



Cook Shire Council

Coastal Hazard Adaptation Strategy

Resilient Cape

Coastal Hazard Adaptation Strategy

July 2021







Foreword

Queensland has a highly dynamic and complex coastal zone, featuring shallow coastal margins and complex estuary systems with significant exposure to coastal hazards including erosion, storm tide inundation and sea level rise. Many of Queensland's cities and towns are located on the coast and are therefore exposed to such hazards.

The frequency and/or intensity of these hazards is predicted to increase in keeping with rising sea levels, and more volatile climate variability. Queensland Government policy calls for coastal hazard risks to be addressed in planning and development decisions. However, dealing with hazards on a development-by-development basis is inefficient and will not provide a suitable holistic outcome for a community at risk. Adaptation strategies are intended to ensure a planned approach is taken to address coastal hazards for at-risk communities for the immediate to long term.



Table of Contents

1. The CHAS Story	6
1.1 Our Shire	7
1.2 The Coastal Hazard Adaptation Strategy	8
1.3 Engagement	9
1.4 Content of the Plan	10
2. The Cook Coastline	11
2.1 Origin	12
2.2 Townships	13
2.3 The Future Coastline	15
3. Understanding Coastal Change	16
3.1 Coastal Hazard Overview	17
3.2 Storm Tide Inundation	18
3.3 Permanent Inundation Due to Sea Level Rise	20
3.4 Coastal Erosion	21
3.5 Current and Future Risk	23
3.6 Potential Impacts	25
4. Adapting to Change	27
4.1 Framework	28
4.2 Adaptation Response by Locality	32
4.3 Multi Criteria Analysis of Coastal Hazard Adaptation Options	33
4.4 Cost Benefit Assessment of Coastal Management and Engineering Options	36
5. Our Adaptation Pathway	38
5.1 Shire Wide Initiatives	39
5.2 Ayton / Bloomfield	40
5.3 Cooktown and Surrounds	42
5.4 Port Stewart	44
5.5 Portland Roads / Restoration Island	46
5.6 Hicks / Haggerstone Island	48
6. Implementation	50
7. References	51
8. Acknowledgments	51



1. The CHAS Story

1.1 Our Shire

Cook Shire covers over 100,000 km² of Far North Queensland, extending from Bloomfield River in the south, to just north of the Jardine River, and occupies 80 % of the Cape York Peninsula. The shire adjoins 13 Aboriginal, regional, shire and town council Local Government Authorities on the north, south and west. Bounding council regions include Douglas, Mareeba and Carpentaria, Aurukun, Torres and Lockhart River.

The Cook Shire is home to approximately 4,200 residents (ABS 2016). Over half of this population reside in the Shire's major township of Cooktown. Smaller population centres are located at Marton, Laura, Lakeland, Coen, Ayton, Rossville and Portland Roads, and offshore islands including Lizard Island. Residents also reside throughout the Bloomfield and Endeavour valleys.

It is expected that many of the coastal communities will be affected by coastal hazards. Six areas within the Cook Shire have been identified as key residential areas that may be impacted, these being:

- Ayton / Bloomfield
- Cooktown and surrounds
- Port Stewart
- Portland Roads / Restoration Island
- Lizard Island
- Hicks / Haggerstone Island

Many of these communities rely heavily on agriculture and tourism. It is therefore important when considering coastal hazard adaptation strategies to consider the impact on the agricultural and tourism industries; to protect agriculture from impacts such as salinity and to preserve the scenic amenity of important natural coastlines, views and natural aesthetics in the region.



1.2 The Coastal Hazard Adaptation Strategy

Context

Much of Australia's coastline has recorded increasing sea levels over recent decades, which is predicted to continue. Climate change forecasting also indicates more intense storm events, though potentially with a reduced frequency. As a result, coastal communities are becoming increasingly vulnerable to shoreline erosion and storm tide inundation. These hazards may adversely impact tangible and intangible community assets and values such as buildings and infrastructure, natural assets, local economy, social and cultural assets, and recreational opportunities.

Purpose

For the protection of future generations, the State Planning Policy 2017 requires that local councils start planning now about how to best minimise exposure to increased coastal hazards. Appropriate management practices should be adopted to avoid exposure to risks in new developments and to mitigate against the exposure of existing infrastructure and assets to these hazards.

Approach

In order to identify risk areas and allow coastal councils to prepare for these hazards, a Coastal Hazard Adaptation Strategy (CHAS) is required. In developing the CHAS, an 8-phase process has been outlined in the QCoast2100 Minimum Standards and Guidelines specifically developed for Queensland Coastal Governments to allow commonality in approach across all councils.



1.3 Engagement

Process

The overall communication process of the CHAS sought to:

- Educate internal and external stakeholders about coastal hazards and risks
- Understand the level of risk acceptable to the community
- Inform decision-making for adaptation options
- Assist stakeholders to understand their role and responsibilities in managing coastal hazards

Communication

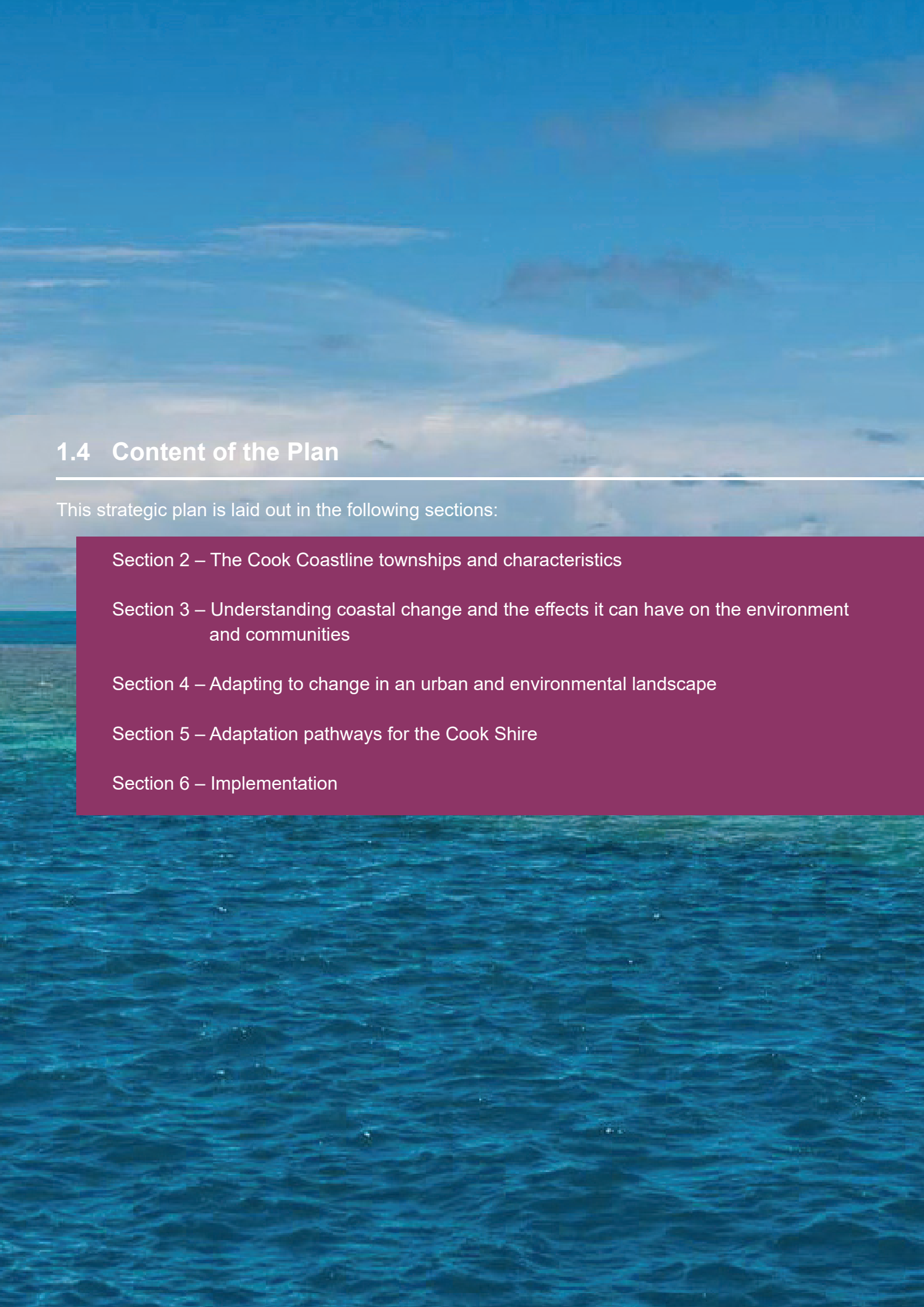
Communication with stakeholders was undertaken using the following mediums through different stages of the CHAS:

- Workshops
- Website
- Email Database
- Information sessions
- Publicity / Media Release
- Advertisements
- Facebook
- Fact sheets
- Letters to Ratepayers
- Direct Engagement
- Mapping
- USB devices
- Branding
- Posters / notices

Outcomes

The intended outcomes of the engagement process are to actively engage the community and provide information in a timely manner. The strategic plan is for the community to be able to plan into the future their adaptation and management pathways.





1.4 Content of the Plan

This strategic plan is laid out in the following sections:

Section 2 – The Cook Coastline townships and characteristics

Section 3 – Understanding coastal change and the effects it can have on the environment and communities

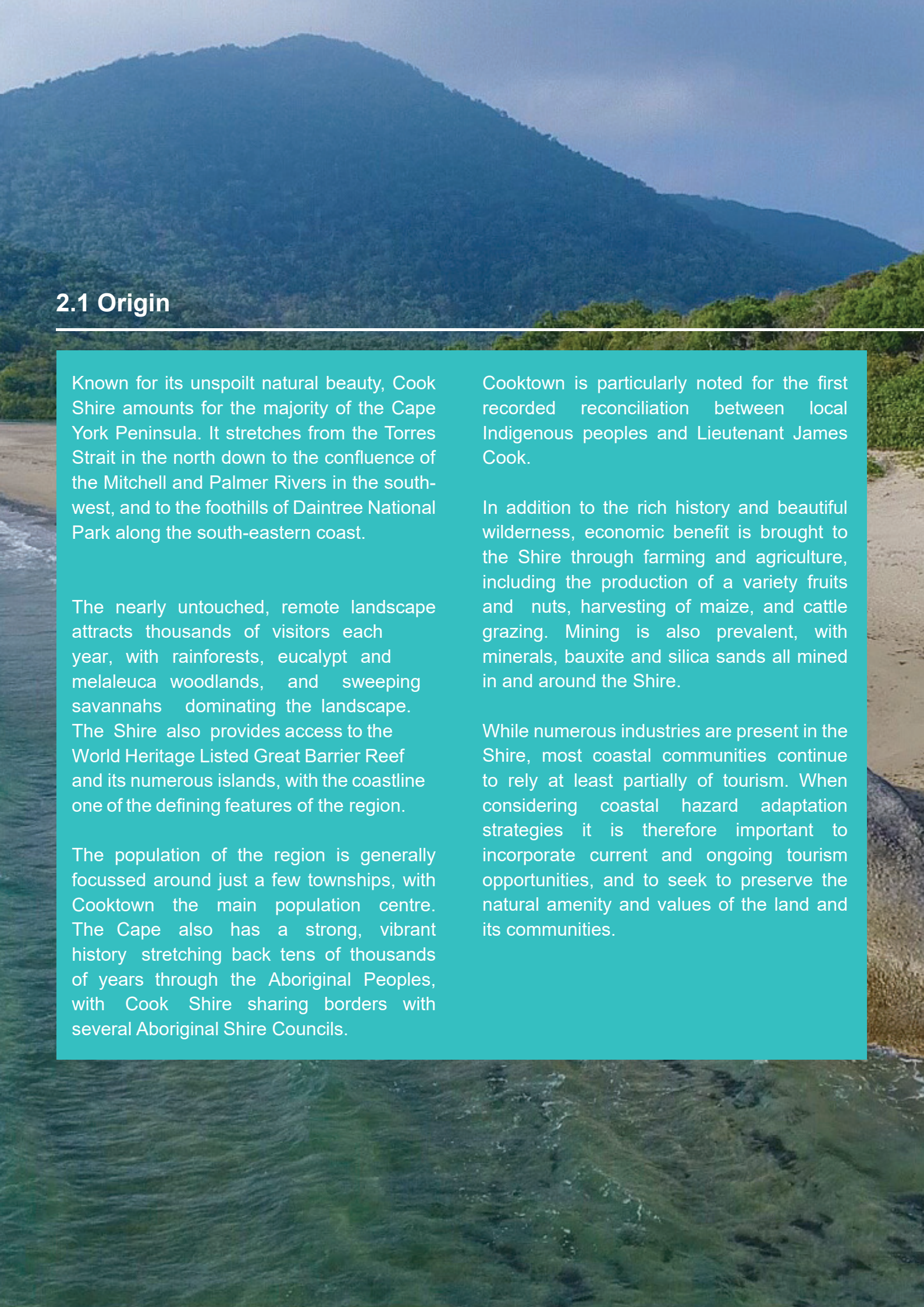
Section 4 – Adapting to change in an urban and environmental landscape

Section 5 – Adaptation pathways for the Cook Shire

Section 6 – Implementation



2. The Cook Coastline



2.1 Origin

Known for its unspoilt natural beauty, Cook Shire amounts for the majority of the Cape York Peninsula. It stretches from the Torres Strait in the north down to the confluence of the Mitchell and Palmer Rivers in the south-west, and to the foothills of Daintree National Park along the south-eastern coast.

The nearly untouched, remote landscape attracts thousands of visitors each year, with rainforests, eucalypt and melaleuca woodlands, and sweeping savannahs dominating the landscape. The Shire also provides access to the World Heritage Listed Great Barrier Reef and its numerous islands, with the coastline one of the defining features of the region.

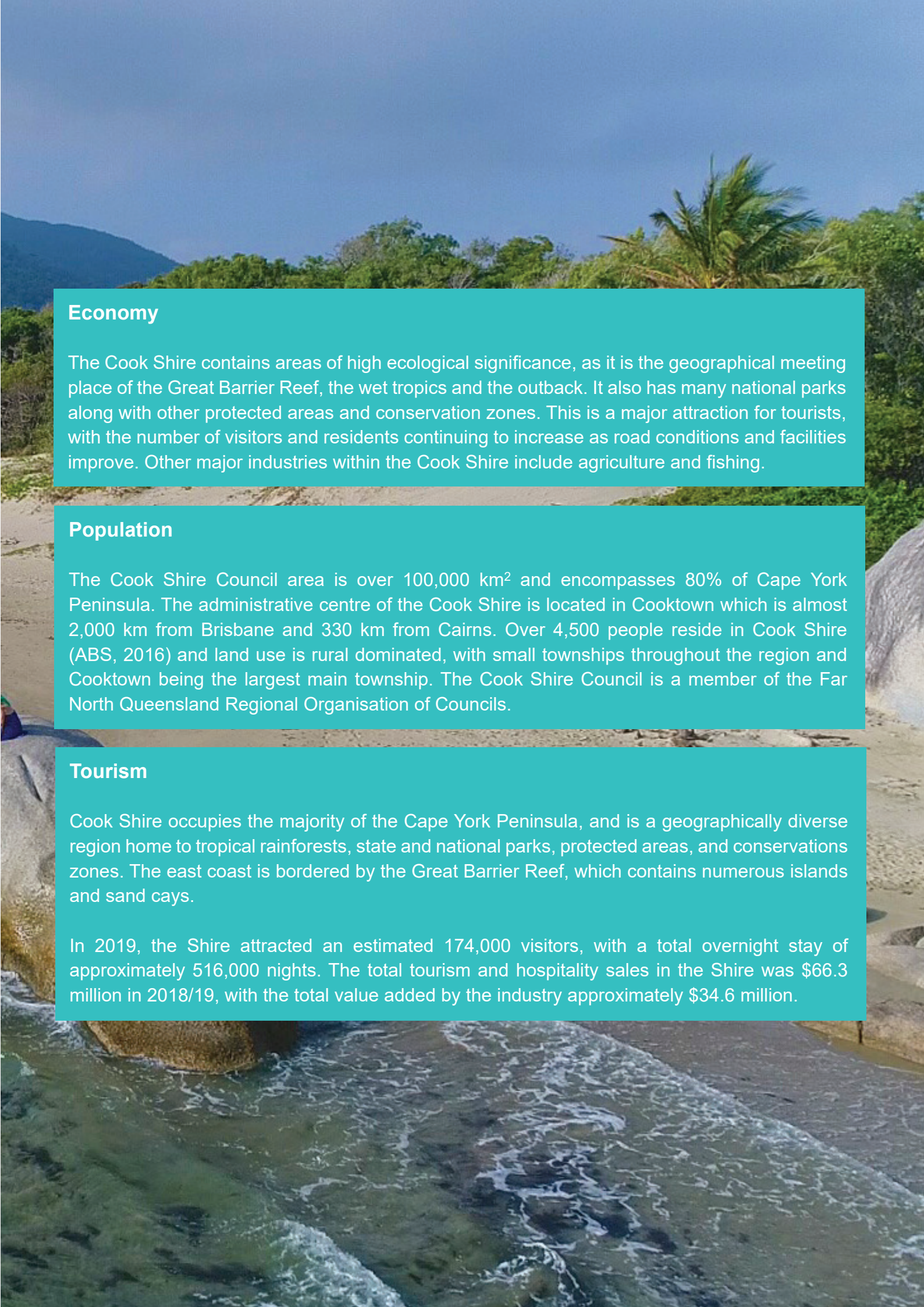
The population of the region is generally focussed around just a few townships, with Cooktown the main population centre. The Cape also has a strong, vibrant history stretching back tens of thousands of years through the Aboriginal Peoples, with Cook Shire sharing borders with several Aboriginal Shire Councils.

Cooktown is particularly noted for the first recorded reconciliation between local Indigenous peoples and Lieutenant James Cook.

In addition to the rich history and beautiful wilderness, economic benefit is brought to the Shire through farming and agriculture, including the production of a variety of fruits and nuts, harvesting of maize, and cattle grazing. Mining is also prevalent, with minerals, bauxite and silica sands all mined in and around the Shire.

While numerous industries are present in the Shire, most coastal communities continue to rely at least partially on tourism. When considering coastal hazard adaptation strategies it is therefore important to incorporate current and ongoing tourism opportunities, and to seek to preserve the natural amenity and values of the land and its communities.





Economy

The Cook Shire contains areas of high ecological significance, as it is the geographical meeting place of the Great Barrier Reef, the wet tropics and the outback. It also has many national parks along with other protected areas and conservation zones. This is a major attraction for tourists, with the number of visitors and residents continuing to increase as road conditions and facilities improve. Other major industries within the Cook Shire include agriculture and fishing.

Population

The Cook Shire Council area is over 100,000 km² and encompasses 80% of Cape York Peninsula. The administrative centre of the Cook Shire is located in Cooktown which is almost 2,000 km from Brisbane and 330 km from Cairns. Over 4,500 people reside in Cook Shire (ABS, 2016) and land use is rural dominated, with small townships throughout the region and Cooktown being the largest main township. The Cook Shire Council is a member of the Far North Queensland Regional Organisation of Councils.

Tourism

Cook Shire occupies the majority of the Cape York Peninsula, and is a geographically diverse region home to tropical rainforests, state and national parks, protected areas, and conservations zones. The east coast is bordered by the Great Barrier Reef, which contains numerous islands and sand cays.

In 2019, the Shire attracted an estimated 174,000 visitors, with a total overnight stay of approximately 516,000 nights. The total tourism and hospitality sales in the Shire was \$66.3 million in 2018/19, with the total value added by the industry approximately \$34.6 million.

2.3 The Future Coastline

The Cook coastline is naturally evolving over time and sees the impacts of both short and long-term transformation processes. The coastline is highly mobile, with constant change that will continue into the future.

These changes could be at a micro or macro level, and are closely linked to the wind and wave environment which continually influence the coastline. Significant weather events such as cyclones also drive large changes.

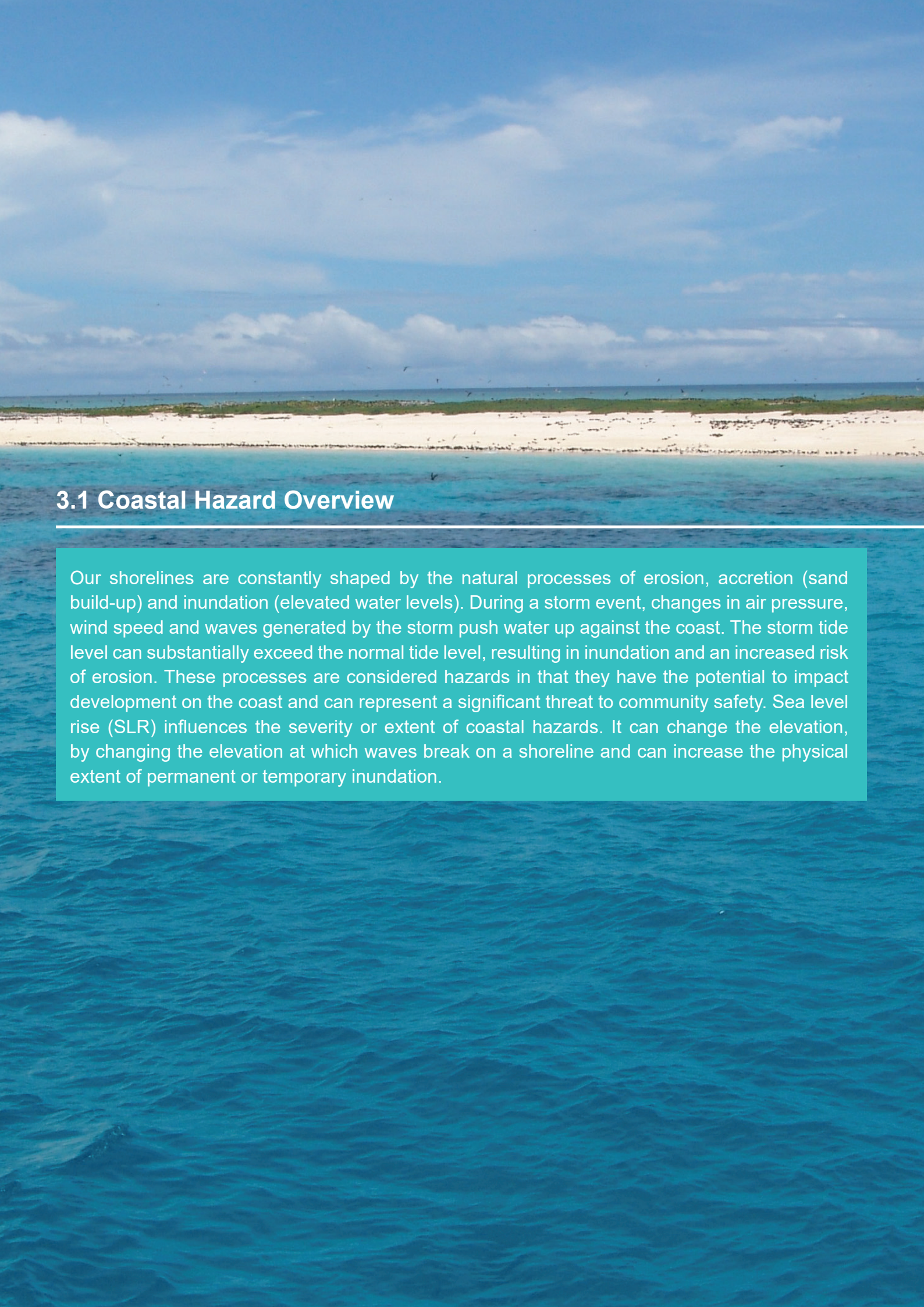
Coastal protection measures can be put in place to help adapt to this change, however

eventually these protection works themselves can be disrupted by natural shoreline evolution. In some cases, coastal protection measures can also disrupt the natural cycle and movement of nature and create adverse effects to other areas.

The future Cook coastline will be resilient to change, but understanding of the natural processes at play and the need to respect the natural evolution of the land where possible is critical in building a robust strategy that can help preserve the values of the Cook community.

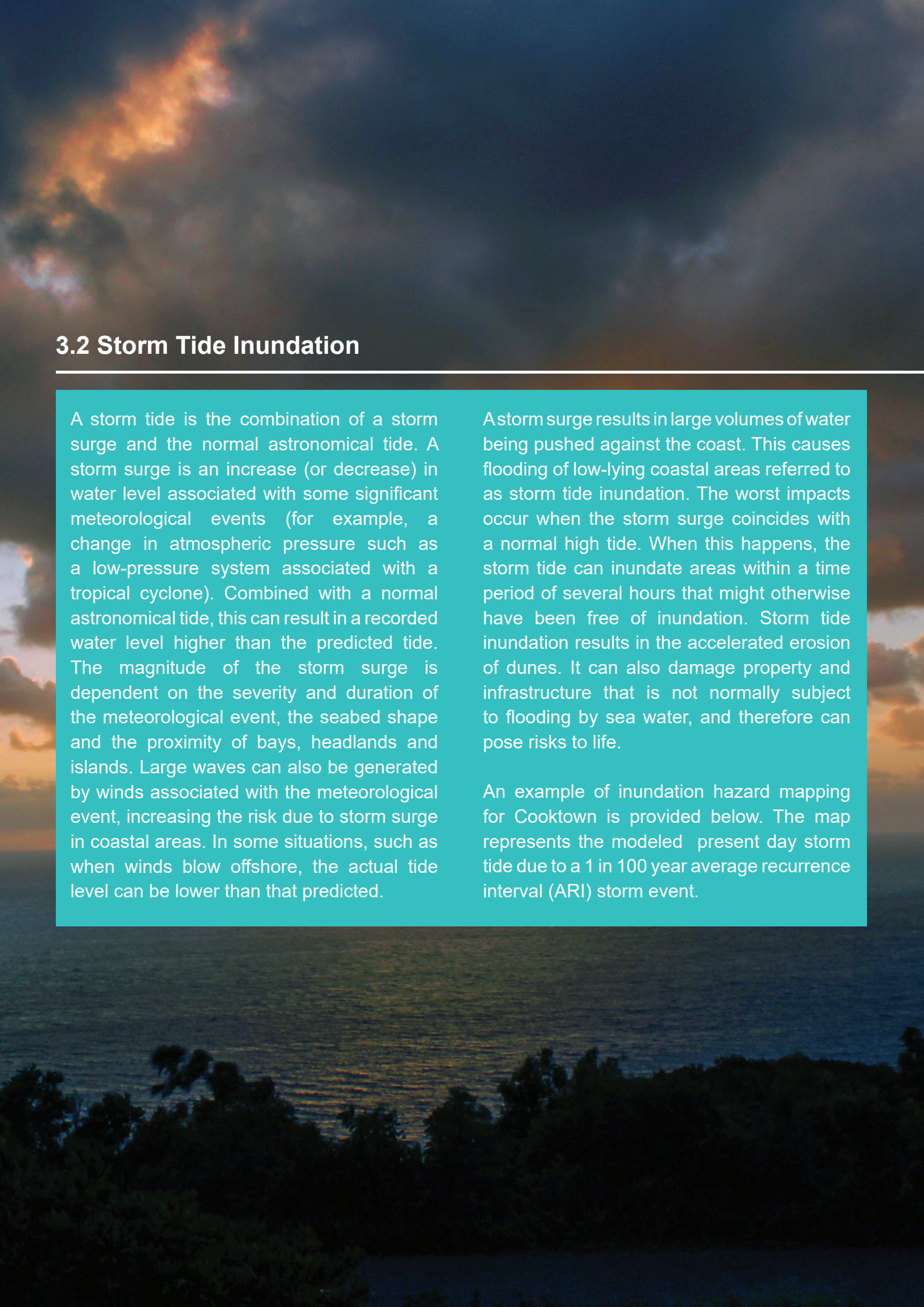


3. Understanding Coastal Change



3.1 Coastal Hazard Overview

Our shorelines are constantly shaped by the natural processes of erosion, accretion (sand build-up) and inundation (elevated water levels). During a storm event, changes in air pressure, wind speed and waves generated by the storm push water up against the coast. The storm tide level can substantially exceed the normal tide level, resulting in inundation and an increased risk of erosion. These processes are considered hazards in that they have the potential to impact development on the coast and can represent a significant threat to community safety. Sea level rise (SLR) influences the severity or extent of coastal hazards. It can change the elevation, by changing the elevation at which waves break on a shoreline and can increase the physical extent of permanent or temporary inundation.

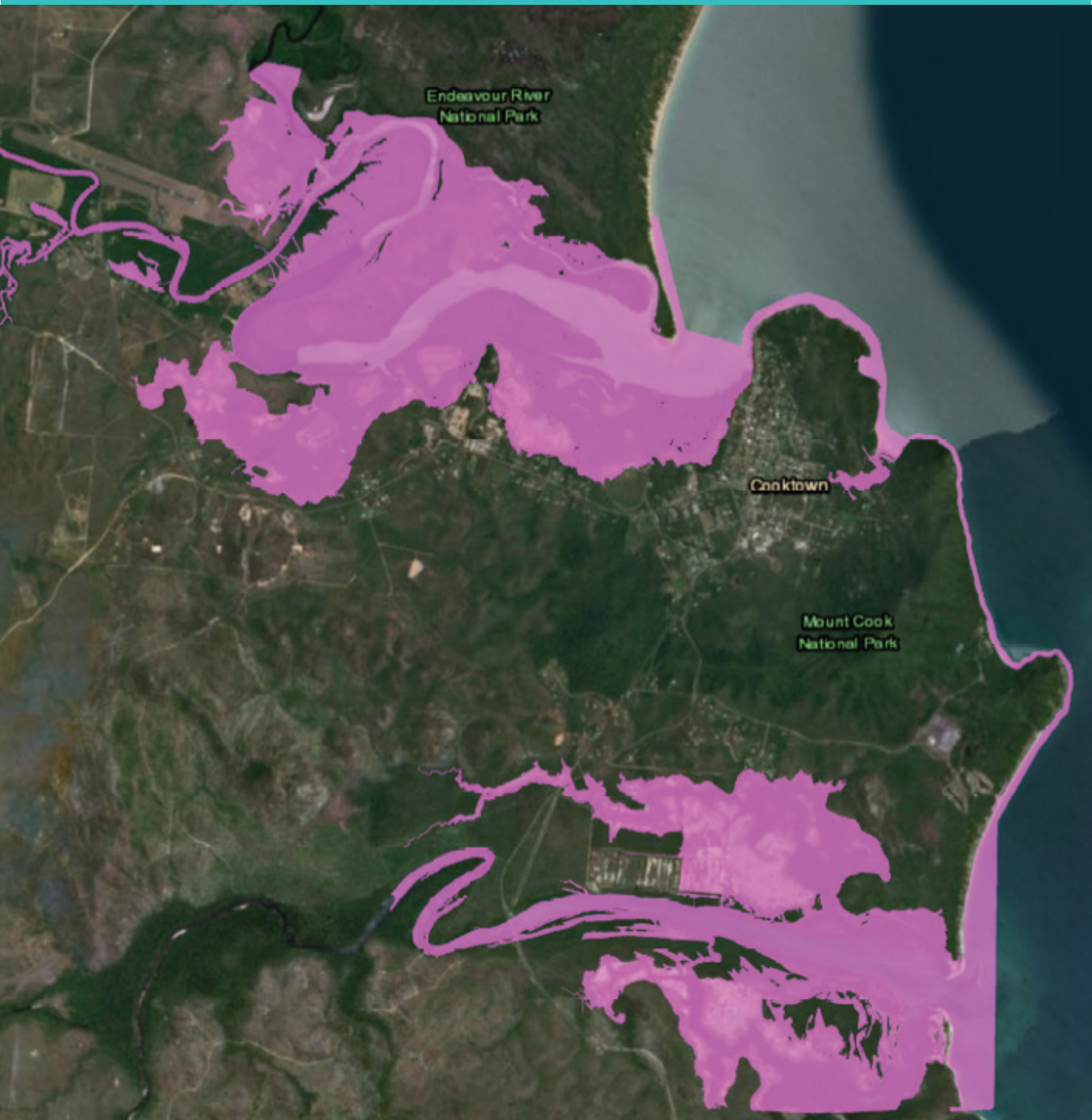


3.2 Storm Tide Inundation

A storm tide is the combination of a storm surge and the normal astronomical tide. A storm surge is an increase (or decrease) in water level associated with some significant meteorological events (for example, a change in atmospheric pressure such as a low-pressure system associated with a tropical cyclone). Combined with a normal astronomical tide, this can result in a recorded water level higher than the predicted tide. The magnitude of the storm surge is dependent on the severity and duration of the meteorological event, the seabed shape and the proximity of bays, headlands and islands. Large waves can also be generated by winds associated with the meteorological event, increasing the risk due to storm surge in coastal areas. In some situations, such as when winds blow offshore, the actual tide level can be lower than that predicted.

A storm surge results in large volumes of water being pushed against the coast. This causes flooding of low-lying coastal areas referred to as storm tide inundation. The worst impacts occur when the storm surge coincides with a normal high tide. When this happens, the storm tide can inundate areas within a time period of several hours that might otherwise have been free of inundation. Storm tide inundation results in the accelerated erosion of dunes. It can also damage property and infrastructure that is not normally subject to flooding by sea water, and therefore can pose risks to life.

An example of inundation hazard mapping for Cooktown is provided below. The map represents the modeled present day storm tide due to a 1 in 100 year average recurrence interval (ARI) storm event.



3.3 Permanent Inundation Due to Sea Level Rise

Sea level rise (SLR) inundation is the periodic or permanent tidal inundation of land due to a rise in mean sea level. In addition, SLR has the potential to exacerbate the existing risks of coastal erosion and storm tide inundation, and the associated impacts.

The QCoast2100 CHAS program requires councils to adopt a minimum projected sea level rise of 0.8 m by the year 2100. This projection is based on climate modelling and probable scenarios presented in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report released in 2014. Aligning with the State Planning Policy

2017, CSC has adopted a 0.8 m sea level rise by 2100 for planning and development assessment.

For this CHAS, the inundation resulting from sea level rise has been incorporated by adding 0.8 m (representing the year 2100) to the current Highest Astronomical Tide (HAT). HAT is the highest tide predicted to occur under average meteorological conditions, but does not include storm tides (an increase in water level associated with a meteorological event such as a storm or sustained winds), which may cause considerably higher tides to occur.

Sea-levels are rising because of climate change



Thermal expansion

Warmer water expands, therefore global warming is causing the water in our oceans to expand



Melting ice

Global warming is melting our glaciers and the Greenland and Antarctic land-based ice sheets



Higher sea levels



Sea-level rise creates risks for our coasts

Higher water levels Floods



Higher wave heights Storm surges



Threats

to land, roads, railways, hospitals, schools, houses

3.4 Coastal Erosion

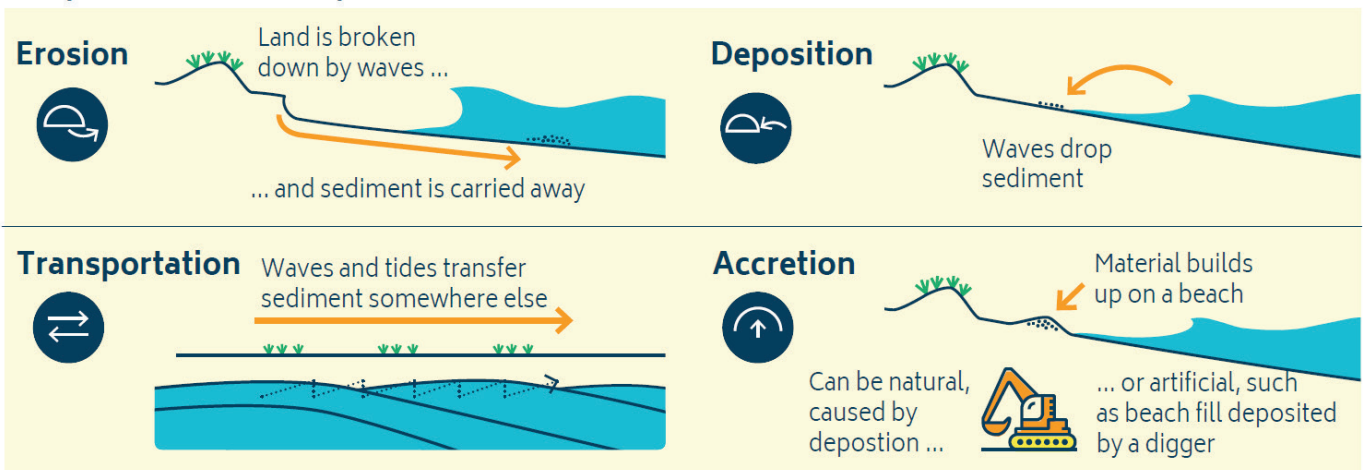
Overview

Coastal erosion is a natural phenomenon. Beaches respond to environmental factors such as annual variations in the amount of sand washed down from rivers; changes in the geometry of river delta channels, and changes in the weather, especially prevailing winds, severe storms and tropical cyclones. The 'active beach system' extends from well back in the dune system to the seaward extent of wave influence on the seabed.

As environmental conditions change, the beach profile changes as sand is moved onshore or offshore seeking an equilibrium profile. The movement of sand may appear as beach erosion, dune build-up or the formation of nearshore sand bars.

Typically, beaches never achieve a stable profile due to ever-changing environmental conditions. However, in some cases there may be a trend of ongoing erosion resulting in long-term shoreline recession.

The processes that shape our coast are:



Long-Term and Short-Term Erosion

Coastal erosion can be classified as either long term or short term. Long-term erosion usually refers to a trend of erosion extending over several decades and can be caused by a deficit in the annual sediment budget, or increasing longshore transport rates along the beach. Such erosion can occur without any reduction in the value of the beach as a natural system or as a public asset, as the beach profile is not changed but merely shifted landwards.

Short-term erosion refers to erosion that occurs over a period of days as a result of extreme weather events, such as severe storm or cyclone activity. Short-term erosion results in changes to the profile of the beach. During short term erosion events, the main sand transport mechanisms occur offshore. After the storm passes normal beach

processes result in onshore sand transport that restores the beach naturally. This natural restoration process may take many months or years. In most cases, intervention to restore the beach to its former condition is not required. However, short-term erosion can be exacerbated when a number of storm events occur in a short timeframe where the beach does not have time to recover naturally. The effect of severe storm systems (such as cyclones or east coast lows) may last for decades and can result in relatively permanent features, such as the relocation of river mouths and other tidal entrances.

Consideration of both long and short-term erosion impacts is critical. In building a robust strategy that can help preserve the values of the Cook community.



The Beach Erosion Problem

Erosion from natural beach processes does not permanently affect the form of the beach and, hence, its value as a public asset. However, it does involve a landward shift in its location. The problems associated with beach erosion only occur once the shoreline recession threatens property. The problem is not so much that the beach is eroding, but that development has occurred within the zone of natural beach fluctuations.

3.5 Current and Future Risk

Cook Shire is currently prone to cyclone and storm events, and other coastal hazard impacts are predicted to increase with a changing climate.

As part of the strategy program, the existing mapping for erosion prone areas (EPAs) and predicted storm tide inundation zones have been updated for relevant areas of the Cook Shire coastline.

These updates have been based on the best available technical data, and have included:

- New modelling of open coast erosion
- Application of the State Government approach to defining erosion prone areas, tailored to the Cook Shire region in consultation with State and LGAQ
- Updated mapping of storm tide inundation zones based on a commissioned study by Systems Engineering Australia (SEA) for the Cook Shire Council CHAS project

Based on the state-wide approach to mapping, the EPA includes components of:

- Modelled open coast erosion potential
- A rocky coast buffer zone
- Tidal areas: the combined area inundated by the HAT plus a defined horizontal buffer, plus any additional area inundated due to potential SLR

Mapping for both erosion and storm tide inundation includes consideration of three planning horizons; present day, a short-term horizon (2050), a medium/long-term horizon (2100).

The State specified SLR for the Queensland northern coastline is 0.3 m at 2050 and 0.8 m at 2100 based on the predictions provided by the IPCC in 2014. The values below indicate the SLR used for the intermediate planning horizons.



Planning Horizon	Sea Level Rise
2020	0.0m
2050	+0.3m
2100	+0.8m

Future Coastal Hazards

Projected SLR and an increase in cyclone intensity for the Queensland coastline is anticipated to increase the extent and impact of coastal hazards.

Coastal erosion:

- Increased water levels will accelerate coastal erosion
- Sediment transport patterns may be altered by shifts in wave direction, triggering changes to the form and location of shorelines
- Low-lying land may be permanently inundated
- Changes in cyclone and storm activity can escalate the severity

Storm tide inundation:

- SLR will increase the apparent severity and frequency of storm tide inundation and will cause inundation to occur further inland
- Increased cyclone and storm intensity will add to the magnitude of storm tide events and the extent of inundation

Climate change may affect coastal processes

Sea level rise



Increases erosion,
increase inundation

Wave climate changes



Increase/decrease wave
run-up, increase/decrease
erosion and accretion,
change transportation

Storm frequency intensity and/or direction changes



changes to wave and
storm surge patterns

Rainfall and runoff changes



increase/decrease
sediment supply
to rivers



3.6 Potential Impacts

With the updated coastal hazards, the Cook coast was split into several regions and impacted assets were identified for all planning horizons. Some key assets that are likely to be affected by coastal hazards now and in the future are shown in the following table.

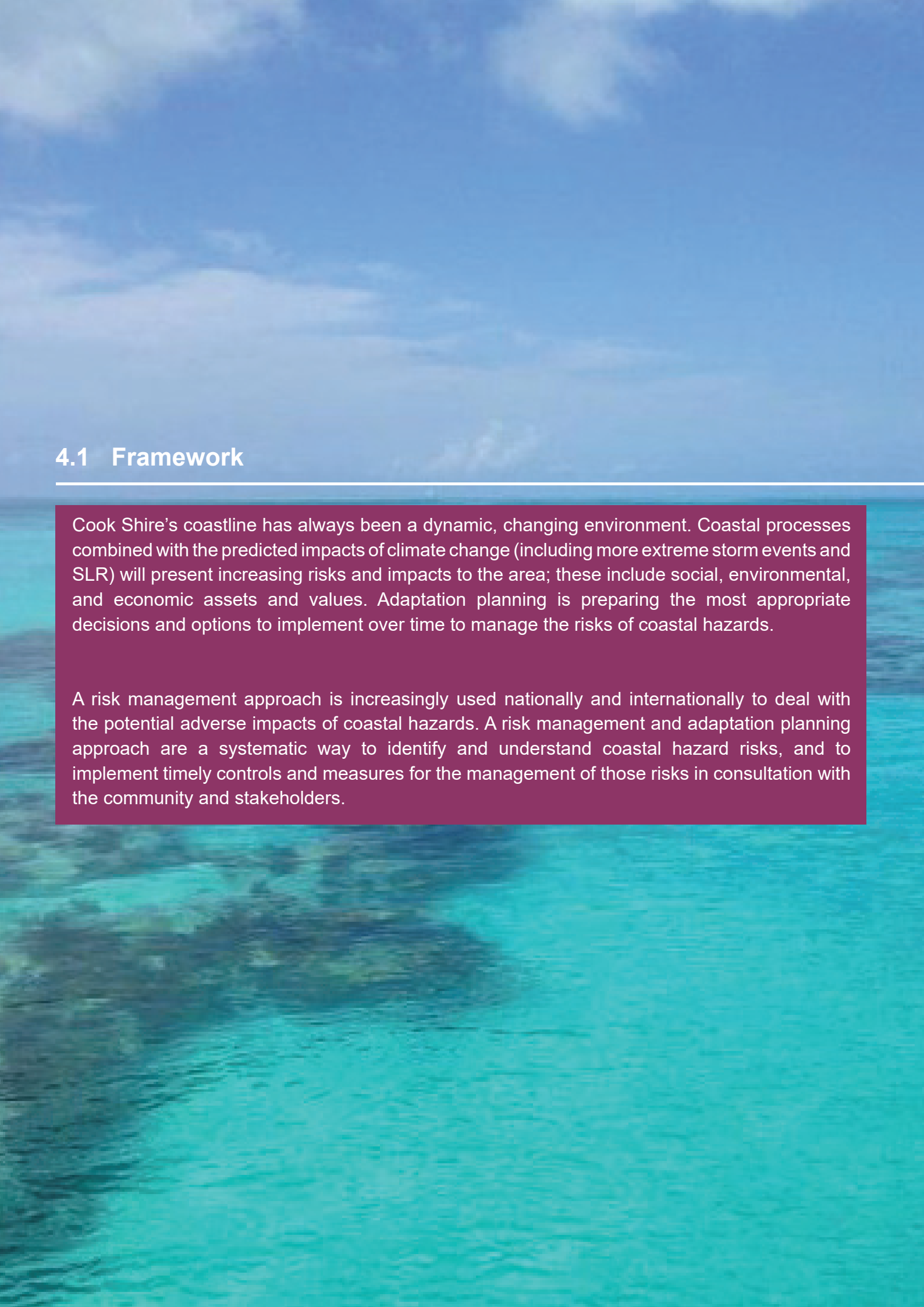
Asset	Hazard / Impact Timeframe		
	Erosion	Storm Tide	SLR
Cook Shire (generally)			
High value agricultural land (including intensive uses, Class A, B, production in natural environments, and irrigated agriculture / plantations, strategic cropping land)	Present day	Present day	Present day
High value natural areas (including national park, wetlands, essential habitat, remnant andw high value vegetation, Native Title Areas, Wet Tropics World Heritage Area, sugar cane, banana and other biosecurity zones)	Present day	Present day	Present day
Ayton/Bloomfield			
Residential lots	2050	Present day	Present day
Environment conservation and management lots	Present day	Present day	Present day
Industry lots	Present day	Present day	Present day
Rural and rural activity lots	Present day	Present day	Present day
Township and community purposes zoned lots	2100	Present day	Present day
Groundwater bores	2100	Present day	Present day
Recreation Areas	Present day	Present day	Present day
Rossville Bloomfield Road	Present day	-	-
The Esplanade	Present day	2100	-
Local/other roads	-	Present day	Present day
Ayton Boat Ramp	Present day	Present day	Present day
Cooktown			
Residential (including rural residential) lots	Present day	Present day	Present day
Environment conservation and management lots	Present day	Present day	Present day
Rural and rural activity lots	Present day	Present day	Present day
Business or Centre lots	Present day	Present day	Present day
Community purpose lots	Present day	Present day	Present day
Groundwater bores	-	2050	2100
Water Treatment Facility	-	2100	2100
Parks, Gardens, and Recreation Areas	Present day	Present day	Present day
Cooktown Racecourse	-	Present day	Present day
Cooktown Country Golf Club	2100	-	-
Endeavour Valley Road	-		2050
Other main/secondary roads	Present day	Present day	Present day
Local/other roads	Present day	Present day	Present day
Cooktown Memorial RSL	Present day	Present day	Present day
Cooktown/Matron Boat Ramp	Present day	Present day	Present day

Asset	Hazard / Impact Timeframe		
	Erosion	Storm Tide	SLR
Cooktown Waterfront	-	Present day	Present day
Cooktown Airport	-	Present day	Present day
Port Stewart			
Rural and rural activity lots	-	Present day	Present day
Groundwater bores	-	Present day	Present day
Port Stewart Road	-	2050	2100
Portland Roads / Restoration Island			
Rural and Rural Activity (includes residential property)	Present day	2050	2100
Portland Road	Present day	2100	-
Lizard Island			
Local roads	Present day	Present day	Present day
Lizard Island Resort	Present day	Present day	Present day
Lizard Island Research Station	Present day	Present day	Present day
Other Areas			
Hicks Island	Present day	Present day	Present day
Haggerstone Island	Present day	Present day	Present day
Skardon River Port	Present day	Present day	Present day
Strategic Port Land – Weipa	Present day	Present day	Present day





4. Adapting to Change



4.1 Framework

Cook Shire's coastline has always been a dynamic, changing environment. Coastal processes combined with the predicted impacts of climate change (including more extreme storm events and SLR) will present increasing risks and impacts to the area; these include social, environmental, and economic assets and values. Adaptation planning is preparing the most appropriate decisions and options to implement over time to manage the risks of coastal hazards.

A risk management approach is increasingly used nationally and internationally to deal with the potential adverse impacts of coastal hazards. A risk management and adaptation planning approach are a systematic way to identify and understand coastal hazard risks, and to implement timely controls and measures for the management of those risks in consultation with the community and stakeholders.

Adaptation Planning

Adaptation planning is a long-term process and it is important to have a decision making pathway to provide context and benchmarks for shorter-term decision-making.

The following principles, developed by GHD in 2015 for the purposes of coastal adaptation planning, underpin the adaptation planning process and guide the decision-making process set out in this adaptation plan.

Principle 1

Adaptation planning in the current planning timeframe does not impede the ability of future generations to respond to increasing risk beyond current planning timeframes.

Principle 2

Adaptation requires a decision-making framework that enables the right decision to be made at the right time, in line with the values and circumstances of the time.

Principle 3

Adaptation planning reflects the public's interest in the social, environmental, and economic value of the coast.

Principle 4

Alternative adaptation measures should consider the full range of land uses and values.

Principle 5

The full life-cycle benefits, costs and impacts of coastal interim protection works should be evaluated when considering adaptation options.

Informed by these adaptation principles, the most appropriate pathway to adapt to erosion and inundation on the Cook Shire coastline is one that enables decision-making on adaptation measures to be made at the right time, in line with the values of that time.

Adaptation Response

There are four key options available when making decisions about managing erosion and inundation.



Avoid

Identify future 'no-build areas' and use planning tools to prevent new development in areas at risk now or in future



Accommodate

Continue to use the land but accommodate changes by building on piles, converting agriculture to fish farming or growing flood- or salt-tolerant crops



Protect

Use hard structures (eg sea walls) or soft solutions (eg dunes and vegetation) to protect land from the sea. May be prohibitively expensive, especially in the long term

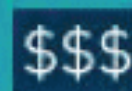


Retreat

Withdraw, relocate or abandon assets that are at risk; ecosystems are allowed to retreat landward as sea levels rise



Cost of response



Low – high

Potential cost to government and regulators

Length of protection



Short- to long-term protection

The most appropriate adaptation option is based on the values to be protected in a certain location and the social, environmental and economic costs of the options. The adaptation options should be considered as a hierarchy; the further down the hierarchy, the less flexibility there is to consider alternative adaptation measures. Effectively, these options become decisions for government and the community to make when planning for the future of coastal assets and land.

Adaptation Options

Regenerative Options

- Beach nourishment
- Dune construction and regeneration
- Riparian channel restoration and generation
- Wetlands restoration
- Artificial Reef

Coastal Engineering Solutions

- Detached breakwaters
- Groynes and artificial headlands
 - Sea dykes
 - Seawalls
- Storm surge barriers

Coastal Engineering Solutions

- Building retrofitting and improved design
- Flood resistant public infrastructure
- Raise land levels

Planning Options

- Development setbacks
 - Land buy-back
 - Land swap
- Land use planning

4.2 Adaptation Response by Locality

As a first pass review, the following adaptation options are indicated as possible by the Compendium of Coastal Hazard Adaptation Options for Queensland Coastal Councils (in conjunction with the Queensland Government, 2012).

Coastal Hazard Adaptation Option	Ayton / Bloomfield	Cooktown	Port Stewart	Portland Roads / Restoration Island	Lizard Island	Hicks / Haggerstone Island
Regenerative Options						
Beach nourishment	✓			✓		✓
Dune construction and regeneration	✓	✓	✓	✓	✓	✓
Riparian channel restoration and generation	✓	✓	✓			
Wetlands restoration	✓	✓				
Artificial Reef	✓	✓		✓	✓	✓
Coastal Engineering Solutions						
Detached breakwaters	✓	✓		✓		✓
Groynes and artificial headlands	✓	✓		✓	✓	✓
Sea dykes	✓	✓			✓	
Seawalls	✓	✓	✓	✓	✓	✓
Storm surge barriers		✓				
Coastal Settlements Design Options						
Building retrofitting and improved design	✓	✓	✓	✓	✓	✓
Flood resistant public infrastructure	✓	✓	✓	✓	✓	✓
Raise land levels	✓	✓	*	*		*
Planning Options						
Development setbacks	✓	✓	✓	✓	✓	✓
Land buy-back	✓	✓	✓	✓	✓	✓
Land swap	✓	✓	✓	✓		✓
Land use planning	✓	✓	✓	✓	✓	✓

* New developments or individual property owners only

4.3 Multi-Criteria Analysis of Coastal Hazard Adaptation Options

An A Multi-Criteria Analysis (MCA) considering social, technical, environmental and economic implications, amongst others, has been undertaken on the short-listed options to determine the preferred Adaptation pathway for each area.

Criteria	Relates to values
Feasibility of implementation	
C1 - Implementation Cost (Public Cost)	Implementation cost includes: - Do nothing or asset relocation costs - Interim protection costs - Strategic transition costs - Accommodation costs
C2 – Implementation Cost (Private Cost)	Private costs to maintain, accommodate or transition private assets.
Social, environment and economic values	
C3 - Commercial property impacts	- Local economy (businesses and Agriculture) - Social places and interaction - Infrastructure and servicing
C4 – Foreshore and parkland impacts	- Local economy (tourism) - Recreation - Social places and interaction - Cultural value - Ecosystem and biodiversity (i.e. dune vegetation and mangrove habitat)
C5 – Beach impacts	- Local economy (tourism) - Recreation - Character, sense of place, scenery - Ecosystem and biodiversity (intertidal zone)
C6 –Residential Impacts	- Land supply in Cook Shire Council - Personal wealth - Infrastructure and servicing
C7 –Community Service / Infrastructure	- Social places and interaction - Education, science and learning - Infrastructure and servicing (community infrastructure)
Safety and risk	
C8 – Residual risk to property	- Safety and risk management - Effectiveness of adaptation option

The results of the MCA for each at risk region is provided in the following tables, where 1 is the best ranked adaptation option.

In the tables, the following definitions generally apply.

- 'Avoid' generally refers to changes to the planning scheme only, thereby avoiding the risk for new infrastructure
- 'Transition' refers to moving infrastructure and/or properties away from the hazard area
- 'Accommodate' refers to options that accommodate changes in coastal hazards, such as raising land levels or building on piles
- 'Protect' can refer to either a 'monitor and regenerative' solution, where beach nourishment and re-vegetation is employed, or a 'coastal engineering solution' such as a seawall (labeled accordingly in the tables below)

Alternatively, there is a 'do-nothing' option, which is the same as the base case or 'unmanged transition'. In other words, nothing is done to lower the risk presented by coastal hazards and ultimately, it is likely maintaining infrastructure or property will become untenable.

Adaptation Options for Ayton / Bloomfield	Rank
Protect / Protect / Transition (Monitor and Regenerative Option)	1
Protect / Protect / Protect (Coastal Engineering Solution)	2
Accommodate / Accommodate / Transition	3
Avoid / Transition	4
Base Case (Unmanaged Retreat)	5

Adaptation Options for Cooktown	Rank
Protect / Protect / Protect (Coastal Engineering Solution)	1
Status Quo / Accommodate	2
Base Case (Unmanaged Retreat)	3

Adaptation Options Port Stewart	Rank
Avoid / Protect / Protect (Coastal Engineering Solution)	1
Do Nothing - No adaptation option - Accept risk	2
Base Case (Unmanaged Retreat)	2
Accommodate / Accommodate / Transition	4



Adaptation Options for Lizard Island	Rank
Do Nothing - No adaptation option - Accept risk	1
Base Case (Unmanaged Retreat)	2

Adaptation Options for Portland Roads	Rank
Accommodate / Accommodate / Transition	1
Avoid / Protect / Protect	2
Base Case (Unmanaged Retreat)	3
Do Nothing - No adaptation option - Accept risk	3

Adaptation Options for Hicks / Haggerstone Island	Rank
Avoid / Protect / Protect	1
Do Nothing - No adaptation option - Accept risk	2
Base Case (Unmanaged Retreat)	2

4.4 Cost-Benefit Assessment of Coastal Management and Engineering Options

A detailed cost-benefit analysis was undertaken to inform the program of coastal management and engineering actions in the adaptation strategy.

The Cost-Benefit Analysis (CBA) is a process commonly used to prioritise options and inform decision-making about alternative courses of action. As a decision support tool, the CBA assists Cook Shire Council to identify the options which achieve the maximum net socio-economic gain for the community.

A critical step in CBA is to identify a comprehensive list of potential costs and benefits. Where costs and benefits are material and where sufficient data was available, cost and benefits of moving from the base case to the project case have been monetised and expressed in 2020/21 terms. The base case was an unmanaged transition for all areas in order to quantify the impacts of any active coastal management activities in place of reactive management.



Results of the CBA have been grouped into the following categories:

- ✓ ✓ Options are highly likely to be economically beneficial
- ✓ Options are likely to be economically beneficial
- ✓ Between 0.3 - 2: Options may or may not be economically beneficial; further analysis of vulnerable assets would be required
- X Options are unlikely to be economically beneficial

The costs and benefits are ranked on the below scale:

\$ - \$0-\$1M \$\$\$ - \$5M-\$10M \$\$\$\$\$ - \$15M-\$20M
 \$\$ - \$1M-\$5M \$\$\$\$ - \$10M-\$15M

The benefits are ranked on the below scale:

+ - \$0-\$1M +++ - \$5M-\$10M +++++ - \$15M-\$20M
 ++ - \$1M-\$5M ++++ - \$10M-\$15M

Area	Adaptation option	PV Benefits	PV Costs	Economically preferred adaptation options
Ayton Bloomfield	Protect / Protect / Transition (Monitor and Regenerative Option)	+++	\$\$	✓
	Protect / Protect / Protect (Coastal Engineering Solution)	+++	\$\$	✓
	Accommodate / Accommodate / Transition	+	\$\$	X
Cooktown and surrounds	Avoid / Accommodate / Transition	+	\$	?
	Protect / Protect / Protect	++++	\$\$\$\$\$	?
	Status Quo / Accommodate	+	\$\$	X
Port Stewart	Accommodate / Accommodate / Transition	+	\$\$\$	X
	Avoid / Protect / Protect	++	\$\$\$	✓
Portland Roads / Restoration Island	Accommodate / Accommodate / Transition	+	\$	?
	Avoid / Protect / Protect	+	\$\$	X
Hicks/Hagge-stone Island	Avoid / Protect / Protect	+	\$	✓

*Costs and benefits should be considered to fall within +/- 50%.



5. Our Adaptation Pathway

5.1 Shire Wide Initiatives

Adaptation pathways for Cook Shire have been developed through modelling of coastal hazards, an assessment of risks to coastal values and assets, and an evaluation of available adaptation options.

While these adaptation options following represent unique solutions to each community, there is an overarching appeal to transition the communities inland over time as coastal hazards increase. The protection of key assets should be considered a short to medium term fix to allow for safe transition.

For Lizard Island, the MCA identified the preferred option as “do nothing” due to the comparatively lower risk due to coastal hazards to key infrastructure. Therefore Lizard Island has not been considered further in terms of an adaptation pathway.



Planning Options

As part of the Shire wide adaptation strategy, implementation of overarching planning initiatives can be considered by Council. This may include options such as:

- Review and update of the local planning scheme and land use development requirements, considering the updated coastal hazard mapping extents
- Utilising the Resilient Cape plan to inform strategic planning, development and future master planning activities
- Updating emergency response planning and reviewing the long-term viability of evacuation routes and facilities

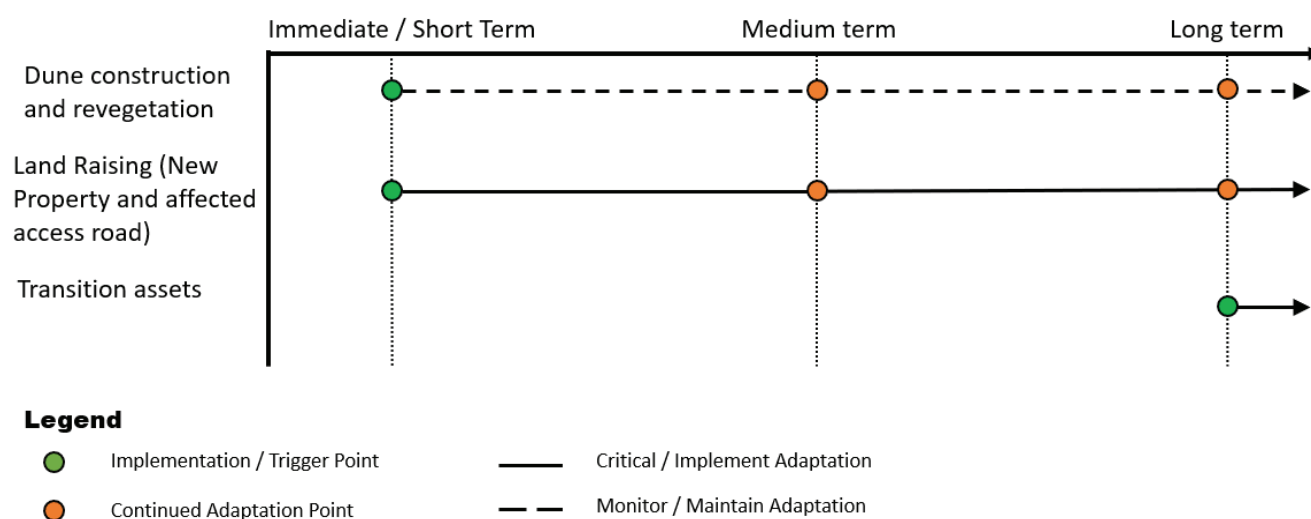
As part of these potential planning changes, the coastal hazard mapping may be used to inform approval conditions for undeveloped land. For extensions to existing approvals there exists the opportunity to review the updated mapping, where stakeholders can be informed of the implications of coastal hazards in terms of the development footprint moving forward.

In the short-term, Council can use the Resilient Cape plan to inform all relevant planning matters, particularly in preparation of potential future changes to the local planning scheme. Once implemented in Cook Shire planning processes, the Resilient Cape plan will be a useful tool to support planning decisions that aim to reduce the risk due to coastal hazards within the Shire.

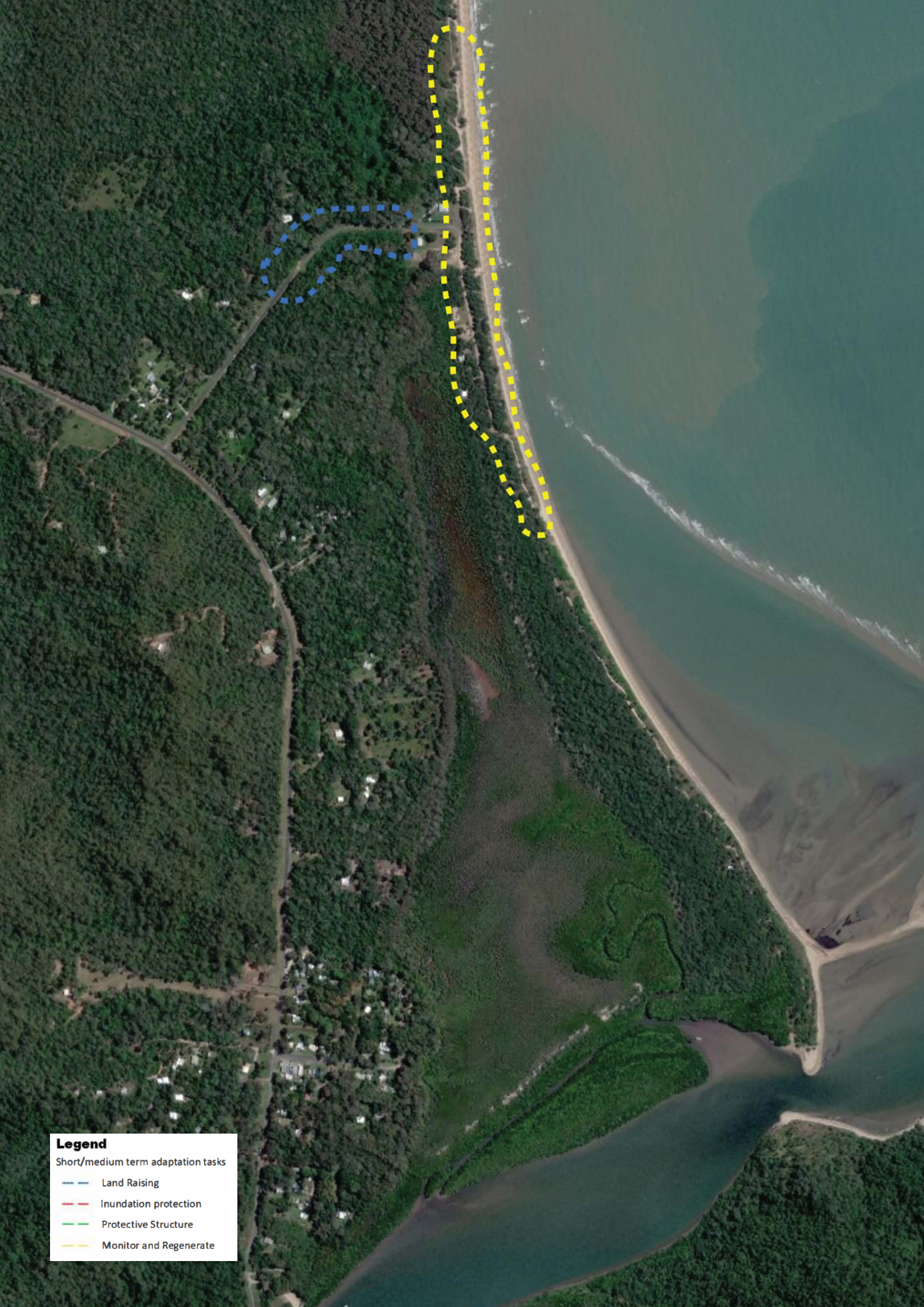
5.2 Ayton / Bloomfield

Ayton lies to the south of Cooktown on the mouth of the Bloomfield River. The coastal beach is the main area affected by coastal hazards as it is an easterly facing beach. There are several properties along this section of beach that presently face a risk due to erosion and may in future be affected by SLR inundation from the marshland behind the dune system. The township is located upriver on a high stand with a salt marsh wedge between the coastal beach and the township.

Ayton / Bloomfield



Adaptation Task	Trigger Point	Likely Timeframe
Dune construction, revegetation (including monitoring)	The dune buffer drops below 40m from the current HAT vegetation line to affected properties and/or assets. A monitoring program should be established by Council in the immediate term to assess this trigger.	Short-term (immediate-term for monitoring program)
Increase Weary Bay Road level	Inundation of road from high tide / storm events on 5 or more occasions in a year.	Short to medium-term
Transition assets away from the hazard area	Triggers for transition vary depending on the asset/ infrastructure, as some assets are more vulnerable to coastal hazards than others. As this is a long-term adaptation task (2100+), triggers should be assessed in the medium-term on a more focused, asset-by-asset basis.	Long-term



Legend

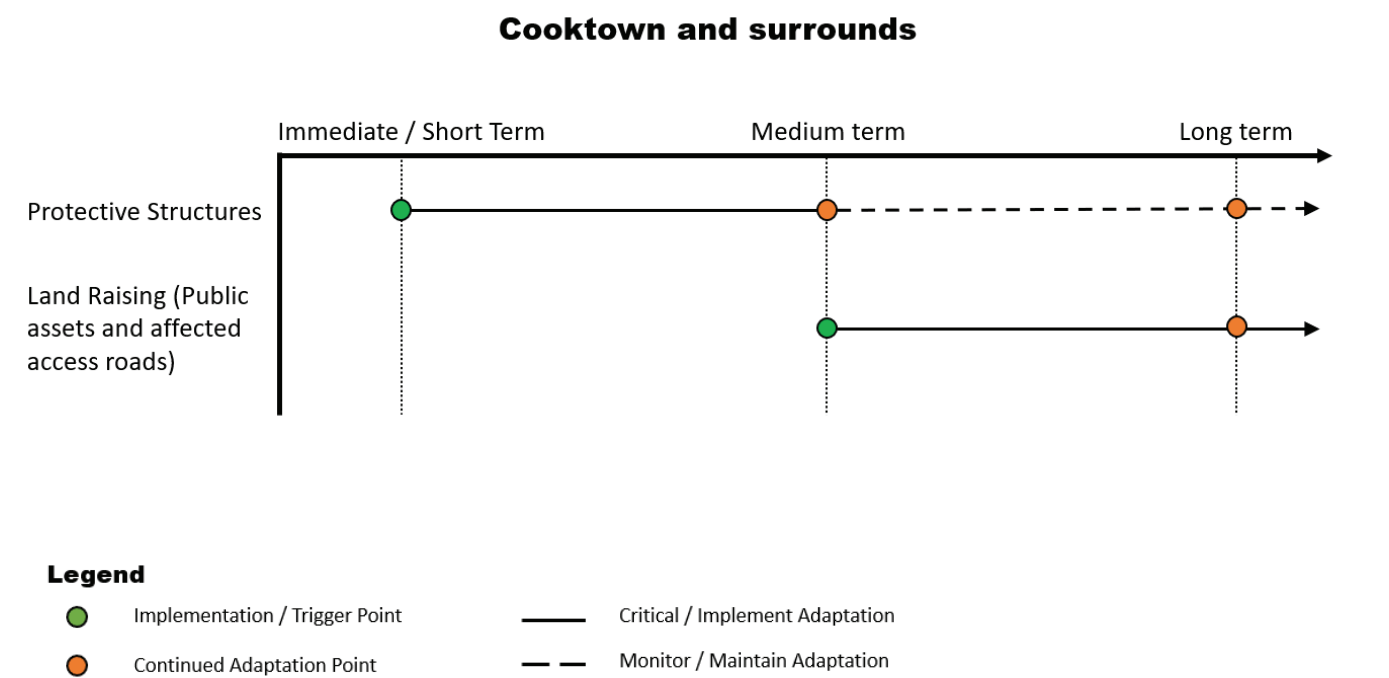
Short/medium term adaptation tasks

- Land Raising
- Inundation protection
- Protective Structure
- Monitor and Regenerate

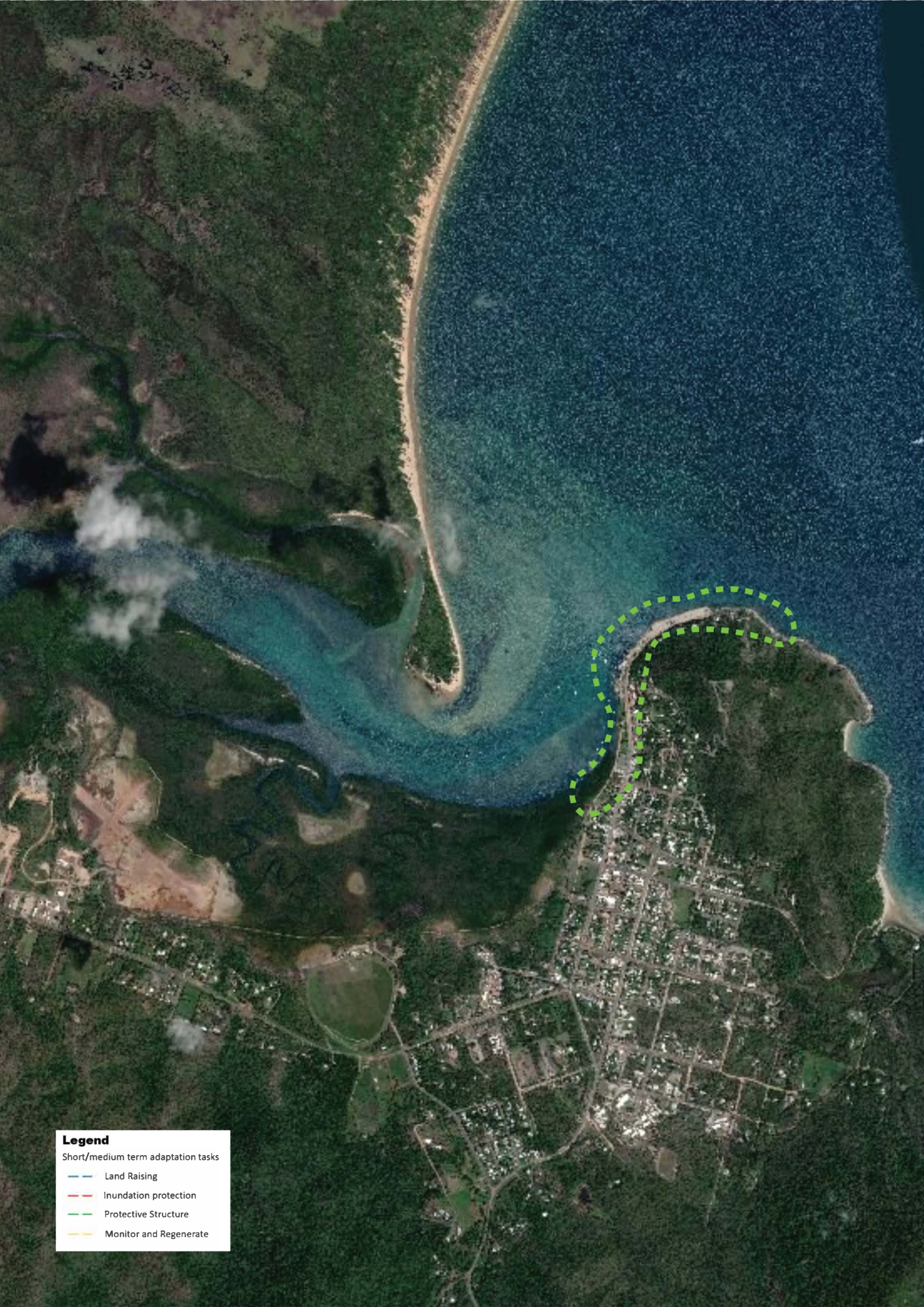
5.3 Cooktown and Surrounds

Cooktown is the main population centre of Cook Shire Council. It is partially protected by the river mouth opening to the north and a large headland positioned behind the township offering protection from the south-easterly trade winds. Key concerns are inundation and storm tide along the town foreshore and the airport located upstream. The esplanade towards the north of the township is presently protected, with protection measures historically the preferred adaptation option. Upstream, Marton is located on a river bend and is therefore subject to ongoing erosion processes.

The preferred adaptation pathway for Cooktown and surrounds is outlined as follows. The figure outlines when a trigger might first be reached (shown in green) and where adaptation tasks should continue after implementation (shown in orange). Additionally, critical tasks (generally classified as such due to safety implications) are denoted by a solid line, while monitor or maintain tasks are defined by a dashed line. Trigger points are defined in the table provided.



Adaptation Task	Trigger Point	Likely Timeframe
Protection structure (seawall or similar) along Cooktown / Marton foreshore / riverbank	Loss of land as compared to 2020 baseline (currently unprotected areas).	Short-term
Protection structure (upgrade / replace) along Cooktown / Marton foreshore / riverbank	Loss of land due to damage/failure of previously installed protection structure. Inundation of road from a high tide/storm event on 5 or more occasions in a year	Medium-term



Legend

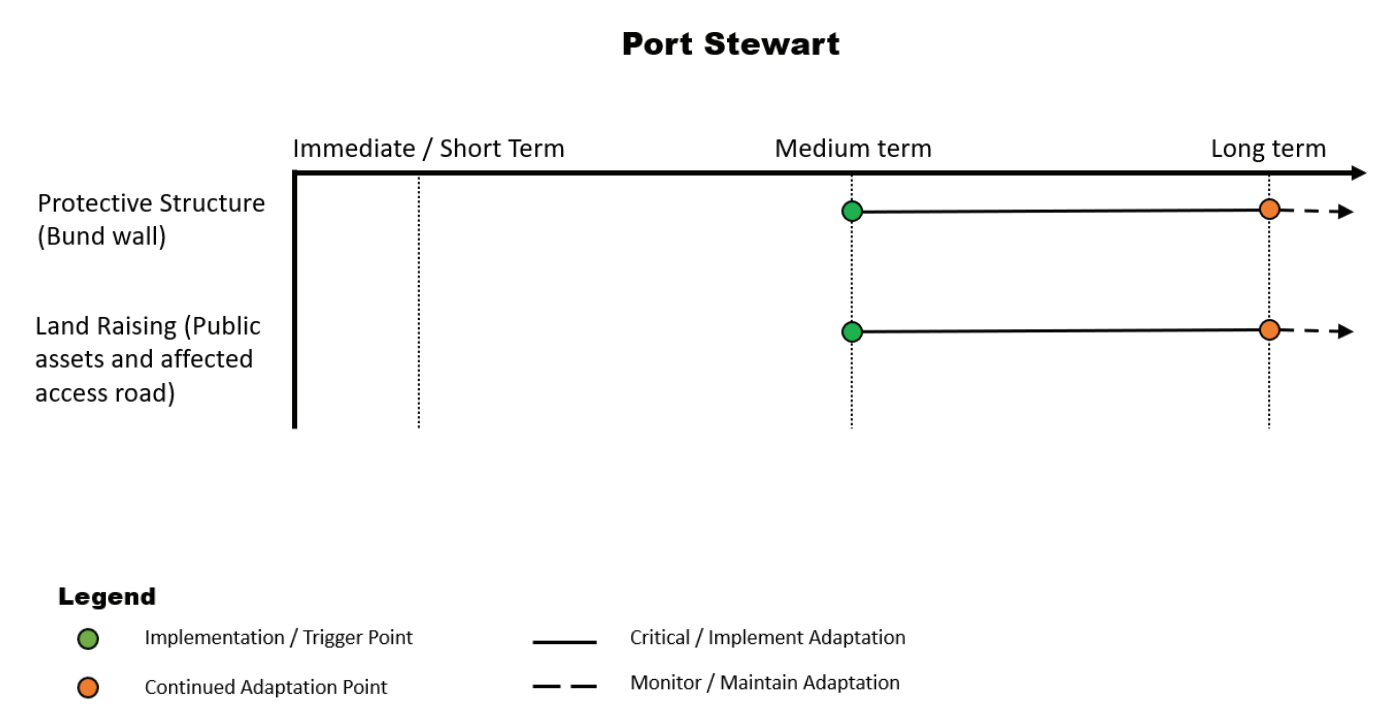
Short/medium term adaptation tasks

- Land Raising
- Inundation protection
- Protective Structure
- Monitor and Regenerate

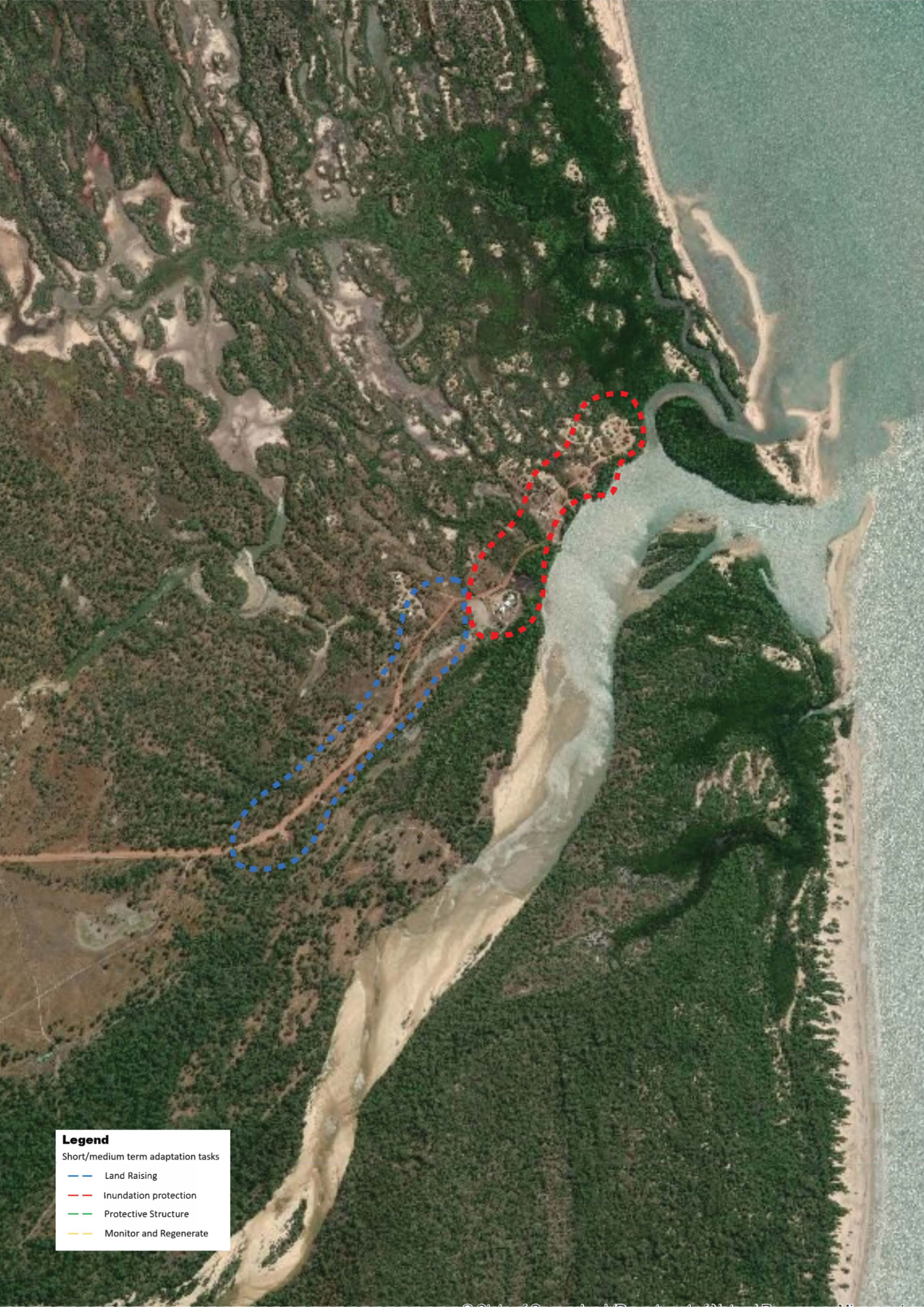
5.4 Port Stewart

Port Stewart is located along the coastline of Princess Charlotte Bay, north of Cooktown. Port Stewart has multiple dwellings and provides access for boating traffic to the bay. It is accessible by a gravel road that connects to the Peninsula Developmental Road south of Coen. The coastline shows evidence of being mobile over a significant long-term period.

The preferred adaptation pathway for Port Stewart is outlined as follows. The figure outlines when a trigger might first be reached (shown in green) and where adaptation tasks should continue after implementation (shown in orange). Additionally, critical tasks (generally classified as such due to safety implications) are denoted by a solid line, while monitor or maintain tasks are defined by a dashed line. Trigger points are defined in the table provided.



Adaptation Task	Trigger Point	Likely Timeframe
Increase Port Stewart Road level	Inundation of road from high tide / storm events on 5 or more occasions in a year.	Medium to long-term
Bund wall protection of Port Stewart properties	Following loss of land (1m +) from 2020 baseline.	Medium to long-term



Legend

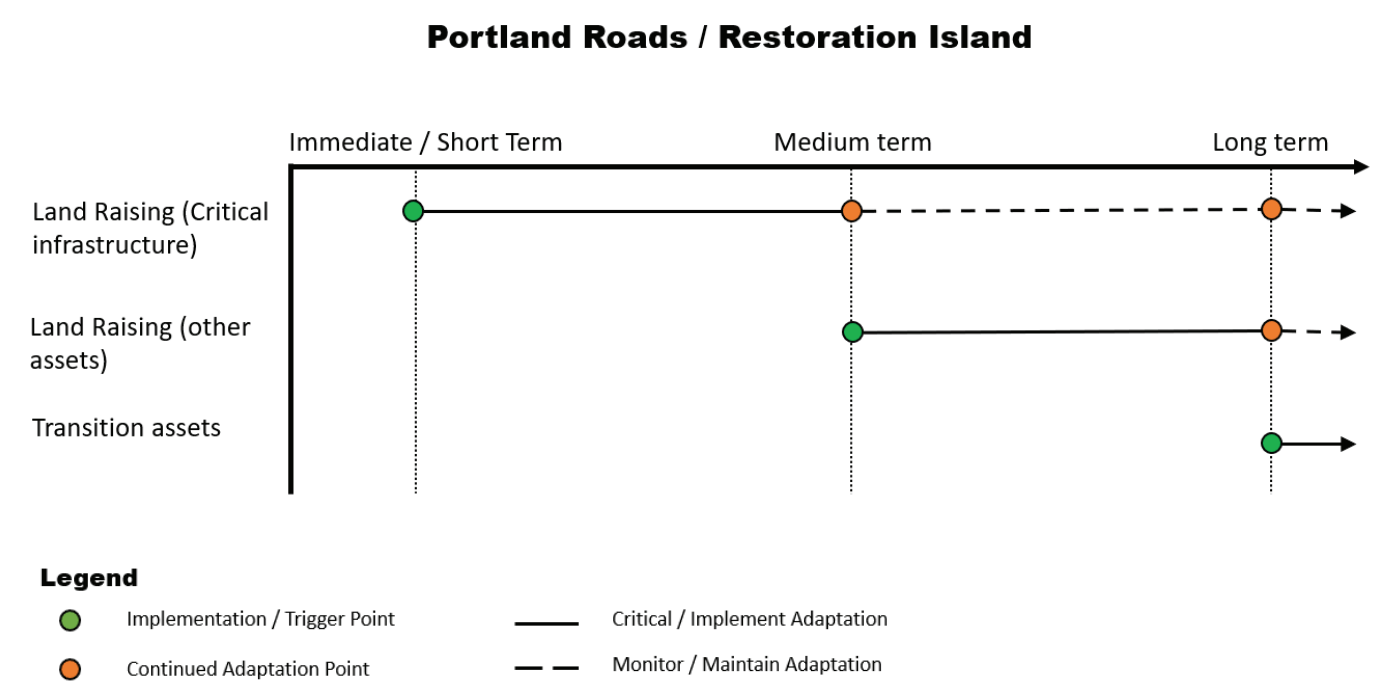
Short/medium term adaptation tasks

- Land Raising
- Inundation protection
- Protective Structure
- Monitor and Regenerate

5.5 Portland Road / Restoration Island

Portland Roads has two prominent headlands that have a small number of dwellings on each. The two locations have small bays that have small to medium rock throughout. Both bays are northward facing offering protection from the majority of weather systems, though they remain exposed to cyclonic weather events. Restoration Island is home to a single property on the western foreshore.

The preferred adaptation pathway for Portland Roads/Restoration Island is outlined as follows. The figure outlines when a trigger might first be reached (shown in green) and where adaptation tasks should continue after implementation (shown in orange). Additionally, critical tasks (generally classified as such due to safety implications) are denoted by a solid line, while monitor or maintain tasks are defined by a dashed line. Trigger points are defined in the table provided.



Adaptation Task	Trigger Point	Likely Timeframe
Land Raising (critical infrastructure including roads)	Inundation of road from high tide / storm events on 5 or more occasions in a year. Inundation of vulnerable assets / property from high tide / storm events on 3 or more occasions in a year.	Short-term
Land Raising (critical infrastructure including roads)	Inundation from high tide / storm events on 5 or more occasions in a year.	Medium-term
Transition assets away from the hazard area	Triggers for transition vary depending on the asset/ infrastructure, as some assets are more vulnerable to coastal hazards than others. As this is a long-term adaptation task (2100+), triggers should be assessed in the medium-term on a more focused, asset-by-asset basis.	Long-term



Legend

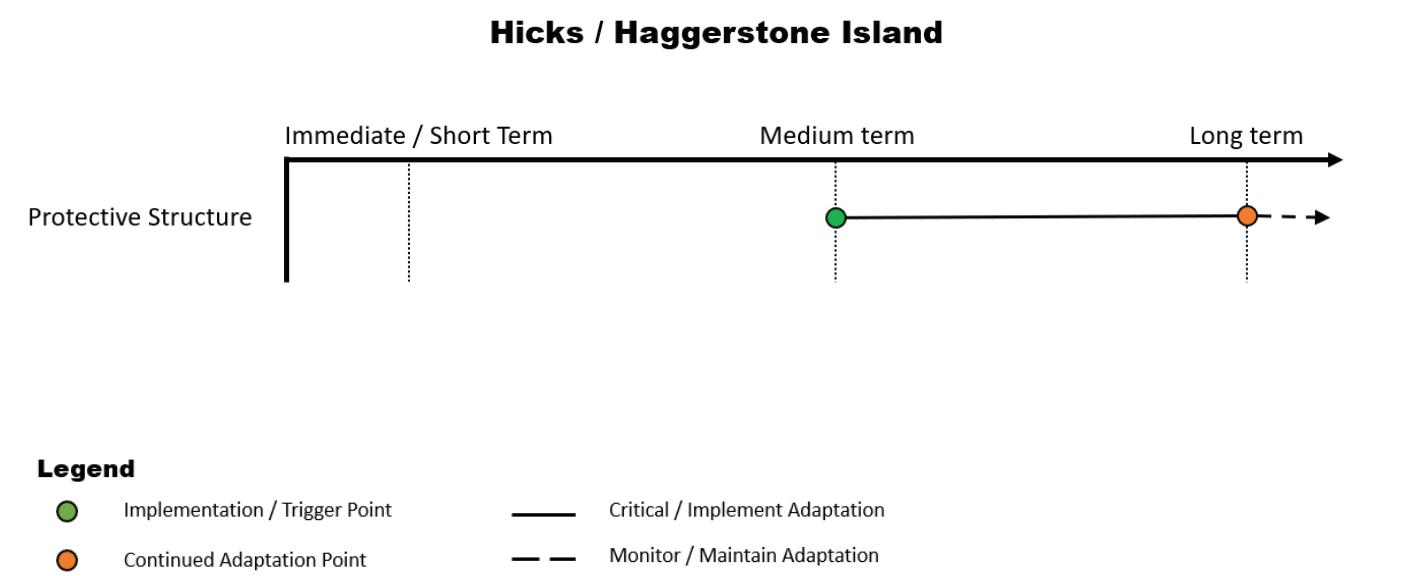
Short/medium term adaptation tasks

- Land Raising
- Inundation protection
- Protective Structure
- Monitor and Regenerate

5.6 Hicks / Haggerstone Island

Hicks and Haggerstone Island lie far to the north of Cooktown and host a small population on each, mostly catering to tourists. The islands are generally protected from significant coastal hazards, however do have some areas of concern.

The preferred adaptation pathway for Hicks / Haggerstone Island is outlined as follows. The figure outlines when a trigger might first be reached (shown in green) and where adaptation tasks should continue after implementation (shown in orange). Additionally, critical tasks (generally classified as such due to safety implications) are denoted by a solid line, while monitor or maintain tasks are defined by a dashed line. Trigger points are defined in the table provided.



Adaptation Task	Trigger Point	Likely Timeframe
Increased protection structure along Hicks Island foreshore	Critical infrastructure is inundated on 5 or more occasions in a year	Medium-term



Legend

Short/medium term adaptation tasks

- Land Raising
- Inundation protection
- Protective Structure
- Monitor and Regenerate

6. Implementation

Cook Shire Council will use this document as a strategic planning tool to adapt and mitigate risk to property and the Cook coastline into 2100.

Key tools at the shire's disposal are:

- Ongoing community consultation
- Adaptive management
- Strategic plan for each community for future coastal hazard mitigation

The Resilient Cape Strategic Plan will be reviewed every 5 - 10 years as part of an ongoing study into the Australian coastline. The anticipated review should be completed before the review of the councils strategic plan, in order to incorporate planning into the overall strategic plan document.

7. References

Queensland Coastal Hazard Guide (DEHP, 2013)

QCoast2100 Minimum Standards and Guidelines (LGAQ, October 2016)

The Compendium of Coastal Hazard Adaptation Options (GHD et al, October 2012)

Cook Shire Council Coastal Hazard Adaptation Strategy, Phase 1 Stakeholder Communication and Engagement Plan (GHD, 2017).

Cook Shire Council Coastal Hazard Adaptation Strategy, Phase 2 Scoping Study (GHD, 2017).

Cook Shire Coastal Hazard Adaptation Strategy (CHAS), Phase 3 (GHD, 2020).

Cook Shire Coastal Hazard Adaptation Strategy (CHAS), Phase 4 (GHD, 2020).

Cook Shire Coastal Hazard Adaptation Strategy (CHAS), Phase 5 (GHD, 2020).

Cook Shire Coastal Hazard Adaptation Strategy (CHAS), Phase 6 (GHD, 2020).

Cook Shire Coastal Hazard Adaptation Strategy (CHAS), Phase 7 (GHD, 2020).

6. Acknowledgments

Cook Shire Council would like to acknowledge and thank the stakeholders who provided input into the Resilient Cape Strategic Plan.

The program has been predominantly funded by the Queensland Government and the Local Government Association of Queensland (LGAQ) through the QCoast2100 program.

The project team and council representatives would like to thank the state government and LGAQ program for the opportunity to undertake the CSC CHAS and the support and guidance provided through the process.

In partnership with the council, GHD Pty Ltd have led the development of the Hinchinbrook Coast 2100 strategy.



**Queensland
Government**



