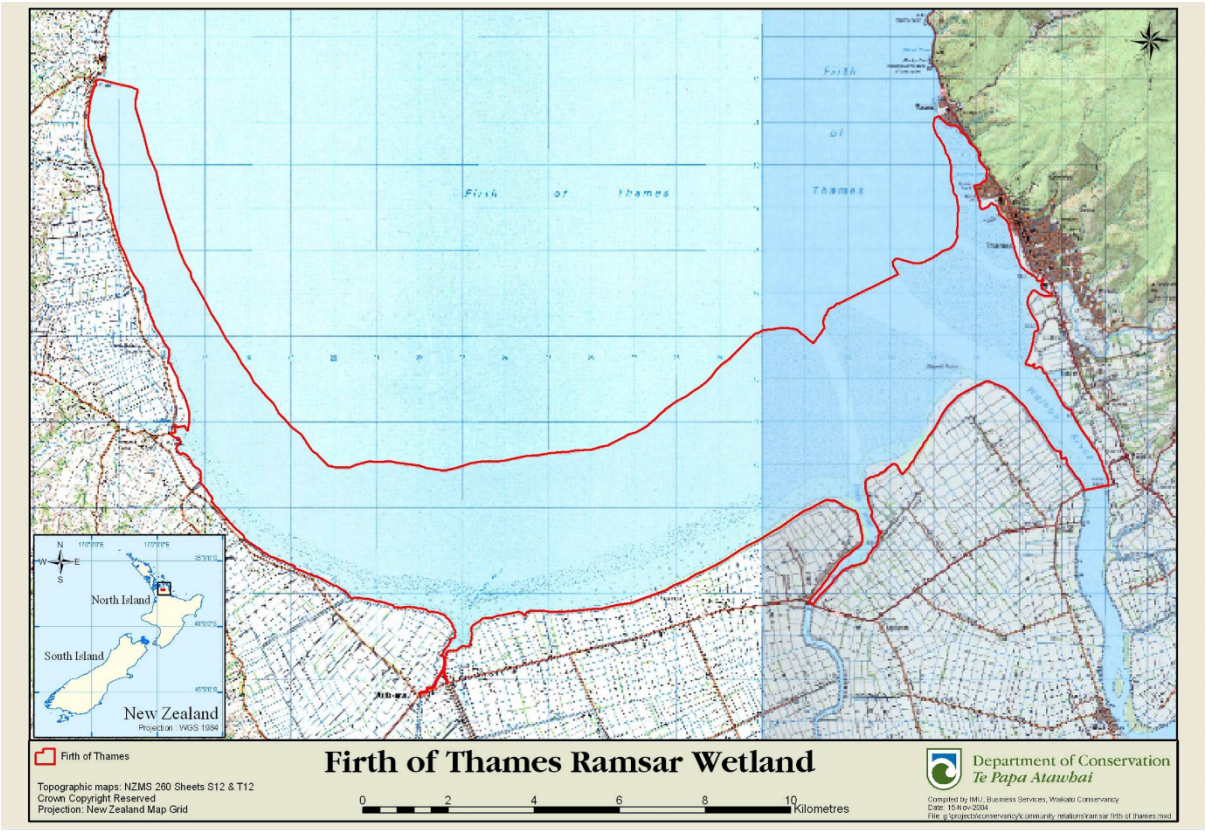
2.2 Paris Agreement on Climate Change 2015

Sitting under the UN Framework Convention on Climate Change, the Paris Agreement has an adaptation goal (that sits alongside a mitigation goal) to enhance adaptive capacity, strengthen resilience, and reduce vulnerability to climate change.

The Agreement obliges Parties to plan for and take action on adaptation, and to report on this. The Agreement does not prescribe how we do this because adaptation to the impacts of climate change is a jurisdictional matter and each country will have its own set of impacts to cope with and adapt to depending on its capacities.

2.3 RAMSAR Convention on Wetlands

NZ has 6 sites included in the List of Wetlands of International Importance (Ramsar sites). Two of these are in or adjacent to the study area. The Kopuatai Peat Dome covers over 10,200ha of the Hauraki Plains, between the Piako and Waihou Rivers. While outside TCDC, this wetland plays an important role in storage of floodwater from these river catchments. The Firth of Thames is also a Ramsar site with an area of more than 8,900 hectares. It lies within the Crown administered Coastal Marine Area with jurisdiction vested in Land Information NZ (LINZ), Waikato Regional Council (WRC) and the Department of Conservation (DOC). It is currently subject to a claim by Hauraki Māori under the Treaty of Waitangi. The Ramsar site extends into TCDC jurisdiction at the southwestern part of the district surrounding Thames and Tararu (see map below).



Map 1 Firth of Thames – extent of Ramsar site

2.4 World Heritage Convention

This recognises that there are some places on earth so important that their enjoyment and protection is an international responsibility. NZ has 3 sites on the list, none of which are in the study area. However, in 2007 DOC compiled a Tentative List of Sites with a further 11 sites recommended for inclusion. One of these sites is Whakarua Moutere (or the 'North East Islands') and extends along the north-eastern coastline of the North Island. The site includes several islands within TCDC, including Cuvier Island, Red Mercury and the lesser Mercury Islands, and Aldermen Islands.

Being on the Tentative List does not confer any World Heritage Status, however it signals a desire from the community for the value of the site to be recognised.

A country's Tentative List is required to be reviewed every ten years, so it is reasonable to expect that DOC will be leading a review of the Tentative List in the near future.
https://www.doc.govt.nz/globalassets/documents/getting-involved/consultations/consultations-results/our-world-heritage/our-world-heritage.pdf

3 National Context

3.1 Te Tiriti o Waitangi (Treaty of Waitangi)

New Zealand has a unique way of governing natural resources to reflect the Crown-iwi partnership encapsulated in Te Tiriti o Waitangi. NZ legislation refers to the 'principles of Te Tiriti of Waitangi' and requires local authorities exercising functions under such legislation to take account of these principles. The Courts and the Waitangi Tribunal express these principles in the context of particular claims or cases, and it is acknowledged that they are not set in stone, but will evolve as conditions change[1]. The most well-established principles can be summarised as active protection, redress, and partnership (including good faith and consultation). The RMA provisions for Māori participation are some of the most significant expressions of how the Crown provides for Te Tiriti o Waitangi and the Māori-Crown relationship.

In relation to the study area, the Crown and Hauraki iwi are currently navigating through a settlement claims process. The areas of interest of the Iwi of Hauraki extends from the Mahurangi coast in the north to the western Bay of Plenty and includes the islands of the Hauraki Gulf/Tīkapa Moana. The Crown and the 12 iwi of Hauraki[2] signed a Collective Redress Deed on 2 August 2018. The cultural redress recognises the losses suffered by the Iwi of Hauraki arising from breaches by the Crown of its Treaty obligations. The Deed does not settle any claims of particular iwi, which will be settled through iwi-specific settlements.

The Deed includes a cultural redress package that recognises the spiritual, cultural, traditional and historical associations of the Iwi of Hauraki with areas owned by the Crown. It also provides for co-governance/co-management arrangements in relation to waterways, catchments and maunga. At this time, the Deed does not provide for cultural redress in relation to harbours. It is our understanding that preliminary pre-settlement arrangements are under discussion in anticipation of the formation of a co-governance authority for the Piako, Waihou and Coromandel catchments.

3.2 National-level policy on climate change

The Government asked the Productivity Commission to undertake an inquiry into local government funding and financing, and a draft report on the findings has recently (July 2019) been published. The report concludes that the current system based on rating properties provides a sound basis, however councils need new tools to help them deal with specific cost pressures, including adapting to climate change.

At a broader level, the Government has committed to a programme of work to consider how to reduce emissions and adapt to the effects of climate change. Cabinet has agreed to the development of a Climate Change Response (Zero Carbon) Amendment Bill to set the

[1] https://www.waitangitribunal.govt.nz/assets/Documents/Publications/WT-Principles-of-the-Treaty-of-Waitangi-as-expressed-by-the-Courts-and-the-Waitangi-Tribunal.pdf

[2] The 12 Iwi are Ngāi Tai ki Tamaki (settled through the Ngāi Tai ki Tamaki Claims Settlement Act 2018), Ngāti Hako, Ngāti Hei, Ngāti Maru, Ngati Pāoa, Ngāti Porou ki Hauraki, Ngāti Pūkenga, Ngāti Rāhiri Tumutumu, Ngāti Tamaterā, Ngāti Tara Tokanui, Ngāti Whanaunga, and Te Patukirikiri.

framework for New Zealand's action on climate change, and the Environment Select Committee is currently considering the bill. Submissions closed in July 2019 and report-back for the Second Reading is anticipated in October 2019.

The Climate Change Response (Zero Carbon) Amendment Bill would be an amendment to the existing Climate Change Response Act 2002, meaning that all of the key climate-related legislation is covered under one Act. This Bill also proposes to establish an independent Climate Change Commission. As a precursor to the Commission, an Interim Climate Change Committee has been established (https://www.iccc.mfe.govt.nz).

The Bill incorporates some of the recommendations from the Climate Change Adaptation Technical Working Group which was set up in 2016 to provide advice on how New Zealand can adapt to the impacts of climate change while sustainably growing the economy. Their second and final report (May 2018) provides recommendations for the actions New Zealand needs to take to build resilience to the effects of climate change while growing the economy sustainably. The report is supportive of the 100-year planning horizon and retaining flexibility and reducing path dependency for adaptation actions in the future. The report also recommends preparation of a National Adaptation Action Plan (NAP) and a National Climate Change Risk Assessment (NCCRA). Both of these are incorporated into the Zero Carbon Bill and, once the Bill is enacted, the Minister of Climate Change will be required to prepare and present to Parliament the first NCCRA within 1 year, and the first NAP within 2 years.

Both documents are likely to be produced within the timeframe of this project, and therefore an awareness of and consistency with these will be necessary. Of further relevance to this project is the philosophy of a co-ordinated and nationally consistent methodology, framework and data sets in relation to climate change adaptation. Keeping abreast of these developments could influence the risk assessment for this project, as well as providing valuable insight to the national programme of work, and potential opportunities for central government support.

3.3 National-level policy on coastal hazards and risk management

National direction on coastal hazard management and adapting to coastal change is provided by the Ministry for the Environment and the Department of Conservation. MfE's 2017 *'Coastal hazards and climate change: Guidance for local government'* document is a major revision of the 2008 report and supports councils to manage and adapt to the increased coastal hazard risks posed by climate change and sea-level rise.

The planning approach in the guidance is new. The dynamic adaptive pathways planning (DAPP) approach differs to earlier approaches to coastal hazard management in two ways; namely how it deals with uncertainty and risk, and by placing community engagement at the centre of decision-making processes. The guidance also emphasises that community engagement lies at the heart of the decision-making process. This guidance document has been adopted by TCDC as a central tenet in developing SMPs for the District.

The MfE guidance is a technical document providing advice on how best to assess the potential coastal risks from climate change, and how to help determine possible response options. The

guidance recommends that planning for the impact of climate change on coastal hazards follow a 10-step decision cycle. The outputs from this process are a long-term strategic plan and decision-making framework for coastal areas affected by coastal hazards and climate-change effects. The 10-step process is iterative, so that responses can be reviewed and adapted as monitoring determines – for example, if new information becomes available. This project closely follows the model laid out in the guidance document.

Guidance notes for the NZCPS on Coastal Hazards (specifically Objective 5 and Policies 24, 25, 26 &B 27) were published by DOC in 2017. These notes provide additional background and context on the direction, interpretation and implementation of the coastal hazard provisions of the NZCPS (and case law). The NZCPS is discussed further in section 3.9 below.

3.4 Thirty Year NZ Infrastructure Plan 2015

Infrastructure resilience is a key component of this plan, specifically relating to the energy system, transport, and the three waters (stormwater, wastewater, and water supply). It promotes taking a longer-term view in relation to asset management practices, with an increased focus on adapting to slower changes over time, including climate change.

A new independent infrastructure body, the New Zealand Infrastructure Commission Te Waihanga is being established to improve how infrastructure is planned, co-ordinated and delivered. The New Zealand Infrastructure Commission/Te Waihanga Bill is currently with the Select Committee. The bill states that "the main function of the Commission is to co-ordinate, develop, and promote an approach to infrastructure that encourages infrastructure, and services that result from the infrastructure, that improve the well-being of New Zealanders." The Commission must have regard to changing demographics and adapting to the effects of climate change.

Within two years, the Commission will prepare a strategy report (building on broad public agreement) identifying the priorities for infrastructure for the next 30 years. There is an opportunity for the TCDC SMP project to feed into this strategy to ensure priority is clear for local infrastructure providers adapting to climate change.

3.5 National legislation

The natural environment of the Thames Coromandel district and the Hauraki Gulf is governed by many agencies, operating under various pieces of legislation and different imperatives. A discussion of these is provided below. There are several other pieces of national legislation that may have a peripheral influence on the development and implementation of SMPs. These Acts are the Walking Access Act 2008, the QE II National Trust Act 1977, the Local Government Official Information and Meetings Act 1987, and the Reserves Act 1977. At this stage, an in-depth review is not provided. It is also noted that there is currently a local bill (the Thames Coromandel District Mangrove Management Bill) proceeding through Parliament. This is currently stalled however, with progress being postponed at the request of Member in Charge Scott Simpson.

Hauraki Gulf Marine Park Act 2000

This legislation (the HGMPA) recognises the international and national significance (Section 7) of the Hauraki Gulf, its islands, and catchments. The Act established the 1.2 million hectare Hauraki Gulf Marine Park and the Hauraki Gulf Forum. The Act's purpose (Section 3) is to integrate the management of the natural, historic and physical resources of the Hauraki Gulf, its islands, and catchments (see map below). It also recognises the unique and special relationship of tangata whenua with the Gulf and its islands. Through Section 8, the Act lists six objectives for the management of the Gulf, associated with protection, maintenance and enhancement of aspects of the environment. There is a legal imperative that anyone exercising powers or carrying out functions under any other Act must have particular regard to the provisions of the HGMPA.

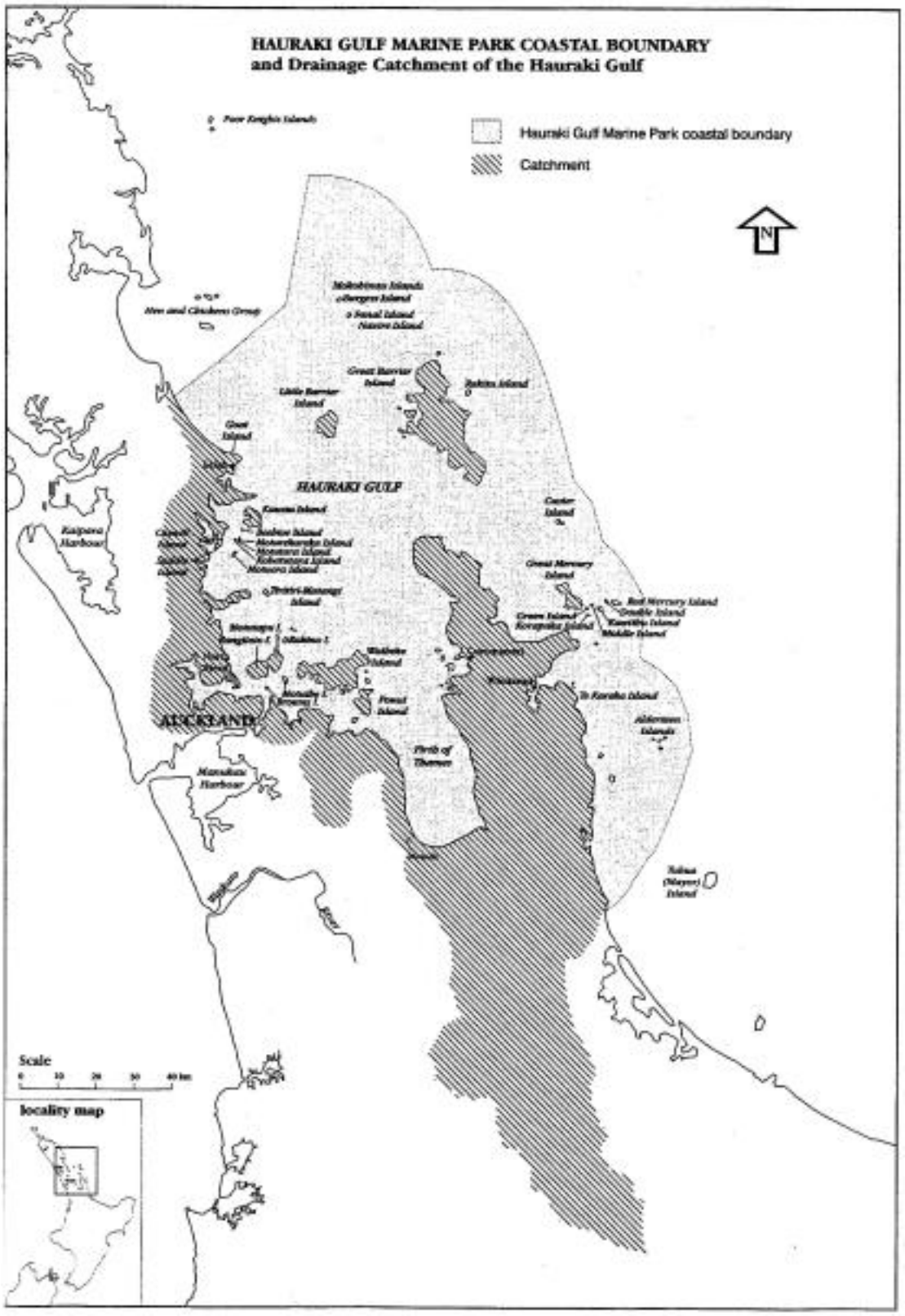
The Hauraki Gulf Marine Park extends from north of Auckland along the entire TCDC coastline to Waihi Beach at the southern end. It encompasses all seawater and common marine and coastal area, all conservation and reserve land, all Crown land (with some exceptions), Ramsar wetlands, and local authority-owned and private land with the consent of the owner. Section 32 of the HGMPA enshrines the four purposes of the Marine Park which recognise and protect in perpetuity the significance of the land and natural and historic resources for their intrinsic value and for the benefit, use and enjoyment of people.

The Hauraki Gulf Forum comprises representatives from iwi and central and local government agencies and has statutory responsibilities for managing use, development and conservation within the Marine Park and its catchments and to coordinate and oversee implementation of the Act. The latest triennial 'State of the Gulf' report (2017) identified that there is now a large body of data and information collected about the Gulf, however there are contradictions and tensions within and between legislation that make decision making challenging.

In 2016, the Hauraki Gulf Marine Spatial Plan ('Sea Change Tai Timu Tai Pari') was released – the culmination of four years of engagement with iwi and the community. This lays the foundation for the integrated management of the Hauraki Gulf. It is a non-statutory document and is not legally binding, instead comprising recommended actions and approaches. The Plan includes 180 recommended actions across 16 themes. The themes encompass habitat restoration, healthy ecosystems and biodiversity, and reducing degradation of water quality and the Marine Park. Of particular relevance are the themes relating to providing access to the Marine Park through place-based decision making, and designing coastal infrastructure that works with nature.[3]

Since 2015, the governance arrangements for the Hauraki Gulf have been under discussion. As a contribution to this debate, the 'Governance of the Hauraki Gulf – A Review of Options' (EDS, 2019) has recently been published. This review builds on other recent organisational reviews, and advocates a strengthened co-governance model of governance. At this stage, no governance changes have been formally proposed however a Ministerial Advisory Committee has been established to help shape the Government's response to the Spatial Plan.

[3] http://www.seachange.org.nz/assets/Sea-Change/5584-MSP-summary-WR.pdf



Map 2 Hauraki Gulf Marine Park extent

Resource Management Act 1991

The Resource Management Act 1991 (RMA) is the central piece of legislation governing management of the environment. The RMA is based on the principle of sustainable management and requires consideration of effects of activities on the environment, now and in the future, when making resource management decisions. The RMA sets out the framework for policy development at the national, regional and local level; as well as how these policies are implemented (e.g. through rules governing activities and resource consents).

Government has provided clear direction to local government regarding the management of risks from natural hazards and the effects of climate change. Amendments to the RMA in 2017 elevated the consideration of natural hazards to Part 2 (Section 6(h)) of the Act. Explicitly, this means that anyone exercising functions and powers under the Act must recognise and provide for the management of significant risks from natural hazards as a matter of national importance. It is noted that this amendment came into effect after the NZCPS 2010, thus providing additional impetus to those policies and objectives under the NZCPS. The requirement to have particular regard to the effects of climate change was incorporated into the RMA in 2004.

> *Section 2: Definitions*
> *'climate change' means a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.*
>
> *'Natural hazard' means any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.*
>
> *Section 6 Matters of national importance*
> *In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:*
> *…..*
> *(h) the management of significant risks from natural hazards.*
>
> *Section 7: Other matters*
> *In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to—*
> *…..*
> *(i) the effects of climate change:*

The RMA establishes a hierarchy of planning documents, with each lower level document required to be consistent with the one(s) above. These documents include the New Zealand Coastal Policy Statement and other national policy statements, national environmental standards, national planning standards, regional policy statements, regional plans, and district plans. Through this hierarchy, councils are empowered to control both new and existing

development, including where such development may be exposed to climate change effects. Councils also have the ability to control the use of land for the purpose of the avoidance or mitigation of natural hazards.

> *Section 30 Functions of regional councils under this Act*
> *(1) Every regional council shall have the following functions for the purpose of giving effect to this Act in its region:*
> .....
> *(c) the control of the use of land for the purpose of—*
> .....
> *(iv) the avoidance or mitigation of natural hazards*
>
> *Section 31 Functions of territorial authorities under this Act*
> *(1) Every territorial authority shall have the following functions for the purpose of giving effect to this Act in its district:*
> *(b) the control of any actual or potential effects of the use, development, or protection of land, including for the purpose of—*
> .....
> *(i) the avoidance or mitigation of natural hazards;*

At the local level, where SMPs are developed and implemented, district councils have the ability to impose rules through their District Plan to manage the effects of subdivision (e.g. through the s106 ability to refuse or place conditions relating to natural hazards), use and development. The provisions of the TCDC Proposed District Plan further realise the direction adopted in the national and regional policies in relation to both climate change and natural hazards, and are discussed further in section 5.3 of this report. Guidance for proposed activities is quite clear.

The management of existing uses is not as straightforward. There is some complexity around the management of existing use rights under the RMA, especially as they relate to natural hazard risk. The RMA appears to make provision for regional councils to control, through rules in a regional plan, existing use rights for the purposes of avoidance or mitigation of natural hazards. This has not been tested through the Courts, however the Whakatane District Council and Bay of Plenty Regional Council are currently pioneering a Plan Change process for the Awatarariki Fanhead which, if adopted, would end residential activity on high risk properties within the fanhead, and extinguish existing use rights on those properties. It is noted that the Waikato Regional Council is planning to investigate the potential transfer of this regional function to territorial authorities through its Regional Plan Review process.

It is noted that there are emergency works provisions provided for within Section 330 of the RMA. These are primarily aimed at assisting in the response to emergency situations, with an emphasis on removing an on-going cause and preventing further damage of the emergency on people and property.

RMA Reforms 2019

The Government has announced its intention to embark upon a two-step reform programme for the RMA. Stage 1 is currently being developed and an amendment bill is anticipated to be introduced to Parliament in 2019. The aim of the bill is to make the Act less complex, increase public participation and provide more certainty.

In July 2019, Cabinet agreed to undertake a comprehensive review of the RMA, including work on spatial planning across the RMA, the LGA and the LTMA (Cabinet minute ENV-19-MIN-0036). Elevating the importance of climate change within the RMA framework forms part of the review, in order that decision-makers are able to fully consider both the effects of climate change on development (adaptation), and the effects of development on climate change (mitigation).

Government is also considering introducing new resource management concepts, such as strengthening community and ecosystem resilience to climate change and natural hazards, into Part 2 of the Act. The review will also consider having an explicit function to actively restore or enhance the natural environment in situations where bottom lines may already be breached. This could potentially impact the scope and ability of Council to address coastal hazard risk. Another consideration is the potential reinstatement of the original subdivision presumption in the Act. Prior to the 2017 amendments, all subdivision proposals required a resource consent unless specifically permitted by provisions in a district plan or national environmental standard. The 2017 amendments made all subdivision permitted unless restricted by a rule, signalling that subdivision is appropriate in all places, at all times and should be allowed, irrespective of location e.g. in areas of high natural hazard risk. This is one of the proposals being considered by the government.

Case Law under the RMA relating to coastal hazards

Case law generally supports a precautionary approach to planning horizons and hazard lines in the face of uncertainty. This is consistent with the NZCPS. Further review of relevant case law (e.g. King Salmon judgement and "avoid adverse effects") in relation to the implementation of the NZCPS (in particular, Policies 7, 13 and 15, 24-27[4]), is recommended as the SMPs are developed and implemented.

Civil Defence and Emergency Management Act 2002

The CDEMA is largely an enabling mechanism and does not affect the functions, duties and powers of Councils under the RMA. It provides a mandate to sustainably manage hazards and promotes risk reduction activities that sit alongside hazard management under the RMA.

The pertinent clauses of the purpose of the CDEMA are:

> *Section 3: Purpose*
> *(a) improve and promote the sustainable management of hazards (as that term is defined in this Act) in a way that contributes to the social, economic, cultural, and*

[4] See DoC Guidance summarising case law relative to these policies

environmental well-being and safety of the public and also to the protection of property; and

(b) encourage and enable communities to achieve acceptable levels of risk (as that term is defined in this Act), including, without limitation,—

(i) identifying, assessing, and managing risks; and

(ii) consulting and communicating about risks; and

(iii) identifying and implementing cost-effective risk reduction; and

(iv) monitoring and reviewing the process; and

[….]

The purpose also encompasses civil defence and emergency management facets. Civil Defence Emergency Management Groups are a core component of the Act, and among other things, their functions include to identify and understand local hazards and risks and implement cost effective risk reduction measures. TCDC is part of the Waikato CDEM Group which prepared a CDEM Plan as required under the legislation. The Plan focusses on identifying the hazards and risks (which includes coastal hazards) and the four Rs (reduction, readiness, response and recovery). It is imperative that the SMPs are consistent with the Waikato CDEM Plan, while recognising that there is the potential for the SMP process and framework to provide invaluable data and insights into the Thames-Coromandel community's attitude to coastal hazards and risk tolerance (and acceptability). In particular, the CDEM Plan acknowledges a future opportunity to work with local communities to address the challenges created by climate change e.g. coastal erosion. This provides a critical opportunity to link the four R's with the longer-term approach to coastal hazards and risks taken by the SMPs.

National Disaster Resilience Strategy

The Government published the National Disaster Resilience Strategy in April 2019. This is a 10-year strategy made under the CDEMA. The Strategy provides the vision and strategic direction, including outlining priorities and objectives for increasing New Zealand's resilience to disasters. The vision of the Strategy is that *"New Zealand is a disaster resilient nation that acts proactively to manage risks and build resilience in a way that contributes to the wellbeing and prosperity of all New Zealanders"*. It identifies 3 main priority areas, being managing risks; effective response to and recovery from emergencies; and enabling, empowering, and supporting community resilience. The Strategy has a strong focus on wellbeing, including incorporating the Treasury's Living Standards Framework, and seeks to ensure any action toward reducing risk is cognisant of different types of vulnerability, and the disproportionate effects thereof.

The Ministry of Civil Defence & Emergency Management has committed to preparing in 2019 a roadmap of actions setting out how the Strategy objectives will be achieved. These actions include, among other things:

- Local government planning, including long term plans, annual plans, and asset management plans.
- Review and reform of key legislation that contributes to risk management and resilience, and any guidance on its implementation.
- Climate change adaptation initiatives.

Some of this work will be undertaken during the lifetime of the SMP project and consequently it will be necessary to ensure the project is aware of progress, as well as influencing where possible, and being influenced by the Strategy. By 2030, the Strategy envisions that as a country we have had a conversation about how to adapt to, or retreat from, the highest risk areas and the likely high costs of these options.

Conservation Act 1987

DOC has responsibilities under the Conservation Act as landowner, as well as preparing Conservation Management Strategies. The Waikato CMS was published in 2014 and sets objectives for the integrated management of natural and historic resources on public conservation lands and waters in the Waikato region, many of which are along the coastline. The CMS focuses on freshwater quality and kauri dieback, but also notes the threat of accelerated coastal erosion due to sea level rise on some parts of the coast.

DOC's General Policy (latest amendments 2019) provides the highest level of policy guidance to public conservation land. Policy 8 relates to natural hazards and clearly states that management of hazards on DOC land should be undertaken with minimal interference to natural processes, natural resources, and historical and cultural heritage.

Land Transport Management Act 2003

The LTMA provides the legal framework for managing and funding land transport activities. The purpose of the LTMA is to contribute to an effective, efficient and safe land transport system in the public interest.

The 2018 Government Policy Statement on Land Transport (GPS) sets out the government's priorities for expenditure from the National Land Transport Fund over the next 10 years. There is clear direction from the government regarding improving the resilience of the land transport system by placing greater focus on resilience to climate change impacts. It applies a whole of system approach to investment logic, particularly to the most critical connections on the network, and a focus on proactive risk management for natural hazard and climate change adaptation. The GPS supports developing and implementing regional plans to this effect. There are potential synergies to be gained here through working with NZTA to prioritise investment to improve resilience on critical routes.

Reserves Act 1977

The Reserves Act 1977 governs the preservation and management, for the benefit and enjoyment of the public, of areas possessing special values (which are listed in the Act). The administration of the Act is also for the purpose of ensuring the preservation of access for the public to and along the 'sea coast'. Reserves that are classified under this legislation are subject to Reserve Management Plans (RMPs) or Conservation Management Strategies, prepared by the administering body – either the Department of Conservation or a local authority.

Systematic work is ongoing to align individual RMPs with the project as they are being reviewed and updated. It is anticipated that these mechanisms will provide the SMPs with additional

'legal weight', particularly for coastal reserves around the Coromandel. A summary of Thames Coromandel RMPs follows in section 5.4.

Marine and Coastal Area (Takutai Moana) Act 2011

The Marine and Coastal Area (Takutai Moana) Act 2011 acknowledges the importance of the marine and coastal area to all New Zealanders and provides for the recognition of the customary rights of iwi, hapū and whānau in the common marine and coastal area. Public access to the common marine and coastal area is guaranteed by the Act.

Land below MHWS owned by the Crown or a local authority became part of the common marine and coastal area at the time this legislation came into effect. The MACAA also requires Crown or local authority land previously above MHWS, but which is now below MHWS as a result of erosion or other natural occurrence, to be part of the common marine and coastal area.

Heritage NZ Pouhere Taonga Act 2014

The purpose of this Act is to promote the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand. Heritage New Zealand has statutory responsibilities for archaeological sites under the Heritage NZ Act. An archaeological site is defined to mean any place including any building or structure that was associated with human activity that occurred before 1900, or is the site of the wreck of a vessel where the wreck occurred before 1900; and provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand.

There are numerous archaeological sites recorded in the Thames-Coromandel district. There remains the possibility that there are unrecorded archaeological sites within the district also. Through the SMP process, it is important that these sites are recognised for their historical value.

Building Act 2004

The Building Act 2004 regulates all buildings and structures to safeguard the health, safety, and amenity of people, facilitate efficient energy use, and to protect property from damage. Most building work requires a building consent, which verifies that the proposed work complies with the Building Code[5].

Sections 71-74 of the Building Act restrict the granting of a building consent where land is, or is likely to be, subject to a natural hazard unless adequate provision is made to protect the land or restore the damage. Building consent can be granted if the building complies with the building code and the building itself does not accelerate or worsen or extend the natural hazard to another property. Such consents are granted subject to the title being 'tagged' identifying the natural hazard concerned.

[5] Building consent is likely to be required for seawalls, depending on the proposed design and height. Resource consent is likely also depending on location, surrounding landform, earthworks and construction method.

Local Government Official Information and Meetings Act 1987

The LGOIMA identifies what information Councils must disclose in a Land Information Memorandum under s44A(2). This includes information identifying any special feature or characteristics of the land concerned, including but not limited to potential erosion… or inundation that is known to the territorial authority but is not apparent from the District Plan. This is an area that requires further consideration as hazard data is compiled and recorded through the SMP project.

Local Government Act 2002

The LGA sets out the functions and powers of NZ's local authorities. The purpose of the Act is provided in Section 10:

> *10 Purpose of local government*
> *(1) The purpose of local government is—*
> *(a) to enable democratic local decision-making and action by, and on behalf of, communities; and*
> *(b) to promote the social, economic, environmental, and cultural well-being of communities in the present and for the future.*

Until May 2019 when it was repealed, Section 11A of the Local Government Act 2002 required a local authority, to have particular regard to the contribution that the core service of avoidance or mitigation of natural hazards (amongst other services), makes to its communities. The repeal of this section was part of a broader set of changes by the Coalition Government that re-instated the earlier broader purpose of the Act being for local authorities to promote the four well-beings (social, cultural, economic and environmental) in their decision making.

There are few specific mentions of hazard

> *101B Infrastructure strategy*
> *(1) A local authority must, as part of its long-term plan, prepare and adopt an infrastructure strategy for a period of at least 30 consecutive financial years.*
>
> *(3) The infrastructure strategy must outline how the local authority intends to manage its infrastructure assets, taking into account the need to—*
> *(a) renew or replace existing assets; and*
> *(b) respond to growth or decline in the demand for services reliant on those assets; and*
> *(c) allow for planned increases or decreases in levels of service provided through those assets; and*
> *(d) maintain or improve public health and environmental outcomes or mitigate adverse effects on them; and*
> *(e) provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and by making appropriate financial provision for those risks.*

Other relevant requirements under the LGA are those in Part 6 (sections 76 to 82) relating to decision-making and consultation. These requirements are relevant to any decisions made outside the legislative framework of the RMA and Building Act 2004, such as the decision to

use other methods to manage risk, e.g. install tsunami warning devices, or dedicate money to risk mitigation.

3.6 National Planning Standards

The first ever set of National Planning Standards was gazetted in April 2019. The first set of national planning standards provide national consistency for the structure, form, definitions and electronic accessibility of Resource Management Act 1991 (RMA) plans and policy statements to make them more efficient and easier to prepare and use. This is relevant for any future plan changes that may be prepared and adopted either as a result of the SMPs, or within the timeframe of the SMP project. It also sets a clear direction for local authority planning in the coastal environment.

Within the National Planning Standards, Mandatory Provisions for District Councils include a Natural Hazards (excluding coastal hazards) chapter, and a Coastal Environment chapter.

> *10. If provisions relating to natural hazards are addressed (except coastal hazards), they must be located in the Natural hazards chapter.*
>
> *11. The Natural hazards chapter must include cross-references to any coastal hazards provisions in the Coastal environment chapter.*

….

> *28. If the district has a coastline, a Coastal environment chapter must be provided that:*
>
> *a) sets out the approach to managing the coastal environment and giving effect to the NZCPS*
>
> *b) sets out provisions for implementing the local authorities functions and duties in relation to the coastal environment, including coastal hazards*
>
> *c) provides cross-references to any other specific coastal provisions that may be located within other chapters.*

3.7 National Environmental Standards

National environmental standards (NES) are regulations made under Section 43 of the RMA that prescribe standards for environmental matters. There are currently 6 NES in force, with a further 3 in development. Of potential relevance to this project are the NES on Plantation Forestry 2017, Sources of Drinking Water 2007, and Assessing and Managing Contaminants in Soil to Protect Human Health 2011. The Plantation Forestry NES is important given the amount of plantation forestry cover in the district, as forestry has an impact on sedimentation into our waterways and coastal receiving environments.

3.8 National Policy Statements

National policy statements are instruments issued under section 52(2) of the Resource Management Act 1991. They state objectives and policies for matters of national significance. There are currently four NPS in place, as well as the NZCPS. In 2016, MfE were working on a National Policy Statement on natural hazards. This appears to have stalled with the change of

government in 2017 and has been reconsidered in light of the recommendations of the Climate Change Adaptation Technical Working Group.

The NZCPS is a key driver for this project. The NPS on Freshwater Management is relevant to the wider concept of integrated management, and only as it relates to the way regional councils implement the NPS-FW recognising the interconnected nature of freshwater bodies and the coastal environment.

3.9 New Zealand Coastal Policy Statement 2010

Sections 56 and 57 of the RMA requires the Minister of Conservation to prepare a New Zealand Coastal Policy Statement (NZCPS) to achieve the purpose of the RMA in relation to the coastal environment. The NZCPS must be given effect to in the RPS and regional and district plans. The current NZCPS came into effect in 2010 and sets clear national policy direction for managing natural coastal hazards and climate change (Objective 5) in the coastal environment.

Other relevant policies include Policy 1, which outlines the extent and characteristics of the coastal environment. This guidance has led to the inclusion of a mapped Coastal Environment Line in the TCDC District Plan (see Section 5.3 below for further discussion). While Policy 3 directs the adoption of a precautionary approach to particularly in relation to the use and management of coastal resources potentially vulnerable to the effects from climate change.

The preamble to the NZCPS recognises that activities in the coastal environment are susceptible to the effects of natural hazards such as coastal erosion and tsunami, and those associated with climate change. Objective 5 seeks to ensure management of coastal hazards is risk-based and takes account of climate change. It requires proactive management, including locating new development away from areas prone to such risks; considering responses, including managed retreat, for existing development; and protecting and restoring natural defences.

Objective 5 gives rise to Policies 24, 25, 26 and 27 which are of particular relevance to the development of SMPs. The focus of Policy 24 is the identification of coastal hazards, assessing risk over at least 100 years, including the consideration of national guidance (see section 3.3 above). Policies 25, 26 and 27 consider the avoidance of any increase in risk, discourage the use of hard protection structures, promote the use of natural defences against coastal hazards, and the address the protection of existing development when avoidance is no longer an option.

With regard to any future plan changes associated with this project, there is significant case law relating to the implementation of the NZCPS, in particular the King Salmon decision (2014) of the Supreme Court. This decision noted that as all regional policy statements, regional plans and district plans are required to give effect to the NZCPS, they must similarly require the 'avoidance' of adverse effects on outstanding landscapes and areas of outstanding natural character. It is suggested that recent and relevant case law (under not just the RMA) is considered in the subsequent phases of this project.

A 2017 review of the effectiveness of the NZCPS found that the Supreme Court's decision on the King Salmon case has had significant implications for implementation of the NZCPS. The review also found that implementation of coastal hazard policies has been challenging, most notably due to a lack of national guidance and consistent methodology for hazard identification and assessment. This is beginning to be addressed with the publication of the MfE guidelines ('Coastal hazards and climate change: Guidance for local government', MfE, Dec 2017).

The NZCPS requires local authorities to give effect to its provisions, including co-ordinated management and collaboration with other agencies with relevant functions and responsibilities for the coastal environment, such as the Waikato Regional Council. This is supported by a 2014 thinkpiece by LGNZ which states its key suggestion for a more strategic collaborative approach to natural hazards management.

Other Documents

The NZ-Aotearoa Government Tourism Strategy was launched in May 2019. This document champions sustainable growth within ecological limits and recognises the impacts of climate change on the tourism industry.

4 Regional Context

The Waikato Regional Council has a statutory role to play under the RMA and the CDEMA in managing natural hazards. Under sections 30 and 62 of the RMA, regional council functions include the control of the use of land for the purpose of avoiding or mitigating natural hazards. The Regional Council is also required to prepare a Regional Policy Statement (which all Regional and District Plans must give effect to) and a Regional Coastal Plan (which covers the entire Coastal Marine Area of the region).

The WRC has a particularly thorough body of work in relation to coastal hazards. This paper focusses on the statutory and policy context, however it is worth noting the following regional information and guidance is available:

- The *Coastal Inundation Tool* is managed by the WRC and identifies areas that may be subject to inundation across the region, particularly with reference to sea level rise. It is not designed to provide specific property data (for example, to inform minimum floor levels); rather provide a snapshot of potential inundation.
- This led to the development of the *Waikato Regional Hazards Portal* which improves access to hazard information, and aims to help the public, local authorities and others make informed decisions about their exposure to natural hazards. The Portal collates available spatial hazard information into a GIS viewer.
- In 2002, the WRC produced "*Development Setback Lines for Coromandel beaches*", which identified two lines along the coast identifying land at risk from coastal flooding and erosion under existing conditions, and in 100 years. These were recommendations provided to both Hauraki and Thames Coromandel District Councils to help them plan for future coastal development, with the aim being that buildings are set back far enough from the sea to avoid any danger from coastal erosion or flooding – thereby

avoiding the need for coastal protection structures. The data informing these has since been reviewed and TCDC has adopted a tighter framework to manage this risk.

4.1 Waikato Regional Policy Statement 2016

The RMA requires the Waikato Regional Council to develop a Regional Policy Statement which provides a consistent set of objectives, policies and methods for the Waikato Region. This includes the management of land use and subdivision in response to natural hazards.

The Waikato Regional Policy Statement (WRPS) was made operative in May 2016.

The RPS also requires territorial authorities to be responsible for the control of the use of land to avoid or mitigate natural hazards, except where the WRC retains control in respect of:

1. structures in primary hazard zones; and
2. the control of the use of land in the CMA and the beds of lakes and rivers.

The RPS (through Policy 4.1 and methods 4.1.9 and 4.1.13) notes that specific focus should be directed to long term risks of sea level rise to settlements and infrastructure, and increased potential for storm damage and weather-related natural hazards. A central tenet of this approach to hazard planning is the development of a consistent risk assessment methodology that can be applied across the region. WRC is currently trialling a methodology which will be tested and refined via application in the Kaiaua Coast 2120 Community Plan project[6]. The opportunity exists for TCDC and WRC to work together through the SMP process and incorporate and test the risk assessment methodology through this project.

Objective 3.6 (Adapting to climate change) and Objective 3.7 (Coastal environment) seek to avoid the potential adverse effects of climate change through integrated management of land use and the coastal environment.

Objective 3.24 (Natural hazards) seeks to manage the effects on communities and the environment by increasing community resilience, reducing risk and enabling recovery from hazard events. Policies 4.1 and 4.2 seek to manage the effects of natural hazards by adopting an integrated and collaborative approach. Other associated policies include:

- that coastal development occurs in a way that provides for setbacks (for both new and existing development), allows for the potential of sea level rise including landward migration of coastal habitats, and avoids increasing risk in coastal area (Policy 6.2);
- that a natural hazard risk management approach be taken that ensures risk does not exceed acceptable levels, prefers use of natural features over manmade structures for defence, and uses best available information and practice (Policy 13.1);
- that subdivision, use and development are managed to reduce the risks from natural hazards to an acceptable or tolerable level (Policy 13.2).

[6] Currently underway, this Plan will look at climate change and natural hazards, district plan zoning and infrastructure, economic opportunities for the area, and community infrastructure. A key input into the project is a natural hazard and risk assessment. The Plan is being led by Hauraki District Council in collaboration with officers and elected representatives from WRC, Waikato District Council and iwi.

The RPS (6.2.4) makes explicit provision for regional plans to identify circumstances where existing development along the coast is to be relocated to avoid natural hazards, including the projected effects of climate change. This must be tied back into Primary Hazard Zone identification and community strategies. This approach of managed retreat is in stark contrast to the historically preferred approach to 'hold the line' but is aligned with current coastal hazard planning. Managed retreat has not been tested robustly in a New Zealand context and its successful implementation is likely to be through a generational strategy. The inclusion of managed retreat within the RPS provides a strong policy framework that has been publicly tested and supported (through the submission process), and gives clear direction on the risk-based methodology to managing natural hazards. The RPS expects that District Plans will identify what is 'acceptable' and 'tolerable' risk for their communities, and defines these terms accordingly[7]. It is anticipated that identifying and quantifying these risks will be advanced through the development of SMPs.

Areas of intolerable risk are those areas that have been classified as a High Risk Flood Zone or a Primary Hazard Zone. The expression of 'intolerable risk' may well vary between communities depending on their level of willingness to accept risk. Under the RPS (13.1.2), the TCDC District Plan is required to recognise and provide for identified primary hazard zones, as well as identifying high risk flood and coastal hazard areas (13.2.2). Given the current draft status of the natural hazard risk assessment methodology, an integral factor to identifying Primary Hazard Zones, these zones are expected to be progressively identified over time and then incorporated into district plans. The SMP process provides an opportunity to empower communities to define local Primary Hazard Zones in the short term, rather than have it imposed on them.

The WRPS also states the projected sea level rise and increase in rainfall intensity that district plans shall have particular regard to; being a minimum increase in sea level of 0.8m by 2090 (relative to 1990 levels). However, in accordance with Method 4.1.13, more recent policy guidance[8] states that councils should use updated 2017 MfE guidance figures for sea level rise and climate change in preference to WRPS values.

In relation to the definition of the 'coastal environment', it is noted that the WRPS clearly identifies the landward extent of the coastal environment at an indicative level (Map 4-11 through to Map 4-18 in the RPS), and goes on to specify that regional and district plans must adopt this indicative extent, unless otherwise determined by further detailed investigation. The Coastal Environment Line in the TCDC Proposed District Plan supersedes the maps in the WRPS as it has been developed in consultation with the local community.

---

[7] **intolerable**: risk which cannot be justified and risk reduction is essential e.g. residential housing being developed in a primary hazard zone; **tolerable**: risk within a range that a community can live with so as to secure certain net benefits. It is a range of risk that is not regarded as negligible or as something to ignore, but rather as something to be kept under review and reduced if possible; and **acceptable**: risk which is minor, and the cost of further reducing risk is largely disproportionate to the benefits gained e.g. residential housing being developed beyond coastal setbacks.

[8] *'Waikato Regional Policy Statement – Implementation Practice note on Natural Hazards', March 2019.*

The WRPS incorporates the concept of 'residual risk' and requires these to be identified in district plans. Residual risk refers to the risk that remains even with a structural defence in place; specifically in the event of a failure or greater than design event occurring. The exercise of mapping these residual risk zones is recommended in the WRPS to be a collaborative effort between regional and district councils, and requires mapping of areas that benefit from a structural defence. It is envisaged that the SMP process will result in mapping of these areas through detailed coastal hazard and risk assessment work.

The WRPS is consistent with the MfE guidelines and the dynamic adaptive pathways planning approach, in particular through the RPS reference to collaboration with territorial authorities to develop long term adaptive management strategies with potentially affected communities (Policy 13.1 and Method 13.1.3). These Long-Term Community Strategies need to also consider and address the implications of allowing development in residual risk zones, which is an opportunity the SMPs can deliver.

This project should consider to what extent the Shoreline Management Plans can deliver Long-Term Community Strategies (LTCS) under the WRPS, including identifying Primary Hazard Zones for local communities by understanding what intolerable risk means in each community. Method 13.1.3 clearly outlines what the LTCS will include, and these components are reflected in the project brief. The region's Natural Hazard Risk Assessment Methodology is anticipated to aid the development of the LTCS's. Conversely, the project will also contribute to refinement of the draft Natural Hazard Risk Assessment Methodology.

4.2 Waikato Regional Coastal Plan 2005

The Waikato Regional Coastal Plan (RCP) was developed in 2005 which is prior to the NZCPS and, as such, does not fully give effect to that document. The RCP applies across the coastal marine area (CMA) of the Waikato region, from the line of mean high water spring (MHWS) out to 12 nautical miles (approximately 20 km). The majority of the Thames Coromandel coastline is recognised as either Locally or Regionally Significant Coastal Environment, except for the northern tip and the offshore islands which are recognised in the WRCP as Nationally Significant Coastal Environment.

Waikato Regional Council has recently commenced work on a review of the Regional Coastal Plan as part of the Healthy Environment He Taiao Mauriora project. This project will also review the Waikato Regional Plan. Ultimately, the Waikato Regional Coastal Plan and Waikato Regional Plan will be combined and will be renamed the Waikato Resource Management Plan. It is WRC's intention to have a fully approved and operative plan by 2028, while currently working towards publicly notifying a revised Coastal Plan in 2021. The purpose of the review is to more fully implement national policies (including the NZCPS), standards and plans, reduce complexity, and update and align with Council's strategic direction.

Notwithstanding that a review of the RCP is underway, there are key elements of the existing RCP that are currently relevant, and will remain relevant for the duration of the SMP project. The RCP lists objectives and policies that it is seeking to achieve in order to address issues that it identifies. With regard to natural hazards, the RCP seeks to adopt a precautionary approach

in identifying coastal hazard risk and developing integrated hazard management strategies for these areas (Policies 8.1.1 and 8.1.2). The RCP seeks a reduction in hazard protection structures to control coastal erosion, and any structures must be necessary and avoid or remedy adverse effects (Policy 8.1.4). Other key issues within the RCP include preserving natural character, amenity values, tangata whenua involvement in management of the coastal environment.

The methods for achieving the objectives and policies of the RCP include both statutory and non-statutory elements. Relevant rules in the RCP relate to governing activities in the CMA that are affected by, or will affect, coastal hazard and risk. While short-term structures[9] for hazard management must be granted resource consent, the rules for other coastal structures are less permissive. The RCP identifies the Firth of Thames as an area of significant conservation value (ASCV 9), and prohibits some activities that would have a significant or irreversible effect, e.g. exclusive occupation of the CMA, some structures meeting certain criteria. There are exceptions to these rules for works for flood or erosion control, and roading infrastructure. Assessment criteria for rules relating to structures in the CMA require regard to be had to the extent to which the structure is designed, constructed and maintained to a standard to withstand coastal processes and 'relative changes in sea level'.

4.3 Waikato Regional Plan 2008

The WRP contains policy and methods to manage the natural and physical resources of the Waikato region. The plan applies across the whole of the Waikato region, but does not apply to the coastal marine area (CMA) below mean high water springs. It is worth noting however that preliminary scientific work is underway on a plan change in relation to freshwater quality in the Waihou and Piako river catchments and the Coromandel Peninsula. It will cover both the plains and the peninsula which both flow into the Firth of Thames. This plan change process is anticipated to merge with the timeline for the Coastal and Regional Plan review.

4.4 Integrated Catchment Management

WRC has divided the region into eight Catchment Management Zones, each with its own Zone management plan to promote and enable integrated catchment management. There are two Zone plans of relevance to the Thames-Coromandel District.

Coromandel Zone Plan – Te Mahere Ā-Rohe o Coromandel 2012

This plan provides the broad direction for the implementation of WRC's integrated catchment management activities. The Zone Plan sets out a number of 30-year goals that recognise the importance of the coastal environment and the need to manage natural hazard risks, including to 'protect people, property and essential services from flooding' and to 'enhance and protect coastal environments'. In the coastal space, this plan largely focuses on the impacts of sedimentation on water quality and ecosystem function, with additional actions around

[9] Rule 16.7.1 defines this as "for periods of time less than 3 months".

mangrove management and the Beachcare programme[10]. The plan also covers natural hazards of note in the Zone, with an implicit focus on information provision and flood protection.

Map 3 WRC's Coromandel Zone Plan coverage

[10] The Beachcare programme addresses hazard mitigation through recovery post-erosion, in additiona to enhancing natural character, amentiy and biodiversity value of restored sites. Works are undertaken on foredunes, back dunes and coastal forests.

Harbour and Catchment Management Plans (HCMPs) implement aspects of the Zone Plan and seek to address priority issues within the harbour and catchment area. In the Coromandel Zone, HCMPs have been developed for Whangamatā, Whangapoua, Wharekawa and Tairua with plans in development for Coromandel/Manaia and Whitianga/Mercury Bay.

Waihou Piako Zone Plan - Te Mahere Ā-Rohe o Waihao Piako 2017

With respect to SMPs, this plan covers the Thames-Kopu coast and has a focus on 'maintaining appropriate flood protection to rural land and urban areas within the zone'. The plan notes the significant risks posed by climate change and rising seas to low-lying areas, highlighting residual risk behind existing flood control works and the challenges of maintaining historic levels of service.

4.5 Coastal Erosion Risk Mitigation Strategy for the Waikato Region 1999

This plan aims to develop a pattern of land use and development that enables coastal communities to live with coastal erosion and minimises the need to modify natural coastal processes. The central tenets of the strategy are an integrated partnership approach. The strategy also identifies priority area for urgent action, including some sites on the Coromandel coast including Buffalo Beach, Cooks Beach, Hahei, Thames Coast highway and Koputauaki Bay.

4.6 Coastal Flooding Risk Mitigation Strategy 1999

This plan sets out efficient and effective flood risk management for the coastal marine areas of the Waikato Region and the role of councils and the community in managing the impact of potential hazards. It too identifies priority sites and promotes a partnership approach to managing the hazard. Priority areas are Thames, Moanataiari, Tararu, Waikawau, Whitianga, Te Puru, Waiomu, Thornton's Bay and Te Mata.

5 Local Context

At the local level, the Thames-Coromandel District Council has a plethora of policy and planning documents that inform management of the coastal environment. The salient documents are discussed further below.

5.1 Iwi Management Plans

The Treaty of Waitangi/Te Tiriti o Waitangi is relevant to the protection of Māori interests and taonga, and iwi management plans provide a means for Māori to assert their tino rangatiratanga and kaitiakitanga.

The development of an Iwi Management Plan (IMP) will reflect the priorities of the iwi/hapū preparing the plan. IMPs are holistic documents that cover more than environmental management issues under the Resource Management Act 1991 (RMA). IMPs will be entrenched in Te Ao Māori and tikanga and acknowledge an iwi's whakapapa (connections) to their taiao (environment), including their whenua (land), moana (sea) and tūpuna (ancestors).

IMPs may include issues, concerns and/or directions relating to economic, social, political and cultural issues as well as to environmental and resource management issues. In addition, IMPs may also provide, objectives, policies and methods relating to ancestral taonga, such as rivers, lakes, seabed and foreshore, mountains, land, minerals, wāhi tapu, wildlife and biodiversity. IMPs may address a single issue (e.g. water quality) or a resource (e.g. fisheries) or provide a high-level overview of resource management issues. IMPs may also include how iwi/hapū expect to be included in the co-management, co-development and active protection of their resources and taonga.

The Resource Management Act 1991 (RMA) describes an iwi management plan as *"…a relevant planning document recognised by an iwi authority and lodged with the council"*. Section 2 of the Act defines an iwi authority as *"the authority which represents an iwi and which is recognised by that iwi as having authority to do so"*. IMPs must be taken into account by regional councils and territorial authorities when preparing or changing a regional policy statement, or a regional and district plan (sections 61(2A)(a), 66(2A)(a), and 74(2A).

TCDC's Coastal Management Strategy 2018 recognises the relationship of tangata whenua with the coastal environment and provides for Council's support of IMPs as they relate to the coastal environment.

There are two IMPs published[11] by iwi within the Hauraki area:

- *Whaia te Mahere Taiao o Hauraki - Hauraki Iwi Environmental Plan* (2004), and
- Ngāti Porou ki Hauraki – Marine and Coastal Plan (2015).

Whaia te Mahere Taiao o Hauraki is a strategy in place to sustain mauri of the natural environment and cultural heritage of the Hauraki rohe over the next 50 years. Whaia te Mahere Taiao o Hauraki contains relevant sections pertaining to the management of coastal habitats, sediments, fluvial and pluvial flooding and would assist with an SMP process. This document is now 15 years old and could be updated to reflect post-Treaty settlement arrangements and the emerging issues associated with climate change and sea level rise.

Whaia te Mahere Taiao o Hauraki is relevant to the beneficiaries of the Hauraki Māori Trust Board who are the descendants of Ngāti Hako, Ngāti Hei, Ngāti Maru, Ngāti Paoa, Patukirikiri, Ngāti Porou ki Harataunga ki Mataora, Ngāti Pūkenga ki Waiau, Ngāti Rāhiri-Tumutumu, Ngāi Tai, Ngāti Tamaterā, Ngāti Tara Tokanui, and Ngaati Whanaunga collectively referred to as the Iwi of Hauraki.

The Ngāti Porou Ki Hauraki plan is designed to protect customary rights and assert the custodial obligations of Ngāti Porou ki Hauraki as they relate to the marine and coastal area.

[11] Three iwi known to be present on the Peninsular (Ngāti Rongoū, Ngāti Pū and Ngāti Huarere) either did not have an IMP available as an online resource or have not developed an IMP. Where an IMP was not detected via an internet search, this does not necessarily mean iwi have not developed an IMP. Some iwi may prefer to maintain ownership of this resource as it contains their mātauranga/knowledge.

5.2 Statutory Acknowledgement Areas

A statutory acknowledgement is an acknowledgement by the Crown that recognises the mana of a tangata whenua group in relation to cultural, spiritual, historic and traditional associations with a statutory area. There is one Statutory Acknowledgement Area in the district – the Ngati Pukenga Claims Settlement Act 2017. The geographical extent of this area comprises the Hauturu Block (inland) and the Manaia River corridor. Council must have regard to this acknowledgement, particularly as it relates to resource consent applications.

5.3 TCDC District Plan

The current district planning framework is characterised by two District Plans; the Operative District Plan (2010) and the Proposed District Plan, which has been under development since 2012. In terms of status, portions of the Proposed District Plan (PDP) can be treated as operative, however some parts are still going through the appeals process. While the hearings have been completed, a consolidated set of decisions is yet to be released by the Environment Court, but is anticipated by Council in the near future[12].

This analysis of the statutory context for Shoreline Management Plans focuses on the Proposed District Plan. While this is not wholly operative, the PDP sets a very clear direction as to what the community sees are the major issues for the district. It is not anticipated that the appeals process will result in expansive and wholesale changes to the general intent and direction of the PDP.

The PDP sets a clear direction on resource management in the district. The PDP gives effect to the NZCPS, the Waikato RPS and Regional Plan, and is required to not conflict with Section 7 (national significance of Hauraki Gulf) and Section 8 (objectives for the management of the Gulf) of the Hauraki Gulf Marine Park Act. This Act is discussed in greater detail in section 3.5 of this report. The PDP identifies issues that need to be addressed, objectives and policies to achieve or implement resolution of these issues, and rules relating to particular activities in defined land use zones. The PDP comprises rules around residential and commercial activities and structures, community facilities, natural hazards, coastal environment, earthworks, infrastructure, subdivision, and other types of land use in the district.

The Coastal Environment (Section 7) is an overlay on the planning maps, and comprises overlays relating to biodiversity, natural character, natural hazards, historic heritage and outstanding natural landscapes and features. Parts of the Coastal Environment chapter are still under appeal. These appeals relate to the indicative Coastal Environment Line which defines the coastal environment for the district, and objectives relating to long term effects of climate change. It is understood that the appeals relating to the Coastal Environment Line do not relate to the overarching use or identification of the CEL; but relate specifically to how the CEL intersects with individual parcels of land[13].

[12] Current status as at August 2019

[13] pers. comm. Kirsten Williamson TCDC (August 2019)

The Proposed District Plan adopts a risk management approach to coastal hazards. Section 10.1.2 provides direction on the assessment of risk as Acceptable, Tolerable and Intolerable. As identified in section 4.1 above, this is consistent with the WRC's direction for risk assessment. It is understood that TCDC will work with communities and WRC to review the likelihood and consequence categories, and this will be incorporated into the PDP through a plan change.

The Natural Hazard chapter (Section 10) of the PDP identifies the three major natural hazards in the District as being flooding, coastal erosion and tsunami. The PDP identifies a key issue being a long-term risk of increasing natural hazards (coastal erosion and inundation, river flooding, drought etc.) due to the effects from projected climate change. Section 10.3 of the PDP outlines the objectives and policies associated with natural hazards. None of these are under appeal. In summary, these objectives and policies provide for natural hazard risk to not increase; protection from risk in a manner that maintains the resilience of the natural environment; for 'soft' coastal defences where they do not increase risk and 'hard' coastal defences as a last resort; for 'future-proofing' development in the face of potential risk; and adoption of the precautionary approach and potential effects of future climate change.

Section 34 of the PDP contains rules managing flooding, coastal erosion and tsunami hazards in areas where an overlay is provided on the planning maps. Of particular note within the PDP are two indicative mapping lines. The first is the Current Coastal Erosion Line (CCEL) which identifies the current erosion risk. Land seaward of the CCEL is currently at risk of coastal erosion, with a 1% chance of a coastal erosion event per year. The purpose of the CCEL is for landowners to be aware of the risk level and plan accordingly. Buildings seaward of the CCEL are not permitted, however reasonable use of existing lots is provided for where the risk is tolerable (34.5.2).

The second mapping line is the Future Coastal Protection Line. This defines the area potentially at risk from erosion in the next 100 years should sea level rise as projected (in this case, a 0.9m sea level rise relative to 1990 levels). The aim of this line is to avoid additional cost or risk for future generations by avoiding more intense residential use or key community assets in this area. Any resource consent must demonstrate how it will deal with the future erosion risk. Typically, the most onerous activity status for development in these areas is non-complying, however there is the occasional instance of prohibited activity in relation to buildings at specific locations. Both of these lines will be reviewed as part of this project. This will also provide Council an opportunity to review the objectives, policies and rules in the District Plan that support them.

The PDP also includes rules around where you can build/undertake activities in relation to flooding risk, tsunami and types of flood risk defences. This can include requiring a minimum floor level for buildings in a flood plain, and requiring specialist reports on identified hazards and how these can best be mitigated.

Historically, Open Space zoning has been applied to areas susceptible to natural hazards. Where advanced hazard modelling has identified specific areas or lots susceptible to hazard,

this information has been applied as an overlay to the planning maps. The Open Space zoning is used to denote areas where detailed hazard modelling has not yet been done.

With regard to growth and development in the coastal environment, the objectives and policies (15.3, 15.3c) require development to allow for the potential effects of sea level rise, and avoid any increase in natural hazard risk. There are 14 Site Development Plans (SDPs - essentially Structure Plans that pre-date the PDP) for particular areas around the district. These are included in the PDP and there are rules associated with each one. While there are no specific provisions in any SDPs relating to coastal hazards, inundation or erosion, the SDPs must be considered in relation to subdivision and development in these areas. In addition to the SDPs, there are 5 Structure Plans within the PDP. The Kopu to Thames Structure Plan is the only Structure Plan to have provisions relating to hazards, specifically the risk of flood hazard from the Waihou River.

The PDP identifies a key issue being the level of recognition given to the strong cultural and historic relationship of tangata whenua with the coastal environment, and significant weight is given to measures to recognise and provide for this. Consideration is also given to protecting regionally significant infrastructure throughout the district (such as the national grid, state highway, lifelines infrastructure).

In relation to integrated management, the PDP clearly identifies collaboration with the Waikato Regional Council as a means of dealing with cross boundary issues such as natural hazards, particularly in the coastal environment. In particular, the PDP notes TCDC's responsibility lies in controlling the use of land (except within the CMA or the beds of lakes and rivers) to avoid and mitigate natural hazards. However, the PDP (section 5.4.2) further acknowledges that:

> *"WRC is responsible for natural hazard identification, assessment of risk and development of strategies, establishing and coordinating a regional natural hazards forum, storing natural hazard risk information, and advocating for natural hazard identification, use of best practice and strategic approaches.*
>
> *WRC will lead the setting of acceptable risk, tolerable risk and intolerable risk thresholds with engagement with district councils and the community. These thresholds are a product of natural hazard consequences and likelihood of occurrence. WRC will also control natural hazard risk and effects in primary hazard zones."*

This summary of the statutory and policy context for the SMP project does not delve into the minutiae of specific rules of the District Plan; rather a high-level scan of the issues, objectives and policies that inform rule development. It is envisaged that an audit of relevant District Plan rules may be undertaken in subsequent stages of the project.

5.4 Reserve Management Plans

All Council reserves and reserves vested in Council are managed under a Reserve Management Plan, these plans provide direction for the day-to-day management, factors that impact these

reserves and establish clear directions for future management and development where appropriate.

TCDC is currently undertaking a rolling review of existing RMPs in order to align the plans better with changing communities needs and expectations for reserves. Council has recently adopted the Coromandel-Colville RMP and the district-wide General Policies RMP which provides a comprehensive and holistic assessment of key issues. The Thames and Thames Coast RMPs are currently being consulted on with Mercury Bay, Tairua-Pauanui and Whangamata RMPs the last to be reviewed.

The General Policies RMP acknowledges that coastal hazards have the potential to impact on the safety and use of reserves. The General Policies RMP emphasises an 'avoidance' philosophy, rather than 'protection', recognising that hazard events are natural occurrences. The objectives and policies in relation to natural hazards seek to assess the risks to Council facilities and visitors, ensure development and use of reserves does not worsen potential effects of hazards, and protect infrastructure assets. The Coromandel-Colville and draft Thames and Thames Coast RMPs identify coastal erosion as a key issue for reserves adjacent to the coast. The proposed actions to manage this erosion is to identify options for intervention through the Shoreline Management Plan. It is anticipated that the review of the remaining RMPS will result in similar content in relation to avoiding coastal hazards. In many cases, these reserves abut private property and land subject to Treaty settlement, providing opportunities for a partnership approach to shoreline management.

5.5 Community Plans

A series of distinct local plans have been prepared for some parts of the district to promote local aspirations for communities. These plans have no statutory weight and communities have developed the plans themselves, although council recognises them as useful in guiding decision-making. There are Community Plans for Coromandel, Hikuai, Manaia, Mercury Bay, Pauanui, Tairua, Thames and Whangamata. It is understood that Council will be reviewing and consulting on Community Plans during 2019.

Some of these plans include actions relating to coastal hazard and shoreline management. For example, the Whangamata Strategic Community Plan (2015) identifies the highest priority action for this community as implementing the Eastern Seaboard Coastal Erosion Strategy, including dune restoration, planting and maintaining beach access.

These plans, and the community engagement processes and governance arrangements they utilise, provide a clear path to make the most of existing social capital and engage with active civil society. It is unclear how they may link with, or align with, Long-Term Community Strategies advocated for by the WRC.

5.6 Marine and Harbour Facilities Strategy 2017

The Strategy sets out a long-term plan for the management, maintenance and funding of boat ramps, wharves and jetties across the District. The strategy aims to find the balance between providing appropriate facilities while not detrimentally affecting the wider community's ability

to enjoy the coastal amenity, in particular the costs associated with these coastal assets. The strategy identifies the impacts of sea level rise and coastal inundation as a key influencing factor. A key action is the stocktake and condition assessment of all marine and harbour assets across the district, and development of a 20-year work programme including clarifying ownership and consenting anomalies across the assets. Council has also committed to working with NZTA to ensure roading and access to key facilities are fit for purpose.

5.7 Long Term Plan 2018

Council's latest Long Term Plan (LTP) sets out the work programme for the decade 2018-2028. There is a clear focus on ensuring council infrastructure and assets are maintained and risk from coastal hazards and climate change are considered. Council has committed to test all major new infrastructure and asset renewals against a potential sea level rise of 1.4m by 2120 up to a rise of 1.88m by 2150 in line with MfE guidelines.

5.8 Code of Practice for Subdivision and Development 2013

This document prescribes the way that infrastructure has to be designed and constructed for subdivision and development. This specifies the engineering requirements for building and development, such as requiring geotechnical investigations to evaluate the risk from natural hazards. This document does not directly reference coastal hazards or increased risks associated with climate change. Nor does it appear to require infrastructure to be designed with consideration given to these factors.

5.9 Hauraki District Plan 2014

The Hauraki District has two operative district plans – the Franklin District Plan and the Hauraki District Plan. The Franklin District Plan covers the part of the district that was formerly part of the Franklin District but was transferred to Hauraki through the changes to local government in Auckland. The Hauraki District Plan covers the area that is adjacent to the Thames Coromandel district, but has not been considered in this review of the statutory and policy context as it is wholly outside the Thames Coromandel district. While, as neighbouring local authorities, there are integrated resource management issues to address, the statutory framework of the Hauraki District is not directly relevant to the establishment of Shoreline Management Plans for TCDC.

5.10 Thames Coromandel District Council Coastal Management Strategy 2018

In June 2018, the Council adopted the *Thames-Coromandel Coastal Management Strategy* which set out the problem, the context for and the challenge of coastal climate adaptation. It also set out goals, objectives and actions to support the sustainable management of natural and physical coastal resources, now and for future generations, with a view to building 'resilient' coastal communities. The Strategy supports the adaptation of council assets and services. While the Coastal Management Strategy is a non-statutory document, it aligns with the intent of national and regional frameworks. In August 2018, Council approved the Coastal Hazards Policy that set out the objectives for risk management, levels of service and emergency events at the coast.

5.11 Coastal Hazard Policy 2018

The Coastal Hazard Policy was adopted by Council in 2018 and is an update of a 2007 policy framework. It sits under the umbrella of the Coastal Management Strategy and sets out how Council will manage coastal hazards, following the risk management approach in the District Plan, while clarifying the different roles that Council has. The focus of the policy is on avoidance or adaptation actions in advance of any emergency situation arising.

In relation to new and existing infrastructure, the policy states that Council will avoid increasing the level of future risk from coastal hazards by (re)locating away from MHWS. The policy also covers coastal protection works and the use of Council foreshore property for coastal protection. There is a clearly specified expectation that landowners seeking to implement coastal protection measures must manage risk within an entire coastal cell (where cells are not identified in the policy) irrespective of land ownership. It is envisaged that this level of technical detail will become more relevant over time as this policy is tested, and also through the development of SMPs.

5.12 TCDC Productivity Plan 2018

Council approved the establishment of this plan in 2018 as the action plan under the Economic Development Strategy. This plan focuses on preparing a Productivity Plan Programme that aligns with government's Better Business Case approach in order that an application can be prepared under the Provincial Growth Fund. The workstreams include land use and productivity, aquaculture, transport connections and tourism. The critical role of resilient coastal infrastructure is addressed as a key challenge for delivering outcomes under this plan.

REFERENCES

http://www.lgnz.co.nz/assets/Publications/de504aaea2/Managing-natural-hazards-LGNZ-think-piece.pdf

https://eplan.tcdc.govt.nz/pages/plan/Book.aspx?exhibit=TCDC_Appeals2016_External

https://www.beehive.govt.nz/sites/default/files/2019-07/Draft%20Terms%20of%20reference%20-%20comprehensive%20review%20of%20resource%20management%20system.pdf

http://img.scoop.co.nz/media/pdfs/1907/Cabinet_paper__Comprehensive_review_of_the_RM_system__scope_and_process.pdf

https://www.doc.govt.nz/globalassets/documents/about-doc/role/policies-and-plans/waikato-cms/waikato-cms-volume-one.pdf

https://www.doc.govt.nz/about-us/our-policies-and-plans/statutory-plans/statutory-plan-publications/conservation-management-strategies/waikato/

http://www.legislation.govt.nz/act/public/1991/0069/latest/DLM233681.html?search=sw_096be8ed8189d710_statutory+acknowledgement_25_se&p=1

https://www.mfe.govt.nz/publications/climate-change/coastal-hazards-and-climate-change-guidance-local-government

http://docs.niwa.co.nz/library/public/EWTR2006_12.pdf

https://www.pce.parliament.nz/media/pdfs/Whangamata_appendices.pdf

https://www.waikatoregion.govt.nz/services/regional-services/regional-hazards-and-emergency-management/coastal-hazards/

https://www.tcdc.govt.nz/Your-Council/Documents-incl-Bylaws-Policies-and-Strategies/Coastal-Management-Strategy/

http://www.waikatoregion.govt.nz/Council/Policy-and-plans/Rules-and-regulation/Regional-Plan/Waikato-Regional-Plan/

https://www.tcdc.govt.nz/Your-Council/Documents-incl-Bylaws-Policies-and-Strategies/Code-of-Practice/Code-of-Practice-Section-1-to-8/

https://www.tcdc.govt.nz/Global/1_Your%20Council/Documents%20including%20Bylaws_Policies%20and%20Strategies/Long%20Term%20Plan/2018-2028%20LTP/2018-

2028%20Long%20Term%20Plan%20-%20FINAL%20-%20amended%2011%20Decemeber%202018%20-%20website%20version.pdf
https://www.tcdc.govt.nz/Documents/Productivity%20plan.pdf

https://www.tcdc.govt.nz/Global/1_Your%20Council/Documents%20including%20Bylaws_Policies%20and%20Strategies/Reserve%20Management%20Plans/Coromandel-Colville%20RMP.pdf

A2 Appendix 2

Communication and Engagement Strategy

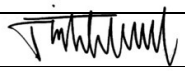
Note that the version of the Communication and Engagement Strategy (CES) included as Appendix 2 to the Scoping Report is an abridged version for the purposes of the scoping phase. A full version of the CES as a standalone report can be obtained if requested.

Communications and Engagement Strategy

Thames-Coromandel Shoreline Management Plans

Te Ara Tapātai o Hinekirikiri
Tīkapa Moana – Te Tara o Te Ika-ā-Māui

CMC
better coasts, together

Project:	TCDC Shoreline Management Plans	
Created By:	Tom FitzGerald, Coastal Management Collective	
Date:	31 October 2019	
Version:	V4 – abridged for inclusion in the Scoping Report	
Approved:	T. FitzGerald	
	SMP Project Office	
	Technical Working Group	
Distribution:		

COVER PHOTO: Waikawau Bay, T. FitzGerald (2018)

© Coastal Management Collective 2019

Contents

Executive Summary

This Communications and Engagement Strategy sits as a companion document to the project Scoping Report. It is intended to be a 'live document' and be continually updated as the project progresses.

This Strategy sets out the importance of building fruitful, trusted partnerships as early as possible in the process of enabling coastal communities adapt to change. A tiered approach to communications and engagement is proposed that allows for both broad public participation and intensive, locally specific collaboration between mana whenua, agencies and key stakeholders and citizens. Critical to this approach is the establishment of a structure to support project governance.

The approach to engagement reflects a mixture of traditional and novel approaches to public participation, designed to enable and inform robust decision-making. Such activities include the establishment of Coastal Panels at locations across the District to work through problems and recommend solutions. Also included are regular communications through a website and newsletter, the development of fact sheets to bed down the latest science or other important foundations, and the dissemination of a public survey to gather detailed information on community understanding of coastal hazards and their consequences, and what they value about the coastal environment.

This Strategy also sets out indicative timeline to match the project timeline given in the Scoping Report.

1 Introduction

- Adapting to coastal risks exacerbated by ongoing sea level rise (Figure 1) will require individuals, families, communities, businesses, infrastructure and utility providers, and governments to make hard choices about an uncertain future. Different interests, expectations, values and world views may result in a lack of consensus. In addition, the impacts of sea level rise and the consequences of coastal risks and solutions will not be the same for everyone (Figure 2). For these reasons, effective community engagement will play a central role in making choices that successfully adapt to coastal change.
- National guidance (Department of Consevation (DoC), 2017; Ministry for Environment (MfE), 2017) recognises that community engagement when developing locally-relevant solutions will be crucial for:
    - Growing community understanding of physical changes that will affect their coast
    - Achieving a collaborative and transparent process that engenders community trust, and
    - Enabling the implementation of long-term risk reduction strategies and action.

Figure 1 Recent erosion along coastal reserve frontage abutting SH 25/Kuaotunu Wharekaho Road.

- The NZ Coastal Policy Statement (NZCPS) (DoC, 2017) also provides explicit recognition of the foundational role mana whenua have as kaitiaki of the coastal environment. The principles of the Treaty of Waitangi set the platform from which tangata whenua participation in the development of Shoreline Management Plans (SMPs) is intended to grow.

- In the preparation of SMPs communication and coordination between the various arms of Council, the project partners, other agencies and communities will be critical, and will require appropriate project governance.

Figure 2 Tractor and trailer for Hahei Explorer Cathedral Cove Boat Tour, Hahei Beach.

2 Project Governance

2.1.1 Introduction

- As part of this project a robust, inclusive and bespoke project governance framework will need to be established to guide delivery of the SMPs and their ongoing implementation. The purpose of this framework will be to lay the foundations for partnerships and ongoing collaboration, both within Council(s) and with external stakeholders and communities.
- In developing the project governance framework, and consistent with Treaty of Waitangi obligations, Coromandel mana whenua should be the project's initial partner, followed by Waikato Regional Council (WRC); with the overarching approach built around this Council-iwi-Council nexus.
- Designed to work across geographic scales the project governance framework (when adopted) will provide the foundation for ongoing adaptive decision-making at the coast, and ultimately enable community resilience outcomes to be achieved.
- The importance of project governance is briefly discussed in the Scoping Report and will be the subject of a report to Council in the new year. The proposed project governance will need to be formally adopted by TCDC and WRC to ensure that the SMPs have the appropriate mandate and required legitimacy to stand the test of time. It is recommended that proposed project governance

arrangements be specifically addressed in a report to Council and a decision sought.

Note: The final project governance framework will have an influence on the Strategy set out herein.

2.1.2 Engaging with Māori

- The coastal environment describes an interwoven relationship between Te Tara o Te Ika-ā-Māui (Coromandel Peninsula) and Tīkapa Moana. It is a taonga which we need to understand, respect, protect and take care of. It is a dynamic place and supports multiple ecosystems that underpin cultural, social and economic values. It is an important part of mana whenua's whakapapa and cultural identity, and is a taonga tuku iho of which mana whenua are kaitiaki. These principles are at the forefront of our engagement with Coromandel mana whenua.
- This Strategy seeks to recognise the strength of the relationship mana whenua have with the coastal environment and expresses a desire to engage and align with mana whenua as kaitiaki. Council intends to build and strengthen partnerships with mana whenua, while aligning with mātauranga and kaitiakitanga to further support mana whenua's deep connections with their moana, whenua and rohe.
- Strong partnerships with mana whenua will enable:
    - the enhancement and protection of the coastal environment
    - protection of wāhi tapu and sites of significance to Māori
    - Te Tiriti o Waitangi settlement obligations to be fulfilled
    - partnerships to help build Māori communities that are resilient to the impacts of climate change.
- In preparing SMPs the intension is to partner with mana whenua and ensure that SMPs reflect mana whenua's values and are founded upon their mātauranga.

2.1.3 Coastal Panels

- A likely key element of the project governance framework will be the establishment of Coastal Panels. Their central aim will be to co-develop SMPs with Council and experts, and recommend a course of action to decision-makers.
- Coastal Panels will be location- or site-specific, matched to coastal compartments and linked to existing governance arrangements where possible, e.g. agency operational or strategic areas, TCDC Community Boards and wards, WRC catchment committees, Civil Defence and Emergency Management community groups, existing stakeholder groups or community organisations, mana whenua and rohe moana. Panels will be asked to grapple with the nature and scale of coastal management issues and recognise that coastal processes ignore administrative boundaries, that cross-boundary issues will arise and that interventions will be necessary.

- This Strategy takes a 'deliberative democracy[1]' approach to the development of SMPs. By establishing Coastal Panels across the District it will aim to supplement existing Council decision-making without seeking to replace it. This approach will:
    - Encourage learning through exchange of perspectives among diverse participants
    - Establish a common understanding of issues and perspectives
    - Seek legitimacy and build trust
    - Focus problem solving at the coast, and wrestle with trade-offs and create real choices
    - Increase diversity representative of the whole community
    - Explicitly link policy decisions with underlying values, a central tenet of a risk-based approach to dealing with coastal change
    - Enable compromise, agreement and possible consensus on the tolerability of coastal risks (Renn & Schweizer, 2009).
- The Panels will involve project partners (political representatives from WRC, TCDC and iwi), key stakeholders and citizens representative of community views. They will provide an efficient and effective route to engaging with social, cultural and political diversity. By ensuring involvement of appropriate participants representative of the community, the Panels will also ensure public and political legitimacy and influence with decision-makers and the broader political sphere.
- To achieve the vision of 'deliberative democracy' the Coastal Panels will be run as mini-publics. Akin to a jury, these small groups of approximately 8-12 persons will be asked to co-design and recommend solutions to deal appropriately with coastal change. This will be accomplished by creating a space for dialogue, deliberation and negotiation to reconcile contested interests.
- Panels will be tasked with working through the development of SMPs according to the sequence of steps and key questions set out in the MfE guidance *Coastal hazards and climate change: guidance for local government* (2017); i.e. What is happening?, What matters most?, What can we do about it?, How do we get it done? and Is it working? They will be facilitated and guided through the process by our experts and have access to the relevant expertise required at each stage. This will be provided by the project team.
- The exact number of Panels that to be established will be finalised in a report to Council seeking approval of project governance arrangements early next year. Key considerations for this decision will be the resourcing, logistics and sequencing required to service the Panels, finalisation of the first pass coastal risk assessment, levels of community concern (as garnered from the Phase 1 community information sessions (see Figure 3), TCDC staff knowledge and the Summer Survey), and completion of the stakeholder mapping exercise (discussed below).

[1] Deliberative democracy describes a theoretical and practical movement that aims to foster engaged citizenship, collaborative proble-solving and the direct involvement of diverse publics in decision-making (from Kahane, D, Loptson, K, Herriman, J & Hardy, M 2013, 'Stakeholder and citizen roles in public deliberation', *Journal of Public Deliberation,* vol. 9, no. 2, pp. 2.).

- The selection of participants for the Panels will be carefully considered to ensure that a diversity of views is represented and that they are balanced. This will be informed through a formal Expression of Interest process (to be run early next year) and by invitation, with Panel Membership to be approved by Council. It is envisaged that Council will also approve draft Terms of Reference (ToR) to establish the Panels, with those ToR to be endorsed by the Panel at their first sitting.
- Panels will be in place only for the duration of the project, however, it is intended that individual participants will have capacity and capability to play a key role in the implementation of SMP Community Action Plans after the completion of the project.
- Panels will be set up in the first half of 2020 and will be expected to operate for 12 months to work through adaptive pathway options for each location. It is envisaged that many panellists will be reimbursed for their involvement, however, the quantum and type of reimbursement will be agreed through the governance paper to Council.
- While there are some risks associated with the formation and operation of 'mini-publics' (Curato & Böker, 2016), this Strategy aims to overcome these through broader democratic processes and institutions. To this end, the work of the Panels will be augmented by traditional, broader forms of public consultation at key milestones, such as those provided for as 'special consultation procedures' under the *Local Government Act 1993*. These broader processes will allow for Panels to justify, clarify, and revise recommendations in response to public feedback.

Figure 3 Community information session at Luke's Kitchen in Kuaotunu, August 2019

3 Purpose of Communications and Engagement

3.1 Introduction

- The overall purpose of communications and engagement in this context is to inform and guide the development, adoption and implementation of SMPs for the Coromandel coast.
- Both the NZCPS 2010 and the 2017 MfE guidance advocate for a risk-based approach to SMPs – central to this is the issue of how to deal with the consequences of coastal change. Witnessed through the trials and failures of previous attempts by local governments at dealing with coastal hazards (e.g. Kāpiti and Christchurch), it is now firmly established that community engagement and collaboration lie at the heart of a successful step-by-step process to assessing, planning, managing, monitoring and reporting on the compounding risks facing coastal asset managers and coastal communities.
- Engaging with the community (Figure 4) can have multiple benefits, including:
    - a better understanding of the problems
    - greater diversity in solutions
    - increased certainty in policy outcome reducing the risk of policy failures
    - more robust decision-making
    - improved efficiency, reduced costs and legal risks through the development of shared understanding and vision
    - educational, capability and capacity building benefits
    - harnesses the collective power of volunteers to support community-led SMPs
    - enhanced trust between government and community, and between stakeholders.

Figure 4 Community drop-in session at Te Puru Hall for WRC's new west coast tsunami models. An example of a number of different engagement methods that may be employed during the Project.

- Our approach will:
    - Enable enduring coastal adaptation solutions by building and maintaining **trusted partnerships** between all stakeholders
    - Aim to **develop adaptive capacity and capability** among partners, key stakeholders and communities to respond to coastal risks
    - **Foster kaitiakitanga** of the coastal environment among stakeholders
    - Ensure **decision-makers are well informed** and able to make legitimate decisions to deal with coastal change, and
    - Ensure that involvement of Māori occurs in a manner **consistent with Treaty objectives.**
- This Strategy is a "living document" and provides a framework and methodology for communicating and engaging with partners, communities and key stakeholders that will be updated at appropriate milestones.

3.2 Principles of engagement

- This Strategy adopts the six principles for encouraging effective dialogue as outlined by MfE (2017)[2] and set out in Figure 5.

3.3 Engagement Goals

1. All partners, communities and key stakeholders are identified, sufficiently informed and appropriately involved in the development, adoption and implementation of SMPs.

2. Trusted relationships are built and maintained with all partners (including Māori), communities and key stakeholders to support implementation of SMPs.

3. Coastal values, knowledge and mātauranga from partners, communities and key stakeholders is appropriately incorporated into the SMPs.

4. The nature of coastal risks are characterised and evaluated on a spectrum of risk tolerability to inform SMPs (and local and regional policies and plans).

5. Real options and new ideas are generated to appropriately deal with risks from coastal hazards.

6. Engagement is effective, efficient and tailored to partners, communities and key stakeholders needs as far as practicable.

7. Recommended actions from SMPs are adopted and implemented with broad community buy-in and sufficient political legitimacy.

[2] This Strategy will also be at least consistent with the 'Principles of consultation' set out in s.82 of the Local Government Act 1993. Broadly, these specify that a local authority must consult in relation to any decision in a manner that allows for persons who may be affected by, or have an interest in, to have sufficient information and opportunity to present their case.

8. Community resilience and kaitiakitanga are enhanced through the ongoing development of capability among partners, communities and key stakeholders.

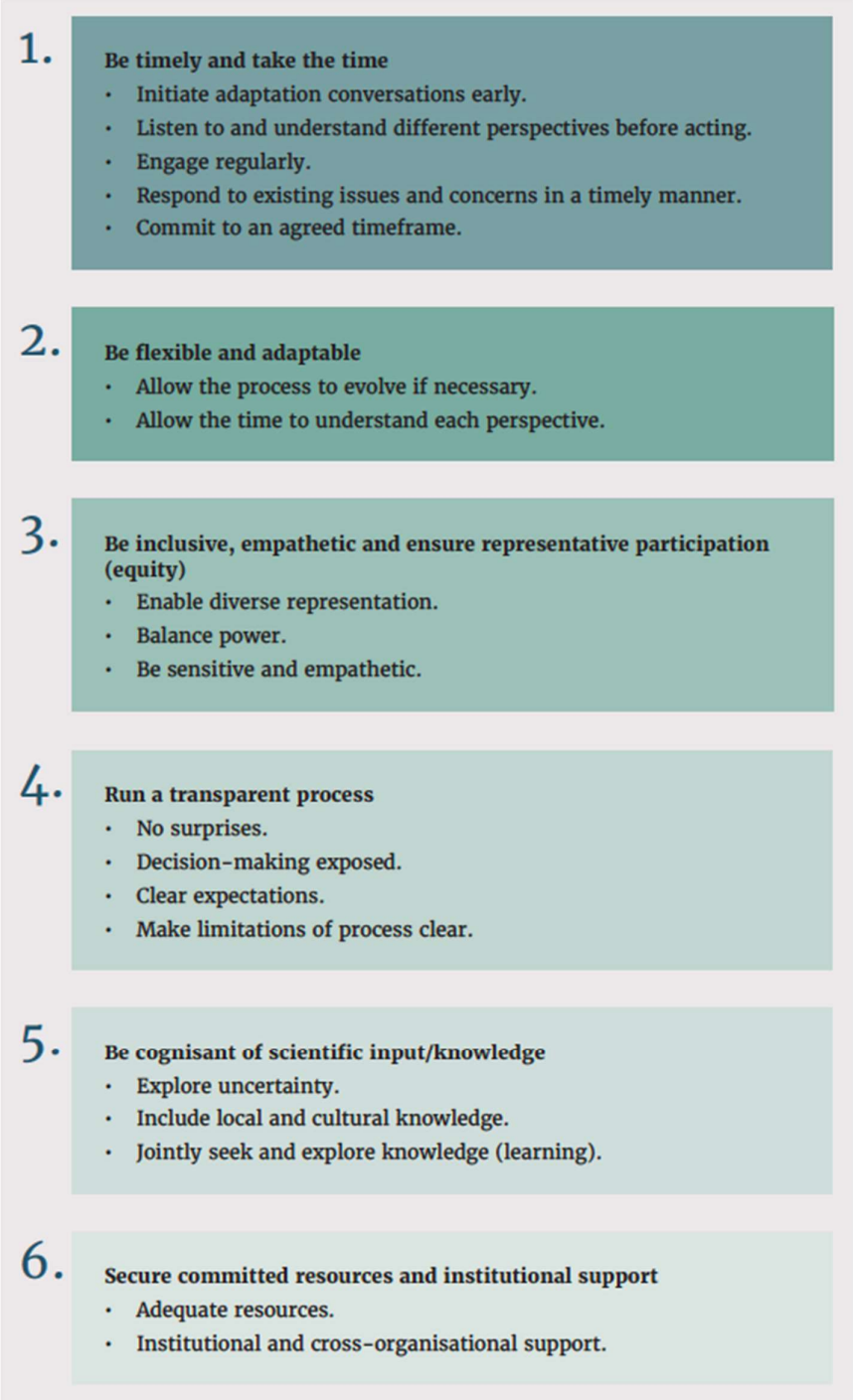


Figure 5 MfE's six principles to encourage effective dialogue

4 Stakeholder Mapping

4.1 Introduction

- This Strategy is based on the foundation that those who are affected, or potentially affected, by a decision have a right to be involved in the decision-making process. In this Strategy we define a 'stakeholder' as an individual or organisation with an interest in SMPs.
- However it is critical to the eventual success of an adaptation effort for governments to effectively engage a broad range of stakeholders when making decisions that will affect the whole community, not just those immediately affected. The following extract describes the difficulties with mapping stakeholders and defining coastal communities:

> "Many coastal Councils undertake a variety of community engagement practices. However, often the public they engage with are either people directly exposed to coastal hazards or members of the community who are actively concerned about the future of their coast (Barnett *et al.* 2014; Smith *et al.* 2016). As a result, a consistent problem has arisen in coastal management; '*how to engage the wider community*?' (Thomsen *et al.* 2009). It must be noted that one, homogenous 'wider community' does not exist. Rather, multiple communities that overlap and are constantly changing make up specific groups, tribes or what we will call 'coastal communities'. Two umbrella categories are commonly used to describe communities: communities of place (e.g. residents) and communities of interest (e.g. tourists, shareholders of companies etc.; Thomsen *et al.* 2009). However, the real challenge in defining coastal communities is considering how each type of community impacts and interacts with the coastal environment and how this may change both temporally and spatially (Thomsen *et al.* 2009)"
>
> UNSW Sydney (2019).

- This Strategy acknowledges that engaging with a community defined by their proximity to coastal hazards or with an active concern in coastal management unnecessarily narrows the scope of engagement, and excludes some voices. This could lead to uninformed decisions, a deficit of public support and ultimately unsuccessful SMP policy implementation. To overcome these challenges this Strategy seeks to engage at multiple scales, in different places and at different times – engagement in particular locations will occur in tandem with attempts to involve the 'wider community'.

4.2 Spectrum of Public Participation

- The recognition that communication and community engagement is not a "one-size-fits-all" activity requires public participation activities to be tailored for different audiences (Figure 6).

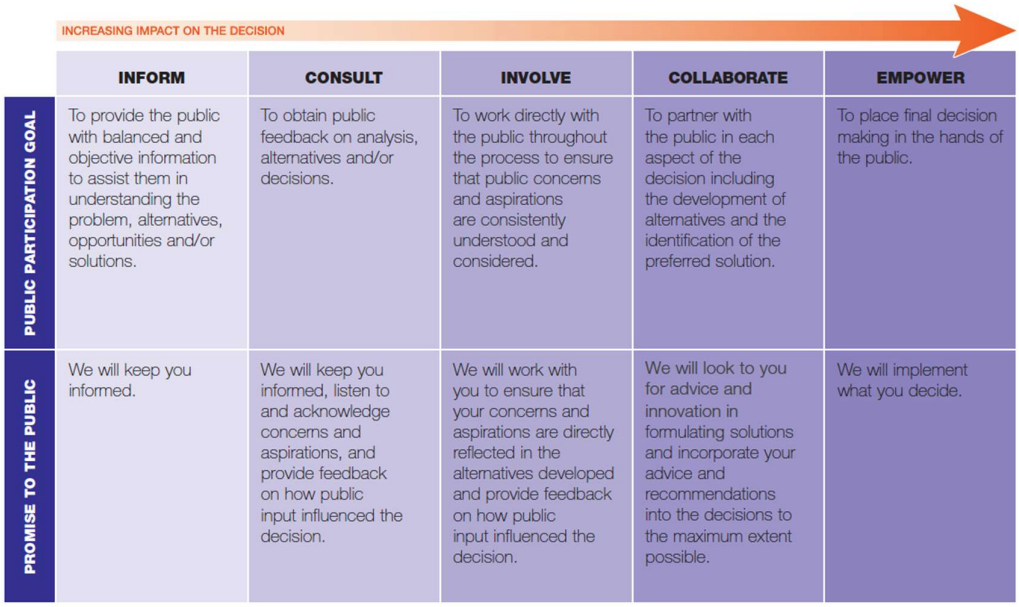


Figure 6 IAP2 Spectrum of Public Participation

- The IAP2 Public Participation Spectrum above helps guide communications and community engagement, and determines the level of participation and influence that may be appropriate for each partner, key stakeholder and community.
- A participants' position on the spectrum will manage expectations as to the level of anticipated influence in decision-making. Fundamental to use of the spectrum (and eventual legitimacy of decision-making) is making appropriate choices around methods of participation that suit the engagement goals, timeframes, available resources and levels of concern. Participants may also move up and down the scale as the Project progresses and new stakeholders may also be identified.

4.3 Stakeholders

- For each Coastal Panel, and the District as a whole, we will identify partners, stakeholders, and communities of place and interest. We will outline their role and connection to the decision, the benefits of their involvement and their levels of interest, influence and impact (Figure 7). Involvement and representation of the 'public at large' will also be identified.
- Note that Coastal Panels as proposed above will aim to be 'collaborative' as described by the IAP2 spectrum.
- A thorough stakeholder mapping exercise has begun and will be completed in conjunction with the final project governance framework to be presented to Council early next year. This will allow for identification of individuals, groups or organisations with an interest in the coastal environment at the appropriate scale. For example, Coastal Panels may be established across the District and will necessitate detailed analysis of partners, key stakeholders and communities of

interest and place at a particular scale. This 'stakeholder map'[3] will be appended to, and inform an updated Communications and Engagement Strategy.

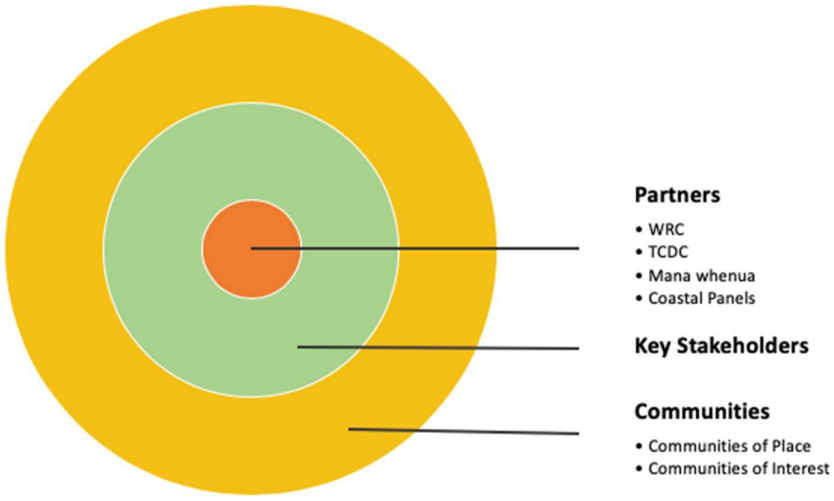


Figure 7 Model representing increasing participation of stakeholders in the development of SMPs. Using the categories of participation and descriptions set out in Figure 9 above: on this scale, partners are to be collaborated with as much as possible, key stakeholders involved and consulted, and communities informed and consulted.

5 Overall Approach

- Key to meeting our eight engagement goals will be consideration, and appropriate use, of scale. The Thames-Coromandel District has an over 400km long coastline, diverse coastal environments that display direct and indirect connections between land and sea, and settlements and landscapes characterised by diverse values. Again, a "one-size-fits-all" approach to communications and engagement for the SMPs will not work.
- Therefore, our approach to communications and engagement for the project will be tailored to the particular audience at the appropriate scale. It will essentially have two parts, working across different scales. They are:
    - Part A – District-wide communications
    - Part B – Place-based community engagement
- Methods employed will be broadly consistent with methods outlined in the IAP2 Public Participation Toolbox.

5.1 Part A: District-wide communications

- Activities under this part fall within the '**inform**' and '**consult**' end of the IAP2 Spectrum. **Key methods** employed will be aimed at sharing information and compiling and providing feedback, including:

[3] See for example NOAA's Working with People: Stakehodler Analysis Exercise quick reference https://coast.noaa.gov/digitalcoast/training/stakeholder-analysis-worksheet.html

    - OurCoast Newsletter/e-Newsletter.
    - Website, media and social media.
    - Technical reports.
    - Fact Sheets.
    - Survey.
- These activities will attempt to "reach out" Coromandel and region-wide targeting usually resident and non-resident stakeholders. They will also make the link between the big picture (coastal adaptation, climate change region-wide) and the site-by-site SMP work.
- Key messages will be developed that are educational and focused on communicating information about coastal environments, the nature of coastal risks, hazards, and the changing nature of coasts and values. These messages should reinforce existing messaging and communications efforts by other parts of TCDC, e.g. Civil Defence and Emergency Management. Final key messages will be agreed with Council.
- Over summer 2019-20 we will deliver the first District-wide survey instrument ("Our Coromandel Coast") using online, mail out and in-person data collection methods. The survey will canvas residents, non-residents and other stakeholders in order to (1) update coastal values from the wider community (2) gauge understanding and perceptions of coastal hazards and risks (3) help identify information that will inform risk communication activities. Importantly the survey will assist the Project in reaching as broad a cross-section of the Thames-Coromandel community as possible – not just those that are directly affected. Depending on the success of this first survey, a second survey will be considered.
- This part will also include the development of a dedicated SMP website/webpage that can be used as a touchstone for coastal activities going forward. This will be a central repository for data and technical reports, fact sheets, newsletters, short videos, programme information and as a community forum. It will also act as repository for all reports, agendas and minutes of SMP-related meetings e.g. Coastal Panels, Council and committee meetings.
- A number of double-sided Fact Sheets will be developed that provide further information or key facts that specifically relate to the Coromandel and the Project[4]. They will also seek to debunk common misconceptions and provide critical facts to inform the development of robust adaptive pathways and Action Plans. Fact Sheets already identified via initial community consultation include:
    - Role of WRC vs TCDC in managing the coast.
    - Historical storms of significance.
    - Local sea level rise.
    - Insurance.
- Citizen science initiatives are anticipated to play a role in educating the public about coastal hazards but also foster a sense of "ownership" of the coastal environment, encouraging citizens to look and think long-term. CoastSnap stations will be established at key sites across the District, with the initial aim of enabling visual representations of coastal change (e.g. time-lapse), but eventually

[4] MfE developed a series of seven fact sheets of part of the 2017 guidance. They covered: sea-level rise, coastal flooding due to storms, coastal erosion, waves, components of sea level, tides around New Zealand, and storm surge.

allowing for accurate measurement of the dynamic nature of shorelines that could embellish existing coastal monitoring (Figure 8).

Figure 8 A CoastSnap station overlooking a coastline, including a bespoke cradle and signage explaining use.

- CoastSnap is an initiative designed to make the most of society's propensity to carry a camera in their pocket and encourage participation in monitoring coastal change. The idea is that a person can use their smart phone to take a photo of a beach or coastline and upload that to a database and social media, encouraging creation of a social network and enabling visualisation of ow coasts can change day to day, week to week and over time. The photo is taken at a fixed location by use of a bespoke cradle positioned to get the best view of the coast and designed to ensure photos can be overlain and display coastal change through the generation of time-lapse videos and maps of shoreline change. This kind of monitoring can have the dual effect of creating a sense of ownership of the local community with their beach, while also augmenting traditional methods of coastal monitoring.

5.2 Part B: Place-based community engagement

- Activities under this part fall towards the 'involve' and 'collaborate' end of the IAP2 Spectrum. Key methods employed will aim to bring people together using a number of methods, including:
    - Deliberative dialogues, workshops and Coastal Panels.
    - Drop-in sessions, public meetings and events (Figure 9).
    - Meeting with existing groups.
- This part revolves around the operation and role of site-specific Coastal Panels.

- Coastal Panels will be tasked with translating values into objectives and criteria upon which to base their local SMP. Participants on the Panels will also feed directly into increasingly detailed hazard, vulnerability and risk assessments, develop adaptation options and set our preferred adaptive pathways for compartments and/or management areas. They will also be able to call in additional experts as the SMPs progress.

Figure 9 Onemana community notice board. An example of a mechanism that could be employed to disseminate notices relevant to the Project.

- Following their constitution each Panel will participate in a sequence of workshops[5] to inform the development of SMPs in those locations. An outline of possible workshops is set out below:
    - Workshop 1: Terms of Reference agreed, introduction to process, NIWA game (Figure 10).
    - Workshop 2: Site visit with key stakeholders, *what is happening*?
    - Workshop 3: Areas for focus, values discussion, *what matters most*?
    - Workshop 4: Development of consequence tables and thresholds.
    - Workshop 5: Introduction to adaptation options and adaptive pathways, insurance discussion.
    - Workshop 6: Development of adaptive pathways.
    - Workshop 7: Evaluate adaptive pathways #1.
    - Workshop 8: Evaluate adaptive pathways #2.
    - Workshop 9: Presentation of preferred adaptive pathways to decision-makers.

[5] This sequence is indicative only at this stage.

- Note that consultation activities with the wider community will be interspersed at agreed points and key milestones during the sequence of coastal Panel workshops.

Figure 10 NIWA Serious Game that encourages role playing and thinking around intergenerational coastal adaptation decisions. This game may be employed during initial Coastal Panel sessions.

6 Project Timeline

6.1 Phase 1

- The scoping phase of the Project ran from April – September 2019. During this Phase community information sessions were undertaken at eight locations across the District. These sessions introduced the team, the intent of the SMP project, our overall approach, and then sought local knowledge and feedback on the approach through facilitated discussions.
- Involving coastal communities in the initial scoping of the SMPs was a new experience for many participants. The purpose of these information sessions was to develop a shared understanding of the Project, but also to begin identifying the concerns and opportunities seen by participants. Key themes that emerged during these sessions were tabulated and summarised (Figure 11).
- A double-sided flyer that explained SMPs was also developed to hand out to attendees at the community information sessions.

Key messages

Coastal hazards like flooding, landslips and erosion can become worse with higher sea levels and stronger storms.	Coastal ecosystems (like sand dunes) play an important role in shielding us from coastal hazards	Waikato Regional Council?	The Coromandel coast is iconic and an asset of national significance
The sea is getting ever closer to us and the things that are important to us like our homes, our roads, and our community facilities.	Managing coastal risks will require collective action, negotiation and compromise between different people and different organisations.	Healthy coastal ecosystems underpin our way of life. We are all guardians (kaitiaki) of our coastal environment.	The coast you see today may not be the coast you see tomorrow.
A changing climate will place increasing stress on our coasts.	TCDC has a variety of obligations and responsibilities in managing the coast, including as a regulator, a landowner, and guardian.	The Coromandel coast is used by an increasing number of people in different ways. This creates more contest for public space.	Coasts are dynamic. They have and always will respond to changing conditions.
Coasts are special places to all of us. For Māori they are taonga.	Some people and some parts of the environment (built and natural) are more comfortable tolerating risk than others.	We must be flexible, allow for uncertainty and ensure decisions we make are responsive to a changing environment.	SMPs will evaluate risks associated with coastal change and present a path toward managing those risks in a sustainable way over time.
Actions we take today should not restrict our ability to respond appropriately tomorrow.	Climate change is putting substantial pressure on the assets Council owns and manages along the Coromandel coast. These assets include sand dunes, seawalls, wharves and jetties, boat ramps, reserves and coastal roads.	Difficult decisions may be on the horizon and cannot be avoided.	We are striving to enable "resilient coastal communities"
			Not all of us have the same capacity to adapt to coastal change.

DRAFT

Figure 11 Key messages arising from community information sessions.

- Meetings were also held with project partners and key stakeholders to facilitate their involvement in the Project and gather intelligence.
- An initial District-wide survey instrument was drafted and will be finalised and undertaken during the 2019-20 summer. The survey will gather baseline information that will assist further communications and guide the development of community objectives.

6.2 Phase 2

- Running from October 2019 to March 2020 communication and engagement activities will focus on Part A of the overall approach. It is anticipated these will be District-wide activities, including:
    - the finalisation of project governance followed by establishment of Coastal Panels;
    - establishment and ongoing update of SMP website/page;
    - initiation of citizen science activities, e.g. CoastSnap in at least two locations;
    - undertaking the District-wide summer survey to elicit current understanding, concerns and values of the broader community; and
    - Ongoing communications and publicity, e.g. fact sheets, social media and videos, media, newsletter/e-Newsletter.

6.3 Phases 3, 4 and 5

- Covering Years two and three of the project, communication and engagement activities during this time will be heavily focused on developing and using the Coastal Panels to work through in detail the bulk of the SMPs. This will involve site-specific work to develop adaptive pathways for each of the SMP management areas, eventually leading to SMPs that cover the length of the Coromandel coast.
- Parallel to this intensive process will be ongoing communication with the wider community to keep them informed of progress. Formal consultation processes such as those provided for in the Local Government Act 1993 may also be undertaken at critical junctures throughout the development of SMPs, e.g. completion of updated coastal hazard studies, development of draft adaptive pathways and Community Action Plans.

7 Engagement Timeline (draft)

2019	
October	- Website content development - Collate partner, key stakeholder and community contact list - Summer survey partner review
November	- Factsheets - Website established - Newsletter, e-Newsletter #1 - Press release
December	- **Council meeting – project update** - Summer Survey/e-Survey launched - CoastSnap station(s) set up - Storytelling video(s) - Fact Sheet(s) - Website updated

2020	
January	- **Community Board meetings – project update** - Summer survey hard copy follow up - Website updated
February	- Survey results analysed - Website updated - Newsletter, e-Newsletter #2 - **Council meeting – project governance**
March	- Coastal Panels EoI - Website updated - Partner, stakeholder and community mapping exercise complete
April	- Coastal Panels and project governance confirmed - Website updated - Newsletter, e-Newsletter #3 - Update engagement timeline

Note: this timeline is indicative only and is contingent upon progress of post-election conversations between Council and Māori around project governance.

8 Monitoring and Review

- This Strategy will be reviewed immediately upon finalisation of the approved project governance framework.
- This Plan shall be reviewed quarterly to confirm whether:
  - any new stakeholders have been identified;
  - the communications and engagement approach adopted for each partner, stakeholder or community is still appropriate; and
  - whether the timeline should be revised.
- Should this Strategy be updated, the revised Strategy shall be presented to the relevant body for endorsement.

Figure 12 Whangamatā wharf managing conflict between user groups.

9 References

Curato, N & Böker, M 2016, 'Linking mini-publics to the deliberative system: a research agenda', *Policy Sciences,* vol. 49, no. 2, pp. 173-190.

DoC 2017, 'NZCPS 2010 Guidance Note Coastal Hazards: Objective 5 and Policies 24-27 ', Department of Conservation, Wellington, NZ.

Kahane, D, Loptson, K, Herriman, J & Hardy, M 2013, 'Stakeholder and citizen roles in public deliberation', *Journal of Public Deliberation,* vol. 9, no. 2, pp. 2.

MfE 2017, 'Coastal Hazards and Climate Change: Guidance for Local Government', Ministry for the Environment, Wellington, NZ.

Renn, O & Schweizer, PJ 2009, 'Inclusive risk governance: concepts and application to environmental policy making', *Environmental Policy and Governance,* vol. 19, no. 3, pp. 174-185.

UNSW Sydney 2019, 'MyCoast NSW Study: New South Wales Community Perceptions of Coastal Erosion and Inundation', UNSW Sydney, Sydney, Australia.

A3 Appendix 3

Conceptual Approach to Coastal Hazard Assessment

Royal HaskoningDHV
Enhancing Society Together

REPORT

Thames-Coromandel Shoreline Management Plans

Conceptual Approach to Coastal Hazard Assessment

Client: Thames Coromandel District Council

Reference: PA1954-RHD-RP-0002

Status: Final/P01.01

Date: 31 October 2019

HASKONING AUSTRALIA PTY LTD.

Level 3
2 Market Street
NSW 2300 Newcastle
Maritime & Aviation
Trade register number: ACN153656252

+61 2 4926 9500 **T**
project.admin.australia@rhdhv.com **E**
royalhaskoningdhv.com **W**

Document title:	Thames-Coromandel Shoreline Management Plans
Document short title:	CHA Methodology
Reference:	PA1954-RHD-RP-0002
Status:	P01.01/Final
Date:	31 October 2019
Project name:	Thames Coromandel SMPs
Project number:	PA1954
Author(s):	RHDHV
Drafted by:	Ben Williams, Dan Messiter, Tom Fitzgerald
Checked by:	Sian John
Date / initials:	25/10/2019 SAJ
Approved by:	Dan Messiter
Date / initials:	30/10/2019 DJM

Classification
Confidential

Disclaimer

No part of these specifications/printed matter may be reproduced and/or published by print, photocopy, microfilm or by any other means, without the prior written permission of Haskoning Australia PTY Ltd.; nor may they be used, without such permission, for any purposes other than that for which they were produced. Haskoning Australia PTY Ltd. accepts no responsibility or liability for these specifications/printed matter to any party other than the persons by whom it was commissioned and as concluded under that Appointment. The integrated QHSE management system of Haskoning Australia PTY Ltd. has been certified in accordance with ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007.

Royal HaskoningDHV

Table of Contents

Table of Figures

Disclaimer
No part of these specifications/printed matter may be reproduced and/or published by print, photocopy, microfilm or by any other means, without the prior written permission of Haskoning Australia PTY Ltd.; nor may they be used, without such permission, for any purposes other than that for which they were produced. Haskoning Australia PTY Ltd. accepts no responsibility or liability for these specifications/printed matter to any party other than the persons by whom it was commissioned and as concluded under that Appointment. The integrated QHSE management system of Haskoning Australia PTY Ltd. has been certified in accordance with ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007.

1 Introduction

1.1 Background

Thames Coromandel District Council (TCDC) are developing Shoreline Management Plans (SMPs) intended to reduce the risk from 'coastal hazards' to an acceptable or tolerable level. Determining the nature and extent of the coastal hazards facing the District, and how they may change over time, is the first step in this process.

This report sets out the proposed conceptual approach to Coastal Hazard Assessment (CHA) to be applied to the Coromandel coastline as part of the Thames Coromandel SMP Project. This approach has been developed based on the principles set out in the Department of Conservation's (DOC's) *New Zealand Coastal Policy Statement (NZCPS) 2010*, the Ministry for the Environment's (MfE's) *Coastal Hazards and Climate Change – Guidance for Local Government 2017* (including Ramsay *et al*., 2012) and the *Thames-Coromandel Coastal Management Strategy 2018*. In particular, the outputs from the CHA will underpin the SMP process by identifying 'what is happening' from a hazard and sea level change perspective. These CHAs will then be used to inform a broad investigation of 'What matters most?', where detailed assessments of vulnerability and risk will be developed, and management options for different time periods (i.e. 'What can we do about it?').

This report has been provided to Waikato Regional Council (WRC) technical experts and Coastal Scientist Jim Dahm for peer review and will be submitted to TCDC for approval. It aims to describe how coastal hazards will be defined in the context of a risk-based 'dynamic adaptive pathways planning' (DAPP) approach. It provides relevant definitions and a proposed framework for first identifying and second defining hazards and hazard likelihood. It also demonstrates, in-principle, how information will be presented to the community and decision makers such that judgements on consequences and risk tolerance can be considered.

It accompanies the **SMP Scoping Report**, which provides overarching objectives for the Thames Coromandel SMPs. Specific objectives will be set for each of the Thames Coromandel SMPs in due course. The Scoping Report also provides a summary of the key statutes and policy documents which affect the management of the TCDC coastline as this relates to coastal hazards. It is important that the links between SMPs and existing legislation, plans and policy are explicit, so that the later has sufficient 'weight' when coastal adaptation choices are being considered. This requires appropriate governance mechanisms to facilitate it.

The CHAs will support the SMPs by providing a level of detail and accuracy sufficient to define the coastal hazards at a particular location and time such that risk-based decisions can be made. This level of detail at the finest resolution will be on a beach compartment (Policy Unit) scale and will not replace the future need for site specific investigations for the purposes of development assessment or the environmental assessment of specific projects. The definition and understanding of coastal hazards at this resolution will, in conjunction with the collective values and objectives of the Council, stakeholders and community, inform the level of risk these groups are willing to accept and inform the selection of management options.

1.2 Relevant Policy and Guidance

The context for this conceptual approach to CHA is the tiered approach to the reduction in risk from natural hazards advocated in New Zealand; beginning with the legislative and policy context from central government, given effect by the regional policy context and enacted through TCDC.

1.2.1 Central Government

1.2.1.1 New Zealand Coastal Policy Statement (2010)

The overarching goal of the NZCPS regarding coastal hazards (objectives and policies) is to manage risks so that the likelihood of them causing social, cultural, environmental and economic harm is not increased. Objective 5 of the NZCPS is that coastal hazards/climate change are managed by locating new development away from risk areas, considering managed retreat for existing development and protecting or restoring natural defences.

Policies 24-27 focus in on coastal hazards and set out:

- to adopt a precautionary approach to the use and management of coastal resources potentially vulnerable to the effects of climate change, to avoid harm to communities;
- to identify areas potentially at risk over the next 100 years;
- to avoid increasing risk of harm, avoid redevelopment that increases risk, encourage redevelopment that reduces risk (adaptive management); and,
- to discourage hard protection structures, while acknowledging they may be the only practicable means to protect important infrastructure, although at a social and environmental cost.

In particular, Policy 24 of the NZCPS requires that Councils identify areas in the coastal environment potentially affected by coastal hazards, giving priority to the identification of areas at high risk of being affected. The risks associated with coastal hazards, *over at least 100 years*, are to be assessed having regard to:

a) physical drivers and processes that cause coastal change, including sea level rise;
b) short-term and long-term natural dynamic fluctuations of erosion and accretion;
c) geomorphological character;
d) the potential for inundation of the coastal environment;
e) the cumulative effects of sea level rise, storm surge and wave height under storm conditions;
f) influences that humans are having or have had on the coast;
g) the extent and permanence of the built development; and
h) the effects of climate change on:
    i. items (a) to (g), above
    ii. storm frequency, intensity and storm surges; and
    iii. coastal sediment dynamics.

1.2.1.2 MfE Guidelines 2017

The 2017 MfE *Coastal Hazards and Climate Change Guidance for Local Government* differs from previous guidance on this topic, in that it attempts to deal with uncertainty by promoting a *dynamic adaptive pathways planning* (DAPP) approach (as outlined in **Figure 1**).

This approach involves the community in setting objectives, sharing learning, deliberating on feasible, adaptive solutions and identifying critical thresholds (or trigger points) where a change in management direction - as a response to a change in 'hazard' or 'risk' - is required.

Chapters 5 and 6 of the MfE Guidelines provide direct guidance on the consideration of uncertainty associated with sea level rise and climate change, as well as techniques for coastal hazard assessment (see also Ramsay *et al*., 2012). Chapter 8 specifically tackles risk and vulnerability assessments (see the shaded blue area in the Figure below). Of note is the risk-based approach adopted in **Figure 1** below.

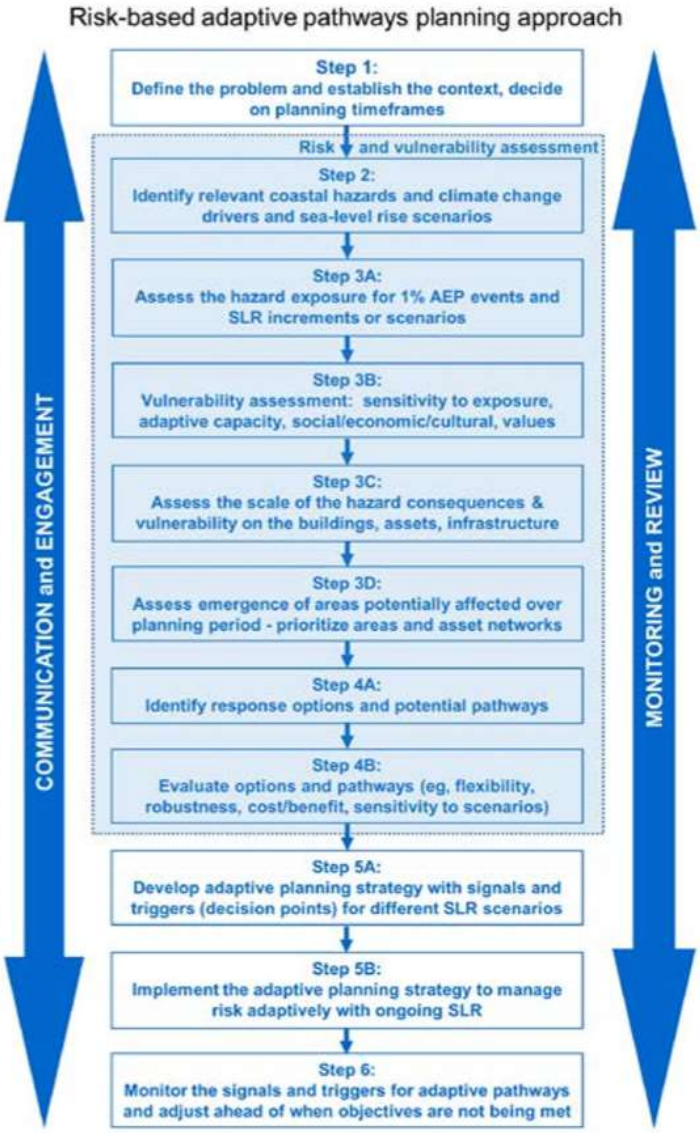


Figure 1: Risk-based adaptive pathways planning approach (from MfE, 2017)

1.2.2 Waikato Regional Council

WRC's Waikato Regional Policy Statement (WRPS) was made operative in May 2016 and last updated in December 2018. The WRPS provides an overview of the resource management issues of the region, and the policies and methods proposed to achieve the integrated management of natural and physical resources.

The WRPS reflects the higher order objectives and policies of the NZCPS. The central concept for the management of natural hazards is the identification and management of activities based on the level of risk to which they are exposed. The WRPS directs regional and district plans to take a risk-based approach to natural hazard management and requires that the risk to people, the community, property and the environment does not exceed acceptable levels or risk is reduced to tolerable levels. The WRPS sets out objectives, policies and methods to enable this.

In achieving those objectives, the WRPS:

- advocates the use of a risk-based approach to dealing with the effects of natural hazards;
- commits WRC to identifying primary hazard zones (where risk is evaluated as intolerable);
- seeks to collaborate with District Councils, tāngata whenua and other agencies to develop long-term strategies that identify hazards, risks and risk reduction options;
- seeks to control subdivision, development and activities in hazardous areas; and
- provides for an effective emergency management framework – planning for readiness, response and recovery.

The following documents are provided in support of the WRPS and were considered in the development of this conceptual approach were:

- *Draft Risk Assessment Framework to support implementation of the WRPS: Natural Hazards (Chapter 13)* (WRC, 2018). This sets out a risk assessment framework based on principles and concepts of ISO31000:2018.
- *WRPS Implementation Practice Note on Natural Hazards* (WRC, 2019). This Practice Note provides interpretation guidance for Chapters 4, 6 and 14 of the WRPS in light of changes to the natural hazard management provisions of the Resource Management Act (RMA) 1991. In particular, it recommends that Councils use MfE's guidance with respect to sea level rise and climate change. It also provides guidance for Councils on high risk coastal hazards, the identification of residual risk zones (e.g. behind seawalls), and the development of Long-Term Community Strategies and Primary Risk Zones.

The WRC *Development Setback Lines for Coromandel beaches* that, following their review by TCDC, lead to the production of the Current Coastal Erosion Line (CCEL), which identified the current erosion risk, and Future Coastal Protection Line (FCPL), which defined the area potentially at risk from erosion in the next 100 years, are also relevant. In principle, building seaward of the CCEL is not permitted. The approach set out herein will allow these lines to be refined based on more detailed local information and to reflect current best practice in hazard and risk assessment.

2 Coastal Hazards

There are numerous definitions available for coastal hazards, across policy document and standards international and within NZ. These include the MfE and WRPS definitions[1]. For the purposes of this report, **coastal hazards** are defined as are physical processes that expose a coastal area to the risk of loss of life, the degradation of environmental and cultural assets, and/or property damage[2].

Hazards can occur over a variety of timescales. For example, hazards that occur episodically over periods of minutes or days include major storms accompanied by high winds, waves and surges or tsunamis created by submarine earthquakes and landslides. Hazards that develop incrementally over longer time periods include erosion and gradual inundation.

2.1 Included

Coastal hazards include:

- beach erosion;
- shoreline recession;
- coastal entrance instability (lake, lagoon, estuary);
- coastal inundation;
- tidal inundation; and
- coastal cliff or slope instability.

These are referred to herein collectively as 'coastal erosion and inundation hazards'. Example sources for coastal hazards and actual or potential effects are shown in **Table 1**.

2.2 Excluded

The identification and assessment of the following hazards are not covered in this methodology:

- All other natural hazards not directly impacting the coastal environment e.g. fluvial and pluvial flooding, ground water flooding, salt water intrusion, meteotsunami, etc. However, the TCDC SMPs will address the issue of coincident flooding as far as possible (e.g. fluvial flooding coinciding with king tides) and consider where existing river flood defences mitigate, or provide opportunity to further mitigate, coastal inundation risk at the inland limit of the SMPs extent.

- Impacts on ground water processes or salt water intrusion;

- Tsunami hazard and associated inundation. This is excluded because existing information regarding the nature of this hazard and the associated emergency management framework is already available, up-to-date and can be directly considered in the SMP process as appropriate.

[1] *Note that a full Glossary is to be provided in the TCDC SMP Scoping Report.*
[2] *Definition derived from the New South Wales Coastal Management glossary https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Coasts/coastal-management-glossary-180195.pdf*

- Earthquake hazard, which may cause ground shaking, landslides and rock falls, subsidence and lateral spreading, and liquefaction. This is excluded because it is not limited to the coastal environment and is not specifically a coastal hazard. Predictions of future major earthquake displacements for a particular locality are also deeply uncertain (in terms of both when and by how much). *Indirect* consideration of earthquake hazard in the coastal hazard assessment is provided in terms of historical rates of vertical tectonic displacements (**Section 4.3.5**) and geotechnical cliff instability (**Section 4.7**).

Table 1: Example sources of hazards and actual or potential effects (MfE, 2017)

Hazard	Sources	Actual or potential effects
Coastal storm inundation	Sea level (SLR, tides, storm surge) Waves River flow Rainfall Influence of ENSO and IPO Wind	Direct inundation of low-lying coastal margins, ponding and elevated groundwater levels Overtopping of dunes, coastal barrier or coastal shore-protection structures Breaching or over-washing of dunes, gravel barrier or shore-protection structures Inundation via beach access points and boat ramps Inundation via rivers and streams Backed-up stormwater systems Wave overtopping of a coastal barrier (figure 35)
Coastal erosion: beaches	Sea level (SLR, tides, storm surge) Waves (height, period, direction) Sediment supply (rainfall and/or river flow) Sediment transport (long-shore or cross-shore processes) Tidal prism in estuaries Stormwater discharge Influence of ENSO and IPO	Ongoing retreat (due to rising sea level and/or deficits in sediment budgets) Retreat (but with fluctuations in the short–medium term) Stable (but with fluctuations in the short–medium term) Fluctuations in coast position due to inlet and river mouth dynamics Increased exposure to tsunami inundation
Coastal erosion: cliffs	Sea level (SLR, tides, storm surge) Waves Rainfall Temperature Wind Influence of ENSO and IPO	Slumping and/or slippage due to: • undermining of cliff • over-steepening of cliff • removal of talus toe protection • lowering of toe beach levels • internal factors (weathering, groundwater, shrinkage)

3 Conceptual Approach to the Assessment of Coastal Hazards, Vulnerability and Risks

3.1 Introduction

The concepts of 'hazard', 'vulnerability' and 'risk' are often the source of confusion. In this Project we intend to make a clear distinction between our proposed Coastal Hazard Assessment approach and subsequent approaches to assessing vulnerability and then risk. Our investigation of vulnerability and risk will assess the predisposition of people and objects to be adversely affected as a result of exposure to coastal hazards.

The MfE 2017 guidance on how to go about adapting to coastal change sets out a clear framework centred around five key questions and enacted through a "10-step decision cycle", as depicted in **Figure 2**. This project adopts the logical sequence encapsulated by those key questions and, where possible, seeks to provide for efficiencies.

Figure 2: The 10-step decision cycle, grouped around five questions (from MfE, 2017)

3.2 Approach to Coastal Hazard Assessment

Traditionally, 'coastal hazard assessments' have undertaken based on a **deterministic approach**, whereby each input variable is assigned a single value (e.g. 'design' storm demand, sea level rise (SLR) projections, etc.) with generally conservative estimates applied. A **probabilistic approach**, by contrast, allows each input parameter to randomly vary according to appropriate probability distribution functions. The randomly sampled parameters are repeatedly combined in a process known as Monte-Carlo simulation. All outputs from the Monte-Carlo simulation are collated to develop a probability curve for the coastal hazard during a study period. We propose to apply a *probabilistic approach* to the TCDC SMP CHA (see **Figure 3Figure 3**).

The probability distribution of the severity of each type of coastal hazard is calculated for a defined planning horizon and then can be used to assess the fragility of assets, infrastructure and the environment to give an indication of risk. When combined with the values and objectives set through the community engagement processes, and a deeper understanding of the *vulnerability* of communities, socio-cultural and economic systems gives a more complete picture of risk[3] (see **Figure 3**).

[3] *Where total risk = hazard x vulnerability (or likelihood x consequence)*

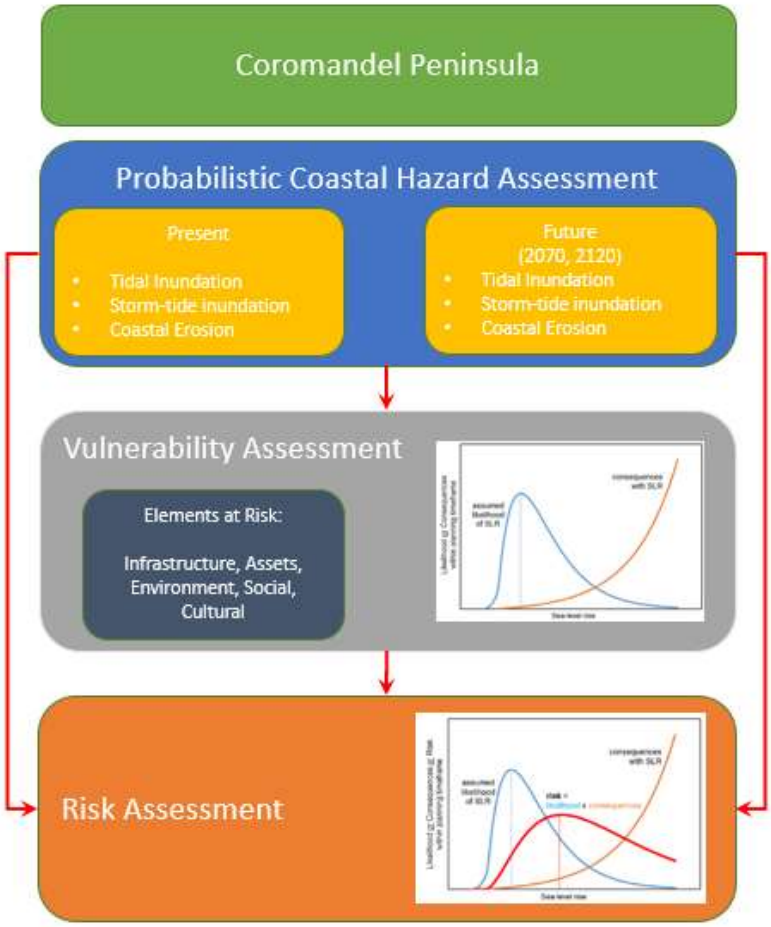


Figure 3: Conceptual framework for a risk-based Coastal Hazard Assessment

The application of a Monte Carlo process in determining probability functions for individual hazard types, and consideration of collective values on a scale localised enough to allow for planning decision making, is a highly resource intensive exercise and requires the prioritisation of limited resources to maximise outcomes. Hence the risk-based CHA proposed here includes a prioritisation process in line with MfE (2017) guidance.

3.3 Approach to Risk Assessment

Risk is often defined as the product of 'likelihood' and 'consequences', or 'the effect of uncertainty on objectives'. In this Project we take a consequence-driven view of risk in order to build robust DAPPs.

Further, the MfE (2017) guidance advocates a staged approach to risk assessment, getting progressively more detailed, which is proposed here.

The need to screen risks and prioritise resources is a particularly relevant consideration on the Coromandel Peninsula due to its length of coastline and relatively low-density population. Risk screening will be undertaken to focus resources on:

- providing detail in those locations where the likely consequences are highest; and
- particular hazards in local areas which have the greatest likelihood of occurrence.

Conversely, where no consequences or likelihood of a particular hazard exist, there is no reason to expend resources investigating this further.

3.3.1 First Pass

A 'first pass', desktop risk assessment for the Coromandel Peninsula is currently being undertaken. In line with best practice in shoreline management planning, at this stage, the assessment is focussed on coastal character, processes and foreseeable hazards, with only limited regard being given to settlements, infrastructure or environmental and cultural values at a local level (albeit it is acknowledged that the latter is fundamental to the assessment as it progresses). It makes use of existing knowledge and data and screens for areas that appear at significant risk.

The assessment is being undertaken on a semi-quantitative basis using available data and information on coastal hazards (e.g. existing coastal inundation and setback mapping). This 'first pass' assessment will inform the prioritisation of areas for further detailed risk assessment as described in the following sections.

Coastal hazards are considered for the present day, as well as future scenarios. To assist with the analysis and communication of the 'first pass' risk assessment, the risks are being considered on the basis of coastal compartments[4] (shown in **Figure 4**) and, within these, potential management areas[5].

[4] *which have been defined based on coastal character and processes.*
[5] *The first pass assessment has also been influenced by the availability of information – which tends to focus on those areas where coastal hazards are particularly relevant.*

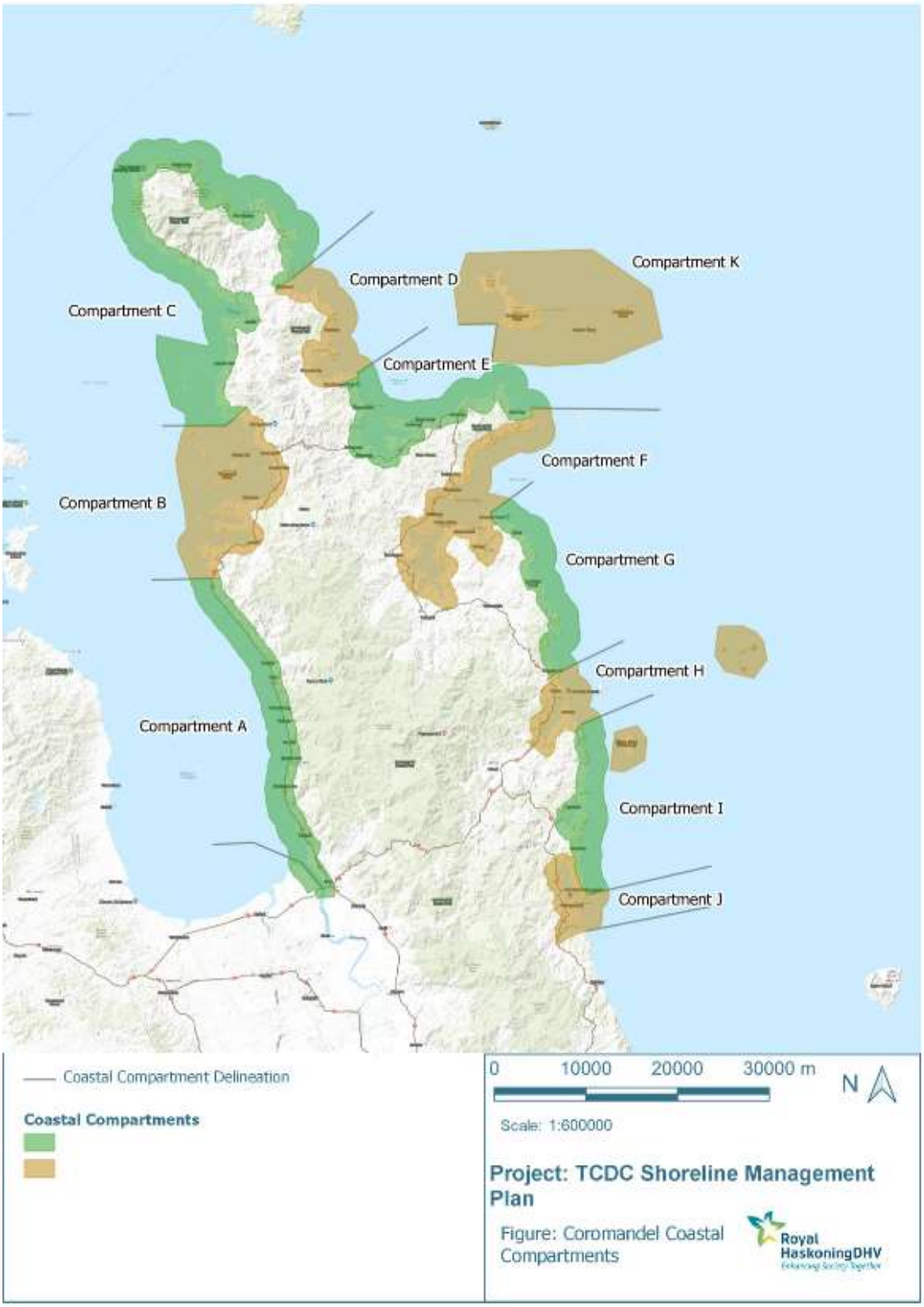


Figure 4: Coastal compartments for 'first pass' risk assessment

As part of this first pass' assessment, the "mapping" of where coastal defences are, and are not, has been initiated in order to allow the consideration of what hazards different stretches of shoreline are exposed to. 'Risk' to the different stretches of shoreline will be assessed (in due course) in the context of the presence/absence of defences and, where they are present, the condition of the asset.

Assessing asset condition is another task under the SMP project, i.e. **Input to the validation of asset condition assessment** which includes detailed site visits and condition assessments by relevant certified engineers.

A risk assessment rating has been used as follows:

Green – no issues now or in the future.
Yellow – generally no existing issues, with some potential for issues to arise in the future.
Orange – minor existing issues and or some potential future issues.
Red – existing and or significant future issues.

This rating has been applied to areas in a spatial database as a means of allowing prioritisation of effort in CHA phase. The rating is broken down into subcategories of risk; either inundation (ocean storm, fluvial or tsunami) or erosion (cliff of soft sediment) risk. Accordingly, the risk assessment can also be prioritised based on individual hazards and not just spatially. **Figure 5** is an example extract (only) from the yet to be completed 'first pass' risk assessment template being utilised.

3.3.2 Exiting Data Analysis and Prioritisation

For the next stage the outputs from the data collation and gap analysis undertaken in Phase 1 will be interrogated to identify where existing information is sufficient to base the CHA on (i.e. where relevant data and/or models are at the required level of detail and suitable for use within the risk-based CHA). Where appropriate information is not available (e.g. for Mercury Bay and Thames township), further detailed investigation will be undertaken.

A prioritisation workshop will also be held to focus the project on the areas at the highest risk and/or with the earliest predicted onset of potential hazards. This will be based on review of the first pass risk assessment (**Section 3.3.1**).

Together these tasks will inform where, and to what level of detail, the work that follows is required; such that an examination of the levels of service provided by (for example) public infrastructure and lifeline utilities (transport networks, storm water and drainage networks), coastal assets (public and private) and the ecosystem can be undertaken. This workshop will also consider greenfield areas that have potential/pressure for growth

It is recognised that the interrogation of the data gap analysis and prioritisation workshop will need to be undertaken concurrently and that this may be an iterative process. Once this is completed, a summary report will be produced early in Phase 2 that sets out what effort and approach is required where, to meet the objectives of the SMP.

The summary report will also detail recommended data collection and monitoring to be undertaken during Phases 2 and 3, if required to inform the SMP process. However, where data is not immediately required, recommendations will be made at the completion of Phase 2 for longer term ongoing monitoring programs (as appropriate).

3.3.3 Detailed Assessment

The locations where detailed hazard and, in due course, risk assessment (potentially including asset condition assessments) is required will be identified based on discrete sub compartments, 'management areas', once the coast has been prioritised in terms of particular hazard likelihood and the associated consequences.

Following completion and stakeholder acceptance of the 'first pass' risk assessment, specific areas identified will be subject to detailed investigation using the *probabilistic approach* to coastal hazard assessment outlined above.

The conceptual methodologies proposed for the detailed investigations are described in the following sections. The detailed assessment will enable further investigation of short-listed risks and inform prioritisation and testing of strategies and actions.

3.4 Adaptation Thresholds and Planning Horizons

National guidance states that hazards should be assessed, at least, for at least a 100-year planning horizon and risk calculated for the 1% AEP event. However, intermediate 'planning horizons' may also be required where there is a need to assess vulnerability or consequential damage to existing or planned structural or infrastructure assets. This is because, in a risk-based adaptive planning approach, risks to structures will be determined as being acceptable (or not) based on the risk of damage ('consequence') to the structure at the end of the design life[6] rather than fixed time-based planning horizons.

In this context the MfE's guidance regarding the need to focus on 'consequence' rather than planning horizons explicitly is acknowledged. The planning horizons adopted as part of this approach will be spatial, rather than time based, triggers (e.g. 10cm SLR increments) and used to inform consequences (not the hazard).

This provides a more adaptive consideration of the use of the coastal zone by not unnecessarily sterilising areas for use based on rigid time frames. That is, risk is related to the design life of a particular type of infrastructure or asset rather than an arbitrary length of time, allowing flexibility in the use of the coastal zone over time and the application of spatially based triggers for adaption management actions.

Therefore, prior to undertaking detailed risk assessment, consideration must first be given to the design life/planning horizons for consideration. This will change depending on the existing or intended use of the area being assessed.

[6] *The design life of a structure or infrastructure assets should be related to the typical design life of its components, such as concrete, steel, masonry, timber, bitumen, rock, sand filled geotextile bags and the like.*

Royal HaskoningDHV

Coastal Zone		General Character	Geomorphology	Coastal Processes	Settlements	Coastal Inundation	Tsunami	Coastal Erosion Set back	Cliff Instability	River / estuarine Flooding
A	Firth of Thames	Relatively narrow developed coastal strip opening to wide coastal plain at southern end.	Naturally constrained but erodible shoreline with shallow embayment's and local fluvial deltas.	Relatively low exposure shoreline with more significant influence of tidal surge. Narrow upper beach sediment movement with increasing siltation at the southern end.	Major settlement at Thames over low lying land, with satellite communities along the shoreline to the north, such as at Tararu, Ngarimu, Te Puru, Waiomu, Tapu and Te Mata and to the south through to Kopu	Widespread moderate existing inundation; significant widespread inundation at +1.0m level	Waihou River: Flood depths of 0-1m along estuary. Piako River: Flooding of 0-1m for widths of 750m near river mouth and along coast.	Little mapping available for Thames. Generally considered to be moderately impacted by erosion, increasing into the future.	Coastal road potentially impacted by cliff instability.	According to a flood risk assessment report, the potential for fluvial flooding for the following rivers are as follows: Tapu: Medium to high flood hazard rating to road and properties. Pohue: High flood hazard rating alongside river path Waiomu: High flood hazard rating for the fan delta at the mouth of the river, posing overall low to medium risks to private/residential properties. Broadscale river flooding indicates large river flood hazard zones along the head of the Firth of Thames.
					Waikawau	Moderate flooding at projected levels	No Mapping	Waikawau: Existing erosion issues. >5 properties in PDS. >10 properties in SDS.		Existing regional scale flood hazard zone prone to fluvial flooding due to estuary, potentially effecting 15 households.
					Tarau	Moderate widespread existing flooding; significant inundation at projected levels	Tarau: Limited flooding across coast of 0-1m from D2 offshore fault.	Some properties in PDS. >10 properties in SDS.		High flood hazard risk alongside river posing a high threat to some properties
					Te Puru	Moderate widespread existing flooding; significant inundation at projected levels	Widespread flooding along coastline of depths of 0-1m predicted from D2 offshore faults. Flooding extends inland by up to 500m.	Some minor ongoing erosion. Most properties (>40) in PDS. Road in SDS.	Generally low-lying land. Some potential for cliff instability to impact coastal road and properties.	Predominately high flood risk alongside the river as it travels inland, posing a low to high risk to properties depending on their proximity to river path.

Figure 5: Spatial and hazard type 'first pass' risk assessment

3.5 Likelihood - hazard occurrence probabilities

3.5.1 Probability

ISO 31000:2018 defines risk as *the effect of uncertainty on objectives*. That is, the probability attached to a particular outcome. The probability, or likelihood, of a particular threat (e.g. the occurrence of a coastal hazard), therefore, is commonly expressed in terms of its:

- **Annual Exceedance Probability (AEP)**, which is the chance of at least one such event magnitude or level being reached or exceeded in any one year.

- **Average Recurrence Interval (ARI)**, also commonly known as **average return period**, which is the **average** time interval between events that reach or exceed such an event magnitude, when averaged over many occurrences; that is, a very long period with many such events (some events may occur close together while for others there may be a long gap between similar events).

- **Encounter Probability (EP)** of an event with a particular AEP or ARI, over a defined planning horizon. For example, 50 or 100 years.

The relationship between *AEP*, *ARI* and *EP* is highlighted in **Figure 6**, which shows the appropriate ARI of the threat (hazard) within a given planning horizon, for various threat encounter probabilities.

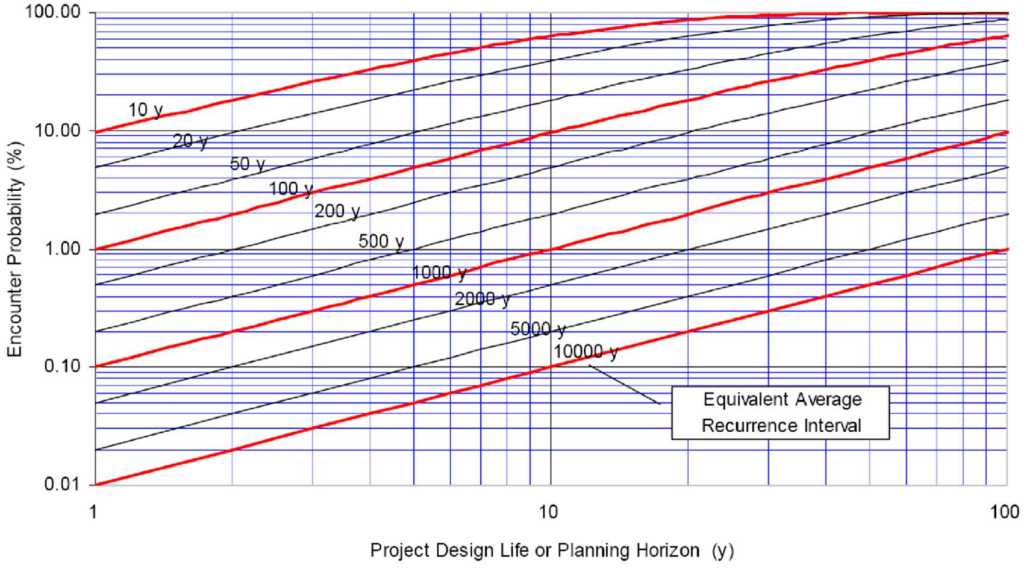


Figure 6: Average Recurrence Interval of a threat in Years for various encounter probabilities and planning horizons[7]

[7] *Engineers Australia National Committee on Coastal and Ocean Engineering. 2012. Climate Change Adaptation Guidelines in Coastal Management and Planning. Barton ACT: Engineers Australia.*

3.5.2 Assessment Framework - for cliff and soft sediment instability and inundation

The Australian Geomechanics Society (AGS) procedures for landslide risk management (AGS, 2007a, b) adopt a risk-based adaptive planning approach. They were developed over a period of more than a decade via a Working Group of experts and have been widely applied in geotechnical engineering practice since 2000. The AGS procedures were also subject to peer review and discussion through the AGS Landslides Taskforce, with 23 members. That is, the AGS procedures are an established, recognised and peer reviewed methodology for defining landslide risk for assessment where development is present and recognised globally as industry leading practice.

With modification to be appropriate for soft sediment coastal hazards, RHDHV have applied the same principles of the AGS procedures to define acceptable risk for development adjacent to soft sediment foreshores in general. RHDHV have adopted a similar approach for the assessment of risk related to inundation events on the coast and propose to use this approach here.

AGS (2007a, b) uses six likelihood descriptors, along with associated annual exceedance probabilities (AEPs); see **Figure 6**. For example, for a planning horizon of 60 years, the cumulative probability of an event of that AEP occurring at least once over the design life can be determined, as also shown in **Table 2**.

Table 2: Likelihood descriptors, associated annual exceedance probabilities, and cumulative probabilities of event occurring at least once over 60 years (AGS, 2007a, b)

Likelihood Descriptor	Designated Annual Exceedance Probability	Designated cumulative probability of event occurring over planning horizon of 60 years
Almost Certain	5%	95.4%
Likely	0.5%	26%
Possible	0.05%	3%
Unlikely	0.005%	0.3%
Rare	0.0005%	0.03%
Barely Credible	< 0.0005%	< 0.03%

It may seem counterintuitive that a seemingly low probability, 0.5% AEP, event is considered to be “likely”. However, when the total duration of the planning horizon or management scheme is considered, this “likely” event has a cumulative probability of 26% which is consistent with the descriptor.

To define the probability of occurrence of a particular coastal hazard, probabilities (or probability distributions) need to be assigned to the various components used to define and delineate that hazard (e.g. for beach erosion/recession):

- storm demand (beach erosion);
- long term recession due to net sediment loss;
- long term recession due to sea level rise; and
- beach rotation (where applicable).

For example, the “unlikely” hazard is delineated by components that have a combined probability of 0.3% over the planning horizon.

One of the advantages of this approach is that sea level rise values can be assigned various probabilities. That stated, it is recognised that Intergovernmental Panel on Climate Change (IPCC) projections are inherently based on assumptions regarding future greenhouse gas emissions for various scenarios, known as representative concentration pathways (RCPs). These scenarios are based on IPCC recommendations, but what is actually realised in the future will depend on various socio-political and economic factors.

Probabilities associated with Bruun Rule type recession (due to sea level rise) will be considered in the second pass risk assessment by assigning different probabilities to different depths of closure.

3.6 Consequences

Consequence is the outcome of an event that may result from a hazard. It may be expressed quantitatively (e.g., monetary value, disruption period, environmental effect), by category (e.g., high, medium, low) or descriptively.

An example of consequence to community, environment or economy from coastal risk is given in **Acceptable Risk**

3.6.1 Introduction

By its very nature the coast is a fringe environment in a constant state of flux. The most visible aspects of this change may be seen through the action of hazards such as storms, cyclones and associated storm surges, flooding, erosion etc. By themselves, these extreme events may not be of consequence. However, humans have chosen, and continue to choose, to live by the coast; and in doing so expose themselves to the consequences of such hazards. It is this ever-growing juxtaposition of natural hazards, human activity and settlement at the coast that creates risks.

Table 3. The approach adopted here considers risks to these three categories equally. The coastal risk consequence is usually dependent upon the values and issues associated with natural and built assets and land within the management area. Consequence measures can include direct damage (direct damage in dollars, clean-up costs and repair times over an expected number of events), affected number of people, indirect disruption and reduction in services, for example, that the community would face for that scenario. Asset value will be determined from relevant publicly available databases (including those held by TCDC, the NZTA and DOC) depending on the asset type at risk or, where the asset has no traditional $ value (e.g. a width of beach, or cultural asset), relevant best practice research, to determine an equivalent $ value (in consultation with the affected community).

The MfE guidance recommends the evaluation of risk by focusing on consequences under different SLR and coastal hazard scenarios (including sensitivity analyses for waves and storm surge) for New Zealand coastal areas.

It is envisaged that a similar set of consequence descriptors to those presented in **Acceptable Risk**

3.6.2 Introduction

By its very nature the coast is a fringe environment in a constant state of flux. The most visible aspects of this change may be seen through the action of hazards such as storms, cyclones and associated storm surges, flooding, erosion etc. By themselves, these extreme events may not be of consequence. However, humans have chosen, and continue to choose, to live by the coast; and in doing so expose themselves to the consequences of such hazards. It is this ever-growing juxtaposition of natural hazards, human activity and settlement at the coast that creates risks.

Table 3 (percentages, time frames or $ values) will be specified for management areas based on consultation regarding community values. The specific values will also take account of the risk profile and consenting requirements of the relevant regulatory authorities.

3.7 Acceptable Risk

3.7.1 Introduction

By its very nature the coast is a fringe environment in a constant state of flux. The most visible aspects of this change may be seen through the action of hazards such as storms, cyclones and associated storm surges, flooding, erosion etc. By themselves, these extreme events may not be of consequence. However, humans have chosen, and continue to choose, to live by the coast; and in doing so expose themselves to the consequences of such hazards. It is this ever-growing juxtaposition of natural hazards, human activity and settlement at the coast that creates risks.

Table 3: Example consequence descriptors of coastal hazard risk to community, environment or economy

Consequence	Society / Community	Environment	Economy
Catastrophic	Widespread permanent impact to community's services, wellbeing, or culture (eg, > 50 % of community affected), or national loss, or no suitable alternative sites exist	Widespread, devastating / permanent impact (e.g. entire habitat destruction), or loss of all local representation of nationally important species (e.g. endangered species). Recovery unlikely.	Damage to property, infrastructure, or local economy > or = $20 million[1]
Major	Major permanent or widespread medium term (somewhat reversible) disruption to community's services, wellbeing, or culture (eg up to 50 % of community affected), or regional loss, or Only a few suitable alternative sites exist	Widespread semi-permanent impact, or widespread pest / weed species proliferation, or semi-permanent loss of entire regionally important habitat. Recovery may take many years.	Damage to property, infrastructure, or local economy >$5 million to $20 million
Moderate	Minor long term or major short term (mostly reversible) disruption to services, wellbeing, or culture of the community (eg, up to 25 % of community affected), or sub-regional loss, or Some suitable alternative sites exist	Significant environmental changes isolated to a localised area, or loss of regionally important habitat in one localised area. Recovery may take several years.	Damage to property, infrastructure, or local economy >$500,000[2] to $5 million
Minor	Small to medium short term (reversible) disruption to services, wellbeing, finances, or culture of the community (eg, up to 10 % of community affected), or local loss, or many alternative sites exist	Environmental damage of a magnitude consistent with seasonal variability. Recovery may take one year.	Damage to property, infrastructure, or local economy >$50,000[3] to $500,000
Insignificant	Very small short term disruption to services, wellbeing, finances, or culture of the community (eg, up to 5 % of community affected), or neighbourhood loss, or numerous alternative sites exist	Minimal short term impact, recovery may take less than 6 months, or habitat affected with many alternative sites available.	Damage to property, infrastructure, or local economy <$50,000

To establish a scale to prioritise the management of risks requires dividing them up into groups of risks that are either unacceptable, tolerable or acceptable. The task is ultimately political and asks society to deliberate over and debate the ambiguities of what is 'of value'.

The MfE (2017) guidance highlights the need to involve New Zealand communities upfront and throughout the risk management process. As a society, making better collective coastal risk decisions requires people with contrasting backgrounds and diverse interests to have time and a supportive space to collaborate, deliberate and decide - finding common ground to manage risk to *tolerable* or *acceptable* levels.

Figure 7 shows how the degree of risk tolerability is influenced by both the frequency and intensity of adverse impact (consequence). What it also shows is that there may be limits to our ability to adapt to coastal change at one end of the spectrum and there is a grey area delineating the difference between what is acceptable and what may be tolerated.

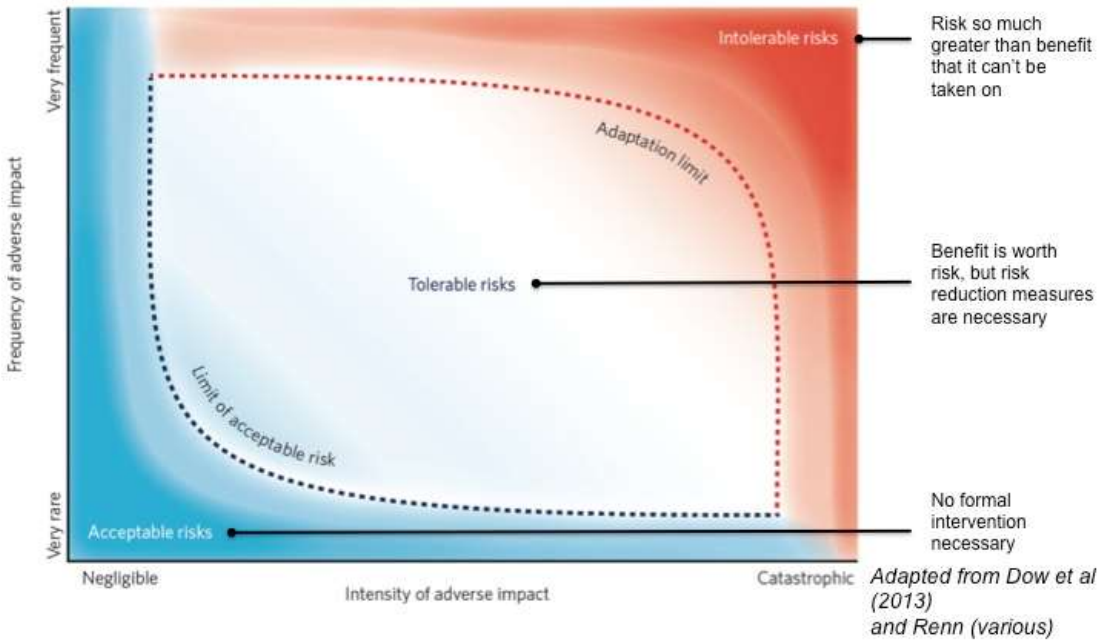


Figure 7: Risk tolerability

3.7.2 DAPP

A DAPP approach incorporates the changing nature of coastal hazards and the changing nature of societal risk preferences. DAPP enables decisions to be taken in stages over time. It does this by first setting objectives, then deciding adaptation thresholds (based on predetermined conditions that are acceptable or tolerable to those affected by coastal hazards) and identifying triggers with (ideally) earlier signals that enable enough lead time to implement the response options by the time the adaptation threshold is reached, thus retaining flexibility for the future.

The concept of 'acceptable risk' is not new and has been used as a way of managing natural or technological hazards worldwide (see, for example, the risk threshold work by Brake *et al.* 2014 for the Bay of Plenty RPS or Fischhoff 1981). AGS (2007a, b) defines "acceptable risk" as follows:

> *"A risk for which, for the purposes of life or work, we are prepared to accept as it is, with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable".*

A risk matrix is presented in AGS (2007a, b), as shown in **Figure 8**. In this case, if the consequences of a particular "unlikely" event were predicted to be "minor", then the risk would be considered to be "low". For example, infrequent tidal inundation of open space areas may be already considered acceptable.

Likelihood	Consequence				
	Catastrophic	Major	Medium	Minor	Insignificant
Almost Certain	Very High	Very High	Very High	High	Medium
Likely	Very High	Very High	High	Medium	Low
Possible	Very High	High	Medium	Medium	Very Low
Unlikely	High	Medium	Low	Low	Very Low
Rare	Medium	Low	Low	Very Low	Very Low
Barely Credible	Low	Very Low	Very Low	Very Low	Very Low

Figure 8: Risk matrix (AGS, 2007a, b)

In advocating the use of such a matrix of risk likelihood and consequence it is recognised that Section 8.2 *Risk Assessment* of the MfE's guidance on CHA notes that *"matrices of likelihood versus consequences are too course to be useful for adaptation planning…"* due to the nature of ongoing sea level rise – thus making the likelihood score virtually certain. However, use of a probabilistic hazard assessment and a focus on community engagement around consequences will overcome that concern. Community defined delineators of acceptable, tolerable and intolerable risks allows for sufficient dynamism and nuance in the evaluation of risks, with the addition of agreed triggers or adaptation thresholds critical in the ability to implement DAPPs.

A key aspect of the AGS (2007a, b) approach is that they defined the acceptable level of risk for development as being "low" risk (or lesser, that is "very low"), as per the matrix in **Figure 8**. This was based on review of the limited literature available, extensive discussion amongst the AGS Working Group, and consideration of the annualised cost of damage to property. AGS (2007a, b) concluded that:

> *"most informed home owners are likely to be risk averse as a result of appreciation of the consequences at a family or personal level, almost regardless of the likelihood of the event. This risk aversion suggests that Low Risk to Property is an appropriate recommendation for acceptable risk to the regulator for domestic dwellings".*

Therefore, as an example, to delineate the coastal hazard for development on conventional foundations, the "unlikely" line (or zone) must be defined. As per **Table 2Error! Reference source not found.**, this line is defined as having a 0.3% cumulative probability of occurring over a design life of 60 years.

The approach advocated by the AGS provides a useful starting point for what are ultimately societal judgements around the acceptability of risk. The deliberative process we are advocating through use of 'Coastal Panels' will seek to augment the scientific and technical analysis of risk with a democratic socio-political process. This process will identify values relevant to the coastal environment, translate those into objectives, overlay the coastal hazard assessment on those values, and tests the viability of solutions and interventions over time against set objectives. Ultimately this will enable fair decision-making based on the best available science.

It is important to note that the above narrative only considers risk to property and infrastructure, and not risk to broader environmental, social, cultural or economic objectives, or risk to life - whether direct or indirect.

3.7.3 Risk to life

The nature of the hazard and the possibility of risks being identified to human life ultimately provide a clear difference, but also a common denominator in evaluating risks from coastal hazards.

This conceptual approach assumes risk to life adjacent to sandy (soft sediment) beaches is be *acceptably low*, as it is highly unlikely that a resident would be occupying a building and would be unaware (or would not have been made aware) that this building was at imminent threat of damage from coastal erosion.

However. this is not the case where the study area is characterised by the following coastal hazards:

- coastal cliffs/bluffs;
- high velocity/depth wave overtopping; or
- high velocity/depth coastal/tidal inundation flows.

In these cases, risk to life may become the primary concern. Accordingly, the evaluation of risk takes on a different perspective in terms of what *"we are prepared to accept as is - with no intervention"*. Where risk to life is identified, this may result in more robust or expensive interventions to reduce that risk to tolerable levels.

3.8 Application

The conceptual approach presented here requires an analysis of 'hazard', an estimation of 'consequence' and the identification of known elements at 'risk', with an eventual series of judgements and recommendations to develop a sustainable pathway for how a particular community may choose to live with the risk posed by coastal hazards.

It is recognised in this analysis, following the definition of hazard probabilities, that there is a significant degree of value judgment required to conclude what is acceptable, tolerable or unacceptable to society. This has to be undertaken in consultation with coastal communities. Accordingly, it is proposed to facilitate consultative, iterative feedback as part of the risk assessment process through the use of deliberative Coastal Panels (refer to the Communications and Engagement Strategy for further discussion).

To initiate this feedback loop, hazards will be presented spatially (via GIS-based mapping layers) for areas where detailed risk analysis is deemed to be necessary. **Figure 9** provides an example of how this mapping may be presented. The example shows erosion hazard for domestic dwelling type development. It should be noted that this figure also depicts the comparison of a traditional deterministic approach (three time denoted lines) to hazard definition with the proposed 'acceptable risk (probabilistic)' approach (denoted by a single line).

Figure 9: Example of 'acceptable risk' mapping (note that the area landward of this particular "acceptable risk" line or zone is not at zero risk, but at an agreed "acceptably low" risk)

These mapping layers will:

- Only show the hazard(s) of relevance to a particular management area.
- Present and map each hazard and the exposure of known elements (population, environment, archaeology and sites of cultural significance, property, infrastructure etc.), in to order to seek feedback on other elements exposed to the hazard.
- Present the 'delineator' (e.g. line or zone) as a series of likelihoods for a particular hazard. Council, partners, stakeholders and the community will be walked through how those hazards may change over time and feedback will be sought as to how that may impact known values. Eventually, the delineator will represent the location beyond which agreed values and objectives become exposed to an unacceptable level of risk.
- Note that the extent of hazard and known elements at risk mapped initially, for consultation, will be based on peer reviewed literature/methods in the risk management of the hazard and element in question (e.g. as described above for AGS guidelines, erosion and residential development).

In taking this approach it is recognised that an integrated approach with parallel SMP Project tasks, to consider and incorporate Council, stakeholder and community values and objectives, is required. This is consistent with the approach suggested in MfE (2017), as illustrated in **Figure 2**, such that 'Hazard (& SLR) Assessment' is undertaken in tandem with establishing 'Values & Objectives' to define 'What Matters Most?' and the assessment of 'Vulnerability & Risk'.

It is anticipated that these value judgments and assessment against defined objectives will guide a further iteration of risk assessment, where the consequences and acceptability of risk are modified in line with community aspirations and the overall objectives of Council and other stakeholders.

The final outputs from this process will be a set of mapping layers that will inform the next step in the risk management process "What can we do about it?" – the development of options for dynamic adaptive pathways to reduce the identified risks.

4 Approach to the Probabilistic Definition of Coastal Hazards

4.1 Introduction

The following sections outline our proposed conceptual approach to the probabilistic definition of coastal hazards and climate change, where the first pass risk assessment identifies that more detailed investigation is required.

Our proposed approach to probabilistic assessment of shoreline erosion and inundation hazards uses methodologies that combine standard and well-tested approaches for defining coastal hazard zones by addition of component parameters, with appropriate techniques for defining and combining parameter ranges to allow for natural variation and uncertainty in individual parameters (Cowell *et al*., 2006). The resulting distributions provide a probabilistic forecast of the potential hazard zone for differing likelihoods, in accordance with Policy 24 of NZCPS 2010 (DOC, 2010) and supported by best practice guidelines (i.e. Ramsay *et al*., 2012).

Modelling scenarios will be derived for different coastal types, including unconsolidated beaches, hard and soft cliffs, and estuarine shorelines, with component values determined using statistical (where practical), empirical and numerical methods.

4.2 Climate Change Consideration

The definitions of coastal hazards for the purposes of the SMP are proposed to be based on the conceptual approach set out in in **Section** Error! Reference source not found.. In applying this approach climate change (or related effects, such as sea level rise (SLR)) will not be defined explicitly but will be inherent in the determination of the likelihood (probabilistic definition) of all coastal hazards.

To define the probability of occurrence of a particular coastal hazard; probabilities, or probability distributions, need to be assigned to the various components used to define the line. Accordingly, climate change related impact (such as SLR) values will be assigned various probabilities based on the latest IPCC scenario projections.

The effects of climate change on the coastal zone are realised through changes to sea level, storm frequency and intensity, waves, wind and storm surge. Changes to any of these processes have the potential to change (increase or decrease) the risk of coastal hazards occurring.

The MfE (2017) states that the projected changes in storm frequency, wave heights, storm surge and winds due to climate change for New Zealand are relatively modest or inconclusive, indicating that the overall influence of these drivers on coastal risk and vulnerability will be secondary to the dominating influence of SLR. However, subtle changes in these coastal drivers in tandem with SLR may lead to substantial changes in shoreline erosion processes, more so than coastal storm inundation. Beyond 2100 (and potentially sooner than this), SLR will tend to dominate over these secondary climate change effects on coastal areas.

4.2.1 Sea level Rise Scenarios

The previous MfE guidance (MfE, 2008a) adopted a risk-based approach, advising users to start assessments of a range of higher sea levels at a base level of 0.5 m and at least consider 0.8 m by the 2090s, with an extension beyond 2100 applying a rate of 10 mm/yr.

Regional and unitary plans more recently have adopted equivalent values of 0.7 m and at least 1 m, extended out by 20 years to 2115 by applying the 10 mm/yr rate; as outlined in *Coastal Adaptation to Climate Change: Pathways to change* (Britton *et al*., 2011).

To satisfy the NZCPS 2010 requirement to assess hazard risks over at least 100 years (e.g. 2120 and beyond), projections need to be extended using recent research and considering potentially significant polar ice sheet contributions beyond 2100.

Four scenarios have been developed for New Zealand to cover a range of possible sea level futures[8], shown in **Figure 10** and **Table 4**, in determining decision points for response-option pathways and understanding the sensitivity of a locality to such a range of sea level futures:

1. a low to eventual net-zero emission scenario (RCP[9]2.6);
2. an intermediate-low scenario based on the RCP4.5 median projections;
3. a scenario with continuing high emissions, based on the RCP8.5 median projections;
4. a higher H+ scenario, considering possible instabilities in polar ice sheets, based on the RCP8.5 (83rd percentile) projections from Kopp *et al*. (2014) [10].

For this assessment, all SLR allowances in **Table 4** will be converted to values relative to 2020 in order to assess relative sea level rise hazard from the present day to the defined planning horizon.

Where necessary, additional consideration shall be given to local changes in vertical ground movements. For example, whilst the Coromandel Peninsular as a whole has an average vertical movement of 0 mm/yr (**Figure 11**), the backshore of the southern Firth of Thames has shown an average subsidence rate of around 8 – 9 mm/yr (2007 – 2016) due to both tectonic and deep-sediment compaction, and the Tararu (Thames) tide gauge recorded subsidence of (3.6±0.7 mm/yr) over the same period.

[8] MfE (2017) Section 5.6.1.
[9] RPC = Representative Concentration Pathways as defined in the 5th Assessment Report of the Intergovernmental Panel on Climate Change
[10] The latter is primarily for the purposes of stress-testing adaptation plans where the risk tolerance is low and/or future adaptation options are limited, and for setting an assumed SLR for greenfield development where the foreseeable risk is to be avoided (Objective 5 and Policy 25(a–b), NZCPS 2010).

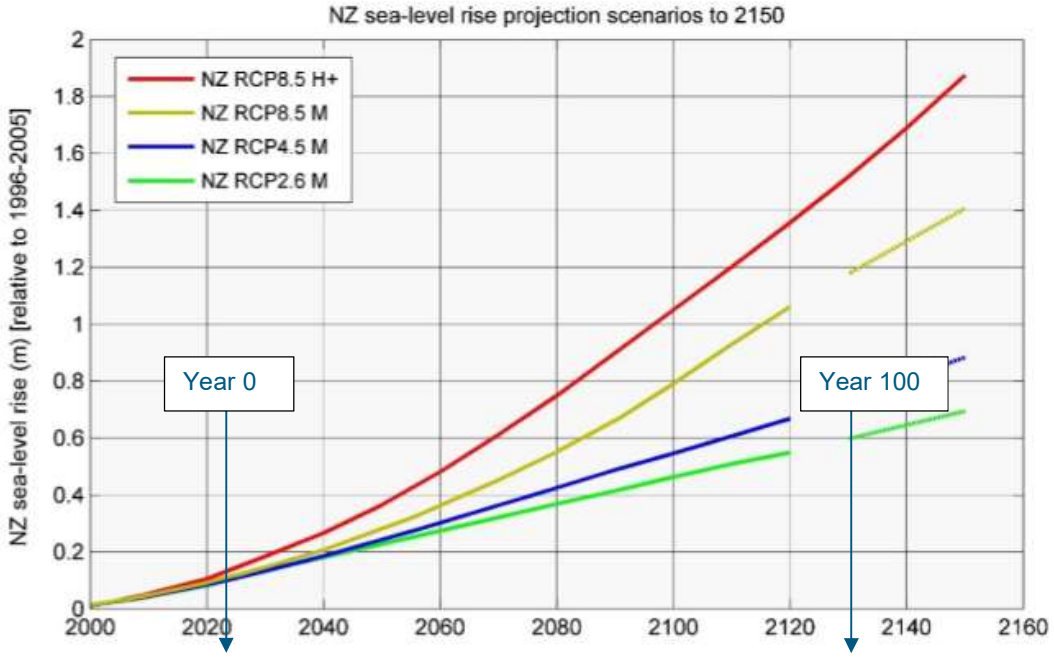


Figure 10: Four scenarios of New Zealand-wide regional sea-level rise projections that will be considered in our approach to sea level rise; "Year 0" (2020) and "Year 100" (2120) planning horizons shown (adapted from MfE, 2017)[11]

Table 4: Decadal increments for projections of sea level rise (meters above 1986 – 2005 baseline) for the wider New Zealand Region (for the four scenarios in Figure 10)

NZ SLR scenario Year	NZ RCP2.6 M (median) [m]	NZ RCP4.5 M (median) [m]	NZ RCP8.5 M (median) [m]	NZ RCP8.5 H+ (83rd percentile) [m]
1986–2005	0	0	0	0
2020	0.08	0.08	0.09	0.11
2030	0.13	0.13	0.15	0.18
2040	0.18	0.19	0.21	0.27
2050	0.23	0.24	0.28	0.37
2060	0.27	0.30	0.36	0.48
2070	0.32	0.36	0.45	0.61
2080	0.37	0.42	0.55	0.75
2090	0.42	0.49	0.67	0.90
2100	0.46	0.55	0.79	1.05
2110	0.51	0.61	0.93	1.20
2120	0.55	0.67	1.06	1.36

[11] *Sections 5.6 and 5.7.*

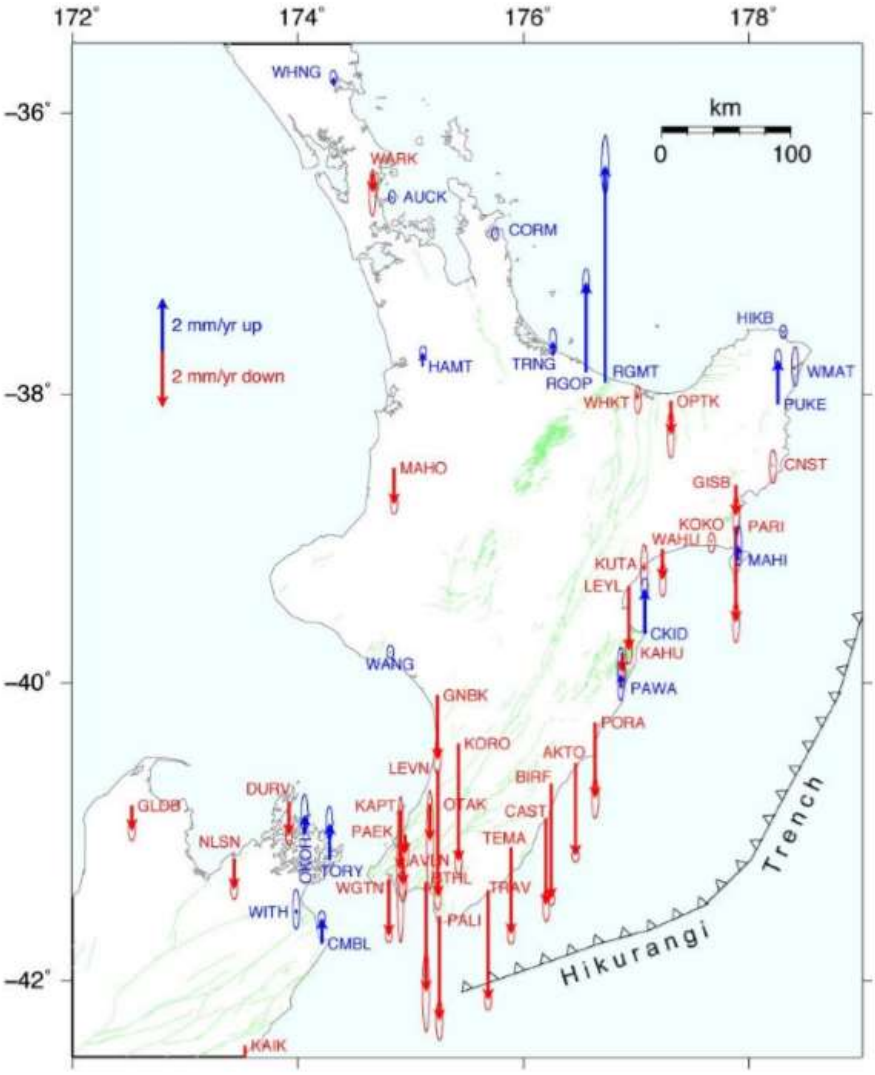


Figure 11: Average vertical land movements (millimetres per year) for near-coastal continuous GPS sites across central New Zealand regions; blue arrows show average uplift and red arrows average subsidence over around a 10-year period (from Beavan & Litchfield, 2012)

4.2.2 Allowance for Climate Change effects on Storm Frequency and Intensity

As stated above, projected changes in storm frequency, wave heights, storm surge and winds overall for New Zealand are relatively modest or inconclusive:

- Analysis of the 99th percentile storm surge peaks simulated under various climate change projections show no consistent changes between scenarios or North Island regions.
- The *mean annual* significant wave height off the north-east coast is expected to decrease by a few percentage points. An increase of between 0 and 5% is expected for the 99th percentile significant wave height (H_s) around New Zealand generally.

- A decrease in extreme winds in the North Island from Northland to Bay of Plenty is likely, however, probably because of increasing anticyclonic conditions

Given the uncertainties in these weather-related drivers of coastal hazards, some sensitivity testing will be undertaken. The following guidance is provided based on recent IPCC AR5- and New Zealand-based studies:

- undertake sensitivity testing for coastal engineering projects and defining coastal hazard exposure areas out to 2100, using –
    - a range of possible future increases across New Zealand of 0–10 per cent for storm surge out to 2100;
    - a range of possible future increases across New Zealand of 0–10 per cent for extreme waves and swell out to 2100; and
    - changes in 99th percentile wind speeds by 2100, incorporating these for the relevant RCP scenario from the MfE (2016) on climate change projections to assess waves in limited-fetch situations, such as semi-enclosed harbours, sounds, fjords and estuaries.

4.3 Shoreline Erosion and Recession Hazard

4.3.1 Introduction

Coastal erosion (or shoreline retreat/recession) is the loss of coastal lands due to the removal of sediments or bedrock from the shoreline. This can be either a rapid-onset hazard (erosion) with possible recovery (occurs very quickly, a period of days to weeks) or slow-onset hazard (recession) occurring over many years, or decades to centuries with no net recovery.

Shoreline Erosion and Recession Hazard analysis assesses hazards occurring on timescales ranging from that of individual storms to that of large-scale coastal response to sediment input and sea level rise. Key input variables in the probabilistic analysis, therefore, include:

1. Event-based erosion due to storm activity – ‘Storm Demand’.
2. Shoreline movement due to sediment budget differentials – ‘Underlying Recession’.
3. SLR and the recession response to SLR – ‘SLR Recession.

The random underlying recession values used in the Monte-Carlo simulations are defined by a triangular probability distribution (). A triangular distribution is defined by three values: the minimum value ‘a’, the maximum value ‘b’, and the peak/mode (most likely) value ‘c’.

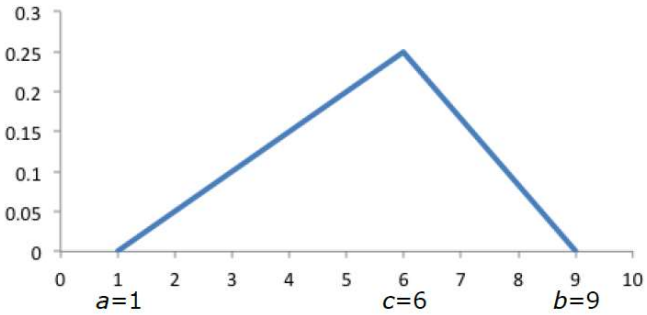


Figure 12: The probability density function of a triangular distribution

Random values for SLR, the Bruun factor and underlying recession will be simulated using triangular distributions, as indicated in **Figure 12**. The values for these variables are then combined in a Monte-Carlo process with a large number of iterations to give a total probabilistic shoreline movement along and across the beach (**Figure 13**).

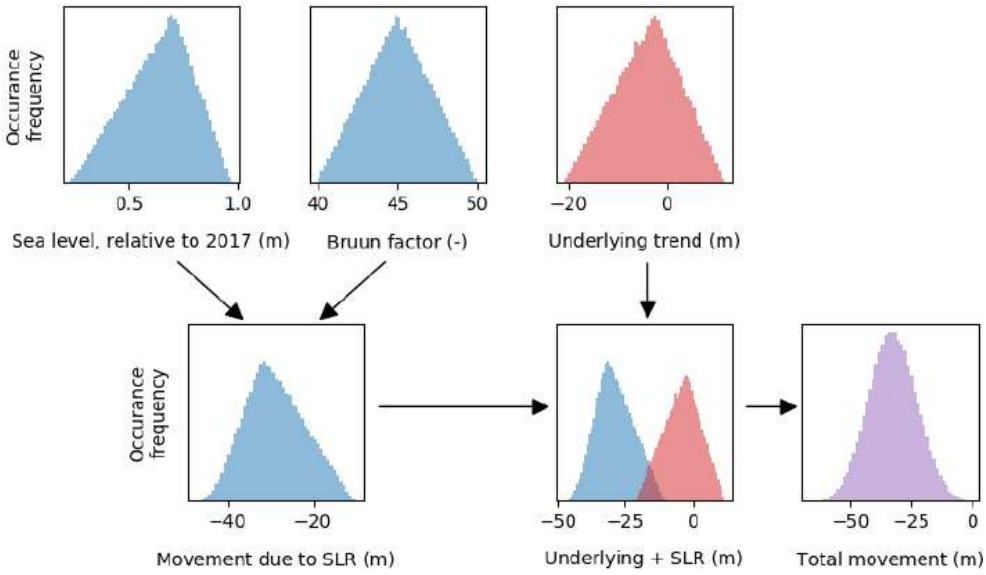


Figure 13: Proposed conceptual methodology for combining random values to estimate shoreline movement (adapted from WRL, 2017)

4.3.2 Storm Demand

Storm bites (or the amount of beach erosion caused by storms) will be simulated using XBeach 1-D cross shore sediment transport model. Predictions will be calibrated against present-day observational data, for example, analysis of available beach profiles.

Probabilities of storm demand will be randomly combined with the recession probabilities in a further Monte Carlo simulation. It will be assumed that the beach recovers from any storm-

driven erosion at the beginning of each year. The shoreline positions (due to storm demand, SLR recession and underlying recession) will be determined for each year within the time series of shoreline change produced for each simulation.

The most extreme erosion event (i.e. maximum shoreline movement) across the planning period will be defined for each simulation, and these values collated to assemble a probability distribution curve for shoreline movement. This process will be completed for each beach profile within the coastal compartment identified as requiring a second pass risk assessment.

There are many locations where existing protective works are present along the foreshore. However, these works are variable in standard, and they may be undersized and/or founded inadequately. Using a probabilistic risk assessment approach, as advocated above, it is possible to take account of the effect of these works in partially reducing storm demand. As a result, different likelihood lines can also be generated in areas with existing protective works.

4.3.3 Underlying Shoreline Movement

Rates of underlying shoreline change will be determined from review of available reports, analysis of available photogrammetry, and analysis of available beach profile data.

For each beach compartment where detailed analysis is required, the rate of change at a defined contour position will be derived by the line of best fit (least squares error) in each case. Average rates of shoreline movement along the shore of each beach compartment will be plotted and key statistics summarising underlying shoreline movement derived.

4.3.4 SLR Recession

In general, rock coasts will be less sensitive to SLR than low-elevation sandy or gravel coastlines, but cliff erosion may be exacerbated by other climate change effects, for example, heavy rainfall and/or prolonged droughts. The generalised impacts of sea-level rise[12] on different types of coastal morphology are shown in **Figure 14**. These schematics are only indicative, because local geomorphology, human impacts and changes to the sediment supply may produce different responses.

SLR may result in shoreline recession due to readjustment of the beach profile to the new coastal water levels. Bruun (1962; 1983) proposed a methodology to estimate shoreline recession due to SLR, the so-called 'Bruun Rule'. The Bruun Rule is based on the concept that SLR will lead to erosion of the upper shoreface, followed by re-establishment of the original equilibrium profile. This profile is re-established by shifting it landward and upward. The Bruun Rule is illustrated in **Figure 15**.

[12] *Note as per Section **Error! Reference source not found.**, SLR Hazard Risk will be calculated on an allowance for future sea level rise based on global climate models plus* historic average *rates of vertical motion due to tectonic activity or ground subsidence.*

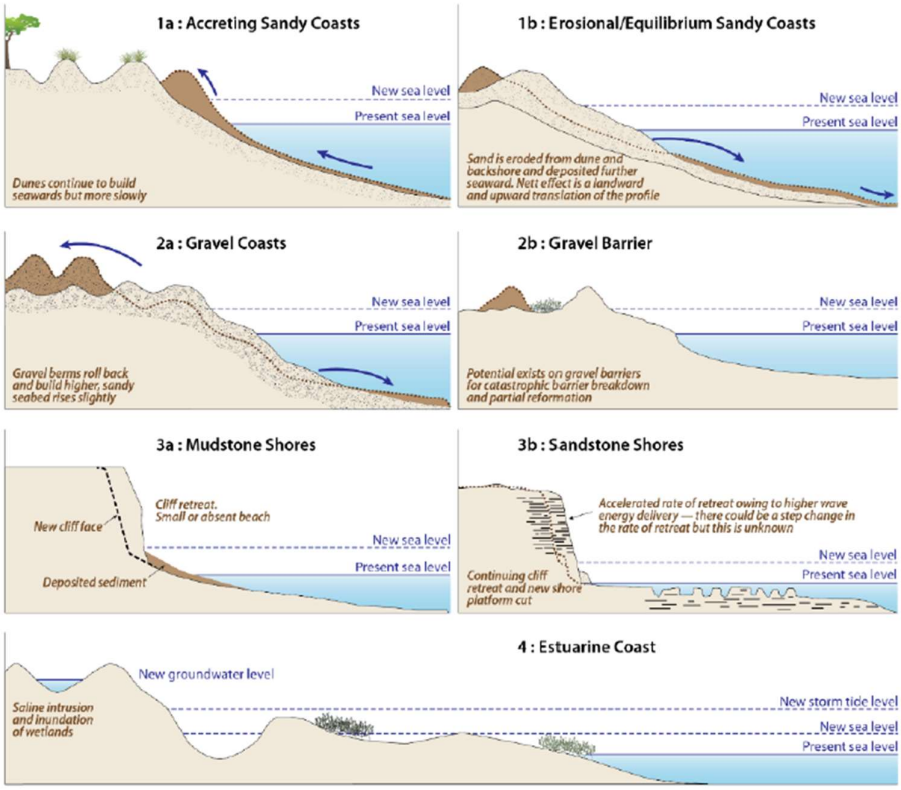


Figure 14: Generalised impacts of sea-level rise on different types of coastal morphology (from MfE, 2017)

The denominator in the Bruun Rule Equation is the offshore beach slope extending to the depth of closure, h_c, which is defined by Bruun (1962) as *"the outer limit for the nearshore littoral drift and exchange zone of littoral material between the shore and the offshore bottom area"*. The inverse beach slope is also referred to as the 'Bruun factor'.

Selection of an appropriate Bruun factor depends on the adopted depth of closure, defined above. The closure depth will be assessed from a combination of wave characteristics, sediment grain size characteristics and beach survey data.

SLR recession hazard is a function of both SLR and the Bruun factor (i.e. R = S × BF). Both SLR and Brunn Factor parameters will be defined by separate triangular probability distributions in the Monte-Carlo analysis, as shown in **Figure 13**.

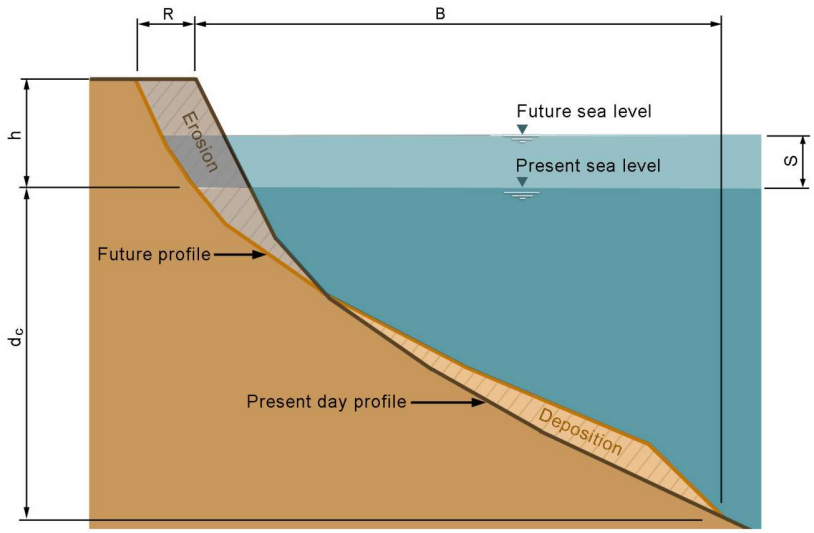


Figure 15: Bruun Rule

4.3.5 Consideration of future tectonic displacements

Predictions of future major earthquake displacements for a particular locality are deeply uncertain (in terms of both when and by how much). Unlike ongoing sea level rise (climate change related or otherwise), displacements could be either subsidence or uplift, other than in those areas with a clear geological history of only uplift or subsidence (Beavan and Litchfield, 2012).

Moderate to strong earthquakes may also generate co-seismic land displacements or, if strong enough, surface ruptures that can instantaneously alter coastal land elevations (Beavan and Litchfield, 2012). For example, the Hawke's Bay earthquake (3 February 1931) resulted in uplift of coastal land, especially around Ahuriri Lagoon, of up to 2.7 metres, but subsidence of up to 0.7 metres along the coast from Clive to Haumoana.

Our consideration of future tectonic movements in defining probabilistic coastal hazards, therefore, will only include an allowance for historical tectonic displacements over an appropriate time period.

4.4 Coastal Inundation Hazard

4.4.1 Introduction

The various components of coastal inundation hazards are shown in **Figure 16.**

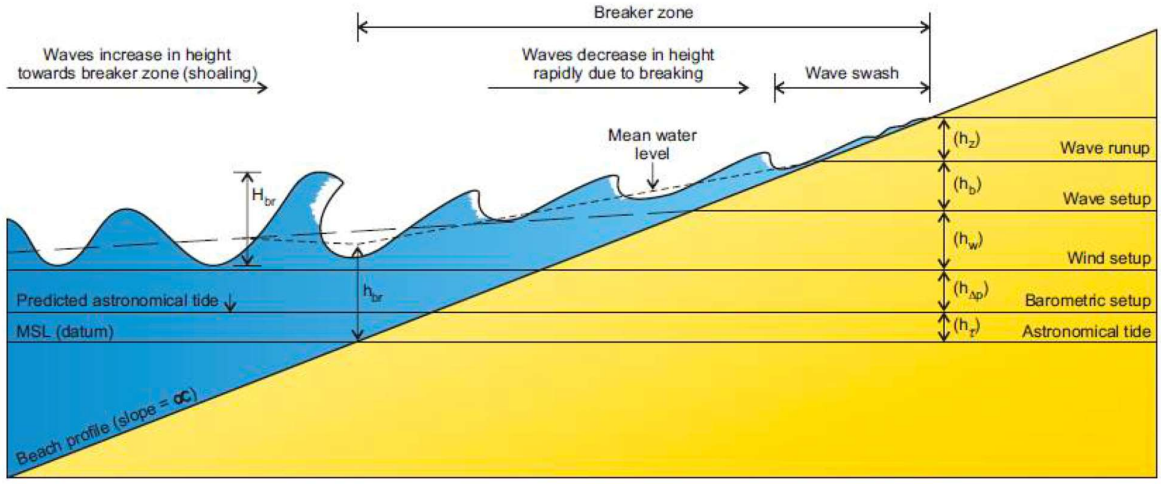


Figure 16*: *Components of Elevated Ocean Water Levels (adapted from DECCW, 2010)

Coastal storm inundation occurs when the sea encroaches onto land. In New Zealand, this usually occurs as a result of a storm coinciding with a higher than normal high tide during storm events (e.g. Stephens et al., 2015a). Analyses of sea level records in New Zealand have shown that, in sheltered areas without large waves, the most extreme sea levels occur when several sea level processes combine to produce high storm tides.

For most New Zealand locations, tide is the dominant component of storm tides, compounded by the MSL anomaly and storm surge. Often the storm surge component is relatively small compared with the tide. However, there is potential for storm tides to occur that are considerably larger than those measured in existing gauge records, should an unusually high storm surge coincide with an unusually high spring tide (Stephens et al., 2015b). If recorded over a very long period of time, the maximum sea level would contain such extreme events, so they provide a useful maximum possible scenario.

Determination of the extent and severity of a storm tide hazard is of considerable significance in relation to land use and maximising the benefits of coastal lands while minimising the risks to people and property. The degree of storm tide hazard at a particular locality is a function of:

- depth of inundation;
- flow velocity; and
- wave height.

4.4.2 Extra-Tropical Cyclones

One of the major types of weather system that can impact the Coromandel Peninsular are extra-tropical cyclones (ETCs) (Lorrey *et al*., 2014). Upon extratropical transition (ETT), tropical cyclones begin to lose their strength as they approach New Zealand because of increased wind shear, interactions with mid-latitude flow and cooler sea surface temperatures (SST) than those in the tropics (Sinclair, 2002).

ETC is a broad term that can include systems as varied as cut-off lows, ex-tropical cyclones, and low pressure systems that develop in situ from a coastal surface trough (e.g. Speer *et al*., 2009), many of which satisfy the Sanders and Gyakum (1980) "bomb" criterion. Accordingly, their spatial scales range from as small as 200km to over 1000km, and temporal scales range from less than a day to several days.

Some of these weather systems are, therefore, often as large as the North Island in diameter. They can induce heavy rainfall as well as strong mean winds and wind gusts, coupled with an increased forward motion, that can make them just as much of a hazard as tropical systems (Jones *et al*., 2003).

ETCs have impacted New Zealand in the past (Kerr, 1976; Sinclair, 1993a, 1993b) and have the potential to cause flooding, generate primary and secondary wind damage to vegetation, and higher-than-normal wave heights and coastal storm surges. For this reason, there is substantial interest in how the frequency, intensity or characteristics of these systems may change over the coming century.

Peak ETC season is during March (Lorrey *et al*., 2014), preceded by an increase in activity during February, with a wide-range of meteorological impacts. Regional circulation patterns, including reduced blocking in the southwest Pacific and synoptic type presence, allow ETCs into the New Zealand North Island region of the southwest Pacific while guiding them either to the east or west of the Coromandel Peninsula (see **Figure 17** and **Figure 18**).

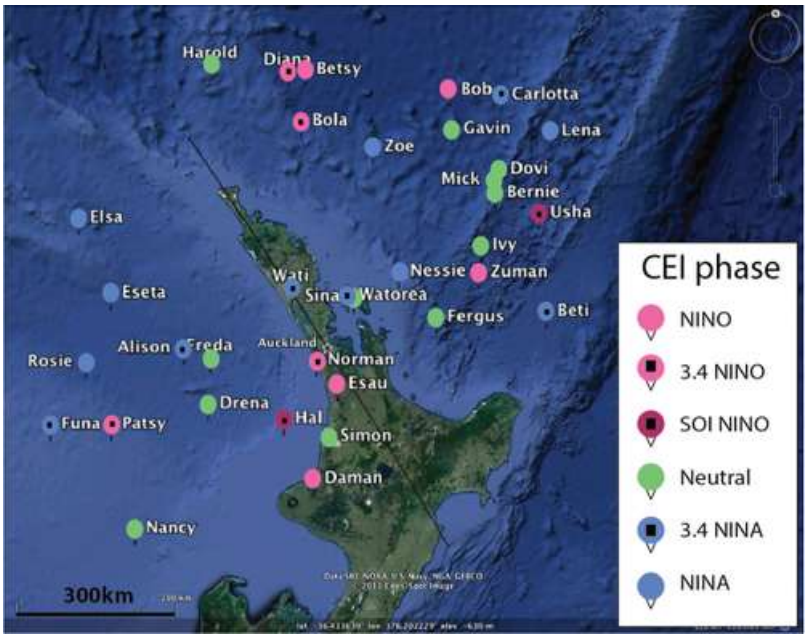


Figure 17: Spatial distribution of 35 ETCs that came within 550 km of Auckland during 1970–2010 (Lorrey et al.*, 2014)*

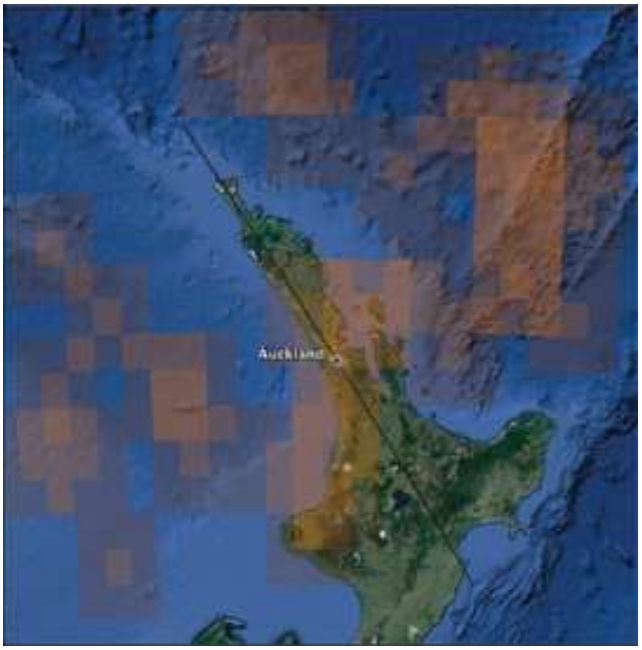


Figure 18: A 'heat map' of ETC activity around Auckland City - 1° × 1° quadrant shading identifies the ETC's closest location relative to Auckland; lighter shading indicates the 1° reach circumscribing the 1° × 1° degree quadrant identified where the closest point of passage for each ETC occurred; darker shades represent 'hot spot' regions of ETCs at their closest point of passage relative to Auckland and where significant proximal influences of the storms are expected – the period of analysis includes the 1969/1970 TC season through to the 2009/2010 season (Lorrey et al.*, 2014)*

4.4.3 General Approach

The general approach that shall be taken for the SMP project to determine storm tide wave and water levels at various encounter probabilities is as follows:

1. Determination of baseline historical storm climatology from latest meteorological and global reanalysis datasets.
2. Construction and calibration of a numerical model system to dynamically downscale wave, tide and storm surge processes from the continent shelf to individual coastal communities.
3. Calibration of parametric wind models to available wind and altimeter data.
4. Numerical simulation of baseline storm climatology using a calibrated numerical model system.
5. Generation of a synthetic storm climatology (region of 1,000 to 10,000 years) by perturbing historical storm track data accepted statistical methods (Monte Carlo random walk).
6. Ranking of synthetic storm events and direct numerical simulation of the most severe synthetic storm tracks to directly assess wave and storm surge from sub-tropical cyclones.
7. Calculation of extremal wave and water levels at required encounter probabilities.
8. Inclusion of climate change effects (using latest IPCC guidance) to determine wave and water levels at defined encounter probabilities and planning horizons.

4.4.4 Baseline Storm Climatology

Two sources of baseline climatology are available for defining the probability of occurrence and movement of ETCs around the Coromandel Peninsular:

1. *The South Pacific Enhanced Archive for Tropical Cyclones* or SPEArTC (Diamond et al., 2012) has previously been used to define all past ETC occurrences for Auckland. The work of Diamond *et al.* (2012) sourced as much historical information as possible (from synoptic charts containing TC tracks) to outline past TC activity in the SW Pacific basin. The SPEArTC database is updated on an annual basis.

2. *ECMWF - ERA5* is the state-of-the-art fifth generation of ECMWF atmospheric reanalyses of the global climate, and the first reanalysis produced as an operational service. It utilizes the best available observation data from satellites and in-situ stations, which are assimilated and processed using ECMWF's Integrated Forecast System (IFS) Cycle 41r2. The nominal spatial resolution is 31 km horizontal resolution. It is currently available since 1979, but will be continuously extended backwards, until 1950.

4.4.5 Automated Storm Tracking Methodology (if required)

There is growing recognition of the role of extra-tropical cyclones in determining lower and intermediate ARI waves and storm surge (e.g. Pepler, 2015). However, 'traditional' cyclone climatologies tend to only consider events that generated in the tropics and undergo extra-tropical transition. Severe storms that do not form within the tropics tend not to be included in the climatologies and therefore hazard assessments that do not account for them may miss important information about the probability of occurrence of storm waves and storm surge.

Available wave and tide gauge data (and, where available, published analysis of this data) will be assessed for correlation between residual water levels and wave height with known storm events within SPEArTC. Any significant surge or wave events that are not correlated with storm events within SPEArTC will be identified and quantified in terms of significance (e.g. severity, longevity).

Should storm tracking be required to more adequately define baseline storm climatology to account for extra-tropical storm events, an automated tracking system will be applied to identify and track extra-tropical cyclones within EMCWF-ERA5 global reanalysis data on the basis of maxima in the Laplacian of mean sea level pressure. This widely used approach has been previously evaluated against other methods and found to have the most skill at identifying observed East Coast Lows in Australia that have a variety of genesis mechanisms that vary with season and latitude (e.g. Pepler, 2017).

The intensity of a cyclone is given by the average of the Laplacian for a 200km radius around the centre. A pressure system is considered to be an ETC if it has a closed low with an intensity of at least 1 hPa $(deg.lat)^{-2}$ for at least 6 hours (two consecutive fixes) and is located within the ETC domain in at least one instance.

4.4.6 Parametric Wind Model

Sub-tropical and extra-tropical cyclone wind fields will be hindcast using a modified parametric approach (e.g. Willoughby *et al*. 2004, 2006; Loridan *et al.*, 2013) that modifies the asymmetry and wind core structure of the cyclone as it transitions from a tropical, warm-core to extra-tropical cold-core structure.

The parametric wind field models generate an asymmetric 2D filed of radial wind speed and direction created by the difference in central pressure relative to the surrounding atmosphere. The equations exploit the basic structure of cyclones in which pressure decreases exponentially towards the centre then levels off in the eye, while the winds increase exponentially toward the centre, then decrease to calm inside the eyewall.

4.4.7 Baseline Storm Hindcast

The baseline storm climatology generated from the assessment of extra-tropical cyclone events will be simulated using the calibrated numerical model system (MIKE21 / Delft3D-FM).

A Monte Carlo synthetic storm track study involves the generation of a database of 1,000 to 10,000 years of synthetic extra-tropical cyclone tracks. These are progressively ranked and simulated with increasing accuracy to establish and identify storm events corresponding to rare and very rare encounter probabilities.

The hindcast storm events will be subject to threshold analysis to retain only the storm events that generate significant wave and water levels, and a statistical algorithm will be constructed to rank the importance of storm events for wave height and residual water level on the basis of storm track history, wind speed and atmospheric pressure. This ranking algorithm will be applied to the synthetic storm climatology (described below).

4.4.8 Synthetic Storm Track Climatology

This involves the following:

- A historical track database is populated and analysed to identify temporal and spatial relationships in key extra-tropical cyclone track parameters.
- Cyclone Central Pressure Tracks passing within (approximately) 500km radius with a central pressure below a determined threshold are incorporated into the database.
- Statistical distributions of the key parameters (time of origin, location of origin, central pressure, forward speed and cyclone heading) are utilised to drive a random walk process model that generates statistically and physically realistic synthetic cyclone tracks.

Each ETC is modelled as a generalised random walk process with the densities of formation, forward speed and direction (initial parameter values and changes in time) estimated from the historical cyclone database.

Each synthetic storm is initiated at approximately 1,000km range with initial conditions for the time of generation, point of origin, central pressure, heading and speed chosen randomly from their respective (initial condition) distributions.

The Monte Carlo synthetic track simulations are performed with a time step consistent with the model sampling interval in the cyclone database. At each time step, based on the synthetic cyclone's current position in the Cartesian grid, a conditional probability is evaluated to determine the change in the key parameters for the next time step.

4.4.9 Consideration of Seasonal and Inter-Annual Changes in MSL

Water level variation on seasonal and interannual timescales is known to be important in a variety of locations, particularly those with defined seasonal changes in barometric pressure or where oceanic currents may play a part in moderating water temperature and density. The long-term water level record for available tide gauges within or close to the Coromandel Peninsular will be analysed to determine trends and cycles in seasonal (monthly-mean) and inter-annual (mean annual by calendar year) water levels.

If sufficient variability is shown in the seasonal mean level of sea data, a probability density function will be fitted and applied to modelling scenarios used to determine probabilistic definition of the coastal inundation hazard.

4.4.10 Allowance for Wave Set-up and Run-up

Wave set-up is the increase in ocean water level near to the coast due to wave breaking and the onshore conservation of momentum flux. It is particularly important during extra-tropical cyclone events where strong winds can generate large waves.

The peak steady water level (PSWL) is often defined as the elevation of the sea level due to the combined effects of storm surge, tide and wave setup. Therefore, the coastal inundation hazard will include some allowance for wave set-up. Wave run-up is the combined effect of wave set-up and swash and is sometimes referred to as the 2% run-up height – the height exceeded by only 2% of the waves for a given set of conditions.

Where appropriate, wave set-up and swash will be parameterised using a non-dimensional form of an Iribarren number (ξ) based expression (Stockden *et al.*, 2006).

4.5 Tidal Inundation Hazard

There are locations in New Zealand where the highest high tides are causing inundation, even in the absence of storm surge and waves. As sea level continues to rise, other locations will start to experience regular 'nuisance flooding' by high tides, and the frequency (and depth) of this flooding will rapidly accelerate (Parliamentary Commissioner for the Environment, 2015; Stephens, 2015; Sweet and Park, 2014).

The first pass risk assessment will inform whether assessment of this hazard is required for individual coastal compartments and management areas.

4.6 Estuarine Entrance Instability Hazard

The likely effects of expected SLR and changes to sediment flux via longshore drift on the future stability of inlets and estuary entrances will be estimated based on the understood key physical processes. Consideration will be given to limitations of available data and simulation results, limitations of the analysis and its reliance on local or site-specific empirical data, and the need for ongoing monitoring.

Depending on the location, size and importance of the inlet entrance, and availability of existing data, analysis of entrance stability is likely to use a combination of known empirical methods, a combination of simplified numerical model and semi-empirical approach, or hydrodynamic model results applied to the tidal inundation hazard study.

Hume (1991) analysed data from 11 estuarine waterways in New Zealand and concluded that Q-AE [13] relationships analogous to those derived for open coast sandy inlets (O'Brien, 1931) hold for waterways in the interior of harbours in the Auckland area (i.e. including the Hauraki Gulf), where sediments are fine grained and where there is no wave action. Hume and Herdendorf (1992) suggested that inlets in this region are geometrically stable in part because of the strong Q-AE relationship they found (r2=0.97), indicating that there is a balance between inlet geometry and tidal flow through the gorge. Hume and Herdendorf (1993) found that the Q-AE relationship holds for a wide variety of estuary types in New Zealand, ranging from lagoons to river mouths to large coastal embayments.

[13] *Where 'Q' = tidal discharge, and 'A_E' is the cross-sectional area of the tidal inlet entrance. The relationship predicts the cross-sectional area of an inlet entrance for a given tidal prism. Below some threshold cross-sectional area, the coastal inlet entrance becomes unstable due to frictional effects and the entrance will become 'geometrically unstable', that is prone to closure or migration in the direction of littoral drift.*

Our proposed approach for assessing the entrance stability of any estuary or coastal inlet may therefore include (but not be limited to):

- Review of available historical photogrammetry on estuarine morphology and adjacent littoral cells.
- Escoffier analysis, using either Keulegan's method (Keulegan 1951, 1963) or hydrodynamic model results.
- Analysis of any changes to the ratio of the spring tide prism and alongshore sediment transport rate, *Q/Mtot* (Bruun, 1978) as a function of either changing wave patterns or sea level rise.
- Prediction of changes to the tidal prism and the degree of flood or ebb dominance.
- Prediction of changes to residual bed shear stress patterns with sea level rise and changing wave energy (instabilities in bank and channel positions etc.).

It should be noted that inlet systems with multiple entrances or channels may exhibit significant differences between inflow and outflow volumes due to the potential existence of large residual flow between inlets, in which case the use of the flood or ebb tidal prisms may lead to different equilibrium interpretations. Therefore, 'typical' Q-AE type relationships should be used as a preliminary guidance for inlet stability only, as they do not make the distinction between flood and ebb tidal prisms.

The specific approach to be used for a particular estuary or coastal inlet shall be determined from the results of the first-pass coastal hazard risk assessment, with more detailed assessment focussed on estuaries and inlets in which communities are more vulnerable to coastal hazard or climate change.

4.7 Cliff / Geotechnical Instability Hazard

Cliff and slope instability have the potential to occur in many parts of the peninsula, including the coastal zones and has the potential to threaten lives and impact on housing, roads, assets and other development. The landslide and cliff instability risk assessments will be completed using the following methodologies:

- Australian Geomechanics Society (2007c) *Practice Note Guidelines for Landslide Risk Management*, risk classification system in which descriptions of the various levels of risk of instability are defined.
- Where roads are potentially impacted by cliff or slope instability then the risk assessment will use the following two relevant guidelines:
    i. Transfund NZ's Risk Assessment Procedure for Optimising Slope-Failure Preventive Maintenance Programmes (1999).
    ii. RMS Guide to Slope Risk Analysis (2014).

The general approach to defining probabilistically the cliff and slope instability hazard would be as follows:

- data gathering / desk study;
- field investigation requirements -
    - complete investigations sufficient to establish a geotechnical model, identify geomorphic processes and associated process rates;
    - inspect the site and surrounds including field mapping of the geomorphic features;
    - determine the subsurface profile from exposures or subsurface investigation such as by boreholes and/or test pits;
    - assess likely groundwater levels and responses to trigger rainfall events;
    - prepare a cross section drawing (to scale) through selected parts of the site to demonstrate the geotechnical model of site conditions and on which landslides may be identified;
    - consider slope forming process rates associated with the geotechnical model and landslides;
    - identify landslides types/locations appropriate to the geotechnical model based on local experience and general experience in similar circumstances; and
    - if required, further detailed investigations should be completed to better define the model, the landslides, the triggers, the frequency (likelihood) or design of stabilisation measures to control the risk.
- landslide characterisation –
    - characterise the landslides based on the desk study and field investigations.
- frequency analysis –
    - adopt a frequency analysis technique appropriate to the level of study and complexity of the geotechnical model and slope forming process;
    - gather local and historical knowledge of slope performance and landslide characteristics and occurrence;
    - empirical methods based on slope instability ranking systems;
    - relationship to geomorphology and geology;
    - prepare a statistical evaluation of rainfall and relate to history of land sliding and population of slopes within area of similar slope type;
    - consider use of simulation models and Monte Carlo sampling analyses to derive a frequency of failure;
    - use knowledge based expert judgment or ‘degree of belief’ method which combines experience, expertise and general principles;
    - estimation of Annual Probability;
    - estimation of Annual Probability (Frequency) (P(H)) of Each Landslide; and
    - complete a review of the assessed frequency in relation to the implied cumulative frequency (see **Figure 19**) of the event occurring within the design life and known performance within the area.

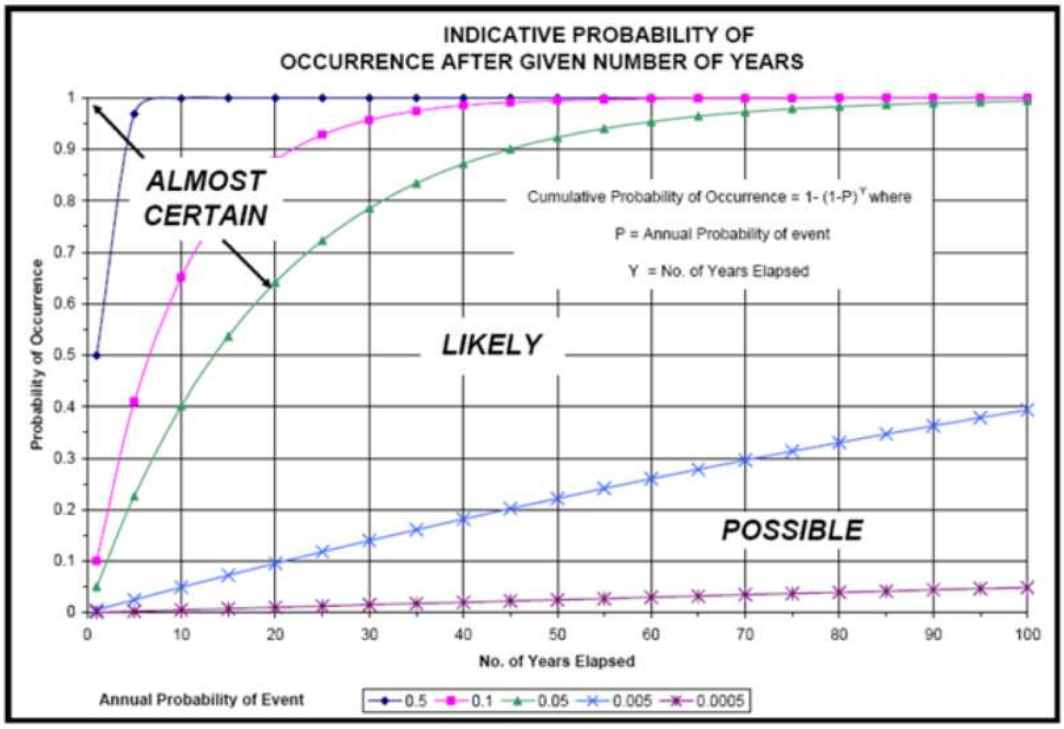


Figure 19: Indicative Probability of Occurrence after a given number of years

5 Summary

This document outlines the process for combining hazard, vulnerability and risk assessments to inform decision-making about coastal change. It summarises the conceptual approach to Coastal Hazard Assessment (CHA) to be applied as a foundational part of the Thames-Coromandel Shoreline Management Plan (SMP) Project. This relates to Steps 2 and 3A to 3D of **Figure 20** below. A detailed understanding of hazards, climate change drivers and sea level rise scenarios is required before undertaking specific vulnerability and risk assessments. This will provide the foundation for the SMPs and clearly identify "What is happening?" before overlaying the hazards on "What matters most?".

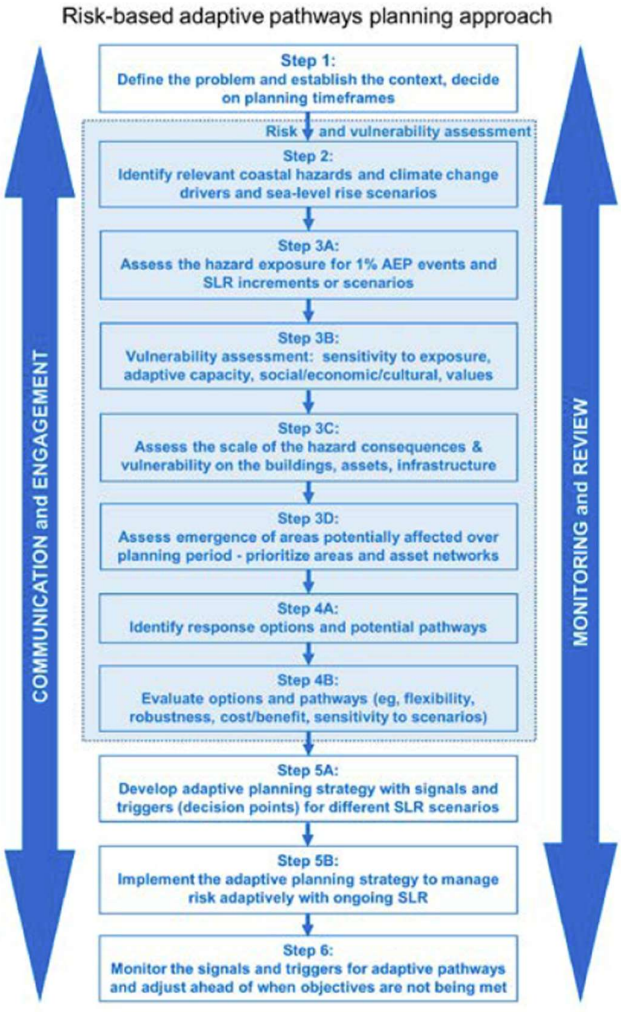


Figure 20 Risk-based adaptive pathways planning approach.

This document also outlines a staged approach to risk assessment, comprising:

- A 'first pass' risk assessment to be undertaken on a semi-quantitative basis using available data (including hazard extent and elements exposed to the hazard) and information to identify and associate coastal hazards with particular coastal compartments and management areas. This process screens out the acceptable risks and focuses effort on areas or populations that may be particularly vulnerable.
- Detailed probabilistic assessment of coastal hazards for management areas identified as vulnerable in the first-pass risk assessment. The technical approaches to be adopted have been described for a range of coastal hazard types, including tidal and coastal inundation, and coastal erosion and recession, incorporating climate change impacts.
- The final outputs from this process will be a set of mapping layers that will inform the next step in the hazard management process, defining "What matters most?", in order to inform a 'second pass' assessment of vulnerability and risk, equating to Steps 3B, 3C and 3D of the above diagram.

Fundamentally, this technical work will provide the basis from which societal judgements around risk can be developed. The completion of these steps in a logical manner is crucial to using Coastal Panels to bring the community along the journey and encourage deliberation using the best available knowledge. This will be important to getting to the bottom of "What can we do about it?" and developing robust, actionable dynamic adaptive planning pathways (DAPPs) to reduce the risks.

6 References

Australian Geomechanics Society Landslide Taskforce, Landslide Practice Note Working Group [AGS] (2007a), “Practice Note Guidelines for Landslide Risk Management 2007”, Australian Geomechanics, Volume 42, No. 1, March, pp. 63-114

AGS (2007b), “Commentary on Practice Note Guidelines for Landslide Risk Management 2007”, Australian Geomechanics, Volume 42, No. 1, March, pp. 115-158

Beavan R.J. and Litchfield N.J. (2012). Vertical land movement around the New Zealand coastline: Implications for sea-level rise. Lower Hutt: GNS Science. Retrieved from: www.gns.cri.nz/static/pubs/2012/SR%202012-029.pdf.

Brake (2014). Proposed Regional Policy Statement Variation 2 (Natural Hazards) Work Stream A: Risk Threshold Engagement. BOPRC, Whakatane, NZ.

Bruun, P. (1978). Stability of Tidal Inlets, Theory and Engineering. Development in Geotechnical Engineering, 23. Elsevier

Cowell P.J., Thom B.G., Jones R.A., Everts C.H., Simanovic D. (2006). Management of uncertainty in predicting climate-change impacts on beaches. Journal of Coastal Research 22(1): 232–245

DoC (2010). New Zealand Coastal Policy Statement. Department of Conservation: Wellington, NZ.

Diamond H.J., Lorrey A.M., Knapp K.R. and Levinson D.H. (2012). Development of an enhanced tropical cyclone tracks database for the southwest Pacific from 1840 to 2010. International Journal of Climatology 32: 2240–2250, DOI: 10.1002/joc.2412. http://doi.wiley.com/10.1002/joc.2412.

Diamond H.J., Lorrey A.M. and Renwick J.A. (2013). A southwest Pacific tropical cyclone climatology and linkages to the El- Nino–Southern Oscillation. Journal of Climate 26(1): 3–25, DOI: 10.1175/JCLI-D-12-00077.1. http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-12-00077.1.

Fischhoff, B., Lichtenstein, S., Slovic, P., Derby, S. L., & Keeney, R. L. (1981). Acceptable Risk. Cambridge University Press.

Hume, T. M. (1991). Empirical Stability Relationships for Estuarine Waterways and Equations for Stable Channel Design. Journal of Coastal Research, 7(4): pp 1097-1111.

Hume, T. M. and Herdendorf, C. E. (1992). Factors Controlling Tidal Inlet Characteristics on Low Drift Coasts. Journal of Coastal Research, 8(2): pp 355-375.

Hume, T. M. and Herdendorf, C. E. (1993). On the Use of Empirical Stability Relationships for Characterising Estuaries. Journal of Coastal Research, 9(2): pp 413-422.

Jones, S.C., Harr, P.A., Abraham, J., Bosart, L.F., Bowyer, P.J., Evans, J.L., Hanley, D.E., Hanstrum, B.N., Hart, R.E., La Laurette, F., Sinclair, M.R., Smith, R.K. and Thorncroft, C. (2003). The extratropical transition of tropical cyclones: forecast challenges, current understanding, and future directions. Weather and Forecasting 18: 1052– 1092.

Kerr, I.S. (1976). Tropical storms and hurricanes in the Southwest Pacific, November 1939 to April 1969.

Keulegan, G. H. (1951). Third Progress Report on Tidal Flow in Entrances, Water-Level Fluctuations of Bas ins in Communication with Seas. National Bureau of Standards.

Keulegan, G. H. (1967). Tidal Flow in Entrances. Technical Bulletin, 14. Committee on Tidal Hydraulics, USACE.

Loridan, T., Khare, S., Scherer, E., Dixon, M. and Bellone, E. (2015). Parametric Modelling of Transitioning Cyclone Wind Fields for Risk Assessment Studies in the Western North Pacific. Journal of Applied Meteorology and Climatology, Vol 54, pp 624 – 642: https://journals.ametsoc.org/doi/pdf/10.1175/JAMC-D-14-0095.1

Lorrey, A.M., Griffiths, G., Fauchereau,N., Diamond,H.J., Chappell, P.R. and Renwick, J. (2014). An ex-tropical cyclone climatology for Auckland, New Zealand. International Journal of Climatology 34: 1157–1168 https://rmets.onlinelibrary.wiley.com/doi/epdf/10.1002/joc.3753

MfE (2017). Coastal Hazards and Climate Change: Guidance for Local Government. Ministry for the Environment: Wellington, NZ.

O'Brien, M. P. (1931). Estuarine Tidal Prism Related to Entrance Areas. Civil Engineering, 1: pp 738-739 Ramsay DLG, Gibberd B, Dahm J, Bell RG. 2012. Defining coastal hazard zones and setback lines: A guide to good practice. Hamilton: NIWA. Retrieved from www.envirolink.govt.nz/Envirolink-tools/naturalhazard-tools/.

Parliamentary Commissioner for the Environment (2015). Preparing New Zealand for rising seas: certainty and uncertainty. Wellington: Parliamentary Commissioner for the Environment. Retrieved from www.pce.parliament.nz/publications/preparing-new-zealand-for-rising-seas-certainty-and-uncertainty.

Pepler, A. (2017). The influences on Australian East Coast Lows in present and future climates. Unpublished PhD Thesis, UNSW.

Ramsay, D., Gibberd, B., Dahm, J. and Bell, R. (2012). Defining coastal hazard zones for setback lines: a guide to good practice.

Riddolls & Grocott Ltd. (1999). A Risk Assessment Procedure for Optimising Slope-Failure Maintenance Programmes. Transfund New Zealand Research Report No. 135. 56pp. (includes appendices)

Roads and Maritime Services (RMS) (2014). Guide to Slope Risk Analysis, Version 4, Roads and Maritime Services, North Sydney, NSW.

Sanders, F. and Gyakum, J.R. (1980). Synoptic-Dynamic Climatology of “The Bomb”. Monthly Weather Review Vol 108, pp 1589 - 1606 https://journals.ametsoc.org/doi/abs/10.1175/1520-0493%281980%29108%3C1589%3ASDCOT%3E2.0.CO%3B2

Sinclair, M.R. (1993a). A diagnostic study of the extratropical precipitation resulting from tropical cyclone Bola. Monthly Weather Review 121: 2690– 2707.

Sinclair, M.R. (1993b). Synoptic-scale diagnosis of the extratropical transition of a Southwest Pacific tropical cyclone. Monthly Weather Review 121: 941– 960.

Sinclair, M.R. (2002). Extratropical transition of southwest Pacific tropical cyclones. Part I: climatology and mean structure changes. Monthly Weather Review 130: 590– 609.

Sinclair, M.R. (2004). Extratropical Transition of Southwest Pacific Tropical Cyclones. Part II: Midlatitude Circulation Characteristics. Monthly Weather Review 132(9): 2145– 2168, DOI:

Speer, M.S. Wiles, P. and Pepler, A. (2009). Low pressure systems off the New South Wales coast and associated hazardous weather: establishment of a database. Australian Meteorological and Oceanographic Journal 58 (2009) 29-39 http://www.bom.gov.au/jshess/docs/2009/speer.pdf

Stephens S.A., Robinson B. and Bell R.G. (2015). Analysis of Whitianga, Tararu and Kawhia sea-level records to 2014. NIWA Client Report to Waikato Regional Council, HAM2015-046: 98.

Stockdon H., Holman R., Howd P. and Sallenger A. (2006). 'Empirical parameterization of setup, swash and runup', Coastal Engineering 53 (2006), pp573-588, Elsevier

Sweet W.V. and Park J. (2014). From the extreme to the mean: Acceleration and tipping points of coastal inundation from sea level rise. Earth's Future 2(12): 579–600.

WRC (2018). Draft Risk Assessment Framework to support implementation of the WRPS: Natural Hazards (Chapter 13). Waikato Regional Council, November 2018.

WRC (2019). Waikato Regional Policy Statement Implementation Practice Note on Natural Hazards Waikato Regional Council, March 2019.

Willoughby, H.E. and Rahn, M.E. (2004). Parametric Representation of the Primary Hurricane Vortex. Part I: Observations and Evaluation of the Holland (1980) Model. Monthly Weather Review, Vol 132, pp 3033 – 3048 https://journals.ametsoc.org/doi/pdf/10.1175/MWR2831.1

Willoughby, H.E., Darling, R.W.R. and Rahn, M.E. (2006). Parametric Representation of the Primary Hurricane Vortex Part II: A New Family of Sectionally Continuous Profiles. Monthly Weather Review, Vol 134, pp 1102 – 1119 https://journals.ametsoc.org/doi/pdf/10.1175/MWR2831.1

A4 Appendix 4

Proposed Management Areas

Coastal Compartment Delineation

Management Area Delineation

Compartment A

0 5000 10000 15000 m

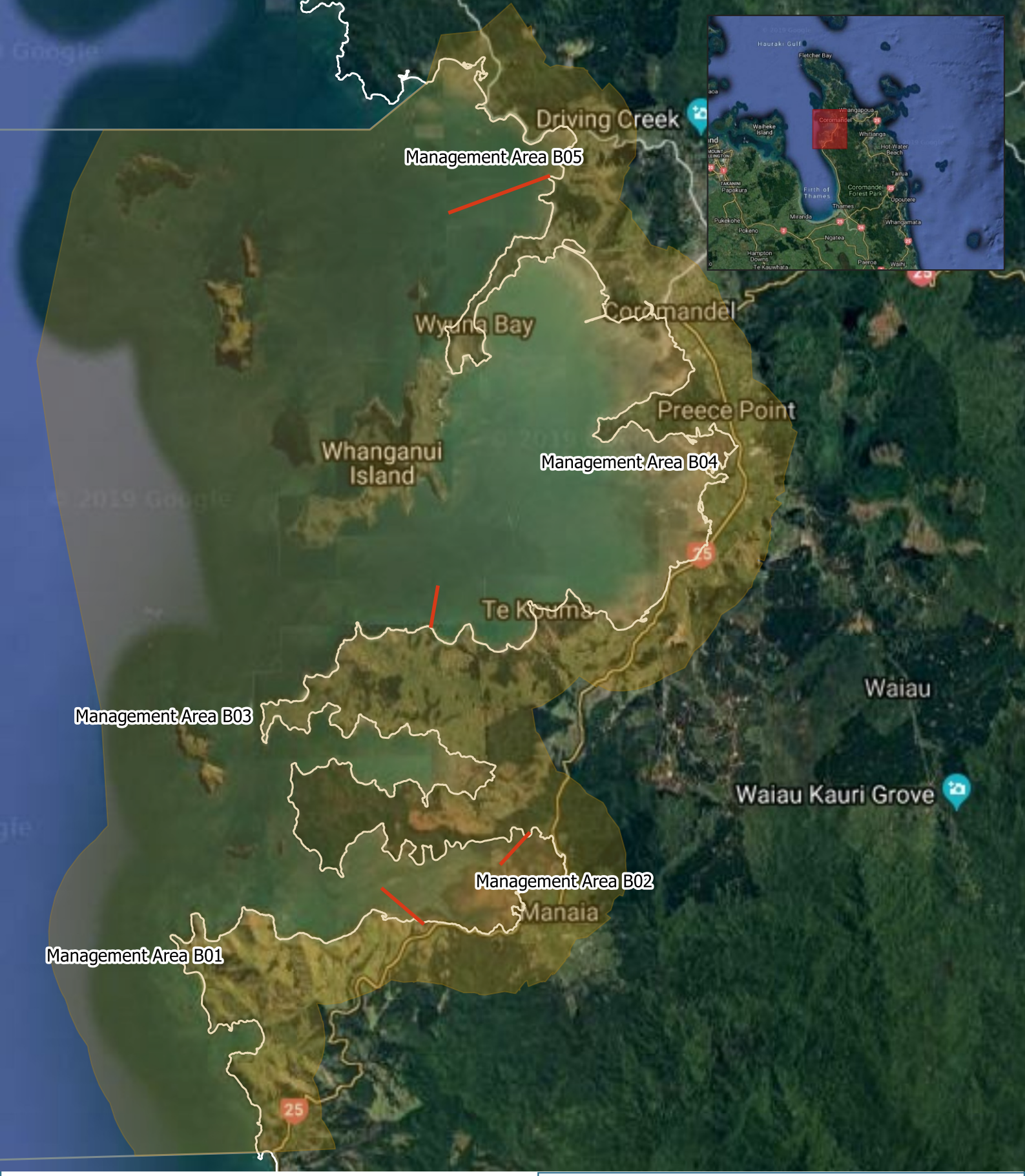
N

Scale: 1:300000

Project: TCDC Shoreline Management Plan

Figure: Compartment A
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together



Coastal Compartment Delineation

Management Area Delineation

Compartment B

0 1800 3600 5400 m

N

Scale: 1:100000

Project: TCDC Shoreline Management Plan

Figure: Compartment B
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together

Coastal Compartment Delineation

Management Area Delineation

Compartment C

0 3000 6000 9000 m

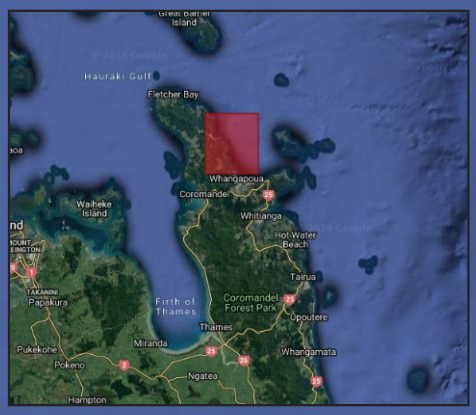
N

Scale: 1:200000

Project: TCDC Shoreline Management Plan

Figure: Compartment C
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together



Management Area D01

Waikawau

Management Area D02

Compartment D

Coromandel Forest Park

Tuateawa

Management Area D03

Kennedy Bay

New Chums Beach

© 2019 Google

Coastal Compartment Delineation

Management Area Delineation

Compartment D

0 1800 3600 5400 m

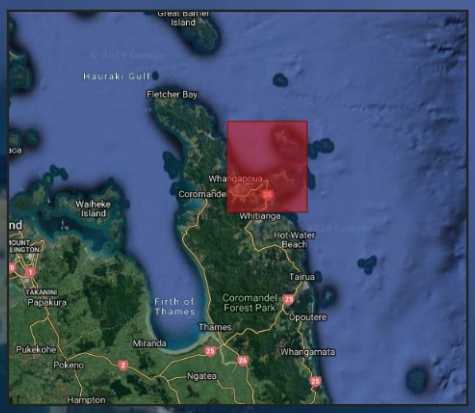
N

Scale: 1:100000

Project: TCDC Shoreline Management Plan

Figure: Compartment D
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together



Great Mercury Island

Compartment E

Management Area E01

Management Area E03

Management Area E04

Management Area E05

Management Area E02

Whangapoua

Matarangi

Kuaotunu

Opito Bay

Coromandel Forest Park

Te Rerenga

Otapaurau

State Forest

Waitaia Bay

Whare Kaho

Mercury Bay

Coastal Compartment Delineation

Management Area Delineation

Compartment E

0 2800 5600 8400 m

N

Scale: 1:150000

Project: TCDC Shoreline Management Plan

Figure: Compartment E
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together

Coastal Compartment Delineation

Management Area Delineation

Compartment F

0 2800 5600 8400 m

N

Scale: 1:150000

Project: TCDC Shoreline Management Plan

Figure: Compartment F
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together

Coastal Compartment Delineation

Compartment G

0 2000 4000 6000 m

N

Scale: 1:150000

Project: TCDC Shoreline Management Plan

Figure: Compartment G
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together

Coastal Compartment Delineation

Management Area Delineation

Compartment H

0 1800 3600 5400 m

N

Scale: 1:100000

Project: TCDC Shoreline Management Plan

Figure: Compartment H
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together

Coastal Compartment Delineation

Management Area Delineation

Compartment I

0 2000 4000 6000 m

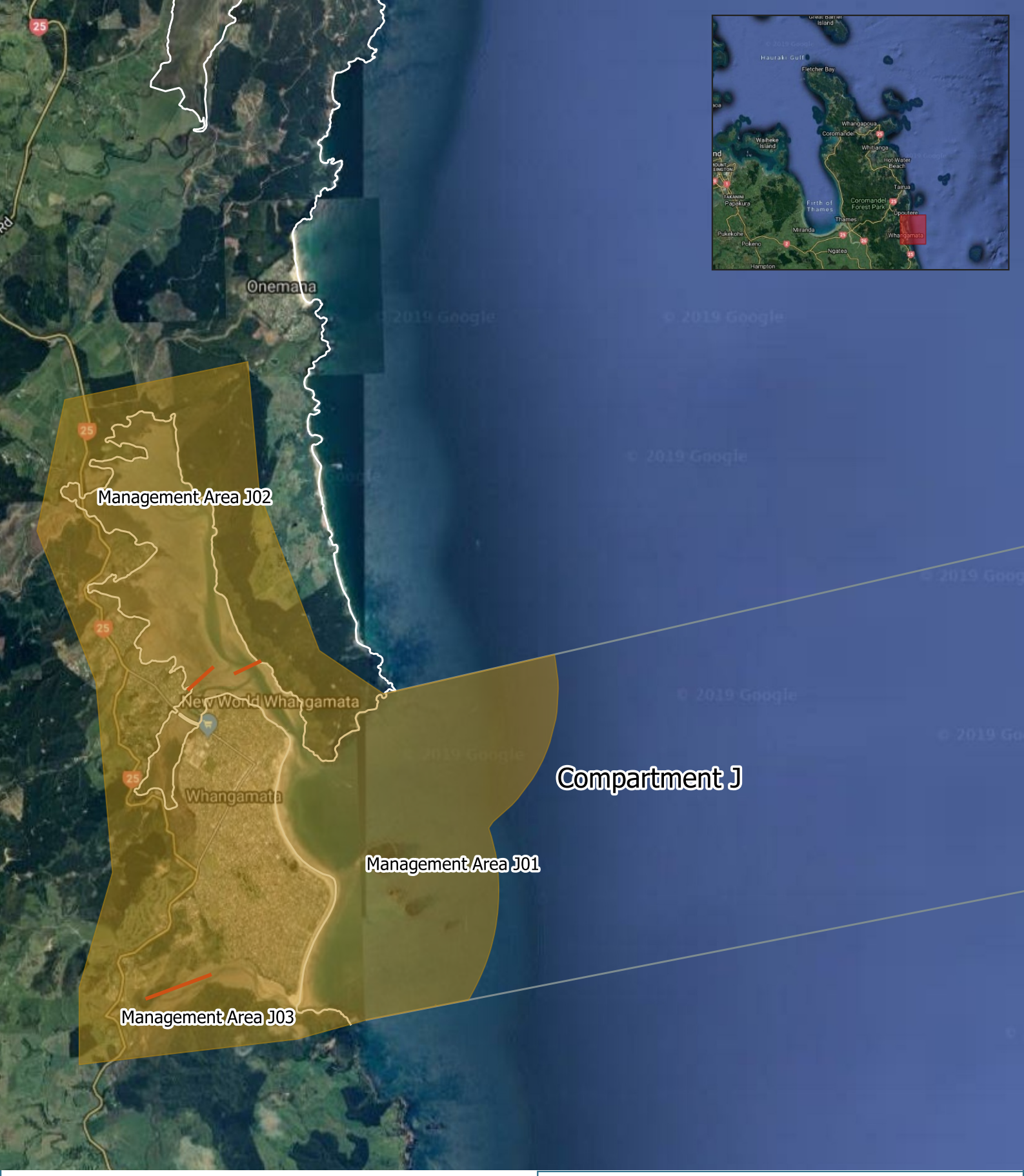
N

Scale: 1:150000

Project: TCDC Shoreline Management Plan

Figure: Compartment I
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together



Project: TCDC Shoreline Management Plan

Figure: Compartment J
Proposed Management Areas

Royal HaskoningDHV
Enhancing Society Together

A5 Appendix 5

First Pass Risk Assessment

A5.1 Introduction

This appendix presents a 'first pass' risk assessment of coastal hazards for the Coromandel Peninsula. Within the assessment, the focus is on hazards to settlements and infrastructure, with only limited regard given to other coastal values, at this stage.

To assist with the analysis and communication of the 'first pass' risk assessment, risks have considered based on Coastal Compartments (A-K, refer to **Figure 5.1**) and, within these, Management Areas (i.e. A1, A2 and A3) which form the geographical basis for discussion within the risk assessment.

The assessment has been undertaken on a semi-quantitative basis using available data and information, and focusses on the following coastal hazards:

- coastal inundation;
- tsunami;
- coastal erosion;
- cliff/slope instability; and
- flooding (fluvial).

Coastal hazards are considered for the present day, as well as for future scenarios, generally 50 year and 100 years from present.

A5.2 Methodology

A5.2.1 Coastal inundation

Information regarding coastal inundation was obtained from WRC's Coastal Inundation Tool, available at: http://coastalinundation.waikatoregion.govt.nz/#. Effectively, any water level (present and future) can be applied to existing land levels (elevation) and used to categorise risk. The following water levels were queried using the inundation tool:

- Storm tide (estimate) upper bound – present day.
- Storm tide (estimate) upper bound – present day plus 0.5m.
- Storm tide (estimate) upper bound – present day plus 1m.

A5.2.2 Tsunami

Information regarding tsunami hazards was obtained from WRC's online documentation of Coromandel Peninsula and Firth of Thames Tsunami Hazards, available at: https://www.waikatoregion.govt.nz/services/regional-services/regional-hazards-and-emergency-management/coastal-hazards/tsunami/eastern-coromandel-tsunami-strategy/.

The information used to characterise the tsunami hazards in Compartment A (Firth of Thames), Compartment B (Coromandel Bays) and Compartment C (Colville and Northern Bays), was obtained from *Numerical Modelling of Tsunami Inundation in the Firth of Thames* (Borrero, 2018). For each of these regions, tsunami flow depths were obtained from predictions of the 'maximum credible earthquake' originating from a local source (the Kerepehi Fault), a regional

source (the Tonga-Kermadec Trench) and a distant source (from South America). Within the report, tsunami modelling for Compartment C focused on the towns of Coromandel and Colville, hence tsunami information for sub-compartments within Compartment C is lacking.

For the remaining zones, predictions of the maximum credible tsunami event were projected onto a map using GIS technology by WRC, and the sources of this data are listed in **Table A5.1**. The cause of this modelled tsunami was the source of the 2011 Tohoku tsunami, Japan, positioned along the Tonga-Kermadec Trench.

Overall tsunami hazard classification within this assessment was determined by analysing whether the extent of tsunami damage would cause an immediate risk to the safety of people and the stability of buildings. If the effect of a tsunami threatened to result in a high hazard to a highly populated area, the overall tsunami hazard risk was considered high. The risk was considered to be less if tsunami damage was predicted to effect less populated regions. The process for Tsunami Hazard Classification as outlined by WRC is:

Low hazard
An able-bodied person is able to manoeuvre through water flow. Light vehicles (cars and motorbikes) may be restricted by flow depth. Buildings may sustain superficial damage to buildings.

Medium hazard
Flood waters have the potential to cause a person to become unstable and unable to manoeuvre. International research suggests that there is a danger of being knocked over when the combination of the flow depth (D) and flow speed (S) exceeds 0.5. Only heavy vehicles or specialist 4wd vehicles are likely to navigate through water. Buildings with structurally weak points, such as doors and windows, are likely to be damaged when the flow speed exceeds ~1.9 knots (1 m/s).

High hazard
Flood waters have the potential to impede a person's ability to rescue themselves or others. When the flow depth exceeds 1.0 m (i.e. adult's waist depth), a person's ability to navigate through water flow (both on foot and using a vehicle) is restricted, therefore impeding the rescue of themselves and others.

A5.2.3 Coastal Erosion

In lieu of a detailed assessment of coastal erosion, *Review of Primary Development Setback at Selected Beaches* (TCDC, 2009) was used as a primary source of information to assess coastal erosion hazards. This document is available at: https://www.waikatoregion.govt.nz/assets/PageFiles/41790/Review_of_Coastal_Development_Setbacks_Coromandel_2009.pdf. In addition, information has been gathered from various sources, including site inspections, review of previous reports and conversations with Council personnel.

Table E.1: Report sources used to categorise tsunami hazard for each Coastal Compartment.

Compartment	Settlement	Source	Author
D (North West Bays)	Kennedy Bay	*Numerical modelling of tsunami inundation along the Kennedy Bay to Opito Bay coast, Coromandel Peninsula, New Zealand*.	Jose Borrero, 2016
E (Whangapoua Harbour and Coast)	Whangapoua Beach, Kuaotunu, Matarangi and Opito		
F (Mercury Bay)	Wharekaho, Whitianga, Cooks Beach	*Numerical modelling of tsunami inundation along the Whitianga to Hot Water Beach coast, Coromandel Peninsula, New Zealand.*	Jose Borrero, 2016.
G (Central East Coast)	Hahei, Hot Water Beach	Waikato Regional Council & NZ Aerial Mapping Ltd 2012-2013, LiDAR Data	A Jeffries, 2016
H (Pauanui and Tairua Harbour)	Pauanui, Tairua	LiDAR Survey 2012 – Coromandel Coast (LiDAR – 2012/2013) data sourced from Waikato Regional Council	A Jeffries, 2014
J (Whangamata)	Whangamata	*Numerical modelling of Tsunami Inundation at Whangamata, Whiritoa, Onemana, Pauanui and Tirua, Coromandel Peninsula, New Zealand.*	Jose Borrero, 2014

A5.2.4 Cliff/slope Instability

In lieu of a detailed assessment of cliff instability, RHDHV personnel undertook a high-level assessment of cliff instability based on the following:

- presence of cliffs and slopes (obtained from site inspections and review of aerial photography;
- presence of infrastructure/assets;
- presence of population.

Cliff instability is only considered where the hazards are within the coastal zone and the source of the hazard is coastal.

A5.2.5 Flood Risk (Fluvial)

Information pertaining to fluvial flooding and its associated risks was attained from several sources. Broad scale flooding information was the primary source of data. This information was made available by WRC for Compartment A (Firth of Thames), Compartment B (Coromandel Peninsula), Compartment D (Northwest Bays), Compartment E (Whangapoua), Compartment F (Mercury Bay), Compartment H (Pauanui and Tairua Harbour) and Compartment J (Whangamata), and is available at: http://www.waikatoregion.govt.nz/Services/Regional-services/Regional-hazards-and-emergency-management/River-flooding/Broadscale-

information/. It should be noted that there are limitations associated with using broadscale data, including:

- The accuracy of the information makes it unsuitable for determining detailed flood hazard information for a specific site (e.g. extent of inundation or design flood levels).
- The information does not consistently represent a particular design flood event (e.g. an event with a 1 % AEP).
- The information does not cover all waterways in the Waikato Region, therefore the presence of a flood hazard zone does not guarantee the existence of such a hazard, nor does the lack of information preclude the existence of a hazard or risk.
- The information is not suitable for land-use planning processes, other than identifying potential flooding issues that may require further discussion and investigation.
- The information does not replace detailed flood hazard information (WRC, 2018).

A Flood Risk Assessment Report published by WRC provided aerial photographic maps outlining the flood hazard rating for many of the rivers in the Thames Coromandel District. This information was used to supplement the broadscale predictions, and can be accessed here: https://www.waikatoregion.govt.nz/services/regional-services/river-and-catchment-management/catchment-management-zone-map/your-catchment-coromandel-zone/thames-coast-project/flood-risk-assessment-report/#Heading2.

Another report detailing flood risk area zones was used to extract information pertaining to specific rivers located within the Thames-Coromandel District (including Waiomu, Te Puru and Pahoe River), which can be accessed here: https://www.tcdc.govt.nz/Global/5_Have%20Your%20Say/District%20Plan%20-%20Plan%20Change%203%20-%20Natural%20Hazards%20Flooding/Thames_Area.pdf.

An interactive GIS resource made available by WRC to view regional scale flood hazard information on an aerial map was also used. This tool is available here: https://tcdc.maps.arcgis.com/apps/webappviewer/index.html?id=94abaea390e74919add4fadf9d0db741. If a particular area had no reported flood hazards included on the map, alongside a physical lack of a nearby river, it was concluded that there were no significant fluvial flood threats posed to the area.

A5.3 Risk Assessment

For the purposes of this high-level 'first pass' risk assessment, an indicative and relatively simple risk assessment rating has been used. The assessment categorisation is as follows:

Green – no issues now or none perceived in the future.

Yellow – generally no existing issues, with some potential in the future.

Orange – minor existing issues and or some significant in the future.

Red – existing and or significant future issue

Coastal Compartment		General Character	Geomorphology	Coastal Processes	Management Areas	Settlements	Coastal Inundation	Tsunami	Coastal Erosion Setback	Cliff Instability	River / estuarine Flooding
A	Thames Coast	Relatively narrow developed coastal strip opening to wide coastal plain at southern end.	Naturally constrained but erodible shoreline with shallow embayment's and local fluvial deltas.	Relatively low exposure shoreline with more significant influence of tidal surge. Narrow upper beach sediment movement with increasing siltation at the southern end.	A1	Waihou	Widespread existing indirect inundation along Waihou River spreading inland	Flood depths of 0-1m along estuary.			WRC Hazards Viewer tool suggests a projected flood risk to Eastern Waihou due to Waihou River. Ponding will occur.
					A2	Thames	Widespread moderate existing inundation, significant widespread inundation at +1.0m level	Minimal flow depths of 0-1m for a few properties along coat of Thames settlement.	Little mapping available for Thames. Generally considered to be moderately impacted by erosion, increasing into the future.	Coastal road potentially impacted by cliff instability.	Broadscale river flooding indicates large river flood hazard zones along the head of the Firth of Thames.
					A3	Tapu	Some existing flooding (incl. indirect inundation) which spreads inland for project levels, posing a risk to a few properties	Predicted flooding ranging from 0-1m to 1-2m in assorted small regions near the coast, posing a threat to some properties and a significant threat to a stretch of coastal road.		Limited surrounding cliffs reducing risk potential	According to a flood risk assessment report, the fluvial flooding from Tapu River poses a moderate to high flood hazard rating to road and properties.
						Waiomu	Minimal existing flooding, significant flooding at projected levels	Flow depths of 0-1m for some of Waiomu's populated region, posing a risk to some properties			According to a flood risk assessment report, the potential for fluvial flooding for Waiomu is high flood hazard rating for the fan delta at the coast, posing overall low to medium risks to private/residential properties.
						Tarau	Moderate widespread existing flooding, significant inundation at projected levels	Limited flooding across coast of 0-1m from D2 offshore fault.	Some properties in PDS. >10 properties in SDS.		High flood hazard risk alongside river posing a high threat to some properties
						Waikawau	Moderate flooding at projected levels	No Mapping	Waikawau: Existing erosion issues. >5 properties in PDS, >10 properties in SDS.		Existing regional scale flood hazard zone prone to fluvial flooding due to estuary, potentially effecting 15 households.
						Te Puru	Moderate widespread existing flooding, significant inundation at projected levels	Widespread flooding along coastline of depths of 0-1m predicted from D2 offshore faults. Flooding extends inland by up to 500m.	Some minor ongoing erosion. Most properties (>40) in PDS. Road in SDS.	Generally low-lying land. Some potential for cliff instability to impact coastal road and properties.	Predominately high flood risk alongside the river as it travels inland, posing a low to high risk to properties depending on their proximity to river path.

B	Coromandel coast	Enclosed sheltered bays with local remote communities at the open coast.	Strongly constrained coastline with deep embayment's	Low wave exposure, with narrow upper beach areas and larger areas of siltation.	B1	Kirita Bay	No flooding at existing or projected levels	No Mapping available	No Mapping. Some existing localised issues impacting road and properties, anticipated to increase into future.	Coastal road potentially impacted by cliff instability in multiple locations. Some localised issues currently	No predicted hazards
					B2	Manaia Harbour	Moderate widespread existing flooding, spreading further inland at projected levels posing a potential risk to SOME properties and Manaia Road.	Limited overland flow depths predicted from D2 offshore fault, however strong tsunami induced currents are predicted averaging 1.4m/s			Slight fluvial flood risk from streams running inland from Manaia Harbour; generally capacitated within 100m of river width.
					B3	Te Kouma Harbour	Minor existing and moderate flooding, posing minimal threat to properties or roads	Very limited areas of inland depths of 1-2m due to D2 offshore fault, generally no risk			No predicted hazards
					B4	Coromandel	Minor flooding at +0.5m and +1.0m	Maximum credible event modelling from D2 offshore fault predicts widespread flooding of 0-1m depths along coast of Coromandel bays, increasing to 1-2m within Waiau stream and Coromandel Township.			Coromandel Flood Hazard Area Report indicates no to low flood hazard risks along the coast situated by Coromandel Harbour. Risk begins to grow in severity further inland.
					B5	Kikowhakarere Bay	Minor existing flooding. Spreading further inland at projected levels posing a threat to entire Kikowhakarere settlement.	No mapping available	Coastal road (Colville Road) likely impacted by future erosion.	Possible effected roads: Colville Roads	No predicted hazards
						Koputauaki Bay, Golden Bay, Oamaru Bay	Minor existing flooding posing no real threat to properties or roads. Moderate projected flooding posing little threat to properties, possible threat to Colville Road.	No mapping available.			Fluvial flood risk to Koputauaki Bay from Waiwhango River based on 2002 flood event and 1% AEP flood extent maps
C	Colville and Northern Bays	Predominantly undeveloped coast with small relatively remote communities.	Strongly constrained coastline with local bays and flooded valleys.	Increasing wave exposure, with locations with wider beaches but generally narrow beaches within sheltered valleys.	C1	Papa Aroha	Minor existing flooding. Spreading further inland at projected levels posing a threat to entire Papa Aroha settlement.	No mapping available.			Possible flood risk affecting Papa Aroha (within C1) from the Flood Hazards Identification Report, posing a possible risk to 19 properties.
					C2	Amodeo Bay, Waitete	Minimal to no impact.	No mapping available.			
					C3	Tukituki Bay	Minimal to no impact.	No mapping available.			No regional scale flood hazard
					C4	Colville Bay	Moderate existing flooding localised at fan deltas within the bay, significant inundation at projected levels in non-populated regions.	Widespread flooding (0-1m depths with some>1m zones) from D2 offshore fault.		Coastal road (Port Jackson Road) potentially impacted by cliff instability in multiple locations.	Fluvial Flood Risk in Colville due to Umangawah Stream identified by 1% AEP flood studies and two previous flood events. Up to 79 properties potentially affected
					C5	Otautu Bay	Minor flooding at +1.0m	<1m flooding of 10-15 properties from D2 offshore fault.	More than 20 properties impacted by PDS and SDS zones.		No regional scale flood hazard
						Waiaro	Minimal to no impact.	No mapping available.			

					C6	Port Jackson	Minor existing and projected flooding localised at estuaries, posing little risks to existing properties.	No mapping available.			
					C7	Sandy Bay	Minor existing, all properties inundated at projected levels of 0.5m.	No mapping available.	Road in PDS. >15 properties SDS	Coastal road potentially impacted by cliff instability in multiple locations.	
						Port Charles	Inundation of waterfront properties at existing levels, with widespread flooding at projected levels.	No mapping available.			Small area susceptible to flood risk identified by 1% AEP flood studies and one previous flood event. Potentially 142 properties affected,
					C8		No impact.	No mapping available.		Cliffs of significant elevation however no roads or major settlements within proximity.	No regional scale flood hazard.
D	Northwest bays	Remote major undeveloped bays with low lying plains	Major bay and barrier systems incised into a strongly controlled hard coastline.	Higher wave exposure, exposed to significant swell, with significant areas of beach sediment movement and spits.	D1	Waikawau	Minor widespread existing flooding, spreading further inland at projected levels posing a potential risk to very few properties.	No mapping available.	.	Properties located primarily in non-threatening low-laying land.	Possible risk of high baseline flood detected by Flood Hazard Identification Report (1990) potentially affecting up to 207 properties.
						Little Bay	Minor existing flooding, projected flooding localised at estuary posing little threat to existing properties.	No mapping available.		Properties localised in primarily non-threatening low laying land.	No regional scale flood hazard.
					D2	Tuateawa	No impact.	No mapping available.		Some properties and roads possibly subject to cliff instability due to location within elevated regions.	No regional scale flood hazard.
					D3	Kennedy Bay	Minimal existing flooding localised at Omoho Stream. Increased depths at projected levels posing a risk to the few properties built within the bay.	Maximum credible event modelling predicts typical tsunami flow depths of 2-3m 0.1km inland and 1-2m about 0.25km inland. Approaching flow speeds are 2.55-5.1m/s, and an overall high tsunami hazard for the majority of its populated regions.	Some properties >5 in SDS at Kennedy Bay	Properties localised in non-hazardous low laying land.	Broadscale river hazard analysis indicates river flood hazard zone across Kennedy Bay stretching 2km inland in some regions. Majority of shoreline region is affected. High baseline, high cumulative flood information, up to 214 properties effected.
E	Whangapoua Harbour and coast	Significantly developed shoreline with associated local communities.	Major open coast bay system controlled locally by hard headlands.	Moderate wave exposure, exposed to swell, with significant sediment supply and movement.	E1	Whangapoua	Moderate inundation above projected +0.5m level.	Maximum credible event modelling predicts typical tsunami flow depths of >5m along the coast, reducing incrementally to 1m around 0.5km inland. Typical flow speeds of 2.55-5.1m/s, and an overall high tsunami hazard classification for the majority of its populated regions, reducing to a medium/low hazard in less populated areas.	Whangapoua: all beachfront properties (>70) in both PDS and SDS.	Properties localised in primarily non-threatening low laying land.	WRC Hazards Viewer tool suggests a fluvial flood hazard at Whangapoua and Whangapoua harbour characterised by four previous floods.

					E2 (must surely have fluvial/tsunami hazards; check) Otapaurau	Whangapoua Harbour	Minimal existing and projected flooding, localised at estuaries	Small regions around the edge of harbour subject to moderate-high tsunamia hazard classifications. Overall low tsunamic water depths of <1m.		Properties localised in primarily non-threatening low laying land.	
					E3	Matarangi	No existing or +0.5m inundation, significant inundation of southern properties at +1.0m	Maximum credible event modelling indicates typical flood depths of 1-2m, and general flood velocities of 2.55-5.1m/s. Overall high tsunami hazard for all of its populated region.	No properties in PDS. >30 properties in SDS.	Generally low-lying land. Some local roads potentially impacted.	No regional scale flood hazard
					E4	Kuaotunu	Existing minor inundation along estuary, widespread moderate inundation of these properties at projected levels	Maximum credible event modelling predicts typical tsunami flow depths of 1-2m inland. Approaching flow speeds at the coast generally 2.55-5.1m/s, reducing to 1.275-2.55m/s about 0.25m inland. Overall high tsunami hazard for some of its populated region	Small number of properties <10 located in PDS and SDS.	Multiple assets (road, reserves) and a small number of properties on cliff tops between Kuaotunu and Rings Beach.	Broadscale river hazard analysis indicates two primary regions of flood hazard zone which originate at Kuaotunu beach, stretching up to 2km inland, and about 0.25-0.5km across the coast.
					E5	Opito	Existing minor inundation along estuary; significant inundation of these properties in projected levels	Maximum credible event modelling predicts typical tsunami flow depths of >5m along the coast, flow speeds of 2.55-5.1m/s, and an overall high tsunami hazard classification for the majority of its populated region.	Some beachfront properties and road in PDS and SDS.	Only 1-3 cliff top properties	No regional scale flood hazard
F	Mercury Bay	Major coastal development with large low lying plains	Major bay system controlled locally by hard headlands.	Relatively sheltered direct wave exposure, with significant exposure to swell. Relatively stable bay shapes with local variation.	F1	Wharekaho.	Minimal to no impact.	Maximum credible event modelling predicts typical tsunami flow depths of 2-3m, flow speeds of 2.55-5.1m/s, and an overall high tsunami hazard classification for the majority of its populated region.	All beachfront properties (>40) impacted by PDS.	Generally low-lying with little cliff-top properties.	No regional scale flood hazard
					F2	Ohuka	Minor existing – moderate inundation at +0.5m, widespread major inundation at +1.0m	No mapping available.	Road impacted by PDS.		No regional scale flood hazard
						Whitianga	Minor existing – moderate inundation at +0.5m, widespread major inundation at +1.0m	Maximum credible event modelling predicts typical tsunami flow depths of 2-3m, flow speeds of 2.55-5.1m/s, and an overall high tsunami hazard classification for the majority of its populated region. Whitianga is also susceptible to a tsunami inundation of a Distant Source Event, which yields tsunami flow depths of 1m, flow speeds of 1.275-2.55m/s and a high tsunami hazard classification for the majority of its populated region.	Ongoing issues with erosion. Significant ongoing erosion issues. > 40 beachfront properties and road in PDS.	Some cliff-top properties in north (at Stormont Lane).	Broadscale river hazard analysis indicates some hazard river zones along Whitianga Beach approx. 0.5km thick. Some hazard zones further inland which follow some branches of Whangamaroro River.

					F3	Whitianga Harbour	Limited existing and projected flooding localised at Whangamaroro River, affecting some properties.	Limited tsunami effects, heightened depths of approx. 1m and speeds of 6m/s limited to mouth of harbour, with little to no effects further inland.		Properties localised in primarily non-threatening low laying land.	Fluvial flood risk at the harbour detected by Flood Hazards Identification Report (1990) and based off two previous floods. Localised around Whangamaroro River. Another widespread flood identified further inland caused by Whenuakite River which occurred in 1998 and poses a threat to up to 378 properties.
					F4	Cooks Beach	Cooks Beach: No existing – moderate inundation at projected levels along waterways; moderate inundation along beach in projected +1.0m level	Maximum credible event modelling predicts typical tsunami flow depths of 3-4m, flow speeds of 2.55-5.1m/s, and an overall high tsunami hazard classification for the majority of its populated region.	Ongoing erosion issues. >25 in PDS, >50 in SDS. Road impacted in east.		WRC Hazards Viewer tool suggests a fluvial flood hazard due to Cooks Stream, where ponding will occur. Characterised by two previous floods, affecting multiple properties (up to 700)
						Maramaratotara Bay	Minimal to no impact.	No mapping available. Anticipated significant impacts.	Ongoing erosion issues. >10 properties and road in PDS	Road currently impacted by unstable cliffs. Some cliff-top properties at Ferry Landing.	No regional scale flood hazard
G	Te Whanganui-A-Hei	Relatively undeveloped coast with local communities.	Predominantly hard rock coastline with local open bays	Higher wave exposure, exposed to significant swell, with significant local areas of beach sediment movement.	G1	Hahei Beach	Existing minor inundation along estuary – more significant inundation of these properties at projected levels	Maximum credible event modelling predicts flow depths of 1-2m inland and 4-5m along the coast. Flow speeds generally 2.55-5.1m/s and an overall high tsunami hazard classification along the coast and down the river; less potential impact upon populated region.	Hahei: some (<20) properties within PDS and SDS zones. Current foreshore erosion in estuary.	A small number of properties located on cliff top.	No regional scale flood hazard
						Hot Water Beach	Limited to no impact upon surrounding properties	Maximum credible event modelling predicts flow depths of >5m along the coast; and inland depths of 1-2m Overall flow speeds are 1.275-2.55m/s, which increase at estuaries. Overall high tsunamic hazard classification for some of its populated region.	No impact		WRC Hazards Viewer tool suggests a fluvial flood hazard from Taiwawe Stream to Hot Water Beach, up to 97 properties affected.
H	Tairua-Pauanui	Major coastal development with large low lying plains	Major bay and barrier beach systems controlled locally by hard headlands.		H1	Tairua.	Existing minor inundation around foreshore properties; widespread inundation in Tairua at projected levels	Southern half of zone susceptible to an overall high tsunami hazard classification for its populated regions. Water depts of 0-1m, gradually increasing to 6-7m along coastline.	Some beachfront properties impacted by SDS.	Numerous properties located on cliff top around Mt Paku headland in Tairua.	Broadscale river hazard analysis indicates hazard zone beginning 3km downstream of estuary, with minimal coastal hazards. Slight potential threat to state highways. WRC identified a fluvial risk from Grahams Creek based off two previous flood events in which ponding does occur.
					H2	Tairua Harbour (East)	Minimal existing flood levels, projected flood levels potentially impacting a few waterfront properties.	A few waterfront properties susceptible to high tsunami risk. Water depths of 0-1m along immediate coast, no flooding further inland.			No regional scale flood hazard
					H3	Tairua Harbour (South)	Some existing widespread flooding poses little risk to settlements; projected levels potentially impacting a few waterfront properties.	No mapping available.			Potential fluvial flood risk from Taiura river based off two previous flood events. Potentially affecting up to 340 properties, some of which are further inland and outside the scope of compartment H3.

					H4	Tairua Harbour (West)	Minimal existing flood levels, projected flood levels potentially impacting a few waterfront properties and properties surrounding Pauanui Waterways.	Medium to high flood risk for a few properties along the coast, with depths of 0-0-1m.			Potential fluvial flood risk from Tairua River based off two previous flood events, potentially affecting up to 20 properties.
						Pauanui Beach	around Pauanui canals for projected levels	High hazard classification along Pauanui Beach for approx. 500m inland, travelling up to 1km southern end of the beach. Water depths generally reaching 1-2m in populated regions, up to 6-7m along coastline.	Pauanui: No current issues. Beachfront properties generally unaffected by PDS and SDS lines.		No regional scale flood hazard
I	Opoutere-Onemana	Major dune systems and undeveloped coast.	Predominantly hard rock coastline major barrier beach system	Higher wave exposure, exposed to significant swell, with significant sediment supply and beach movement.	I1	No settlements.	No impact.	No mapping available.		Regions of high elevations posing threat to no properties.	No regional scale flood hazard
					I2	Opoutere Road	Opoutere: Existing inundation of road and farm land. Future increased inundation of road and farmland.	No mapping available.	Opoutere: No mapping available. Likely minor erosion of road in future.	Generally Low lying with no/little properties on cliff.	WRC Hazards Viewer tool suggests a fluvial flood hazard zone covering a small stretch of land potentially affecting 27 properties.
					I3	Set back at the coast at Onemana	No impact.	No mapping available.	No existing threats.	Generally Low lying with no/little properties on cliff.	No regional scale flood hazard
J	Whangamata	Major development and estuary system	Barrier beach system between estuaries, influenced by nearshore islands.	Higher wave exposure, exposed to significant swell, with significant sediment supply and beach movement.	J1	Whangamata Beach	Minor existing flood hazards, wide-spread inundation along estuary for projected levels.	Maximum credible event modelling predicts typical tsunami flow depths of 4-5m along the shore, and depths of 1m 200m inland. and 1.275-2.55m/s on land. High tsunami hazard classification along the coast and for a 0.2km² populated region, reducing to a low hazard 300m inland and no posed hazard for a majority of the populated region.	Little present/ongoing issues. Some existing erosion in estuary foreshore. Most beach front properties located within both primary and secondary development setbacks.	Generally Low lying with no/little properties on cliff.	Broadscale river hazard analysis indicates a hazard zone as the river travels inland (up to 5km). General flood hazard to properties which border Wentworth River and Waiharakeke stream. Possible flood risk to state highways, district roads and multiple properties. WRC Hazard tool identified fluvial risk for Wentworth River in which ponding does occur
					J2	Whangamata Harbour	Limited existing flood hazard, projected flood levels posing a threat to very few (<5) properties	Medium hazard classification and water depths of 0-1m along river for a very narrow area; very few properties affected. Flow speeds of 2.55-5.1m/s within estuary,			WRC Hazard view tool suggests a fluvial flood risk from Waikiekie Stream based off two previous flood events posing a potential threat to 35 properties.
					J3	Otahu River	Limited existing flood hazard, projected flood levels posing a threat to very few (<5) properties	Medium-high hazard classification and water depths of 0-2m 1km inland along Otahu River; very few properties affected.			WRC Hazard viewer tool suggests a fluvial flood risk from Waiharakeke Stream based off one previous flood event identified by local residents.
K	East coast islands	Largely undeveloped islands	Islands			Individual properties to the west coast of Great Mercury Island and Slipper Island.		No mapping available.			No mapping available.