Form 7
Notice of appeal to Environment Court against Kaipara District Council decision on Private Plan Change 83

Clause 14(1) of First Schedule, Resource Management Act 1991

To the Registrar
Environment Court
Auckland, Wellington, and Christchurch

1. Introduction

I, Joel Cayford on behalf of Mangawhai Matters Incorporated (MMI), appeal against part of a decision of Kaipara District Council (Council) on the Private Plan Change 83, to the Kaipara District Operative District Plan.

MMI made a submission, further submissions, and oral submissions on that Plan Change.

MMI received notice on 8th July 2024 of the decision made by Kaipara District Council to adopt the Commissioner Recommendations.

The parts of the decision that MMI is appealing are those relating to performance standards and provisions that control for the discharge of sediments from development activity in the PC 83 area into the Mangawhai Estuary. These are insufficient or inadequate.

2. Reasons for the Appeal

The reasons for the appeal are as follows:

1. Among other things, MMI is concerned to protect the Mangawhai Estuary from sedimentation as its catchment gradually urbanises. MMI commissioned expert advice from Terry Hulme (attached), which was presented at the hearing, and which includes:

- Mangawhai Harbour is shallow, with two thirds exposed at low tide. As a “permanently open lagoon” it would be expected to infill over the long term. Today, it remains open because of a balance between sedimentation, wind and wave action, and tidal movement.

- Water quality and the clarity of the middle and lower harbour remain good and generally recover quickly from siltation following heavy rain. Small, wind-generated waves lift sediment from the shallow floor so that strong currents flush it from the harbour, leaving clear water and a sandy floor. In contrast, the upper reaches comprise mangrove-covered, soft, muddy flats from the build-up of sediment because here there is less wave action and flushing. More frequent storms and intensive rain in an increasingly developed catchment could still overwhelm the capacity of the harbour to clear itself, with progressive loss of water quality and extension of the muddy substrate down harbour.
- The catchment is just 12km2 in area. The main land use impacts on the harbour have occurred with historical logging, clearance, and grazing. The change from forest to pasture increased the velocity, volume, and channelling of runoff, with additional sediment washed into the harbour as a result. This is evident in today's turbid waters and siltation of the upper harbour. The urban area covers around 3% of the catchment, although this is increasing. While expansion is subject to the regulation of stormwater within subdivisions, the current council consent is for direct discharge into the harbour. Any inadequacy in stormwater management in these areas can therefore pose a significant risk to water quality. In addition, much of the rural area is transitioning from pasture to low density residential development and small-scale horticulture. More intensive rural land use inevitably increases hard surfaces, increasing run-off, sedimentation, and contamination in the harbour.

MMI is concerned that the Mangawhai Estuary is already suffering from sedimentation which is not being flushed naturally. MMI has received expert advice that future urbanisation of existing rural lands will increase sediment flows into the estuary if sediments are not controlled and retained on development sites, or retained by Council owned and operated stormwater infrastructure used to transport and discharge runoff from the site.

The receiving environment for any stormwater or/and sediment runoff from development activity at the Rise, enabled by PPC83, forms part of the catchment of the Mangawhai Estuary. MMI wishes to ensure that the performance of onsite sediment controls required by PPC83, will ensure that sediment discharges from the Rise development into the Estuary are minimised.

2. The Decision did not properly reflect provisions in the relevant planning instruments including:

- the New Zealand Coastal Policy Statement;
- the Northland Regional Policy Statement;
- the Proposed Regional Plan for Auckland

3. Relief Sought

MMI seeks the following relief:

MMI seeks the following specific changes and additions to provisions relating to PPC83 development that have been adopted into the Operative District Plan:

1. Section 13.10.1a, relating to excavation and fill, should include a Note 5, requiring that the management of sediment flows within and from Cove Road North Precinct follow good management practices as set out in the GD05 Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region
2. The matters for discretion in section 13.12.2 relating to Subdivision Design should include a further matter Va: The extent to which sediment control and detention systems, including consent holder maintenance obligations, will be provided onsite and/or within the public network, that protect the environment including the Mangawhai Estuary from sediments generated from the activity during and after construction stages.
3. Note 4 in Section 13.14.5a, relating to stormwater disposal, should be worded: Note 4: Within Cove Road North Precinct, Stormwater Management shall follow good management practice equivalent to those set out in the GD01 guideline document, Stormwater Management Devices in the Auckland Region.
4. Section 13.14.5a, relating to stormwater disposal, should include a Note 5, requiring that the management of sediment flows within and from Cove Road North Precinct follow good management practices set out in the GD05 Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region

MMI seeks any other changes to the provisions which will reduce sediment loadings being discharged from the Plan Change 83 area, and thereby avoid further adverse effects of sedimentation within the Mangawhai Estuary.

4. Documents Attached or Available

I attach the following documents with this notice:

(a) a letter from Mangawhai Matters Inc confirming the decision of MMI authorising Joel Cayford to act on its behalf in this appeal.

(b) a copy of the expert evidence of Terry Hulme in respect to Mangawhai Estuary (The Sustainable Mangawhai Project Stage One Summary 14 November.pdf)

(c) a copy of the MMI presentation to the PPC83 hearing

Other documents relevant to this notice are on the KDC website for PPC83, including:

(d) a copy of the PPC83 decision including District Plan provisions

(e) copies of MMI's submissions and further submissions

(f) a copy of the Northland Regional Council Resource Consent dated July 2017, permitting the Kaipara District Council to divert and discharge stormwater into the Coastal Marine Area of the Mangawhai Harbour

(g) a copy of the Stormwater Management Plan accompanying the application, prepared by Chester Consultants in January 2024, which cites KDC's Mangawhai Stormwater Infrastructure Strategy, prepared by Stantec Consultants and dated 2018.

Signature of appellant

15th August 2024

Address for service of appellant: 142 Estuary Drive, Mangawhai Heads, 0505

Telephone: 0274 978 123

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Contact person: Joel Cayford (Authorised to act on behalf of Mangawhai Matters Inc)

Mangawhai
Matters

4th Aug 2024

To Whom it May Concern

Joel Cayford is authorized to represent and act for Mangawhai Matters Society Incorporated in its Appeal to the Environment Court of Kaipara district Councils Private Plan Change 83 decision.

Yours Sincerely

Doug Lloyd
Chair
Mangawhai matters Society incorporated

MANGAWHAI HARBOUR, COAST, AND COMMUNITY

The Sustainable Mangawhai Project

Stage One Report

Mangawhai Matters Inc

October 2023

Mangawhai Matters

Protecting our Environment, Sustaining our Community

The Sustainable Mangawhai Project aims to assess the physical risks to the integrity of the harbour and distal spit and the consequences for the environment and community of any damage to them. The objective is to provide a comprehensive information base so that the community and agencies responsible can cooperate in the preparation and implementation of harbour management guidelines.

The harbour and its protective spit support biodiversity, recreation, economic activity, and cultural, community, and personal well-being. When considering how we might best manage the harbour, all the services it provides need to be considered.

This is the report of Stage One of the project. It summarises in-depth studies of the physical processes affecting the harbour and its significance to the community. It also considers the implications of a warming climate and rising sea level and presents some options for mitigating the threats that they may pose.

MANGAWHAI HARBOUR, COAST, AND COMMUNITY

The Sustainable Management Project
Stage One Report:
Mangawhai Matters Inc.
September 2023

This report has been compiled by Dr Philip McDermott with assistance from Dr Terry Hume
It has been subject to minor editing of typographic errors and for clarity with no change to content, November 2023
Cover photo by Elevated Media.
For further information, visit **www.mangawhaimatters.com/sustainablityproject**.

PREFACE

Mangawhai Harbour is one of 16 tidal lagoons in Northland protected by a barrier spit. They are all facing the challenges of an increasingly volatile climate. Mangawhai is a little different, though: it has already suffered the effects of severe weather. Severe weather in 1978 breached the spit with major negative aftereffects. The harbour mouth blocked, water quality degraded to below swimming standards, and the only access to the sea was through a dangerous, shifting, shallow estuary mouth.

When Cyclone Gabrielle struck in early 2023, it almost happened again. This time, the community dodged a bullet. The storm, while more violent, did not last as long. And the inner shoreline of the harbour held up so that inundation from the harbour did not merge with wave- and wind-driven flooding from the ocean to create a breach.

The latest evidence on sea level rise points to a warming Pacific regularly generating similar or even more destructive storms in the future. We know that the spit could breach again, leaving the harbour unprotected. Occasional intensive downpours and sea surge also mean that we face the prospect of more damaging inundation of the harbour margins and increased sedimentation of the harbour bed.

Gabrielle hinted at the damage that can done to the spit, the harbour, environment, and property, destroying much that makes Mangawhai a valuable and valued natural, recreational, and residential destination today.

With these very real threats in mind, Mangawhai Matters commissioned a study to describe processes affecting the harbour and spit. It is summarised in this report, along with studies of why people visit Mangawhai, what it is worth to them, and what they bring to the town.

Our work shows that there is too much at stake not to do our best to mitigate such outcomes. While Stage One set out to scope the issues, its findings mean that we are presenting it now as a call to coordinated action. There is no time to lose. Hence, the final chapter in this report sets out a draft framework for strengthening harbour management.

The starting point is the need for the parties responsible for the health of the harbour and spit to collaborate to respond to the challenge we now face. Mangawhai Matters is therefore inviting the Northland Regional Council, the Kaipara District Council, Te Uri O Hou, and the Department of Conservation to join us in this endeavour.

It is also important that any plans or actions that follow such collaboration are informed by a sound understanding of the environmental as well as community issues at stake. In Stage Two we will therefore promote independent expert studies into the impact of the events outlined on Mangawhai's biodiversity.

This is a major and important study only made possible by generous donations of time and money. My thanks to all who contributed.

Doug Lloyd
Chair,
Mangawhai Matters Incorporated
October 2023

Mangawhai Matters

SUMMARY

Mangawhai lives by its harbour. Yet the harbour is at risk, and with it the lifestyle and livelihoods of residents, the benefits to the thousands of visitors, its cultural heritage, and the biodiversity it supports. The Sustainable Mangawhai Project aims to ensure that the adverse impacts of major weather events on the harbour, environs, and community are mitigated by a well-founded, coordinated, and comprehensive harbour and spit management plan.

This report presents the results of an in-depth study of processes impacting on the harbour and spit, and exploratory analyses of the services they provide to the community. The main findings are that:

- The spit, the harbour, and harbourside properties are at risk from more intensive storms, the effects of which will be compounded by sea level rise.
- The harbour floor and water quality are also under threat. Combined with poor catchment management such storms would increase silting of the harbour.
- The 2023 report of the International Panel on Climate Change indicates that ocean warming is exceeding projections, raising weather-related risks.
- The Hume report, prepared for this study, shows that the risks to Mangawhai Harbour will increase if the physical threats are not actively mitigated.
- Mangawhai is a desirable residential destination. The population of the Heads and Village grew 115% between 2013 and 2022. Its appeal and capacity to support growth will be undermined by the threats described in the Hume report.
- Residential properties estimated at well over $100m are on the line even under modest sea level rise, and all other properties stand to lose significant value.
- Mangawhai is highly popular with holiday makers: visitors to the harbour at present receive recreational and wellbeing benefits worth around $55m a year.
- Apart from the value of the recreation visitors enjoy, they spend $27m a year in local stores. Much of this would be lost if the harbour is compromised and visitor numbers fall.

These figures indicate far-reaching community impacts from any loss of harbour utility. Yet, Northland Regional Council, the Department of Conservation, and volunteer groups spend just $1,000,000 in wages, materials, and volunteer labour on it. Of that, only 22% goes into active management of the threats to the harbour environment after legal and administrative costs.

Too much is at risk to ignore the physical threats. Failing to manage the harbour and spit using the best information and tools available increases the prospect that they suffer serious damage sooner rather than later.

Hence the need for the long-term harbour management plan proposed in this study.

Such a plan will only be as good as the information it is based on. This report points to the further research needed. First, it is important to understand the impacts of changes to the harbour environment on biodiversity. Second, detailed work is needed to establish what methods of mitigation are likely to be most effective.

While using the best available information is a necessary condition for successful planning, it is not sufficient. Preparing a plan that can be implemented to good effect requires that the agencies responsible work together towards the common goal of sustaining the harbour and its environment. This report provides the justification and the framework for proceeding down this path with urgency.

1. INTRODUCTION

This Chapter introduces the harbour and the issues facing it and explains the purpose of the Sustainable Management Project as a response to these issues.

The Sustainable Mangawhai Project was initiated by Mangawhai Matters in response to the physical risks to the harbour in the face of a changing climate and ongoing development. The aim is to develop a comprehensive information base to inform the preparation and implementation of a long-long-term management plan for the harbour.

Stage One assesses the risks to the harbour and their possible consequences for the community. This report summarises a commissioned study into the physical character of the harbour and its environment, the processes affecting them, and the threats they face. Stage One also describes the value of these natural resources to the community and sets out the actions that can be incorporated into a long-term plan to mitigate the threats to them.

It is proposed to commission expert assessment into the potential effects on biodiversity to assist with development of such a plan in Stage Two.

1.1. Mangawhai's Harbour

Mangawhai is a coastal settlement defined by its harbour. The Sustainable Mangawhai Project aims to ensure that the appeal of the harbour at the heart of the community is maintained by well-directed management in the face of climate change and catchment development.

Understanding the dynamics of the harbour is the starting point. A harbour is an estuary (defined as where fresh water meets salt water) which offers protection from the open sea. Mangawhai Harbour is protected by a 3km barrier sandspit. Together, the spit and harbour provide important habitat for wildlife, embody cultural values, and support the recreational, lifestyle, and commercial opportunities that shape the Mangawhai community.

However, history demonstrates the fragility of the spit and the vulnerability of the harbour. What happened when the ocean overpowered the spit in 1978 and again through Cyclone Bola in 1988 can happen again. The entrance silted up and closed off. The new mouth formed by the breach to the south was unstable, shoaling, and precarious for boating. Wildlife habitat was destroyed. A remnant lagoon stagnated in what had been the lower harbour. Without protection from the open sea, recreational use and property values fell.

Eventually, there was community-initiated action to restore the harbour. Through the Big Dig in 1991, locals set about closing the breach and getting the northern entrance reopened.

That the spit has remained intact since is in large part due to the Mangawhai Harbour Restoration Society (MHRS) dredging sand deposited in the harbour by the wind and returning it to the "bund wall", the low harbour-edge dune along the middle of the spit's western shoreline. MHRS also builds and maintains sand trapping fences and native grasses to facilitate dune building by natural processes, as endorsed by a 2016 report to the Regional Council[1].

[1] Dahm, J. Bergen, D.O. (2016) *Mangawhai government purpose wildlife refuge reserve: Dune restoration management strategy* Prepared for Northland Regional Council.

Increasingly volatile weather, strong winds, high energy surf, and tidal surges are making maintaining the spit more challenging. At the same time, catchment development and more intensive rainstorms increase sedimentation, diminishing the harbour's value to marine and coastal wildlife, and to the community. Together, these changes threaten the harbour and the services it provides to the environment and the community.

Another breach would have far-reaching consequences. Important nesting and roosting areas would be destroyed, impacting on the diverse birdlife that uses the spit. There would be changes to marine life and to harbour edge vegetation. Important cultural sites would be destroyed. Recreational use would diminish, threatening the income and employment base of the town. Consequently, businesses would be affected, and jobs lost. Valuable public and private assets would be at risk.

1.2. The Sustainable Mangawhai Project

The Mangawhai coast, harbour, and catchment are natural resources that provide "ecosystem services." These include:

- Biodiversity services that regulate the condition of the habitats, the flora and fauna within the environment.
- Economic services that support production for human consumption; for example, water quality, or the food chain. These sorts of services are the focus of the Blue Economy Project[2].
- Community services, which include cultural, recreational, and aesthetic values, all of which support human wellbeing.

An important challenge in planning for the health of natural resources is achieving an appropriate balance between the biophysical and the cultural services they offer and the productivity impacts of different planning and management practices.

It is against this background that the Sustainable Management Project aims to:

- **Increase our understanding of the threats to the harbour and spit, and what they might mean for the environment and the community, and:**
- **Encourage the bodies involved in managing the harbour to work together using a comprehensive and robust information base to inform their planning for its future.**

The Project is being conducted in stages. Stage One focuses on the dynamics of the harbour, the risks it faces, and the services it provides to the community. Expert investigation of the impacts of any degradation of the spit and harbour on biodiversity is planned for Stage Two.

Together, the first two stages will provide authoritative information to the community about the risks facing the harbour, their consequences, and options for their management. This information will also provide a framework for the agencies responsible for managing the harbour to work jointly to develop policies to sustain it in the face of increasing threats.

[2] Blue economy - Sustainable Seas National Science Challenge (sustainableseaschallenge.co.nz)

1.3. This Report

Chapter 2 summarises a study of the processes shaping the harbour and the spit, the threats they face, and management policies to mitigate those threats.[3] **Chapter 3** considers the potential for a changing climate to increase the risk that those threats come to pass. **Chapter 4** considers the significance of recreation and the visitor sector to the Mangawhai community.

Chapter 5 sets out a series of actions considered necessary to develop policy aimed at strengthening mitigation. It also proposes additional research focusing on the impacts of potential harbour and spit degradation on biodiversity.

Our report draws mainly on the following papers available on the Mangawhai Matters website:

- Hume T, *Mangawhai Harbour and Spit: Coastal physical processes and management*, Report to Mangawhai Matters Inc.
- Mangawhai Matters *A summer story: Visitors and Retail Spending in Mangawhai* Research Note 1, Sustainable Mangawhai Project
- Mangawhai Matters: *What we do in the Shallows: Recreation in Mangawhai*, Research Note 2 Sustainable Mangawhai Project
- Mangawhai Matters *Wish you were here: the Value of Visiting Mangawhai,* Research Note 3 Sustainable Mangawhai Project
- Mangawhai Matters *Managing our harbour,* Research Note 4, Sustainable Mangawhai Project

Harbour, Coast, and Community

[3] Hume T, (2003) Mangawhai Harbour and Spit: Coastal physical processes and management, Report for Mangawhai Matters Incorporated

2. COASTAL PHYSICAL PROCESSES

Threats to the integrity of the barrier spit are threats to the quality and utility of Mangawhai Harbour. A more volatile climate and higher sea levels will see more frequent and wider-spread inundation than in the past. With more intensive rainstorms as well, sedimentation from runoff will also increase, raising the prospect that water quality in the harbour will deteriorate.

This chapter outlines the processes behind these possibilities, based on a commissioned study by Dr Terry Hume. His report describes the development of the harbour and spit, and the processes influencing their form.[4] It identifies actions to mitigate the risks of damage from climate change and catchment development, and provides a framework for prioritising them.

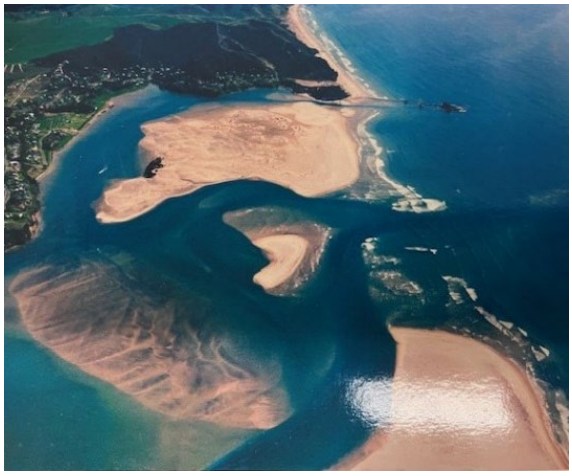
2.1. Spit Formation and Recent Changes

Originating 7,000 to 8,000 years ago, the Mangawhai spit comprises sand transported from the central North Island by the Waikato River. Following the Taupo eruption 26,500 years ago[5] this source was lost as the river changed course to the west coast Today, very little new sand is introduced into the Mangawhai-Pakiri embayment within which the harbour lies.

The spit assumed its current form 1,000 years ago after around 3,000 years of sea level fall. It began to rise again 100 years ago, which will have reduced spit size slightly. This process continues, but currently the shorelines fluctuate mainly in response to storm events.

The spit's structure is subject to ongoing change. Fire destroyed the forest that covered much of it 800 years ago, leaving it barren and unstable. The movement of sand by wind and waves has lowered the protective dunes and left the ocean coast vulnerable to erosion and flooding by high seas. The harbour channel and shoals shift with changing water flow and sediment transfer. The channel meander shifts slowly, constantly eroding the spit shoreline.

A Spit divided - Southern Breach River Mouth



While slow, these processes also render the spit more vulnerable to storm damage. The 1978 breach resulted from bad weather converging with high tides and the spit already vulnerable. A series of storms had destroyed much of the foredune, leaving pathways for ocean inundation. The downstream and eastward migration of the channel meander over the preceding 15 years had eroded the harbour coast, narrowing the neck of the spit, leaving it open to flooding.

4 Available on www.Mangawhaimatters.com

5 Manville, V.; Wilson, C. J. N. (2004). "The 26.5 ka Oruanui eruption, New Zealand: A review of the roles of volcanism and climate in the post-eruptive sedimentary response". *New Zealand Journal of Geology and Geophysics* 47 (3): 525.

The 1978 storm lasted three-days. Average wind speed peaked at 40knots with 5m waves. It coincided with a spring tide, low barometric pressure, and intensive rain, raising the estuary water level around 0.2m, combining flooding from the river in the west with inundation from the sea in the east.

Loss of Harbour mouth
– and a Stagnant Lagoon

The resulting breach ultimately led to the closure of the northern entrance and the widening of the southern inlet. The new inlet was characterised by a complex and shifting configuration of shoals and channels, while closure of the northern entrance led to poor flushing and eventually eutrophication (stagnation) of the lagoon. Following engineering works initiated by the community in 1991 (the Big Dig) the breach was finally closed, and the harbour entrance restored.

2.2. The Harbour

Mangawhai Harbour is shallow, with two thirds exposed at low tide. As a "permanently open lagoon" it would be expected to infill over the long term. Today, it remains open because of a balance between sedimentation, wind and wave action, and tidal movement. Given its small catchment, and the large volume of water moving in and out with the tide, internal physical processes are dominated by the tides, including maintenance of the harbour mouth channel.

The water quality associated with the two main tributaries that do flow into the estuary is mixed. Forest Stream, which feeds the northern tributary, originates in the nearby, bush clad Brynderwyn range. Its water quality sits well within national guidelines for lowland streams. In contrast, Tara Creek in the south records high readings for phosphorus, ammonium, and nitrogen, as well as high turbidity and E. coli readings after heavy rain.

Water quality and the clarity of the middle and lower harbour remain good and generally recover quickly from siltation following heavy rain. Small, wind-generated waves lift sediment from the shallow floor so that strong currents flush it from the harbour, leaving clear water and a sandy floor. In contrast, the upper reaches comprise mangrove-covered, soft, muddy flats from the build-up of sediment because here there is less wave action and flushing.

More frequent storms and intensive rain in an increasingly developed catchment could still overwhelm the capacity of the harbour to clear itself, with progressive loss of water quality and extension of the muddy substrate down harbour.

2.3. The Catchment

The catchment is just 12km^2 in area. The main land use impacts on the harbour have occurred with historical logging, clearance, and grazing. The change from forest to pasture increased the velocity, volume, and channelling of runoff, with additional sediment washed into the harbour as a result. This is evident in today's turbid waters and siltation of the upper harbour.

The urban area covers around 3% of the catchment, although this is increasing. While expansion is subject to the regulation of stormwater within subdivisions, the current council consent is for direct discharge into the harbour. Any inadequacy in stormwater management in these areas can therefore pose a significant risk to water quality.

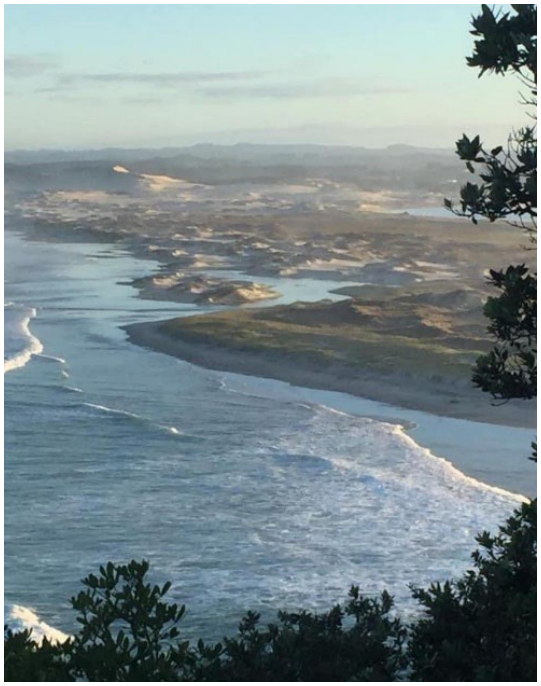
In addition, much of the rural area is transitioning from pasture to low density residential development and small-scale horticulture. More intensive rural land use inevitably increases hard surfaces, increasing run-off, sedimentation, and contamination in the harbour.

2.4. Issues and options

2.4.1. The Ocean Shoreline

The biggest threat facing the harbour is another spit breach. Between 12 and `14 February 2023 Cyclone Gabrielle created conditions not unlike the July 1978 storm. Pressure fell to 968HPa. Winds reached between 60 and 70knots, with 138mm of rain recorded over 24 hours at Whangarei. A wave of 10.9m was recorded at the Bay of Islands[6].

Overtopping of Foredunes, Northern Spit 2023



One reason the damage may have been less was that Gabrielle was not as prolonged as the 1978 storm. High tide may not have aligned with peak storm energy to create a storm surge. While we do not know for sure, the dunes on the ocean shore may not have had the same gaps for the sea to penetrate inland, although inspection after the storm did reveal areas where the sea had penetrated the foredunes.

Perhaps most important, continued maintenance of the defensive bund wall on the harbour shore will have prevented spit inundation from the harbour merging with waves from the coast.

Even so, Gabrielle severely eroded foreshore dunes, leaving gaps today where the sea can potentially work its way through. Given this, maintaining the integrity of the bund wall may today be even more critical.

[6] Lisa Murray (14 February 2023) *Tropical Cyclone Gabrielle, Event Summary,* www.blog.metservice.com

Another storm of similar energy coinciding with a king tide, or a sequence of such storms progressively destroying the coastal dunes, and a failure in the harbourside bund wall could see a repeat of the breach. The consequences would be farther reaching today in a much larger community and more developed environment. The Big Dig would not be allowed today.

Options

The integrity of the spit depends on maintaining its shorelines. On the open coast this refers to the height, volume, and continuity of the dunes. More intense storm events and a tidal surge sustained for days are the main threats. In addition, clusters of storms can lead to greater erosion than might occur in single large events. It is important, then, that shoreline stability is monitored, and erosion and inundation hot spots are identified.

Rebuilding and increasing the height of dunes is important. Sand could be pumped from the dredge for this. Given the practical difficulties of pumping that distance, though, earth moving machinery is an alternative, or could be used as an emergency option to speed up recovery following storms.

Sand trap fencing and planting, along with rabbit control, is likely to be more acceptable as a longer term, pro-active option supporting natural processes. Vegetating the dunes in this way also stabilises the coast, with less sand blown into the estuary.

2.4.2. The Harbour Shoreline

Today, the shoreline at the neck of the spit is a weak point, just 400m wide where the bund wall, the middle stretch of the spit's harbour coastline, was constructed to close the breach inlet. It is on the outside of the channel meander where ebb tide currents focus, making it continuously vulnerable to erosion. Erosion of this shoreline was the critical pre-condition to the 1978 breach.

Preconditions to spit breach: erosion of the harbour shoreline, 1976

With wind-driven spit deflation, low-lying areas are prone to ponding. It is therefore important to maintain the remaining elevated areas of the shoreline, especially the bund wall, to avoid the flooding that would further diminish the dune, contributing to a breach.

Options

The existing line of the bund wall needs to be maintained, continuing the sand build up from dredging and fencing, supported by planting. With climate change and sea level rise, however, this may be insufficient to prevent inundation in storms. One alternative to soft engineering is to armour the western shore of the spit near the neck with rock to fix the meander in place. Another would be to construct groynes into the channel to trap sand.

Such hard engineering options may offer a permanent solution involving less maintenance and ongoing costs. However, the Proposed Regional Plan prioritises non-structural measures. This means that avoiding the impact hard structures might have on naturalness and aesthetic value is judged to outweigh the higher cost and potentially lower the effectiveness of dredging.

Another option is to dredge the middle shoal to stop it pushing the channel meander east and potentially eroding the neck of the spit. This would need consenting based on analysis of channel bathymetry and sand movement, and assessment of the ecological effects.

First Line of Defence - Dredging from the channel to maintain the spit harbour shoreline

While acknowledging the advantages of soft engineering, it is important to provide for emergency dredging and even sand scraping to protect or remediate the harbour shoreline if it is seen to be under threat from successive storms or has been reduced to a critically low level.

It is also important that the stability of the spit's inner shoreline and the effectiveness of the current management, including the volume of sand recovered from the channel, are monitored to inform ongoing maintenance, or warn of damage thresholds.

2.4.3. Coastal Inundation

The flooding of lowland from the sea is a major risk when a king tide, low atmospheric pressure, strong winds, and large waves converge. Climate change and sea level rise (SLR) will increase the potential frequency and severity of such inundation.

Options

While a little can be done at the time of inundation to mitigate the effects, a lot can be done beforehand. Warnings of pending extreme weather events are available from a variety of sources, enabling short term mitigation measures to be taken. The potential for coastal inundation can be mapped and combined with predictions of return frequencies and the extent of inundation to inform longer term avoidance or mitigation action.

After the storm – receding inundation, Lincoln Street Reserve

There are also tools for identifying where and how often the shoreline will be flooded, where road levels should be raised and bridge abutments strengthened, and where flood pathways and escape routes exist or can be developed. Such tools can also be used to identify structures at risk and whether house raising, relocation, or demolition is justified.

2.4.4. Sand mining

While there is some uncertainty over the numbers, input of new sand to the Mangawhai-Pakiri coastal embayment from streams, cliff erosion and the ocean is limited so that mining large quantities of sand increases shoreline erosion. Because the effects are spread over a wide area, though, just how significant the impact of continuing to extract sand from the Mangawhai-Pakiri embayment will be on the spit and harbour is hard to determine.

However, as coastal erosion and shoreline retreat are expected to accelerate with SLR, applications for consent to continue at former levels have become contentious.

Options

There is uncertainty over the sand budget in the embayment and hence the precise consequences of mining. Modelling of sand supply was undertaken 25 years ago. This could be updated using today's improved tools to inform any future allowance for sand mining.

Consents for continuation of mining are currently subject to an Environment Court hearing. In the meantime, the debate continues about whether (or how much) mining contributes to local beach erosion and whether the practice is sustainable. They have, in fact, been refused in the southern part of the catchment, beyond Te Arai Point.

2.4.5. Water Recreation and Associated Infrastructure

The few boat ramps and moorings have very limited impact on the harbour. Ramps form a partial barrier to sand transport, backing up or causing scouring of sediment adjacent to the structure depending on the direction of longshore transport.

Disturbance to the shoreline and seabed by boat wakes and prop wash or by vehicles traversing the intertidal areas is also minor, and their effects controlled by Maritime NZ rules Prop wash can disturb the seabed in very shallow water and on a narrow track.

Vehicle use on the foreshore or seabed is a permitted activity subject to certain conditions: e.g., apart from emergency services, vehicles must ensure minimal disturbance and must not drive over pipi or cockle beds (Rule C.1.5.1 in the Proposed Regional Plan).

Options

While the effects are generally minor and transitory, enforcement of the rules governing vehicles and watercraft in the harbour environment to ensure compliance will minimise the possibility of any significant or lasting damaging impact from irresponsible recreational use.

2.4.6. Mangroves

There appear to have been few if any mangroves in Mangawhai Harbour prior to 1950. They have expanded substantially since, occupying about 25% of the pre-1950 water area.

Arguments for mangrove removal are that they accelerate deposition by fine sediment, reduce harbour flushing, concentrate pollutants, and change substrate from sand to mud. Arguments for retention cite increased organic matter and shelter for wetland birds, carbon sequestration, and protection against storm hazards by silt retention and accelerating land aggradation.

For the community, the argument is perhaps more prosaic, about the type of environment favoured rather than ecological trade-offs. The harbour was originally free of mangroves, favouring shellfish on sand flats, wading birds, and channel feeders, and offering greater water area and clarity, thereby supporting traditional recreational and aesthetic values.

Options

Sedimentation resulting from climate change is likely to see mangroves expand faster than SLR will see them retreat. Given likely changing conditions, future decisions about their control need to be based on credible data. Even though the clearance of 16ha of mangroves took place in 2015, monitoring the benthic and faunal ecology of cleared areas and adjacent mangrove forest should be undertaken to inform decisions about their management.

In addition, short substrate cores of cleared areas would identify any underlying sand layers and help manage expectation for the timing of a change from mud to sand.

Importantly, mangrove removal is a temporary fix unless catchment management decisions are taken and enforced to minimise land-based sediments and nutrients entering the harbour.

2.4.7. Causeways

Causeways are said to reduce flushing and cause mud accumulation and mangrove expansion upstream. Mangawhai's causeways do appear to trap sediment, raising the channel bed to above mid-tide, favouring mangrove colonisation. They will continue to shelter tidal flats upstream from reworking by tidal and wave action, promoting sediment accumulation.

Downstream, Insley Causeway and Bridge, Low Tide Flats (cleared of mangroves, 2016)

In Mangawhai causeways have been in place for at least two decades so the channel throats have had time to accommodate constricted flow by channel scour. Whether or not they are reducing tidal flow to the upper reaches is uncertain. However, under sea level rise and increased runoff their openings may be too small to accommodate the increased discharge.

Options

Adding culverts to improve throat capacity would help address this issue. Embankment heights also need to be checked to ensure they are high enough to avoid overtopping during storm surge and floods. Channel design modification could be evaluated through modelling.

2.5. The Challenges

2.5.1. Risks and Impacts

Aligning the likelihood of threats described above being realised with their potential outcomes provides a framework for prioritising management measures. Such risk assessment enables:

- Comparison of threats to prioritise resources among them based on considering both the probability of and consequences of occurrence;
- Assessment of the relative costs of prevention (avoidance), risk reduction (mitigation), and responding to the consequences if a threat is realised (recovery);
- Requiring explicit identification of the environmental and community values of concern;
- Identifying what needs to be monitored; and
- Identifying knowledge gaps for further investigation.

Risk assessment ideally uses an estimate of the probability that an event will occur (the risk) and the magnitude of its impact if it does. Currently, there is insufficient information to conduct such an assessment for this study. Instead, the Hume report provides an indicative assessment, comparing the risk and impact of each significant threat identified.

Figure 1 Risk-Impact Matrix

		Risk (Probability of Occurrence)		
		High	Medium	Low
Impacts (Scope and scale)	High	Coastal Inundation	Spit breach	
	Medium		Erosion of western shoreline Sedimentation	
	Low		Decline in water quality	Expansion of mangrove forest Causeway Constraints

A breach of the sandspit is seen as the event with the most disruptive impact. It would interact with other threats, heightening the damage it might do by way of erosion of the harbour shoreline of the spit, for example, potentially blocking the northern entrance leading to eutrophication of the cut-off arm, and increasing the risk of coastal inundation.

The risk of a spit breach (currently assessed as moderate) will increase with changing climate conditions, sea level rise, and any relaxation of current spit protection measures.

Coastal inundation has a higher risk of occurrence, but a more localised impact, albeit directly impacting on infrastructure, properties, and specific wildlife habitats, and is, perhaps, the one calling for the most immediate response.

Loss of **water quality** and sedimentation are significant and widespread risks but with potentially lower effects than a spit breach or coastal inundation. Because ways to avoid or mitigate sedimentation and contamination are known and relatively straightforward, (through catchment and riparian management), initiatives to reduce risk can be justified.

Mangrove forest expansion is identified as low impact and low risk because under the existing consent for clearance their downstream spread is constrained. However, further investigation and monitoring of the influence of clearance and juvenile control would determine whether there is a need for further clearance and, if so, how it might best be achieved.

Similarly, an assessment of the **capacity of the causeways** to cope with higher tide levels and runoff events is called for to determine whether investment in increased flow capacity will reduce the possibility of road and bridge damage, the risk of falling water quality, and the further spread of mangroves.

Relative to these impacts, **recreational use** of the harbour poses very little risk to the state of the spit or harbour. The real issue here is that recreational use would be severely curtailed by the impact of the events identified, especially a breach or excessive sedimentation.

2.5.2. Protecting the Spit

The matrix points to a high priority for spit maintenance and providing capacity for a strong recovery if needed.

The main measures for reducing risk are maintaining its volume and form by moving and replenishing sand, the placement of structures to modify water flow, sand deposition on the shoreline, and ongoing measures to maintain and extend vegetation cover.

Dredging is constrained to the months of March to August to avoid disturbing fairy tern spring and summer breeding. However, it may be appropriate to ensure that emergency dredging and placement are provided for at any time in the event of a major weather-related threat.

If more intensive weather conditions begin to reduce the effectiveness of dredging and sand placement, alternative methods such as groyne development or rock armour may be called for to protect the spit's western shoreline. Under these circumstances, earth moving equipment may also be called for to re-establish foredune defences, calling for prior agreement among the parties over the conditions under which this provision might be activated.

Monitoring

Drone surveys of the spit can provide high resolution data of spit topography from which digital terrain models can be used to establish and track sand volume and movement. This information can be used to determine dredging needs and to target sand placement and planting. Such surveys should be undertaken annually, supplemented if needed by surveys following extreme weather.

The existing dredging operation should also be monitored, recording quantities and location of sand placed on the spit.

2.5.3. Managing water quality

Heavy rain events, poor catchment management, or inappropriate land use threaten harbour water quality and excessive runoff and sedimentation. This leads to loss of sandy substrate to mud from sediments, nutrients, and bacterial contamination. Long-term warming and more intensive La Nina and El Nino oscillation threaten more frequent, intensive, and longer duration rainstorms. Increased flooding will lead to catchment erosion, and silt laden runoff entering the harbour.

Seawall protection, Back Bay mangroves, and post-storm silt deposits, February 2023

It is difficult to reverse and remediate these water quality effects. The focus must be on avoidance. The only practical solution is to control activities at source through initiatives such as riparian planting of stream margins, imposing strict conditions for stormwater management on new subdivision, maintaining the integrity of existing stormwater assets, and reviewing the conditions and impacts of the Council's stormwater discharge consent.

2.5.4. Sand mining

Renewal of permits for sand extraction are currently going through the hearing and appeal processes. Evidence presented and decisions from the hearings will determine future extraction levels, where it occurs, and for how long (if at all). In the meantime, consents for sand extraction in the nearshore and mid shore should be opposed on precautionary grounds.

Whether the sand extracted is replenished or balanced by input from streams, cliff erosion, shell production and sources offshore, the sand budget prepared 25 years ago should be updated. Today's improved tools for modelling for cross-shore and longshore sand inputs and transfers should be used as a basis for monitoring the possible effects on the spit of any mining that may be consented.

After the Storm

3. What Does the Future Hold?

The analysis of physical processes indicates the damaging impact of climate change on Mangawhai Harbour and the compounding effects of poor catchment management. Chapter 3 considers the major driver of such effects, sea level rise (SLR). It briefly outlines the evidence and analysis that enable consideration of potential outcomes. Simulations indicate how much the harbour and surrounds are at risk. This exploratory analysis raises a strong argument for stepping up measures to safeguard the harbour and spit and to provide for the management of inundation of the harbour margins.

3.1. The Global Setting

The 2023 report of the International Panel on Climate Change, which reviewed recent experience against earlier predictions for climate change, points to accelerating sea level rise (SLR) as a key confirmed outcome:

Global mean sea level increased by 0.20 [0.15 to 0.25] m between 1901 and 2018. The average rate of sea level rise was 1.3 [0.6 to 2.1] mm yr-1 between 1901 and 1971, increasing to 1.9 [0.8 to 2.9] mm yr-1 between 1971 and 2006, and further increasing to 3.7 [3.2 to 4.2] mm/yr between 2006 and 2018 (high confidence). Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones … has further strengthened since AR5 [2021], with high temperatures and heavier precipitation each of the past four decades. [7]

While there may still be debate about the cause, the evidence is clear that the climate is changing rapidly in the direction predicted by scientists two decades ago. This is expected to continue for some time, regardless of the rate of greenhouse gas emissions reduction.

3.2. The Mangawhai Setting

The main threat to Mangawhai lies in ocean warming and increased atmospheric moisture north and northwest of New Zealand. These conditions generate cyclones that pass over or east of Northland as deep low-pressure systems, bringing gales, heavy rain, and large swells.

The damage storms cause will be greater with their increased frequency and intensity. Their effects are compounded by SLR as high tide waves will wash further up the ocean beach, extending their erosive capacity further into the spit. Increased frequency of flooding from the sea will degrade foredunes and penetrate inner shoreline dunes. The spit as a whole being deflated by high winds will reduce its effectiveness as a protective barrier, and perhaps even destroy it in the long term.

Increased erosion throughout the Mangawhai-Pakiri embayment is likely to diminish sand available from the sea which would sustain the foredunes under more benign conditions. A larger tidal prism (the volume of water entering harbour on the incoming tide), and increased catchment runoff could extend the ebb tide delta (the shoaling sand at the harbour mouth), capturing sand lost to the beaches. Changes in longshore currents, which transport sand northwards, could see further long-term depletion of sand.

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[7] IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

In the immediate future, El Nino conditions may see less wind and wave damage on the east coast, although strong offshore winds could blow significant quantities of spit sand into the ocean. An intense El Nino may also see cyclonic storms pass east of Northland, generating high energy, erosive surf as they do so.

In the longer term, a more pronounced southern oscillation is expected to see more severe El Nino and La Nina conditions. There is little doubt that the return of La Nina later in the decade will again see strong easterly winds, stormy weather, and intense rainstorms.

These prospects justify reviewing options for mitigation to forestall the future destruction of the spit and degradation of the harbour. The question may not be "*can we expect overtopping of the spit by the ocean?"* so much as "*when will it happen?"*

3.3. Looking Ahead

The Ministry for the Environment recommends adaptive planning for the long-term challenges of hazardous coastlines[8]. This means using five scenarios promoted by the IPCC to reflect the uncertainty around the pace and effects of a changing climate. [9]

A scenario approach avoids locking policy into a single projection. The scenarios recommended align differences in global development and policy environments with impacts on greenhouse gas emissions and sea level rise (SLR). This allows agencies to adapt policy to the climate outlook of the scenario that seems most likely at the time, without losing sight of other possibilities if the global policy environment changes.

Five scenarios - Shared Socio-Economic Pathways (SSP) – have been developed to capture the relationship between different ways in which the international community might develop and the consequences for climate change. They are described as:

SSP 1: Sustainability - taking the green road (a world of sustainability-focused growth and equality);
SSP 2: Middle of the road (a world where trends broadly follow their historical patterns);
SSP3: Regional Rivalry – a rocky road (a fragmented world of "resurgent nationalism");
SSP4: Inequality – a road divided (a world of ever-increasing inequality);
SSP5: Fossil-fuel development – taking the highway (a world of rapid and unconstrained growth in economic output and energy use).

Each SSP can be matched with one or more Representative Concentration Pathways (RCP) to projected climate-related outcomes[10]. RCPs measure the balance between radiation in and radiation out of the global atmosphere (radiative forcing) in watts/square metre. These, in turn, will determine the rate of SLR.

For Mangawhai, the impacts of three SLR scenarios have been projected for the outer spit coast (east of Don's Landing) using a tool developed by NZ SeaRise (Figure 2)[11]. This measures rises in SLR post-2005.

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8 Ministry for the Environment (2022) *Interim guidance om the use of new sea-level rise projections*
9 E.g., "The rapid loss of Antarctic sea ice brings grim scenarios into view: The extent of newly exposed ocean is the size of Argentina "The Economist, 2 August 2023
10 Explainer : How 'Shared Socioeconomic Pathways' explore future climate change www.carbonbrief.org
11 NZ SeaRise Programme, www.searise.nz

Three scenarios (with RCPs) of projections of SLR have been selected for illustration (Figure 2):

SSP1-2.6 0: Global population peaks mid-century; limited long-term warming; emissions peak this decade and approach zero in last quarter of the century.

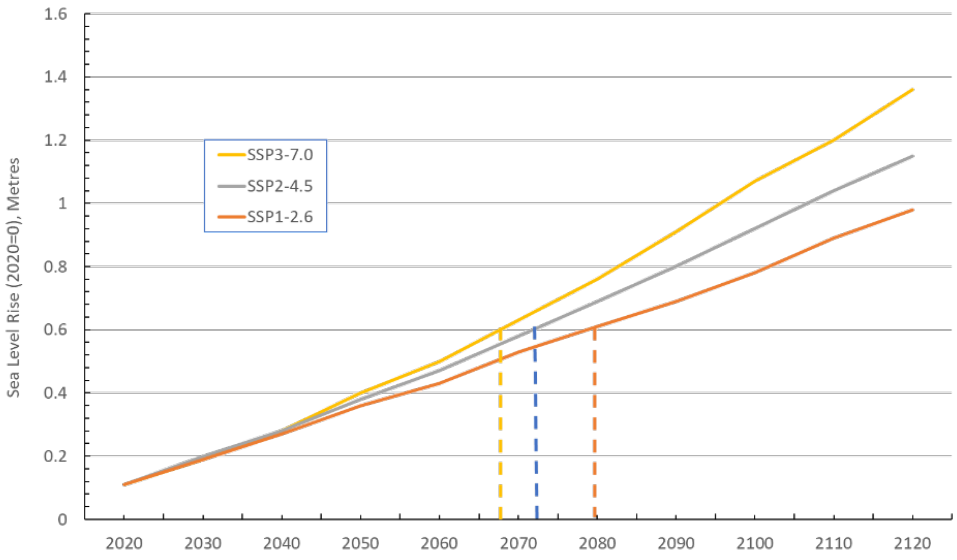
SSP2-2.4.5: Population stabilises towards end of century; current economic, technological trends continue, slow progress. Emissions peak around 2050.

SSP3-7.0: High population growth in developing countries, emphasis on nationalism, slow development, fossil fuel dependent, weak global institutions.

SSP4 and SSP5 are omitted on the grounds that the evidence currently points to increasing international progress being made in green policies and technology. Conversely, SSP1-2.6 may be seen currently as aspirational.

For all three scenarios SLR will reach around 0.2m by 2030 and be approaching 0.3m SLR by 2040. There is a relatively limited divergence of projections for the next 50 years. Under SSP3-7.0 the sea level will be 0.6m higher than in the base year, 2005, by 2073, or around half a metre higher than it is now. That level of rise is projected to occur under the more optimistic SSP1-2.6 around seven years later.

Figure 2 Sea Level Rise Scenarios, Mangawhai Spit Ocean Coast



The limited divergence of the projections in Figure 1 reflects the fact that ocean warming, which is a key driver of SLR, lags the warming of the atmosphere. This means the sea level rise projected over the next two or three decades is virtually inevitable. The pathways only diverge significantly late in the century. The divergence across the scenarios becomes wider later because of the greater uncertainty over how effective green policies in the next twenty or thirty years will be in curbing SLR (as well as the limits to our understanding of cumulative impacts if those policies fall short).

3.4. The Impact of Sea Level Rise in Mangawhai

Our focus is on SLR because the impact of adverse events like intensive, low pressure storms will be shaped in large part by the height of the tides. In effect, today's king tide may be the new normal in 10 years' time, increasing the frequency and reach of dangerous storm surges.

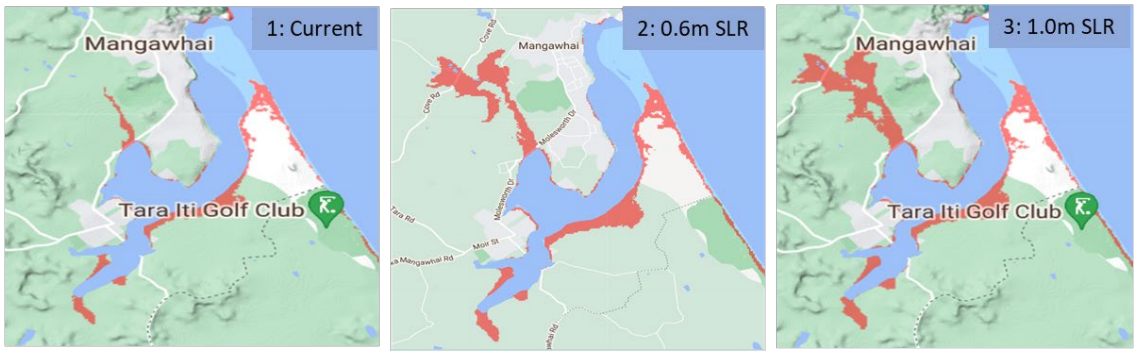
The possible effects of SLR have been simulated for the middle of the road scenario (SSP2-4.5) using a tool developed by Climate Central[12] based on elevation and tide data. In Figure 2 the first set of simulations shows land area below the tide line, while the second includes the height above sea level exceeded by a once-per-year flood. [13]

Simulation identifies areas at risk (rather than predicting specific outcomes).

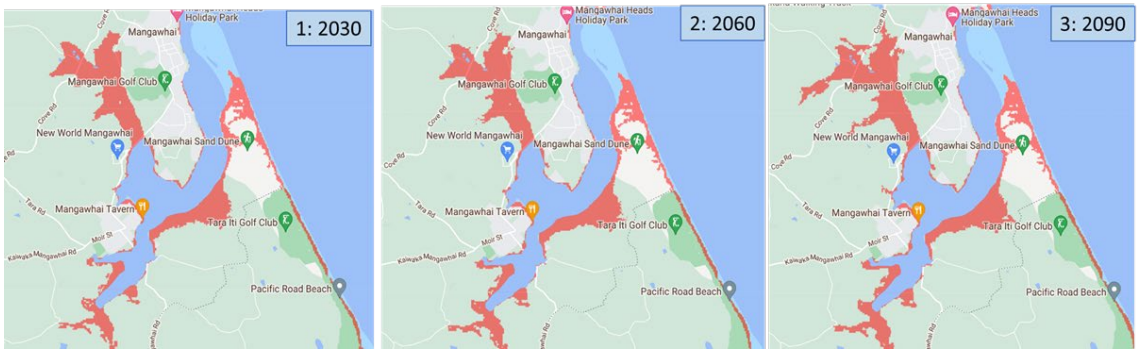
Set A indicates that if SLR reaches 0.6m in 40 to 50 years as indicated in Figure 2, there will be significant incursion around the northern arm of the estuary. Under storm conditions the high tide shoreline would also extend onto the low coastal terraces fringing the western, northern, and southern reaches of the lower harbour impacting on harbourside property and amenities.

Figure 3 Sea Level Rise Simulations, Mangawhai

A: Land Under Raised Water Level



B: Land Below Annual Flood Level



Source: www.coastal.climatecentral.org/map

12 An independent organisation of climate scientists. Details are included on the Climate Central website. See Our story | Climate Central

13 An annual flood's height above sea level is exceeded once per year on average.

The consequences of continuing on the current trajectory are illustrated in scenarios set B, which projects the impact of inundation associated with a once-a-year flood. This would see extensive inundation around and north of the Thelma Rd arm of the harbour (raising questions about the long-term security of the Eco-Care plant in this locality, among other things) and on the spit. Perhaps most interesting is the potential for inundation as early as 2030. The flood footprint of February 24 2023 confirms this vulnerability.

Also important is the prospect of more flooding on the spit. This, along with more wind and wave erosion together with tidal surge suggests that the risk of a breach will be increasing.

While these maps are approximate, they align with similar maps prepared for Northland Regional Council by NIWA in 2021[14] which project flood levels for 50-and 100-year storms. These simulations all point to major impacts from climate change by way of destruction of habitat on the spit and harbour. The maps clearly indicate threats to property and property values, roads, bridges, infrastructure and community assets and ecological sites. They also point to the loss of sites of cultural significance. They further raise the prospect of poor harbour water quality, a loss of swimming beaches, and a shift from a navigable harbour mouth to a dangerous estuary mouth.

On these grounds, it is important that more fine-grained mapping of inundation risks is undertaken.

The next section explores the importance of the Mangawhai Harbour and coast to visitors, businesses, and residents to develop and understanding of community value at risk with degradation of the spit and harbour.

Harbour and Spit, 2023

[14] www.nrc.govt.nz/environment/natural-hazards-portal/

4. The Coastal Community

In the light of the risks facing the harbour and environs, this chapter examines their significance to the wellbeing of visitors and the local community. It identifies why people come to Mangawhai, confirming the central role of the harbour and coastal setting to multiple recreational experiences. Next, it estimates the number of visitors a year, where they come from, and what the experience is worth to them. It then shows what they spend when they are here to support Mangawhai retailing. Finally, it addresses what is spent on managing the harbour by taxpayers, ratepayers, and volunteers.

4.1. The Role of Recreational Services

A major role of Mangawhai is the provision of recreational services. The area has long attracted holidaymakers and day visitors to its harbour and beaches. A large share of its dwelling stock comprises second homes, or baches. However, recent rapid growth has been driven by full time residents looking for a coastal, small-town lifestyle.

The discussion covers four pieces of research aimed at establishing the nature and value of the recreational services Mangawhai provides[15]. The first examines what attracts people based on a survey of visitors and residents conducted from January to April 2023[16]. The second estimates annual visitor numbers, the accommodation they use, how long they stay, and where they come from. This enables us to estimate the worth placed on visiting[17].

The third part flips the narrative, looking at what visitors are worth to Mangawhai by analysing how much they spend here.[18] This is followed by an analysis of what the relevant agencies invest by way of time and money on harbour management and maintenance.[19]

4.2. What attracts the visitors

Surveying from January to April 2023 identified what visitors do in Mangawhai, and hence why they visit. The survey was frustrated by poor weather which kept numbers down, limited what they could do, and impeded interviewing. Having to rely on a mix of protocols, the survey nevertheless revealed consistent views on the importance of different facets of Mangawhai to visitors. While unsurprising, respondents' activities and opinions highlight the distinctive diverse opportunities Mangawhai offers for outdoor recreation in a natural setting.

Most visitors came from Auckland, 61% of those who stay for a night or more and 47% of day visitors. Another 39% of day visitors came from Northland. Clearly Mangawhai is an important recreational destination for the adjoining regions.

The main form of accommodation used comprises private dwellings. Baches were rented by 31% of holiday makers, 19% were using their own second homes, and 39% were staying with

15 Each part is based on a set of research notes available on the Mangawhai Matters website.

16 *What we do in the Shallows: Recreation in Mangawhai*, Sustainable Mangawhai Project, Research Note 2, 2023.

17 *Wish you were here: the Value of Visiting Mangawhai,* Sustainable Mangawhai Project, Research Note 3, 2023

18 *Wish you were here: the Value of Visiting Mangawhai,* Sustainable Mangawhai Project, Research Note 3

19 *Managing our harbour,* Sustainable Mangawhai Project, Research Note 4

friends or relatives. Only 11% of those surveyed were staying in a camping ground, although poor weather may have depressed their numbers.

The average number of visitors in each visiting group varied slightly according to type of accommodation used: 4.2 for bach owners or renters and 4.0 for campers. Groups staying with friends and relatives were smaller again, at 3.7. Most residents and second homeowners reported multiple visits and large numbers of friends and relatives visiting over the period.

The average length of stay was also similar across groups, 3.4 nights for campers, 3.4 and 3.5 nights for bach renters and owners, and 3.8 for visitors to friends or relatives.

There was a strong similarity in activity profiles. Swimming in the surf or harbour (or both) was most popular, followed by walking on the coast (and for many, the nearby bush tracks). Based on these results, recreation in the coastal environment is the obvious explanation for why most people come to Mangawhai in the summer.

There were contrasts among groups, though, reflecting the variety of opportunities available. Campers were most active, with relatively high levels of participation in wind sports, fishing, and bush walking. Day visitors, renters, and visitors to friends or relatives favoured swimming and walking the coast. Bach owners leant towards the harbour and watercraft use.

Even though the coast figured large in terms of activities, the harbour topped the list of what people think is important about Mangawhai.[20] What really comes across, though, is that the combination of surf beach, coastline, and a clean harbour defines Mangawhai for visitors.

Reading visitors' comments, what emerges is that they enjoy the range of activities available in a natural setting. A patrolled ocean beach of moderate wave energy provides access to spectacular coastal walking as well as being a short walk away from a clean harbour. The holiday park is adjacent to sandy, shallow swimming and a well-used boat ramp. The estuary offers options for watercraft of all types. Nearby native bush and an extensive walking track network add to Mangawhai's appeal.

Visitors also value the character of the settlement itself, the range of amenities, and the friendly and vibrant nature of the community. These things individually may not attract people,

[20] This is consistent with a 2021 survey regarding priorities for Mangawhai:
"Consistent with the value attached to the coastal environment, protection of the harbour is a priority for almost everyone. This is reinforced by many people prioritising access to the coast by (by providing sufficient amenities) and maintaining dredging and mangrove control".
Summary, *About Mangawhai: Values and Priorities*, MMI (2021)

but their combination, their proximity to each other and to the natural attractions help define Mangawhai as a distinctive and well-liked holiday and coastal living destination.

Interestingly, while visits were dominated by Aucklanders, proximity to the city was not cited by many as a leading reason for being there, just 5% of the total. Not surprisingly it was most important to second homeowners (20% rated it as the most important attribute).

4.3. What is it worth to come to Mangawhai?

Decisions about how much to spend providing access to, preserving, and improving public recreational assets such as parks and reserves are ideally informed by setting the costs incurred against a measure of their value to people.

Measuring the value of abstract benefits associated with recreation and enjoyment associated with a place is a challenge. The methods generally used make substantial demands on research resources, information, and analytical capacity. Given limited resources, for present purposes we have simply assumed that the cost of getting to and staying at Mangawhai broadly indicates what the recreational experience is worth to people.

A starting point for this is an estimate of overnight visits in a year. Bookings data provided by accommodation operators BachStay and Mangawhai Heads Holiday Park (MHHP) show recent volatility. Strong growth in March year 2020 was followed by a fall in 2021, a bounce in 2022, and another fall in 2023. The traditional summer peak also fell over this period, although 44% of revenue in year ending March 2023 still accrued from December to February

Based on the share of respondents in different accommodation types and knowing the actual number of visits to MHHP enables us to use actual camping arrivals to estimate visits across all types of accommodation. To offset recent volatility, the base figures derived were averaged over three years (20212-2023), giving an estimate of 52,000 visits per year.[21]

It is also possible using the visitor survey to indicate where domestic visitors come from in New Zealand and, consequently, to estimate trip costs incurred in getting to Mangawhai. In addition, the operators' data give insight into accommodation costs.

The combination of estimated numbers, origins, trip costs and accommodation charges lead to an estimate of value to visitors of around $55m/year (average over the three years), or $1,240/visit, or $32/person. These figures seem plausible if somewhat conservative. For

[21] Based on empty dwellings recorded on Census night 2018, figures for bach owners and renters our estimates indicate 45% occupancy. This may be high given the increase in second homes since.

example, they compare with a recent estimate of the recreational value of the Hauraki Gulf of $1,310 per active user per year, or $2,600/year for the average household.

The estimates here are based on generally conservative assumptions. Importantly, they do not include what visiting Mangawhai is worth to day visitors or international visitors. Nor do they include the less easily quantified but nevertheless significant option and existence values.

Option value is what a person might pay simply to ensure that they can visit a recreational asset should they choose to do so. It is captured, for example, in the assumed willingness of citizens or ratepayers to meet the cost of national, local, or regional parks and reserves. Given proximity to Auckland's large population, Mangawhai's option value is likely to be substantial.

Existence value is the value a person places on a natural or cultural asset on the grounds that it should be maintained for historical, spiritual, emotional. or public good reasons even if they have no intention of visiting it. Again, this is likely to be a significant figure for Mangawhai, if only based on the longer term relationship of mana whenua with the harbour, the spit, the coast, and the catchment.

4.4. What Visitors are Worth to Mangawhai

Visitors also spend significant amounts in the local retail and service sectors.

Using Paymark (now Worldline) data, total retail sales 2023 in Mangawhai were estimated at $91m, a spectacular 65% ahead of 2019 (in 2023 dollars). In the year ending March 2023 visitor spending accounted for $37m, or 40% of the Mangawhai total. It accounted for an even bigger share in the summer months, at 50%. [22]

Visitor spending is most important in hospitality (59% of sales over five years) and "other retail" (50%, covering gift shops, pharmacies, sports equipment, etc). Least dependent were the home, hardware, and electrical category (although still reliant on visitors for 47% of sales over five years), the automotive and fuel sector (44%), and liquor and grocery stores (39%).

The opening of the New World and Bunnings large format stores in late 2022 saw annual grocery sales grew by 40% and hardware by 145%. In groceries, visitor spending grew ahead of local spending, suggesting an expanded catchment. In hardware there was a strong local response, reflecting the strength of the building sector in a growing economy.

Their level of spending suggests that visitors support a local retail sector 30-40% larger than the resident population alone would. This, in turn, supports retailing as the major employer in Mangawhai, accounting for 225 jobs in February 2022 (20% of the total) according to Statistics New Zealand data. The numbers employed in retailing doubled over five years even before the arrival of Bunnings and New World (which will have added at least another 60 or so jobs). Construction employment also doubled, to 180 jobs. Hospitality accounted for 13%, although it was hard hit by Covid and poor weather, having been the main employer through to February 2020.

[22] Spending by residents has not been separated from people elsewhere in Kaipara. Hence, leading to underestimation of visitor spending estimate. Offsetting this, some residents live in trust-homes so theirs will be counted as visitor spending. It is assumed that these two sources of error balance out.

Despite strong growth in resident numbers, visitors are critical to the hospitality sector. More than that, it has justified and supported the expansion of retail capacity offered by the new large-format stores and a range of personal services. Consequently, permanent residents enjoy a range of local retail and service options that would not otherwise be available to them.

4.5. The Value to Residents

Variations in house sales and prices reveal the impact of the character of a locality once the attributes of sites and dwellings (structural factors) are accounted for. At a general level, the rapid growth between 2013 and 2022 suggests that Mangawhai as a whole is highly valued by the wider community. The town population grew by 114% compared with just 18% across the rest of Kaipara and 14% across Auckland (Statistics New Zealand).

In order to assess the values associated with the harbour and coast more closely we have compared average residential property value between three areas within Mangawhai:

- **Waterfront**: Homes on roads adjacent to the coast and harbour shoreline or no more than one road back with elevated and expansive harbour or coastal views;
- **Mangawhai East:** The balance of homes east of and including Molesworth Drive, which are generally within walking distance of the shoreline;
- **Mangawhai West**: The balance of the built-up area from the Insley Road to Mangawhai Domain and Longview Drive, Thelma Road, and as far as but excluding Cove Road.

Waterfront properties were worth $390,000 (39%) more a site than the average value of other properties east of Molesworth Drive, and more than twice as much as properties to the west. Just over 70% of the overall price uplift between the waterfront properties and the rest of Mangawhai is attributable to the difference in the value of land. Only 29% attributable to differences in the value of improvements (dwellings, garages, and the like).

Taking just half the difference in land values would indicate a (conservative) price premium property of $184,000. Multiplied by the 350 waterfront properties gives $64m, or a conservative 13% premium attributed to proximity to the coast. In practice, the premium will be higher, falling in a linear fashion with increasing distance from the coast, rather than cut off arbitrarily at the boundary of our geographic units. Higher sites away from the waterfront will attract their own price premium based on their views of the coast.

4.5.1. Capitalising the benefits

Paying extra for a coastal view or proximity to the shoreline capitalises the benefits households anticipate from favoured access to recreational opportunities. Baches also capitalise the benefits a site offers. However, very little, if any, of their value is attributable to provision of the shelter and day-to-day living amenities a primary dwelling provides. The total value of second homes can be attributed to the recreational services Mangawhai offers.

The 2018 Census puts the number of baches in Mangawhai at 806 (empty dwellings excluding those with owners away)[23]. While many of these will fall within the waterfront area, it is

23 Kaipara District Council provided property values classified local or non-local according to owners' mailing addresses. This was only available for the Mangawhai-Kaiwaka Ward and did not distinguish between residential and other property. It reveals a high level of non-local investment across the ward.

assumed that their average capital value (i.e. value of land and improvements) is the same as the average for Mangawhai East of just over $1m. This gives rise to an estimated capitalised value of recreational benefits of $914m.

Jointly, these figures reflect an investment of nearly $980m in property attributable to the ongoing access to the recreational services Mangawhai' provides.

4.6. Managing Our Harbour

Another indicator of the value attached to the harbour environment is the cost incurred by public and private agencies to manage it. This includes taxpayer and ratepayer funded bodies that have a mandate for specific areas of management including providing access, and amenities, enforcing regulations relating to use, and protecting and enhancing the natural environment. Mangawhai also benefits from substantial volunteer support across a range of mitigation activities, including a number which impact on harbour management.

The organisations identified with management responsibility for or commitments to the health of the harbour environment include:

- *Department of Conservation* – protect and preserve biodiverse flora and fauna.
- *Northland Regional Council* – managing the effects of using coastal waters, mitigating soil erosion and flood control.
- *Kaipara District Council* – manage infrastructure, stormwater, adjacent recreation areas, urban development, water quality and consenting authority.
- *Fairy Tern Trust* - focus on the endangered fairy tern.
- *Shorebirds Trust* – focus on endangered shore birds.
- *Mangawhai Harbour Restoration Society* – focus on restoring and sustaining the spit and harbour.
- *The Riparian Planting Group* – focus on planting waterways feeding the estuary.
- *Mangawhai Tracks Charitable Trust* – providing track access to parts of the harbour

Te Uri o Hau has a deep cultural and historic connection to the harbour.

To estimate investment in managing the harbour, each of the organisations was asked to provide a sufficiently broad breakdown of operational expenditure that the costs could be aggregated across them. Accurately measuring and assigning volunteer labour was problematic. Nevertheless, sufficient data was collected to draw some conclusions.[24]

Kaipara District Council was excluded as the separation of areas such as esplanade management and maintenance –activities that relate to Mangawhai's recreational role -- could not be provided.

In the five years to 2022, the surveyed organisations spent a minimum of $4.2m, $842,000 per annum. Expenditure grew by 32%, peaking at $947,000 in 2021. Although this estimate is conservative, expenditure appears low relative to the value of the assets it is directed towards.

[24] *Managing our harbour,* Research Note 4, Sustainable Mangawhai Project

Direct spending on the physical environment is even lower. Spending by organisations focused on endangered birds was significant, though, almost doubling from $300,000 to $572,000 a year in 5 years, reflecting significant investment by the Shorebirds Trust.

Spending by on the physical protection and condition of the harbour and spit has remained essentially static over the five years. It is dominated by the MHRS. Its operations, including planting and dredging, are funded by a local ratepayer levy.

When averaged over five years, bird conservation emerges as the main management activity, accounting for 37% of surveyed spending. Administration, research, and planning jointly account for 20%, legal and compliance costs 18%, and water testing 3%.

That means just 22% of spending on harbour management was directed at operations.

The bulk of that was committed to dredging and sand placement (15%) and the balance (7%) split between planting on the dune and mangrove management.

4.7. Counting the Cost

This discussion provides an economic lens through which to consider the impacts of increasing sea levels and volatile weather conditions on the Mangawhai community.

While the estimates above can be considered partial and generally conservative, they nevertheless show that the recreational services provided by the harbour and coast create substantial value and support a major share of local economic activity.

It is possible to summarise the connection between the main physical threats identified in the Hume report (Section 2) and their impacts on the community to get an idea of how they might impact on the values set out in this section (Table 1).

Table 1 Physical Threats and Economic Risks

	Physical Impact	Community Impact
Coastal Inundation	Flooding of public and private infrastructure, infrastructure damage	Loss of property Loss of property value High recovery costs Growth constrained Lower visitor capacity & numbers
Breach of Spit	Loss of navigability, reduced recreational appeal (fishing, awimming, paddling sports) increased lower harbour inundation	Loss of property Loss of property value Growth constrained Lower visitor capacity & numbers
Sedimentation **Decline in Water Quality**	Reduced aesthetic and recreational appeal (swimming, fishing, wind and paddle sports)	Slow growth, Lower visitor numbers

The main risks are a reduction in visitor numbers and the destruction of property value, the latter directly through the inundation and destruction of property and indirectly through a reduction in the quality of recreational services. The latter would reduce the appeal of Mangawhai generally, impacting on growth potential as a residential destination and the visitor market. The latter would undermine the economic base of the current community.

4.8. Impact of Inundation

While the studies reported here have put indicative figures on different economic values, it is not possible to quantify how much would be lost if the recreational services are undermined. It is possible, however, to look to the one area in which the impact of climate change on the harbour would be most direct, dramatic, and damaging, the inundation of private property.

The simulation based on land above the 0.6 m contour subject to flooding through a combination of the higher sea level, tides, and storm surge has been adopted to explore the possible impact. This corresponds with Scenario SSP2-4.5 by 2070 (Figure 3A2, above). It also corresponds with land that could be inundated by annual high floods much sooner (2030 and 2040 in Figures 3B1 and 2), a likelihood illustrated by the February 2023 flooding.

Inspection of the distribution of properties relative to elevation above sea level indicates that some $100m worth of real estate (2021 valuations) will be at risk of inundation. This is based on around 90 harbourside properties falling under the 0.6m elevation. 47% of the value that could be lost comprises improvements, the balance being the land they sit on. Vacant sites were not included.

Some 50% of those properties are around the Thelma Road arm north of the Molesworth Drive causeway, particularly at the upper (Jack Boyd Drive) end. This is marked by a large area of mangroves on the estuary and the convergence of streams rising in the Brynderwyn ranges which are subject to rapid increases in volume and rates of discharge in rainstorms. It is also an area exposed to additional run off directly from the urban development immediately to the east.

This analysis is presented for illustration only. However, it provides a very strong case for more detailed inundation and hydrodynamic modelling to be undertaken as a matter of urgency.

Perhaps the most graphic proof of the vulnerability described here lies with the February 2023 floods. Much of the area projected as susceptible to SLR rise and the impacts of more severe weather conditions have already been exposed by an event that promises to become more frequent and more far reaching in the future.

5. Towards a Long-Term Management Strategy

It is time to rethink the management of Mangawhai Harbour.

A step-up in active management and monitoring of the environment and the effects of policy initiatives is called for. This chapter argues for a holistic and coordinated approach to long-term planning. It sets out a framework of actions that must be considered, along with areas in which further research is needed to inform mitigation decisions.

5.1. Rethinking Harbour Management

Given the physical threats to the harbour and the scale of their obvious impacts on the community, the amounts spent on protecting it are modest. More than that, much has been wasted on disputes about what should and should not be done with no integrated plan to coordinate management of the different elements of the physical environment. There is no consistent view among agencies of the long-term outcomes that best serve all stakeholders.

Narrowly focused groups all-too-often work within professional, disciplinary, or proprietary silos. Each tends to dictate a preferred outcome that is treated as prevailing over all others. This devalues individual commitments and programmes and has led to expensive planning conflicts over potentially beneficial initiatives.

As a result, scarce funds and energy are directed away from any coordinated effort to meet the sustainability goals on which recreation, biodiversity, lifestyle, and cultural values all depend.

The first step in increasing the community's capacity to mitigate the expected effects must be recognising a common interest in maintaining the integrity of the spit and the harbour, and developing and implementing measures that will mitigate the anticipated impact of SLR and storms on property, business, the community, and the environment.

Some of the possible measures are described below.

5.2. The Actions

The first response should be to accept the importance of maintaining the spit while the consequences of sea level rise and increased storm events are examined and further and actions for boosting long-term management and mitigation are adopted.

5.2.1. Maintain bund wall and dune replenishment and stabilisation

It is critical that current defences are maintained. The shoreline and dunes need sufficient height and volume to prevent overtopping by the harbour and incursion by the sea. Fencing, vegetation, and dredging and sand placement have maintained the spit through recent storms, even as the ocean penetrated the foredunes. With the prospect of more to come, it is essential to continue those actions to avoid increasing the risks to the spit and harbour. Indeed, these programmes should be stepped up if more severe conditions justify it.

The second line of defence: fencing and planting

5.2.1. Baseline Investigations and Monitoring Initiatives

The Hume report highlighted gaps in our knowledge that justify immediate attention. A number of measurement and modelling exercises are called for to provide a baseline from which to monitor changes in the medium to long-term, to inform possible responses, and recognise where responsibility lies (Table 2).

Table 2 Issues, Information, and Actions

Issue	Purpose	Baseline Requirement	Follow-up Monitoring	Possible Responses	Action
Inundation	Minimise damage and costs from flooding	Harbour bathymetry, hydrodynamic model Inundation modelling Runoff projections	Check on SLR projectiions, RCP Values	Stormwater management Riparian Management Build up low lying harbour edges Land use rules (District	Modelling required
Spit Stability	Minimise the prospect for overtopping or breaching	Map spit morphology and topography, shorelines, dune heights and continuity, sand volume Sand budget	Drone Surveys, LIDAR Analysis; field inspections Dredge logging (sand extraction, placement)	Dredging & placement, fencing and planting, Seawall & groynes, Sand shifting	Continue Continue Investigate Investigate
Water Quality	Maintain harbour water quali	Harbour bathymetry, hydrodynamic model, Land use modelling	Harbour and contributary stream quality monitoring	Stormwater management Riparian Management Land use rules	Modelling required

Inundation: Perhaps most urgent given recent events is modelling inundation prospects. An inundation model based on surveying the topography of the harbour margins (from LiDAR or drone surveys) and a knowledge of tide and extreme water levels can be used to identify and map areas likely to be flooded due to spring tide, storm surge, and run-off events, and how those areas might change under selected sea level rises scenarios. This modelling needs to be fine-grained and accompanied by a survey of public and private assets to enable the risks to be costed and mitigation measures prioritised.

In some areas the alternatives may include developing water retention areas behind low bund walls, improving and maintaining drainage, investigating areas where flood gates may be appropriate, and possibly raising or relocating buildings. In others they may include raising land through backfilling a low bund wall with dredged sand. It may be appropriate to remove

mangroves from upper reaches if it can be demonstrated through hydraulic monitoring that this will improve channel flow and limit sedimentation.

It is important that the results of any mitigation modelling are incorporated into the district plan with, for example, areas in which development is not permitted, or where particular drainage or other provisions are required as a condition of development.

Spit stability: Surveys of spit topography and vegetation cover (from LiDAR or drone imagery) can be used to map areas prone to instability, erosion, and inundation to help focus restoration initiatives. Updating can be undertaken using annual drone imagery and field inspections to identify medium term changes and identify points of vulnerability. These may be repeated as required after storm events to identify hot spots requiring early remediation.

The annual volume and placement of sand dredged should be logged regularly, both to inform the dredging programme and to signal any significant changes in sand transport from the spit.

The preparation of a sand budget would provide information on the possibility of a net loss of sand to the ocean contributing to deflation of the spit. It would also provide baseline data from which any monitoring of the impact of sand mining, if it continues, can be done.

Water quality monitoring: Northland Regional Council currently conducts water quality monitoring. Ideally, this will be aligned with rainfall and runoff records and utilised in the analysis of changing land use and land management practices.

Harbour flushing: Based on a bathymetry survey of the harbour, a hydrodynamic model would complement inundation modelling. It would provide a clearer picture of tidal currents and sediment movement, their impacts on loss of protection from the ocean or increased inflow from the catchment.

Among other things a hydrodynamic model would help with evaluation and refinement of management actions. It would identify where sand might be deposited as flows shift. From the point of view of water quality, a hydrodynamic model can be used to assess dilution and dispersion of inputs from the streams. It may also identify the effects of mangrove expansion, retreat, or removal on water movement and sediment transport.

Mangroves: Whether mangroves should be allowed to continue to spread or be subject to further removals justifies independent investigation. One issue is how far down-harbour they should spread. Differences in biodiversity between cleared areas and adjacent mangrove forest need researching along with the rate of recovery of cleared areas. This can be done by coring the substrate to establish the time frame over which it is changing from mud to sand.

It may be most appropriate to address these matters under the wider heading of plant ecology. As it stands, further expansion is controlled by the consents allowing removal of juveniles. Whether sea level sees their further containment (from higher tides), or expansion (from more intensive sedimentation and harbour shallowing) remains to be seen.

Causeways: There is debate about whether causeways impede flushing, foster sediment build up, and lead to mangrove spread. While they may be adequate now, causeway openings may be too small to deal with increased inflows from climate change. If so, they may need to be raised, the effectiveness of small culverts investigated, and bridge and causeway channel design modified. A hydrodynamic model would help assess the needs at different level of SLR.

5.2.2. The Unanswered Questions

Two issues not addressed in detail in Stage One are those concerned with catchment land use and biodiversity.

With respect to the first, research is required to indicate the potential for land use and management practices to exacerbate harbour sedimentation and contamination.

With respect to biodiversity, independent research is needed to assess likely impacts of changes to habitat and species from degradation of the spit or harbour relative to possible impacts from the management measures that might be taken to mitigate it. The following are considered important topic areas for expert investigation in Stage Two to help inform, prioritise and programme harbour management actions.

Land Use and Riparian Management:

Runoff is best controlled at source rather than relying on dredging the harbour. This requires initiatives to reduce sediments, nutrients, and contaminants from entering streams by:

- Ensuring land use is aligned with the capacity of the land;
- Stream edge retirement and riparian planting;
- Restoration planting; and
- Sediment load reduction through construction water management via site specific erosion and sediment control plans.

Biodiversity

Subject to funding, expert analysis is necessary to address the impact on ecosystems of the sorts of physical changes discussed and projected in this report with respect to the following issues. It should also address the possible impacts on them of different management options.

Fish: It is anticipated that this would focus on the harbour rather than the open coast. It would cover changes in the structure of the benthic layer and water column, impacts on associated flora and fauna, and on the food chain within the harbour.

Shorebirds: It is anticipated that this would focus on the spit and saltwater habitats (including but not limited to mangroves), but not freshwater wetland habitats except were these may be modified by saltwater intrusion (the intermittent dune lake may be an exception).

Plants: Spit vegetation is significant on three grounds, the first being its capacity to survive and bind sand through root networks in the harsh spit environment; the second being the tendency for introduced flora to displace native vegetation; and the third, is the potential habitat for vegetation to shelter predator and pest fauna – stoats, rats, cats, hedgehogs, and rabbits – that threaten native species.

Vegetation in and around the harbour and its tributaries is significant for the shelter it may provide to shorebirds and for its role in the marine food chain. In the case of mangroves, the conflict around their ecological value need to be resolved to avoid unnecessarily impeding effective sustainability initiatives.

5.3. Conclusion

This report provides the grounds for advancing the initiatives described above. Recent experience of major weather-related events and their impact on the harbour and coast provides the proof. The challenges raised by climate change and sea level rise are very real and the prospect is for their impact on the community to be far-reaching. The importance of harbour and coast to lifestyle, culture, economy, and environment means that the events canvassed are very disruptive.

While highlighting the challenges, this Stage One report has also provided the knowledge and identified the tools that will enable the community, through its councils, to put measures in place to mitigate them. It has identified the urgent need for an inundation model around which a management plan can be both fine-tuned and monitored.

At the same time, it is important to acknowledge the remaining gaps in our knowledge and move to fill them.

Stage Two of the Sustainable Mangawhai project is intended to build further on the relationship between community concerns and science to fill some of those gaps with respect to the dynamics of the harbour and spit and to the biodiversity they support.

Oral Submission of Joel Cayford to PPC83 Hearing for himself and Mangawhai Matters Inc

Presented 26 March 2024

1. I'm here as a layperson, and member of Mangawhai Matters Inc Ctte

2. These submissions primarily focus on sediment risks to the Mangawhai Estuary, that we understand are likely to arise due to the lack of protection against sediment flows, contained in the planning controls proposed for the urbanisation of The Rise.

3. About the estuary

- Receiving environment for stormwater flows from surrounding catchment
- Inland sea especially vulnerable, due to lack of tidal flushing, growth of mangroves
- KDC installed Ecocare to manage sewage inflows
- Mangawhai Harbour Restoration Society has obtained consent to dredge sections of estuary to enable better tidal flushing, and also to clear sections of Mangroves also to enable flushing and to protect sandy areas from sedimentation
- Gabrielle and other heavy rainfall events have focussed attention on vulnerability of estuary. Sediment deposits 1 to 2 centimetres thick remain around coastal edges and some previously sandy areas of the estuary, covering shellfish beds

4. MMI raised funds and commissioned Terry Hulme to begin a major piece of research into the health of the estuary, including the vulnerability of the containing spit to weather and climate changes. That was the major focus of the preliminary study, but other risks were highlighted. Quoting from pgs 5 and 6….

- Mangawhai Harbour is shallow, with two thirds exposed at low tide. As a "permanently open lagoon" it would be expected to infill over the long term. Today, it remains open because of a balance between sedimentation, wind and wave action, and tidal movement.
- Water quality and the clarity of the middle and lower harbour remain good and generally recover quickly from siltation following heavy rain. Small, wind-generated waves lift sediment from the shallow floor so that strong currents flush it from the harbour, leaving clear water and a sandy floor. In contrast, the upper reaches comprise mangrove-covered, soft, muddy flats from the build-up of sediment because here there is less wave action and flushing. More frequent storms and intensive rain in an increasingly developed catchment could still overwhelm the capacity of the harbour to clear itself, with progressive loss of water quality and extension of the muddy substrate down harbour.
- The catchment is just 12km2 in area. The main land use impacts on the harbour have occurred with historical logging, clearance, and grazing. The change from forest to pasture increased the velocity, volume, and channelling of runoff, with additional sediment washed into the harbour as a result. This is evident in today's turbid waters and siltation of the upper harbour. The urban area covers around 3% of the catchment, although this is increasing. While expansion is subject to the regulation of stormwater within subdivisions, the current council consent is for direct discharge into the harbour. Any inadequacy in stormwater management in these areas can therefore pose a significant risk to water quality. In addition, much of the rural area is transitioning from pasture to low density residential development

and small-scale horticulture. More intensive rural land use inevitably increases hard surfaces, increasing run-off, sedimentation, and contamination in the harbour.

5. Mangawhai Matters has shared this report with DOC, NIWA, KDC, NRC and lately with Auckland University experts. Feedback has been universally positive, and participation and funding has been sought for related detailed and specific reports. In particular we have asked NIWA to prepare a formal brief on land use and sediment and contaminant supply in which they have experience and models, based on this report. Funding is being sought for this work – though we are concerned that this issue has not been explored properly for the current application. We consider that commissioners have insufficient information to determine the application.

6. Further information should be sought.

The application and its stormwater management plan

The nub of the PPC83 SMP is at section 11 and states:

- The PPC area is primarily composed of varying steepness of ground terrain with only the southern perimeter of the PPC area consisting of gentler sloping terrain. The gentler sloping terrain though contains watercourses that flow along this area and so are prone to flooding. Due to the topography and flooding hazards, it is unlikely that all parts of the PPC area can be serviced by downstream 'end-point' stormwater devices as there is limited space downstream. Furthermore, considering that all lots within the PPC are owned by separate owners, it is extremely unlikely that an owner will concede a majority or a significant amount of land within their lot for a stormwater device. Therefore, we believe that at-source stormwater devices are the more feasible and practical method to achieve the stormwater objectives of the PPC.

8. The objectives of the PPC appear to focus on chemical contaminants, and not sediments, and focus on post development effects (when roads and driveways and lawns and houses are built) and not what happens when the land is being cleared and cut and filled for development when it is at greatest vulnerability from sediment being washed off exposed areas and into the downstream catchment.

9. We observe that the various channels, culverts and pipes that make up the KDC stormwater network in the area, are where overland flows of sediments gradually accumulate in low rainfall events, only to be washed out in bulk into the estuary when there's a big rain, where they settle out in the mangroves and onto the estuary sands. We understand some of these sediments get swept by the tide out to sea, but we know, and the Hume report underlines, that some of these sediments settle and accumulate on the estuary floor. And that is our chief concern.

10. We see a sort of flush and forget attitude in the evidence that accompanies this application. Like when a loo is flushed. It's gone. Out of sight out of mind. As if somehow managing sediment at allotment level, then directing overland flows across downstream PPC83 land, to combine with other similar flows, and discharging the whole lot into a Council network, avoiding flooding along the way, is consistent with best practice, avoids downstream risks, and complies with the overall purposes the Act.

Best Practice

11. It is always a challenge to unpick exactly the stormwater decision tree proposed in the PPC83 provisions. When an application is permitted, restricted discretionary, restricted etc. However, it appears that consent applications are to be accompanied by a stormwater assessment which must be in accord with KDC's engineering standards dated 2011, or "relevant performance standards", or the Cove Road North Precinct SWP. While the text of the application and evidence to this hearing do mention Auckland Region standards for management devices (GD01), it does not make any reference to Auckland Council's updated code of practice for land development and subdivision which accounts for changed rainfall patterns and an up to date understanding of best stormwater management and planning practice.

12. We acknowledge and support the planning approach now adopted in Auckland for new development (as set out in The Auckland Code of Practice for Land Development and Subdivision: Stormwater – January 2022) , including:

- The stormwater system shall be designed for the maximum probable development of the entire upstream catchment and in accordance with TP108, with allowances for climate change…
- Primary stormwater systems include both open and closed conduits and shall be designed to cater for the flows generated by the event specified in the design standards in Section 4.3.5.2. As far as possible, the location of primary systems should be aligned with natural flow paths….
- A secondary stormwater system consists of ponding areas and overland flow paths with sufficient capacity to transfer the flows generated by the event is specified in the design standards in Section 4.3.5.2. As far as possible, the location of secondary systems should be aligned with natural flow paths. The existing constructed or natural flow paths shall be retained as far as practical….

13. While this Auckland Code of Practice relates to infrastructure that might be transferred to Auckland Council ownership and management, this does not negate their applicability here.

14. It is not our job to design the stormwater system for PPC83. However we do see examples in Mangawhai where freshwater overland flows, during and post development, are directed to wetland areas where sediments in particular can settle out, so that discharges from whole developments are managed in terms of discharge rates and sediment loading.

15. The approach is detention of sediment and retention of stormwater.

16. It is our submission that Commissioners have not been presented with sufficient information about the sensitivity of the receiving environment to increased sediment loadings, about the amounts of sediments that will be discharged by this development itself, or/and from the channels in the public stormwater network that the increased flows from this development will inevitably mobilise.

Statutory Framework - NZ Coastal Policy Statement

17. The NZ Coastal Policy Statement (NZCP) is important in this matter: regional policy statements, regional plans and **district plans must give effect to the NZCPS**.

> Objective 1 **To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries**, dunes and land, by:
>
> • maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature;
>
> • protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and
>
> • **maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity**.

18. We submit that the Mangawhai Estuary falls within this objective.

19. Policy 22 Sedimentation

> (1) Assess and monitor sedimentation levels and impacts on the coastal environment.
>
> (2) Require that subdivision, use, or development will not result in a significant increase in sedimentation in the coastal marine area, or other coastal water.
>
> (3) Control the impacts of vegetation removal on sedimentation including the impacts of harvesting plantation forestry.
>
> (4) Reduce sediment loadings in runoff and in stormwater systems through controls on land use activities.

20. We submit that this policy is relevant in this application, and we see no information that compliance with either Policy 22.1 or 22.4 has been demonstrated. In addition there is insufficient information to demonstrate compliance with Policy 22.3.

21. Policy 23 Discharge of contaminants

> (1) In managing discharges to water in the coastal environment, have particular regard to:
>
> (a) the sensitivity of the receiving environment;

(b) the nature of the contaminants to be discharged, the particular concentration of contaminants needed to achieve the required water quality in the receiving environment, and the risks if that concentration of contaminants is exceeded; and

(c) the capacity of the receiving environment to assimilate the contaminants;

And

(4) In managing discharges of stormwater take steps to avoid adverse effects of stormwater discharge to water in the coastal environment, on a catchment by catchment basis, by:

(a) avoiding where practicable and otherwise remedying cross contamination of sewage and stormwater systems;

(b) reducing contaminant and sediment loadings in stormwater at source, through contaminant treatment and by controls on land use activities;

(c) promoting integrated management of catchments and stormwater networks; and

(d) promoting design options that reduce flows to stormwater reticulation systems at source.

22. In regard to Policy 23.1, there is no evidence of any assessment of the sensitivity of the receiving environment (the estuary – especially the upstream areas) to increases in sediment loadings – let alone the higher standard of "paying particular regard to". In regard to Policy 23.4, emphasis is put in the application on allotment by allotment approaches, rather than catchment wide approaches which are integrated with stormwater networks in ways which reduce flows from very large storms and which function to reduce sediment loadings.

Concluding remarks

23. Mangawhai Matters' principle concern in this matter is the health of the estuary from increased sediment flows from this development. Our contention is that insufficient information about this issue and how to reliably manage it, has been placed in front of commissioners. The NZCPS imposes a duty to assess and monitor sedimentation levels and impacts on the coastal environment. No evidence has been presented at this hearing, as far as I am aware, that this duty has been complied with. KDC's current stormwater discharge consent cannot be treated as a blank cheque to permit more and more sediment to be discharged into the estuary.

24. Until this and other related NZCPS duties have been complied with, we submit this hearing needs to consider its options.

26th March 2024