ZENADTH KES

Coastal Hazard Adaptation Strategy

Torres Strait Island
REGIONAL COUNCIL

DRAFT

Foreword

For millennia – since Bipotaim - Torres Strait Islanders have demonstrated remarkable resilience and adaptability in the face of a dynamic and changing environment, guided by Ailan Kastom, Lore, and Law. Their unwavering connection to land, sea and sky - Zenadth Kes - has enabled them to sustainably manage and protect the region's rich cultural and ecological heritage.

Today, the Torres Strait faces unprecedented challenges due to coastal hazards, including coastal erosion, storm tide inundation, and sea level rise. In response to these pressing issues, the Zenadth Kes Coastal Hazard Adaptation Strategy has been developed to ensure that Torres Strait Island communities continue to thrive in harmony with their environment. This strategy weaves cultural knowledge and western knowledge, incorporating the best available science, management expertise, and insights from local communities and their leaders to address coastal hazards while preserving the region's unique cultural and ecological values.

The Zenadth Kes Coastal Hazard Adaptation Strategy has been supported by funding through the Queensland Government, in partnership with the Local Government Association of Queensland. It seeks to build on the momentum of other local, State, Commonwealth, and international initiatives to empower local communities in the decision-making process and to collaborate with various partners, including local, regional, and national stakeholders, in addressing coastal risks. The strategy emphasises the importance of integrating Indigenous aspirations, knowledge, needs and perspectives with contemporary scientific understanding, fostering a holistic approach to coastal adaptation and management.

Local communities and Councillors have been actively involved in shaping this strategy, expressing their deep desire to remain in their homeland and maintain the connection to Country and ancestors. Continued cultural adaptation cannot occur unless the people are in their own Country. Contributing their knowledge, vision, and desired outcomes for the region's coastal future, they have demonstrated their commitment to addressing the challenges and opportunities presented by coastal hazards. Together, they strive to develop effective pathways and mechanisms that ensure a sustainable and resilient future, allowing them to preserve their invaluable bond with the land and culture.

As we embark on this journey together, the Zenadth Kes Coastal Hazard Adaptation Strategy serves as a beacon, guiding us towards a sustainable and resilient future for our region and its people. It provides both operational leverage to enable government support, as well as community 'grass roots' leverage to encourage local ownership and support. Through open dialogue and meaningful engagement, we will continue to work in unity to develop and implement the most effective pathways and mechanisms to achieve our shared vision.

On behalf of the Torres Strait Island Regional Council and the Island communities we serve, we express our gratitude to those who have contributed their time, passion, effort, knowledge and wisdom in the development of this strategy. We are committed to working together under this guiding framework to navigate the challenges ahead and secure a vibrant and thriving future for our island communities and culture.

Acknowledgment of Country

We acknowledge the Kemer Kemer Meriam, Kulkalgal, Kaiwalagal Kaurareg, Maluligal, and Gudaw Maluligal Peoples as the Traditional custodians of the Torres Strait Islands. We pay our respects to their Elders past and present. We acknowledge the connection to Country by all Aboriginal and Torres Strait Islander Peoples of this region and their role in caring for and maintaining Land and Sea Country over thousands of years.

We also acknowledge the youngest and emerging generations of Aboriginal and Torres Strait Islander Peoples, for which this document and resulting actions will benefit most.

Summary

The Torres Strait Island Regional Council's (TSIRC) coastal areas boast a unique landscape, rich history, and diverse people. With islands encircled by tropical seas, it is distinctive Country, where the natural environment and traditional cultures intertwine and flourish together, creating an unparalleled connection to the land, sea and sky.

The TSIRC communities enjoy safe and easy access to the coast, preserving essential cultural connections to the sea. Activities such as fishing, hunting and gathering, and spending time by the water are highly valued. The coastal areas also host numerous plants and animals, such as coral reefs, sea turtles and dugongs, which are woven into cultural stories and practices, and are integral to the unique and cherished ecosystem.

Coastlines are inherently dynamic, continually changing with each tide and storm event. Erosion and flooding by seawater (also referred to as storm tide inundation) are natural processes that have shaped, and will continue to shape, the coast in the future. When these processes impact how we live on the islands, they are referred to as coastal hazards. The TSIRC coast is susceptible to coastal hazard impacts, driven by tropical cyclones, storm events, and annual trade or 'Kuki' winds. King tides already cause widespread inundation in many of the communities, and coastal hazard impacts are expected to increase with changing climate conditions and sea level rise.

The Queensland Government and Local Government Association of Queensland (LGAQ) provided funding to Queensland coastal councils to develop a strategic long-term approach to managing coastal hazards. With the funding awarded to TSIRC, we have been able to develop this Zenadth Kes Coastal Hazard Adaptation Strategy.

The Zenadth Kes Coastal Hazard Adaptation Strategy enables us to be better prepared in the future to reduce the negative impacts of coastal hazards on our communities, environment, cultural values, infrastructure, liveability, and essential services. This strategy is designed to benefit the TSIRC community both now and into the future (to 2100), ensuring that our children and their children can maintain their connection to Land and Sea Country, Zenadth Kes.

Contents

1. Introduction

The Torres Strait Island region is spread across an area of 48,800 km^2 in far north Queensland, extending from the northern-most point of mainland Australia (Cape York Peninsula) to Papua New Guinea (PNG). The region adjoins Torres Shire Council (TSC), Northern Peninsula Area Regional Council (NPARC) and PNG. Torres Strait Island Regional Council (TSIRC) represents the fifteen "outer" island communities that are bounded by the Coral Sea and Arafura Sea as shown in Figure 1, and are listed below with the European name in brackets.

Eastern cluster

- Mer (Murray Island)
- Erub (Darnley Island)
- Ugar (Stephen Island)

Central cluster

- Iama (Yam Island)
- Masig (Yorke Island)
- Warraber (Sue Island)
- Poruma (Coconut Island)

Southern cluster

- Kirriri (Hammond Island)

Western cluster

- Badu (Mulgrave Island)
- Arkai (Kubin) – Mua Island
- Wug (St Pauls) – Mua (or Moa) Island
- Mabuiag (Jervis Island)

Northern cluster

- Saibai
- Boigu (Talbot Island)
- Dauan (Mt Cornwallis Island)

Figure 1. *Torres Strait Island Regional Council area and communities*

1.1 People and communities

Eastern Islands *Kemer Kemer Meriam Nation*	Central Islands *Kulkalgal Nation*	Western Islands *Maluligal Nation*	Southern Islands *Kaiwalagal Kaurareg Aboriginal Nation*	Top Western Islands *Gudaw Maluligal Nation*
Mer (Murray Island) Erub (Darnley Island) Ugar (Stephens Island)	Iama (Yam Island) Masig (Yorke Island) Warraber (Sue Island) Poruma (Coconut Island)	Badu (Mulgrave Island) Mabuiag (Jervis Island) Moa: Arkai (Kubin) Community Wug (St Pauls) Community	Kirriri (Hammond Island)	Saibai (Saibai Island) Boigu (Talbot Island) Dauan (Mt Cornwallis Island)

TSIRC has a population of nearly 5,000 people of which over 90% identify as Aboriginal and/or Torres Strait Islander peoples[1]. The 15 communities that make up the Torres Strait Island local government area are made up of unique and diverse traditional language and dialect groups.

TSIRC communities are located on traditionally owned land and TSIRC provides municipal, land administration and other services. Native Title exists on all of the islands and claims have been settled on nearly all islands, except Kirriri (Hammond Island).

The communities that inhabit the Torres Strait region have strong cultural, social and spiritual connections with their land and sea country, and maintain their distinct Ailan Kastom, Lore and Law.

Many of these communities rely on hunting, fishing, trade and also partly on tourism. It is, therefore, important when considering coastal hazard adaptation strategies to also consider impacts on these industries and local economies and to preserve the scenic amenity of important natural coastlines, views, natural aesthetics and cultural sites in the region.

[1] Australian Bureau of Statistics - Torres Strait Island (R) (LGA) (36960) Regional Summary - https://www.abs.gov.au/

Ailan Kastom

Ailan Kastom (Island Custom) is the system of knowledge, traditions, laws, protocols, and practices that maintain Torres Strait Islanders' relationships with others and their connections to country.

This body of knowledge has been passed down through generations by tribal leaders and Elders to heads of clans and kin through sit downs, cultural teaching, song, dance, myths, legends, art, and stories. In the Torres Strait, each tribal group has its own parliamentary and social system for creating and managing all the associated processes and protocols applicable to the communal structure.

It is important to recognise that Lore/Kastom, like law, can respond to change by absorbing contemporary influences and adapting to its consequences (e.g. Coming of the Light).

Source: TSRA

1. Introduction

1.2 Geography, ecology and climate

The Torres Strait region is known for its ecological complexity, biodiversity and relatively pristine marine and island environments. The region provides a multitude of habitats for the highly diverse Indo-Pacific marine flora and fauna, including dugongs, crocodiles and marine turtles. It has the largest continuous area of seagrass meadows in the world, significant areas of coral reefs with high biodiversity, extensive areas of mangroves, and productive fisheries.

The landscape has been shaped through the millennia by natural processes of wind, water, and waves. The continual cycles of sand loss (erosion) and rebuilding (accretion) of the shoreline and flooding of coastal areas by king tides and storms, are all part of these natural processes. These processes are referred to as coastal hazards when they have the potential to impact infrastructure, access, services, the economy and our lifestyle and culture.

The region has a tropical climate with mean temperatures of around 25-30 °C and mean annual rainfall of over 1,700 mm. Few tropical cyclones directly impact the region given the proximity to the equator, however cyclone or low-pressure events can still occur and impact communities.

Due to their remoteness, often low land elevations and limited capacity to respond and adapt to additional social, financial and ecological stressors, indigenous island communities are recognised as being on the front line of climate change impacts. Furthermore, impacts on the marine environment pose a significant threat to the livelihood and culture of Torres Strait Island communities.

Seasons in the Torres Strait

Torres Strait Islanders associate themselves with the land, the sea and the sky. These are interwoven through spiritual beliefs, stories, songs and dances. There are four seasons associated with the wind changes in the environment - Kuki, Sager, Zey and Nay Gay.

KUKI (pronounced Cook-ee):

- North-West winds (strong winds)
- Blows from January until April
- Wet Season (monsoon)

SAGER (pronounced Sa-gerr):

- South-East trade winds
- Blows from May until December
- Dry season

ZEY (pronounced Zay):

- Southerly winds
- Blow randomly throughout the year

NAY GAY (pronounced Nai-gai):

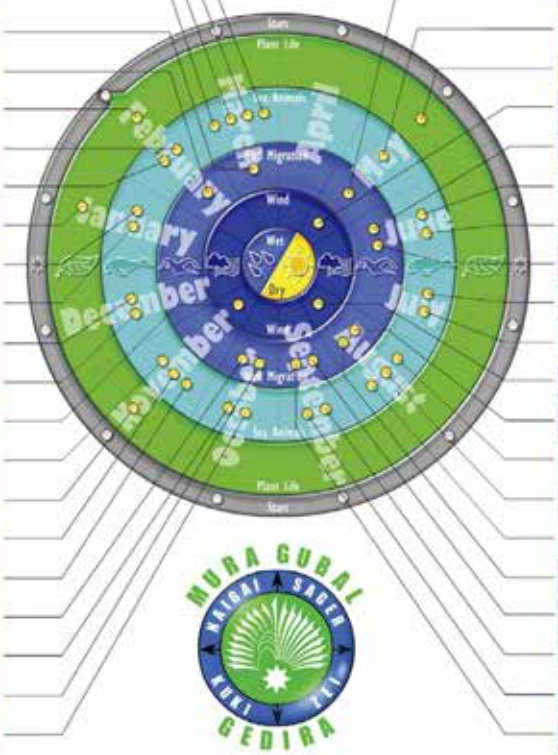
- Northerly winds
- Blows from October until December
- Season when both heat and humidity are at their highest

Source: Gab Titui Cultural Centre

Torres Strait Islander Seasonal Calendar

Designed by Steve Foster. Additions by Jeff Aniba-Waia and Steve Grady.

Tunic/Teneb (Sea Perch)	Sea Perch are plentiful
Dangal/Degar (Dugong)	Dugong start to produce young
Dubai/Dab (Mackeral)	Mackeral are plentiful
Koedal (Crocodile)	Crocodile found in swamps
Gidi Gidi/Niporoporo (Ducks)	Ducks leave the swamps
Waumer (Frigate Bird)	Frigate birds are plentiful
Uzi/Sorbi	Fruit is ripe, trees in flower
Zaber/Zab (Garfish)	Garfish are plentiful
Kaiar/Kairr (Crayfish)	Crayfish come back to the reef
Uzu/Sorbi	Fruit starts to ripen
Bidai/Gele (Cuttlefish)	Squid are plentiful
Barramundi	Found in creeks and swamps
Waru Kakur (Turtle Eggs)	Turtle eggs are plentiful
Tup (Sardines)	Sardines are hatched
Naigai/Naiger	Seas are dead calm
Zaber/Zab Garfish	Garfish are plentiful
Bell Fruit	Starts to ripen
Dangal/Degar (Dugong)	Dugong produce young
Tupmul (Stingray)	Found near the beach
Awai/Gawer (Pelican)	Found around drying swamps
Barramundi	Easy to catch as swamps are dry
Dollarbirds	Dollarbirds are seen
Tup (Sardines)	Go out to sea to spawn



Biru Biru (Rainbow Birds)	Biru Biru appears
Waru/Nam (Green Turtle)	Turtles come up to lay eggs
Uru Gubau (Sweet Potato)	Plant Sweet Potato
Kuki/Koki (NW Monsoon)	Seas are rough, start of Zogob
Gidi Gidi/Niporoporo (Ducks)	Ducks return to the swamps
Kaiar/Kairr (Crayfish)	Crayfish get new skin
Barramundi	Found in swamps
Waumer (Frigate Bird)	Waumer are plentiful, fly low
Werzi/Gib (Stonefish)	Come to edge of the beach
Bidai/Gele (Cuttlefish)	Bidai and Kaura found on beach
Sager	Strong winds, seas are rough
Ginau/Daumer (TS Pigeon)	Fly from PNG to Australia
Saibei (Unicorn Letherjacket)	Found on surface near reefs
Koedal (Crocodile)	Starts to build nest and lay eggs
Kaiar/Kairr (Crayfish)	Leave the reef
Biru Biru (Rainbow Birds)	Greater numbers Turtle season
Ginau/Daumer (TS Pigeon)	Fly to PNG from Australia
Waru/Nam (Green Turtle)	Mating season for green turtle
Kagui (Prawns)	Prawns found in swamps
Biru Biru (Rainbow Birds)	Travel south in great numbers

2. Yumpla plan, for Yumpla home and Yumpla future

2.1 Context

The QCoast$_{2100}$ Program is a state-wide initiative of the Queensland Government and Local Government Association of Queensland (LGAQ). Its purpose is to help coastal councils proactively plan for managing coastal hazard impacts, from present day to 2100.

The Torres Strait Island Regional Council was awarded funding through the QCoast2100 Program to develop a locally specific Coastal Hazard Adaptation Strategy (CHAS).

The *Zenadth Kes Coastal Hazard Adaptation Strategy* (the Strategy) has been:

- developed to proactively manage the impact of coastal hazards now and for our children and our children's children
- developed in close consultation with Council, community leaders, and regional and local stakeholders
- tailored to develop local adaptation plans for each of the 15 distinct TSIRC island communities.

2.2 Purpose

The purpose of the Strategy is to:

- foster collaboration and the shared custodianship of our communities.
- inform future decisions regarding the protection and management of our coast, foreshore areas, and other areas impacted by coastal hazards.
- inform future land use and master planning
- guide the management of public utilities, facilities and services such as water supply, wastewater, roads and boat ramps
- inform the management of areas of environmental and cultural significance

2.3 What information is in the Strategy

The Strategy includes an overview of:

- coastal features that are important and meaningful to the local community (values)
- a description of the types of coastal hazards that may be experienced in the TSIRC area including areas that may be exposed in the future to erosion and tidal inundation and storm tide inundation.
- the implications of this exposure (risk) including potential cultural, environmental and economic impacts
- Council's approach to managing these impacts and details on how the Council and community can adapt to future coastal hazards, including a framework for shared responsibilities, adaptation responses and options
- Council wide actions to promote community resilience
- local adaptation plans with specific adaptation actions for each community
- a plan for implementation and continual review and improvement.

2.4 How we developed the Strategy

The Zenadth Kes Coastal Hazard Adaptation Strategy has been developed using a specific process outlined in the QCoast2100 Minimum Standards and Guidelines[2] (Figure 2).

The process has included a series of technical studies and activities that sought to:

- identify coastal hazard areas
- understand vulnerabilities and risks to local community assets and infrastructure (e.g. roads and buildings)
- engage with the community to understand their preferred approach to managing and adapting to coastal hazards
- determine adaptation actions, costs, priorities, responsibilities and timeframes for implementation.

[2] (LGAQ and DEHP 2016)

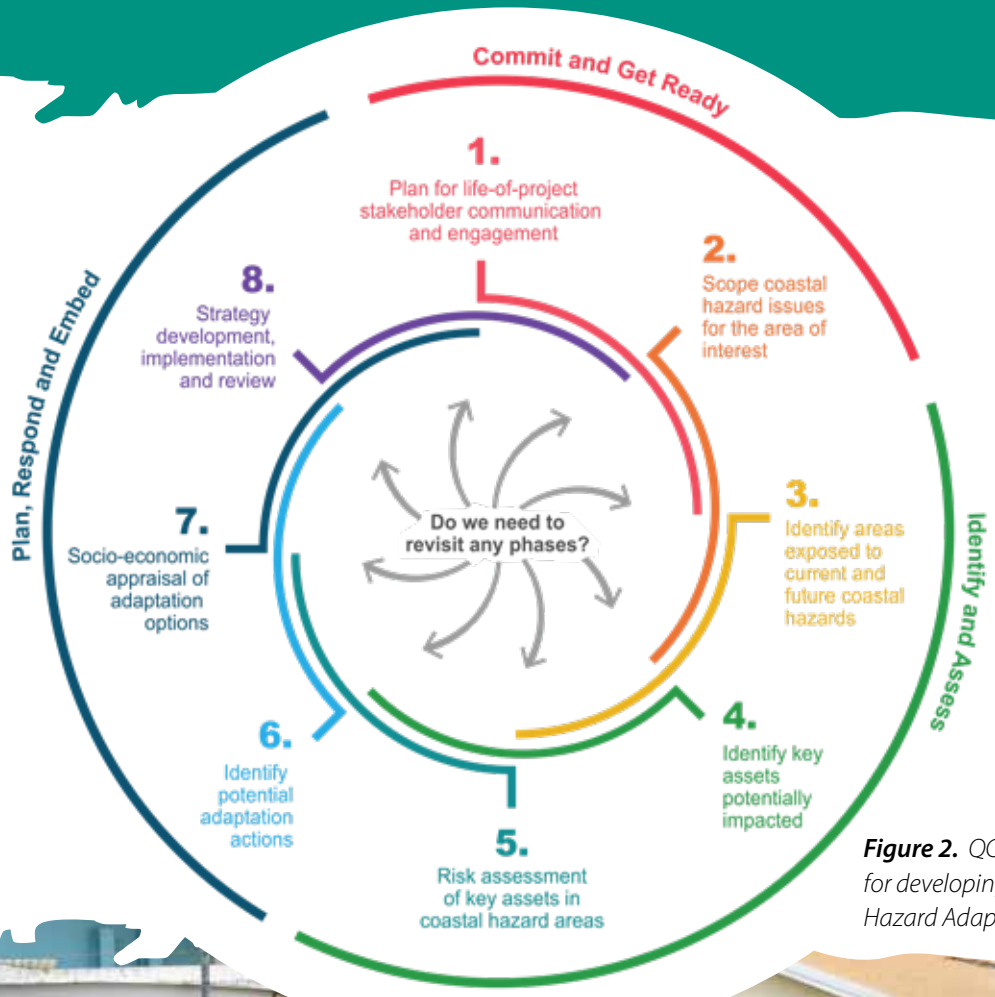


Figure 2. *$QCoast_{2100}$ process for developing a Coastal Hazard Adaptation Strategy*

2. Yumpla plan, for Yumpla home and Yumpla future

2.5 Listening to the community

The Zenadth Kes Coastal Hazard Adaptation Strategy has been informed by conversations with community leaders and key stakeholder groups over a period of nearly 18 months in 2021-2023.

Many engagement activities were undertaken during the development of the Strategy including:

- Targeted and ongoing conversations with Councillors, Traditional Owners, community leaders and council staff.
- An initial one-day workshop with elected Councillors and council staff.
- Engaging with Councillors, Traditional Owner representatives, Local, State and Commonwealth representatives, Non-government organisations and academics at the Torres Strait Regional Authority's *Stronger Together - Responding to Climate Change in the Torres Strait* two-day workshop.
- Workshops with council staff, including executives and on-ground project managers.
- A workshop with a project working group comprising the Councils Climate Change Adaptation and Environment Committee, as well as executive staff representatives.
- A two-day forum with elected Councillors and youth representatives.

These workshops were particularly useful in incorporating on-island understanding for each community. The outcomes from these workshops have helped inform the pathways and actions contained in this Strategy. An overall vision for the Torres Strait region is presented in Section 4, and specific island values are captured in the community profiles.

Local radio, as well as Council's website and social media pages were used to publicise specific events, share information, and encourage participation.

2.6 The next generations

Climate change and adaptation strategies will significantly impact the lives of younger generations. They will live with these decisions long-term and should, therefore, have a say in them. Including the younger generation in the conversation ensures that the efforts initiated today will be continued in the future. They are the torchbearers who will carry forward the strategies and actions implemented by today's leaders.

A group of Torres Strait Islander high school students, representing the next generation attended the workshop with elected Councillors. The students' presence at the workshop with elected leaders offered several valuable opportunities:

- **Intergenerational transfer of knowledge** - Being part of the workshop allowed the students to gain firsthand insight from experienced leaders, providing them with the opportunity to learn from those who have been navigating community and regional challenges.
- **Voice and empowerment** - Participating in such workshops empowers the younger generation. It gives them a platform to voice their concerns and ideas and fosters a sense of responsibility towards their community and the issues it faces.
- **Leadership development** - Exposure to leaders and decision-making processes at a young age is a powerful way to groom future leaders. The experience of engaging with elected leaders, such as through a Youth Council, provides students with practical knowledge about leadership, governance, and civic responsibility.

Such initiatives will work to bring the younger generation into the conversation and enhance intergenerational decision-making and collaboration.

3. What are coastal hazards?

Our islands and coastline experiences constant, and often rapid change. Wind, waves, tides and currents continually work to move sand and sediment to shape the shoreline. Seasonal weather patterns and extreme weather events such as king tides and tropical cyclones can periodically result in significant erosion and flooding by sea water.

When these processes threaten local values, infrastructure, or our island way of life, they can be considered coastal hazards.

Coastal hazards include erosion of the shoreline (both short-term and long-term), tidal inundation (increasing with sea level rise), and temporary flooding of low-lying coastal land (storm tide inundation).

3.1 Island types

The different islands in the Torres Strait are exposed to different hazards based on their morphology. They can be categorized into three morphology types, each with its own unique characteristics and susceptibility to coastal hazards. Understanding the unique characteristics and coastal hazards of each morphology type is crucial for effective coastal management and ensuring the safety of island communities in the Torres Strait.

Coastal Hazards

Coastal hazards are when natural coastal processes threaten local values, properties, or our local way of life. Some coastal hazards include storm tide inundation, erosion, and tidal inundation.

Erosion

Erosion is when coastal forces such as waves, winds, tides and currents remove sand from the beach and move it offshore. This can cause the shoreline position to move landwards. Big erosion events can threaten buildings, roads and important cultural areas.

Tidal inundation

Tidal inundation is when normal astronomical tides cause flooding of low-lying coastal land. Areas exposed to tidal inundation are expected to periodically flood. With global average sea levels expected to rise, areas effected by tidal inundation are also expected to increase.

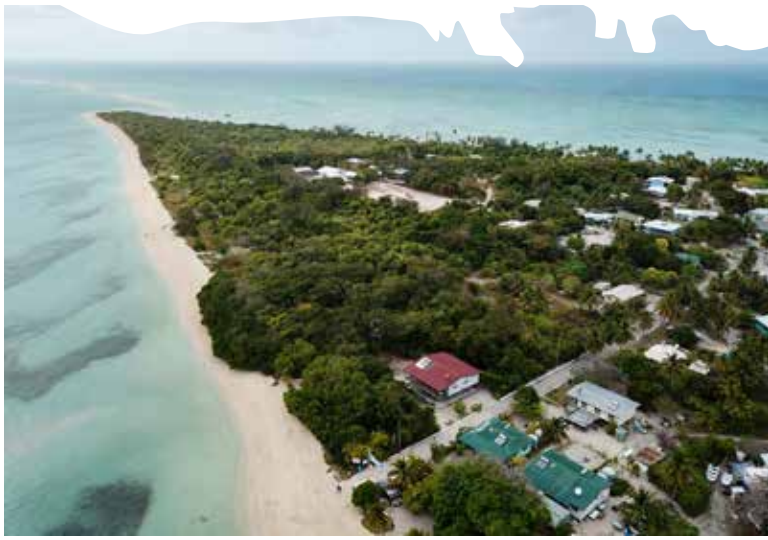
Storm tide inundation

Storm tide inundation is when big storms cause temporarily higher water levels leading to flooding of normally dry land. Storm tide inundation is often accompanied by big waves and strong winds which together can cause widespread destruction.

Coral cays

(Examples include Masig, Poruma, and Warraber)

- formed on top of coral reefs from sedimentary debris produced from the reef and surrounding marine environments
- highly mobile, particularly when affected by longshore currents, wind, and wave forcing over long periods
- low-lying and susceptible to coastal hazards due to geology and elevation constraints



Masig, a coral cay island

Continental islands

(Examples include Badu, Dauan, Erub, Iama, Kirriri, Mabuiag, Mer, Moa, and Ugar)

- generally stable in nature and formed by a large volcanic and granite rock base with small coastal fringes and embayments
- often, fringing reefs may form around the islands, offering some protection to the coastline from ocean waves
- townships on these islands are generally exposed to coastal hazards due to their location on the coastal fringe

Erub, a continental island

Delta islands

(Examples include Boigu and Saibai)

- low lying delta islands formed from the deposition of sediments from Papua New Guinean river systems.
- susceptible to all coastal hazards due to low elevation and soft sediments
- predominately support mangrove swamp vegetation and are prone to flooding.

Boigu, a delta island

3. What are coastal hazards?

3.2 Coastal erosion

Coastlines naturally erode and accrete periodically over time, driven by sediment supply, tidal currents and waves.

Short-term erosion

Coastal erosion occurs when winds, waves and coastal currents take sand away from the shoreline. This can be a temporary change, often associated with storm activity (termed storm bite), and the beach will then gradually rebuild (Figure 3).

When a beach is stable, all the sand moved offshore during a storm eventually moves back onto the beach (potentially taking months to years). In this case, short-term beach erosion does not result in a long-term landward movement of the shoreline.

Long-term erosion

In other cases, due to changing sediment supply or climate conditions, the beach may not be able to rebuild between storm events. Without intervening, long term erosion (termed recession) may occur, which is the landward movement of the shoreline over a longer timeframe (decades).

Both short term and long-term erosion processes may impact on coastal assets, depending on how close to the shoreline assets are located.

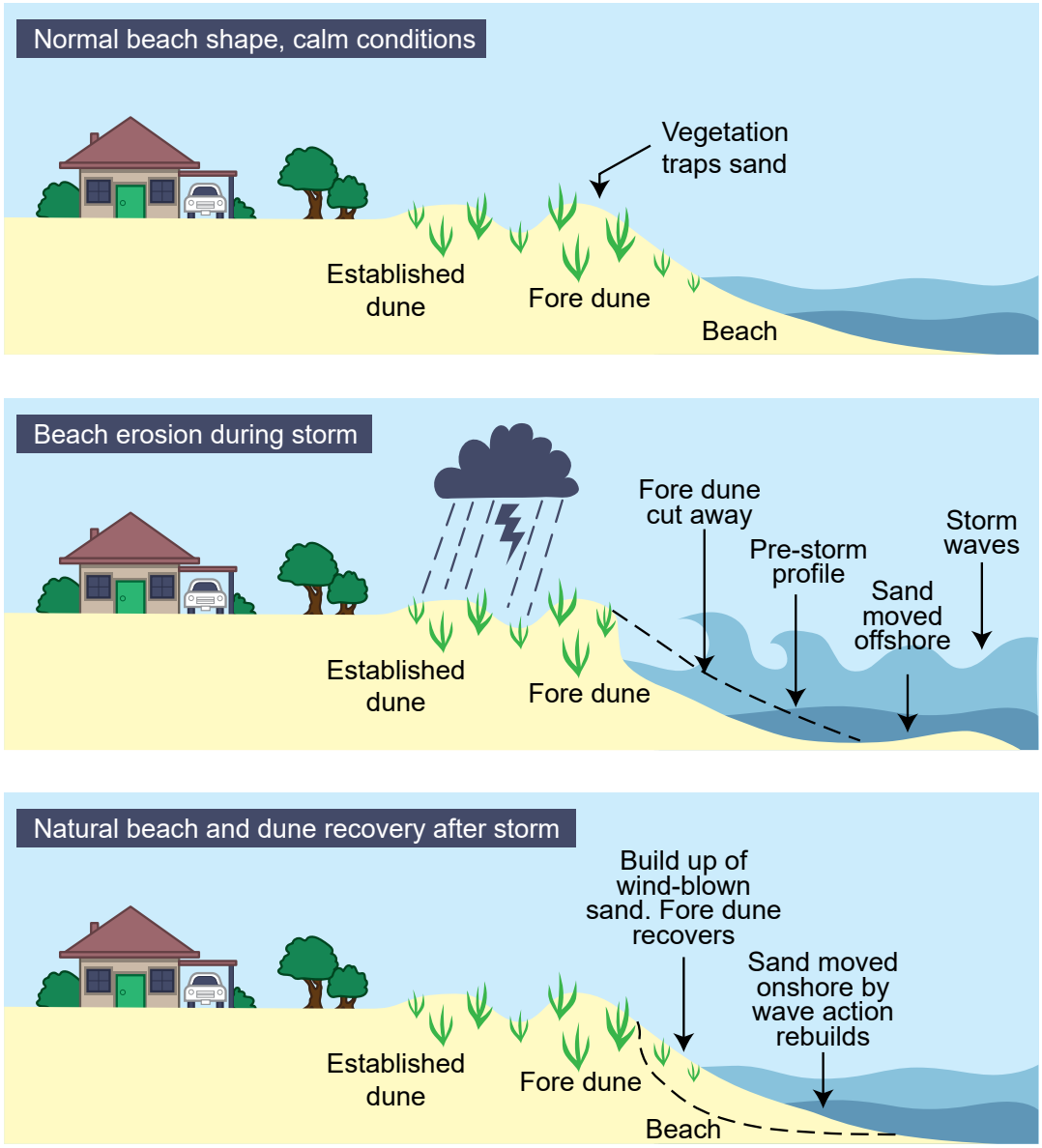


Figure 3. *Natural short-term erosion and dune rebuilding process*

3.3 Tidal inundation due to sea level rise

Tidal inundation is regular flooding from the tidal cycle, including up to the Highest Astronomical Tide (HAT). Very high tides, also known as spring tides (commonly referred to as king tides), can impact low lying areas. This can lead to increased damage especially if a spring tide coincides with a cyclone or other storm. Areas of low-lying coastal land will experience increasing tidal inundation with sea level rise. A 0.8 m sea level rise by 2100 is currently planned for by the Queensland State Government, however actual levels of sea level rise remain uncertain due to various factors including future global greenhouse gas emissions.

Some communities in the Torres Strait are impacted annually by inundation during spring tides, affecting houses, infrastructure, community facilities, cultural sites and coastal ecosystems. Inundation can result in coastal erosion, further threatening community assets.

3.4 Storm tide inundation

Storm tide inundation is the temporary flooding of low-lying coastal land from a locally raised sea level (the 'storm tide'). The storm tide is a combination of the normal tide, storm surge, and wave action (Figure 4). Storm surge is driven by the low atmospheric pressure and high winds associated with events such as tropical cyclones.

Storm tide inundation, like tidal inundation, can cause damages to houses, infrastructure, community facilities, cultural sites and coastal ecosystems. However these impacts can be of higher magnitude, given it is likely to impact areas not usually inundated on a regular basis.

Some communities in the Torres Strait are impacted by storm tide inundation, and these areas are likely to increase as mean sea level rises over time and storms increase in frequency and severity.

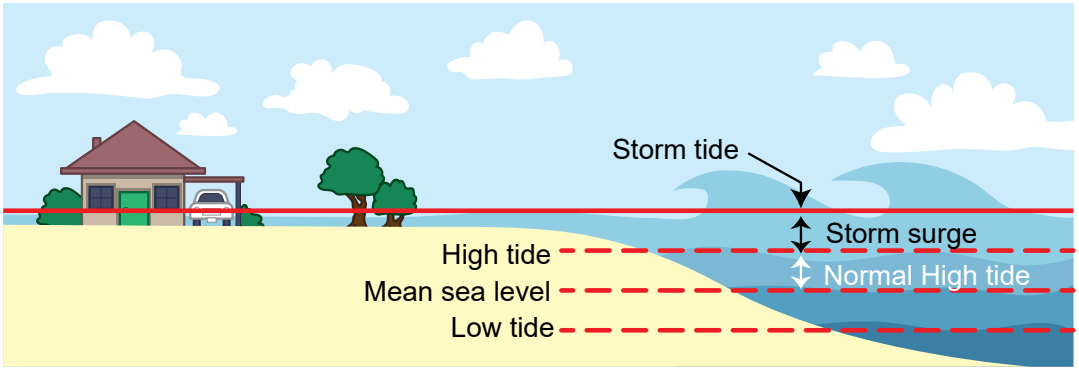


Figure 4. *Components of storm tide (Source: coastadapt.com.au)*

3. What are coastal hazards?

3.5 Current and future exposure

Updated mapping

As part of the Strategy, the existing mapping for Erosion Prone Areas and predicted storm tide inundation zones have been updated for the TSIRC communities. These updates are based on the best available technical data[3], and have included:

- new modelling of open coast erosion
- application of the Queensland Government approach to defining Erosion Prone Areas, tailored to TSIRC in consultation with State and LGAQ
- mapping permanent inundation due to SLR using the current day Highest Astronomical Tide (HAT) extents with a progressive SLR.
- mapping storm tide inundation using probabilistic extreme water levels for each community.

Based on the state-wide approach to mapping, the Erosion Prone Area includes components of:

- **Open coast erosion:** A calculated component of open coast erosion potential, informed by erosion modelling
- **Tidal areas:** the combined area inundated by the (HAT) plus a defined horizonal buffer, plus any additional area inundated due to sea level rise.

As required by the Queensland Government, a projected sea level rise of 0.8 m by 2100 has been adopted for the Strategy (with 0.3 m by 2050). The Queensland Government's projections are based on climate modelling presented to the Intergovernmental Panel on Climate Change (IPCC), however there is still much uncertainty about how quickly these changes will occur and by how much they will change locally.

AEP

Annual Exceedance Probability, or AEP, is the likelihood that certain conditions will occur in a given year. AEP values are based on computational modelling that considers measured coastal data and multiple thousands of simulated scenarios.

Planning horizons

Planning horizons are points in the future for which strategic decisions are made. This Strategy considers planning horizons of present day (2020), 2050, and 2100.

Mapping for both erosion and storm tide inundation includes multiple planning timeframes or horizons and considers a 1% annual exceedance probability (AEP) meaning that mapped conditions have a 1% chance of occurring each year. Tidal inundation for the HAT was also mapped for multiple planning horizons.

Hazard	AEP	Planning horizons
Storm tide inundation	1%	Present day, 2050, 2100
Erosion	1%	Present day, 2050, 2100
Tidal inundation	HAT	Present day, 2050, 2100

Erosion Prone Areas and storm tide inundation zones do not represent a predicted loss of coastal land. The maps provide an indication of areas that may be exposed to erosion or inundation processes (now or in the future), and in many cases the impacts can be avoided, minimised or managed through adaptation planning.

Hazard maps for each community are provided in Supplement B to the Strategy.

Additional detail on the mapped components and the approach is provided in the Phase 3 summary report (TSIRC 2020).

[3] Refer to Phase 3 Summary Report (TSIRC 2020)

3.6 Coastal hazard risk

Coastal hazard risk is the possibility of loss, damage, or injury arising from coastal hazards. As part of the Zenadth Kes Coastal Hazard Adaptation Strategy, technical assessments have been used to determine the coastal hazard risk for a range of assets that exist in the communities.

Risk is assessed based on the likelihood of an asset being exposed to a coastal hazard, combined with the consequence of that exposure.

Likelihood

Likelihood describes how common or rare an event is. Likely events are expected to happen regularly and multiple times within the average lifespan. Possible events are expected to happen every so often and a few times in the average lifespan. Rare events are unusual and might occur once or twice in the average lifespan.

Consequence

The potential impact or outcome of exposure to a hazard, considering the severity and extent of damage or harm.

Risk

The assessment of likelihood and consequence, evaluating the probability of exposure to a hazard and the potential impact or harm it can cause.

The risk assessment has included analysis of:

- data on infrastructure assets (drainage, sewerage, electricity, telecommunications, stormwater, water supply, and roads)
- information on homes and other buildings
- coastal protection structures such as sea walls and other beach and foreshore assets such as boat ramps and barges
- cultural heritage sites and sites of cultural and historical significance
- the Zenadth Kes Planning Scheme and TSIRC Islands Master Plans

To complete the risk assessment:

- The likelihood of exposure (likely, possible, rare) was determined for each asset / land parcel, separately for erosion and tidal inundation and storm tide inundation
- The consequence of exposure (insignificant, minor, moderate, major, catastrophic) was determined for each asset / land parcel, separately for erosion and inundation
- Coastal hazard risk was assessed (low, medium, high, very high), based on the likelihood and consequence for each asset / land parcel, separately for erosion and inundation.

The risk matrix in Table 1 was used to determine a risk profile for individual assets and areas. On a community wide scale, this information was used to determine the risk profile for each island, for all three coastal hazards.

A tailored approach to assessing consequence was developed, based on community feedback on the important elements for the coastal zone (lifestyle, coastal access, public safety, environmental values, cultural landscapes, property and infrastructure, and economy and growth) (Table 2).

Table 1. Risk matrix

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	Likely	Low	Medium	High	Very high	Very high
	Possible (1% AEP)	Low	Medium	Medium	High	Very high
	Rare	Low	Low	Medium	Medium	High

3. What are coastal hazards?

Table 2. Consequence categories (modified from LGAQ and DEHP 2016)

	Community and lifestyle		
	Lifestyle	**Access**	**Public safety**
Consequence	Considers elements of modern and traditional lifestyle such as community services, cultural connection, recreational and social activities and day to day business activities.	Considers access for recreational activities such as boating and fishing, as well as access to areas used for hunting, gathering and cultural / ceremonial sites.	Considers threats to human health and safety such as injury, disease, mental and physical wellbeing.
Catastrophic	Widespread semi-permanent impact (~1 year) to highly utilised community services, wellbeing, or culture of the community with no suitable alternatives.	Widespread and permanent impact on access to key sites and activities. Recovery unlikely.	Loss of lives and/or permanent disabilities.
Major	Major widespread long-term (~1 month) disruption to well-utilised services, wellbeing, or culture of the community with very few alternatives available.	Severe and semi-permanent impact on access to key sites and activities. Full recovery may take many years.	Widespread serious injuries/ illnesses.
Moderate	Minor medium-to long-term (~1 week) or major short-term disruption to moderately utilised services, wellbeing, or culture of the community with limited alternatives.	Substantial impact on access to key sites and activities requiring significant works to repair or restore access. Full recovery may take less than 1 year.	Isolated serious injuries/ illnesses and/or multiple minor injuries/ illnesses.
Minor	Small to medium short-term disruption (~1 day) to moderately utilised services, wellbeing, finances, or culture of the community with some alternatives available, or more lengthy disruption of infrequently utilised services.	Small to medium short term disruption of access to key sites and activities which may require some works to repair or restore access.	Minor and isolated injuries and illnesses.
Insignificant	Very small short-term disruption (~1 hour) to services, wellbeing, finances, or culture of the community with numerous alternatives available.	Very little to no impact on access to key sites and activities.	Negligible injuries or illnesses.

Environment	Place and planning		
Environmental values	**Cultural landscapes**	**Property and infrastructure**	**Economy and growth**
Considers elements such as ecological values, ecosystem services, and cultural and traditional uses.	Specific consideration of traditional cultural values and the ability to maintain and pass on traditional knowledge and practices to future generations	Considers the threat of damage to built assets and any interdependencies such as regional access and ability to deliver critical services	Includes existing business and potential economic growth opportunities, especially for locally owned and operated enterprises.
Severe and widespread, permanent impact on multiple regionally or nationally significant environmental values of the region. Recovery unlikely.	Severe and widespread, permanent impact on multiple sites of cultural significance, including loss of land, connection to land, and ability to continue traditional practices. Recovery unlikely.	Widespread major damage or loss of property or infrastructure with total value >$5 million. Full recovery/repair may take many years.	Regional economic decline, widespread business failure and impacts on state economy.
Severe and widespread semi-permanent impact on one or more regionally or nationally significant environmental values of the region. Full recovery may take many years.	Severe and widespread semi-permanent impact on one or more sites of cultural significance, including loss of land, connection to land, and ability to continue traditional practices. Full recovery may take many years.	Major damage or loss of property or infrastructure with total value >$1 million. Full recovery/repair may take several years.	Lasting downturn of local economy with isolated business failures and major impacts on regional economy.
Substantial impact on one or more locally significant environmental values of the region. Full recovery may take several years.	Substantial impact on one or more sites of local cultural significance.. Full recovery may take several years.	Moderate - major damage to property or infrastructure with total value >$250,000. Full recovery may take less than 1 year.	Significant impacts on local economy and minor impacts on regional economy.
Small, contained and reversible short-term impact on isolated ecosystem services and natural features of the region. Full recovery may take less than 1 year.	Small, contained and reversible short-term impact on sites of cultural significance. Full recovery may take less than 1 year.	Minor damage to properties or infrastructure with total value >$100,000.	Individually significant but isolated impacts on local economy.
Little to no environmental impact.	Little to no impact to sites of cultural significance.	Minimal damage to properties or infrastructure with total value >$25,000.	Minor short-term impact on local economy.

4. A vision for resilient TSIRC islands and communities

4.1 What is resilience?

Updated mapping

Safe and healthy resilient islands have social, economic and environmental strategies in place to avoid, and reduce the impact of hazardous events or disturbances (e.g. coastal hazards). These strategies are discussed in Section 5.

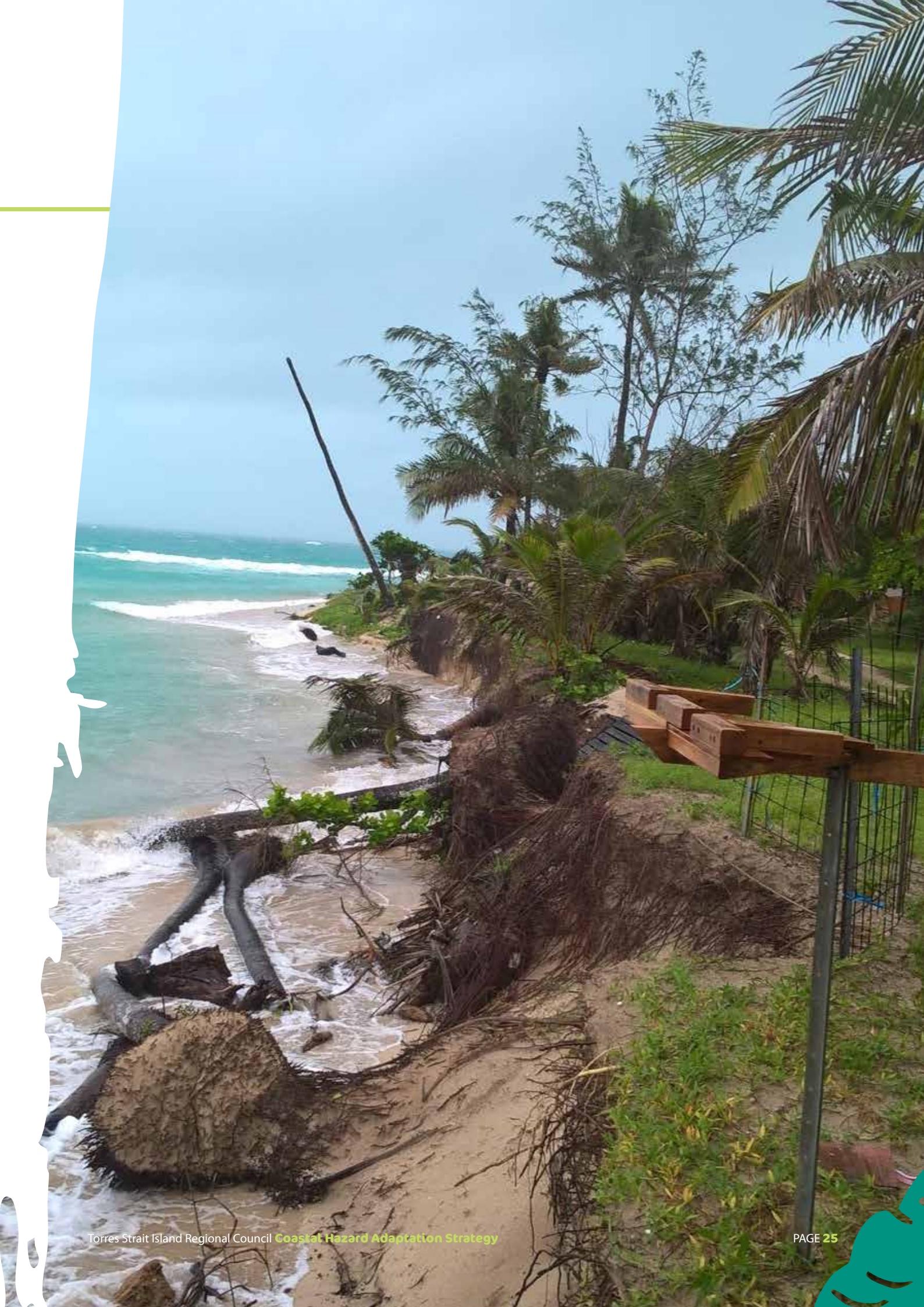
There are many ways we can improve resilience for our islands. Caring for our coast and keeping it clean and healthy increases the natural resilience of our coast. Understanding natural processes helps to avoid and reduce exposure to coastal hazards, making our beaches safer and more resilient. Resilient islands have the ability for the beaches and coastlines to respond to or reorganise in ways that maintain natural processes and the values of the region, while also being able to proactively adapt to change.

Resilience also applies to communities. A knowledgable, and prepared community can cope with the impacts of coastal hazards, and recover swiftly and efficiently when disruptions occur. Resilient communities actively participate in preserving their coastal environments, implementing sustainable practices to reduce harm and potential threats. They understand the role of the local ecosystem in mitigating climate impacts and utilise this knowledge to develop adaptive, eco-conscious strategies.

Specific actions to improve our resilience and support our strategies to avoid and reduce the impacts of coastal hazards are defined in Section 6.

Resilience

Resilience is the ability for something to withstand stress and continue to function and recover from damage. Resilience applies to the coastal environment as well as the community. Resilience happens when coastal ecosystems are clean and healthy, and when the community is prepared and safe for coastal hazards.



4. A vision for resilient TSIRC islands and communities

4.2 Values and threats

The coastal landscapes of the Torres Strait islands hold importance not just for their breathtaking beauty, but also for their central role in our daily lives and overall wellbeing.

These areas are where land meets sea, where the rhythm of human life harmoniously intertwines with the ebb and flow of the sea. They are the lifeblood of our community. Not only do they help us get to and from the water but they shield us from the elements, serving as buffers against high tides and storms.

Our coasts and beaches are places where people come together, fostering connections amongst individuals, families, and the community at large. They set the stage for social and cultural activities, strengthening our bonds and facilitating the transmission of our rich cultural heritage.

Our coastal zone plays host to a diverse array of flora and fauna, including nesting and migratory coastal birds and marine turtles. The preservation of these vital habitats is crucial, underscoring our commitment to ecological stewardship and biodiversity conservation.

In essence, our coastline embodies our identity, encapsulates our shared culture and history, and is a testament to our enduring commitment to sustainability and harmony with nature.

Threats:

1. **Climate change** - Rising seas, extreme weather, and changing ecosystems pose a direct threat to our coastline and way of life.
2. **Coastal erosion and inundation** - This ongoing issue threatens our homes, infrastructure, and culturally significant sites.
3. **Biodiversity loss** - Habitat loss, and climate change could upset our local ecosystems.
4. **Cultural erosion** - Without proper preservation efforts, significant cultural sites, knowledge, and practices are at risk.
5. **Economic instability** - A reliance on natural resources means changes in their availability can greatly impact our local economy.

Interpreting climate change through Yumpla culture

- *Insights from the two-day Councillors workshop*

When examining climate change, we must intertwine it with our lived experiences and traditional knowledge. A significant transformation in our seasonal weather patterns is evident. Periods traditionally associated with dry conditions are now experiencing increased rainfall, indicating that climate change is disrupting our conventional understanding of the seasons.

This shift in weather patterns affects migration and breeding of species, crop growth, and cultural activities deeply tied to these seasons. Our traditional knowledge interprets the messages from the stars and changing seasons, which guide our actions on land and sea, demonstrating that all elements of our life are interconnected and influenced by our surroundings.

With the changing climate, these time-tested signals are becoming less predictable.

Story from the heart

- *Pastor Collin Messa*

Collin was born on Mer Island but is now a Masig community member, where he lives with his family, works and finds peace.

When Collin came to Masig he found this coconut tree in an isolated section of the beach, this beautiful tree standing there alone.

I would go there often; it was my place, a place where I could reflect, feel safe and at peace. It was also a place for me to carry out my hobbies, I would come here to cast nets to catch fish and often rest in the shade of the tree. Through time, I could see the waves get larger and after storms would see the sand get moved around and waves hitting against the tree. My safe place was being damaged by climate change.

As each storm passed, the tree began to fall. Each time I would visit the tree I would take a picture capturing the changes before me and for every inch the tree tilted over, more of me began to sadden, as I knew that one day this tree that I have loved and would come to for solace and peace would be gone forever, and there is nothing I could do about it.

The tree has now fallen and I have lost my special space, the place where I felt connected to place (land, sea and sky), could go to reflect and dream. It is these spaces that coastal hazards will be impacting and it is important to safeguard these areas for our future generations.

4. A vision for resilient TSIRC islands and communities

4.3 Goals and aspirations

The goals and aspirations represent what the community want the coastline to look like for their children and their children's children.

Community concerns and threats to achieving these goals and aspirations have also been identified and will also help to prioritise the selection of adaptation options. The threats directly and indirectly relate to the risk of coastal hazards in the Torres Strait Islands.

GOALS:

1. **Holistic coastal health:** Strive for a coastline thriving with diverse ecosystems and wildlife.
2. **Cultural preservation:** Uphold and honour our rich cultural heritage and sites of significance.
3. **Sustainable resource management:** Promote the sustainable use of our natural resources to protect the community's livelihood and the environment.
4. **Resilient development:** Build infrastructure that can endure coastal hazards and future environmental changes.
5. **Aware and active community:** Foster a well-informed community actively participating in coastal

ASPIRATIONS:

1. **Ecological harmony:** Aspire to live in harmony with our natural surroundings, preserving the delicate balance of our unique ecosystems.
2. **Cultural continuity:** Preserve and pass on our rich cultural traditions and knowledge to future generations.
3. **Thriving local economy:** Support a vibrant local economy that is sustainable and respects our natural resources.
4. **Self-sufficient community:** Aspire to be a resilient community capable of independently managing natural disasters and emergencies.
5. **Climate-conscious community:** Encourage a community that is educated and proactive about climate change and sustainable practices.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5. How can we adapt to future coastal hazards?

5.1 Framework for adaptation

A strategic approach

Across Australia and internationally, coastal land managers are taking a strategic approach to managing the risk of coastal hazards and enhancing the resilience of our coastal zones.

Common elements of this strategic approach include:

- Identifying **adaptation objectives** that align and support community values, goals and aspirations.
- Assigning a strategic **adaptation response** to different communities, to guide decision making with an adaptation pathways approach across present day, intermediate and long-term future planning horizons.
- Assessing the range of **adaptation options** suitable in different locations to help avoid, mitigate, and manage the risk of coastal hazards.

Adaptation

Adaptation is adjusting to actual or expected conditions and events. Adaptation can have good or bad outcomes and should be guided by understanding the desired state of being. Good adaptation to coastal hazards means taking action to reduce risk and increase resilience.

- Developing a **strategic plan** (this document) for coastal adaptation over the long term (to 2100), with prioritised actions over the short to medium-term (5—10 years).

A tailored approach has been developed to guide decision making on adaptation response and options across the TSIRC communities.

Adaptation objectives

The goals and aspirations of the community have informed the development of a number of objectives for future coastal hazard adaption, management and investment.

The purpose of clarifying adaption objectives is to help guide an appropriate adaptation response, and to screen adaptation options, across different localities.

These objectives provide a reference for considering the suitability of different coastal hazard adaptation options across the TSIRC region.

Objectives for the *Zenadth Kes Coastal Hazard Adaptation Strategy*, as informed by consultation with stakeholders and the community, include to:

Maintain ecological health and biodiversity: Strive to ensure clean healthy beaches and protect coastal habitats, including those crucial for wildlife nesting, refuge, and feeding. Waterways, wetlands, and the ocean should support healthy fisheries and aquatic wildlife.

Preserve cultural heritage and rights: Aim to continually maintain access to places of spiritual and cultural significance, protect sites of cultural importance, including marked and unmarked burial sites, while respecting and reinforcing native title rights, Ailan Kastom, Aboriginal Lore/Law, and Traditional Owner interests.

Support sustainable access and use of natural resources: Ensure access to boating, traditional hunting, and fishing sites, keeping the unique features of the Torres Strait secure for future generations. Protection of natural resources and local environments should be prioritised to ensure sustainable fishing and tourism industries, and to support the local economy.

5. How can we adapt to future coastal hazards?

Adopt holistic, evidence-based, and culturally appropriate decision-making processes: Implement integrated and culturally appropriate decision-making that leverages evidence-based approaches for long-term sustainability. This includes learning from experience, supporting self-determination at the local and regional scale, and promoting genuine collaboration regarding the management of natural resources, community infrastructure, and services.

Ensure durable, resilient, and sustainable development: Deliver enduring outcomes that will enable future generations to remain on their home islands. Homes and communities should be built to withstand natural disasters and provide access to safe refuge and emergency services. Implement environmentally, economically, and socially sustainable solutions for long-term resilience.

Promote climate change awareness and education: Leverage community events, local schools, and public spaces to educate residents and visitors about the impacts of climate change on the coastal environment, the significance of sustainable practices, and how individual actions can contribute to coastal resilience.

Implement regular monitoring and evaluation frameworks: Establish systems for regular assessment of the health and integrity of coastal environments, cultural sites, and effectiveness of implemented adaptation strategies. This will ensure timely response to emerging threats, allow adjustments to strategies as necessary, and contribute to the evolving body of knowledge on coastal hazard adaptation.

Encourage community participation and custodianship: Foster a sense of ownership and shared responsibility among residents by creating opportunities for community involvement in coastal protection efforts, such as beach cleanups, habitat restoration projects, or citizen science initiatives. This will not only provide practical support but also help strengthen the community's connection to their environment.

Adaptation response

The tailored framework for the Zenadth Kes Coastal Hazard Adaptation Strategy includes four adaptation responses (Table 3):

- Avoid (and maintain)
- Monitor (look and learn)
- Actively manage
- Transition and change

A general adaptation response was determined for each TSIRC community and for each time frame (planning horizon) (Table 4). This helps to determine the appropriate adaptation approach for each community.

Table 3. Adaptation responses for TSIRC

Adaptation response – How do we respond and adapt to coastal hazards?	Increasing risks as a result of coastal hazards →			
	Avoid (and maintain)	**Monitor (look and learn)**	**Actively manage**	**Transition and change**
	Prevent new risks from occurring and avoid placing new development or assets in coastal hazard areas.	Monitor the risk of coastal hazards. Monitor until local trigger levels are reached to initiate mitigation.	Proactively manage or mitigate the risk of coastal hazards through a range of adaptation options. Mitigate until management options are no longer socially, culturally or economically feasible or local trigger levels are reached to initiate transition.	A strategic decision to transition or change a specific land use (or location) to an alternative land use Active management or mitigation may be part of the transition process.

Avoid (and maintain)

The general first principle is to avoid placing new development or built assets in coastal hazard areas. The preference is to develop (or transition over time) land use in coastal hazard areas to locations with lower risk for coastal hazard impacts, while allowing for uses that maximise economic, cultural, social and environmental value to region. Any new development or infrastructure in coastal hazard areas must be in accord with local and State Planning Policy and approvals requirements and include necessary mitigation measures.

It is also important to avoid creating new risks or increasing existing ones. Maintaining infrastructure in good condition and protecting coastal areas from future harm will increase the natural resilience and help to avoid or delay the need for more active management.

Monitor (look and learn)

At localities where the coastal hazard risk profile is low, the adaptation response is to monitor risk by observing changes and regularly reviewing what these changes mean in terms of changing risk – look and learn. Best practice is to undertake maintenance/asset management activities and continue active stewardship of the coastal zone. Where these observations suggest an increased risk (as indicated by local trigger levels), then the adaptation response may change to active management.

Continuing to collect and record data on culturally significant sites and places, and places of high environmental value will help to grow knowledge and inform future decisions.

Actively manage

At localities where coastal hazard risks have been identified, the adaptation response is to proactively manage the risk through implementing a range of adaptation options. Adaptation options will be tailored to each locality, incorporating site-specific processes, community input, and statutory planning considerations. If, over time, the risk profile is observed to increase (as indicated by local trigger levels), and active management becomes infeasible (due to economic or other factors), then the adaptation response may shift to transition requiring a change in land use or relocation of assets.

Transition and change

In some specific areas within a locality, if the coastal hazard risk profile is very high, and active management becomes infeasible (due to economic or other factors), a strategic decision may be made in consultation with the local community to transition to an alternative land use. Transition is likely to be a gradual process over time, where mitigating hazards for a period is part of the transition process. A range of adaptation options will be part of the transition process.

5. How can we adapt to future coastal hazards?

Table 4. Adaptation response for each TSIRC community

Island	Present day	2050	2100	Current
Arkai	Avoid (and maintain)	Avoid (and maintain)	Monitor (look and learn)	The Arkai community on Moa Island is currently considered at low risk from coastal hazards in the present day and 2050. The risks for tidal and storm tide inundation increases by 2100.
Badu	Avoid (and maintain)	Avoid (and maintain)	Monitor (look and learn)	The Badu community is currently considered at low risk from coastal hazards in the present day and 2050. Though some assets may be at risk from coastal hazard conditions in the present day, the risk remains low. The risks for tidal and storm tide inundation increases by 2100.
Boigu	Actively manage	Transition and change	Transition and change	The Boigu community is presently at very high risk from storm tide inundation, high risk from tidal inundation, and low risk from erosion. Tidal inundation risk is expected to increase by 2100 and while erosion poses less risk at present, it also expected to increase by 2100. Recently built defences may contribute to increased protection from coastal hazards and potentially lessen the overall risk.
Dauan	Monitor (look and learn)	Monitor (look and learn)	Actively manage	The Dauan community is currently considered low risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy. Erosion is a greater risk with some assets located in erosion prone areas.
Erub	Actively manage	Actively manage	Actively manage	The Erub community is presently at low to medium risk from inundation and high risk from erosion, with many of the mapped assets located in the coastal fringe. The inundation risk is expected to increase; however, the topography of the island may provide opportunities to relocate structural assets whilst maintaining a strong connecting to culture and place.
Iama	Actively manage	Transition and change	Transition and change	The Iama community is presently considered at medium-high risk from coastal hazards. Existing protection structures mitigate the threat from erosion however they will need to be upgraded in the future to maintain their function. Risk from storm tide inundation is high and expected to increase substantially in the medium to long term.
Kirriri	Monitor (look and learn)	Monitor (look and learn)	Actively manage	The Kirriri community is currently considered medium to low risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy. Some assets in the community are at risk from erosion but protected from non-engineered structures which will lose efficacy over time leading to an increased risk from erosion.
Mabuiag	Avoid (and maintain)	Actively manage	Actively manage	The Mabuiag community is currently considered low risk from coastal hazards, with the risk from storm tide expected to increase to high risk within the medium to long term planning horizon of this strategy. The erosion risk is expected to increase somewhat to in the medium to long term.

Island	Present day	2050	2100	Current
Masig	Actively manage	Actively manage	Transition and change	The Masig community is currently considered low to medium risk from coastal hazards. Existing sand management activities around the barge ramp reduce the risk to residences. However, the culturally significant cemetery in the south of the island is in the erosion hazard zone. Risk from storm tide and tidal sea level rise is expected to increase to high/very high risk within the medium to long term planning horizon of this strategy.
Mer	Monitor (look and learn)	Actively manage	Actively manage	The Mer community is currently considered low risk from inundation coastal hazards, and high risk from erosion. The risk from inundation does not significantly increase within the planning horizon of this strategy. The risk from erosion remains high, mainly due to the proximity of assets to the erodible sections of coast.
Poruma	Actively manage	Transition and change	Transition and change	The Poruma community is presently considered low to high risk from inundation and very high risk from erosion. There are existing and planned coastal protection structures around the island to address this risk. The risk from storm tide inundation is expected to increase to high risk in the medium to long term planning horizons of this strategy.
Saibai	Actively manage	Transition and change	Transition and change	The Saibai community is presently at very high risk from storm tide inundation, high risk from tidal inundation, and low risk from erosion. The low risk from erosion is due to the recently built seawall. The medium to long term erosion risk gets progressively higher as the seawall deteriorates with age. Without maintenance and eventually an upgrade, the erosion risk will increase. The Saibai community is very familiar with this risk which provides an element of resilience, however high risk conditions have been severe enough in the past to force a mass migration to the Northern Cape York Peninsula in Bamaga and Seisia, which occurred in the late 1940s (Saibai to Bamaga, 2000).
Ugar	Monitor (look and learn)	Monitor (look and learn)	Actively manage	The Ugar community is currently considered low to medium risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy. The risk from erosion is expected to increase to high with the effects of a groyne potentially causing downdrift erosion to the west of the barge ramp. There are also some culturally significant sites such as the old cemetery that have experienced erosion and are at higher risk.
Warraber	Actively manage	Transition and change	Transition and change	The Warraber community is presently considered low risk for erosion and tidal inundation, in part due to the existing seawall offering protection. However, the community is presently at high risk from storm tide inundation with that risk expected to increase within the medium to long term planning horizons for this strategy.
Wug	Monitor (look and learn)	Monitor (look and learn)	Monitor (look and learn)	The Wug community on Mua Island is currently considered low to medium risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy.

**A transition and change response may be appropriate for a specific area within the locality*

5. How can we adapt to future coastal hazards?

Adaptation options

Five themes of adaptation options have been defined for the Zenadth Kes Coastal Hazard Adaptation Strategy, with a range of options that relate to avoiding, mitigating and managing the risk of coastal hazards. The themes are:

1. Council-wide initiatives to enhance community custodianship
2. Planning updates
3. Resilient built infrastructure
4. Nature-based coastal management
5. Coastal engineering

The range of common adaptation options across these themes are described in Table 5. More detailed descriptions of the options are provided in Supplement A, along with preliminary screening of the relevance of options to different communities.

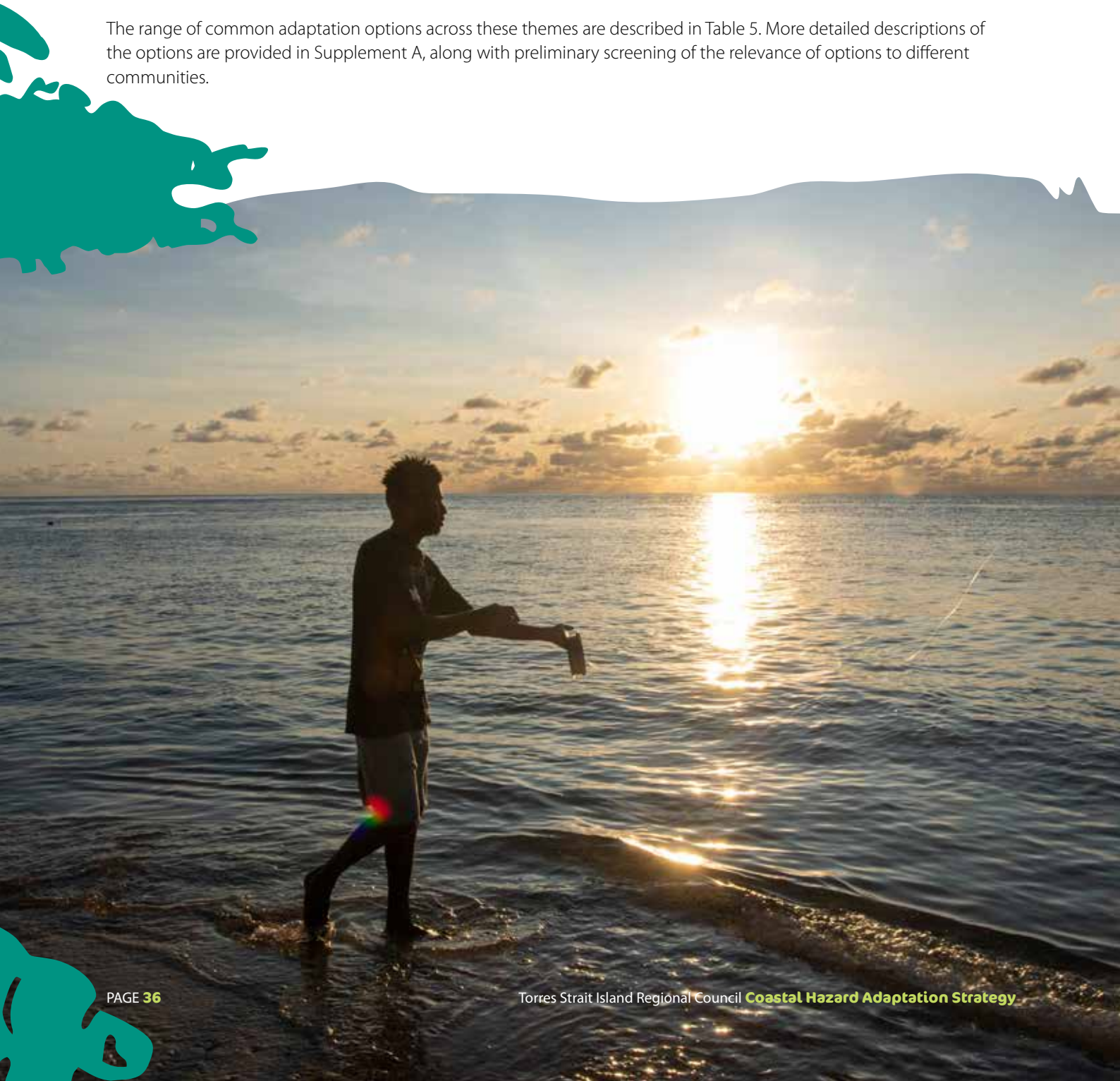
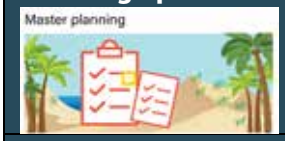


Table 5. Adaptation options by theme

Theme	Adaptation option	Descriptions	Supplement A sheet number
Council-wide initiatives to enhance custodianship  	**Community custodianship**	Enhancing custodianship of the coastline	Sheet 1
		Dune and foreshore protection and maintenance	
	Education and knowledge sharing	Facilitating knowledge sharing and education on hazards and adaptation	Sheet 2
	Monitoring	Monitoring changes in coastal hazard risk and effectiveness of adaptation	Sheet 3
		Photo point monitoring	
Planning updates 	**Land use planning**	Statutory planning / planning scheme updates	Sheet 4
		Other strategic planning – including land purchase / swap / relocation	
	Disaster planning	Update emergency response planning	
Resilient built environment  	**Maintaining and improving infrastructure**	Upgrading infrastructure	Sheet 5
		Improving drainage networks	
		Resilient homes	
		Relocating infrastructure	
Nature based coastal management  	**Dune, mangrove and reef protection and enhancement**	Dune management	Sheet 6
		Mangrove protection	
		Natural reef enhancement	
	Living shorelines	Mangrove protection and enhancement	Sheet 7
		Shoreline vegetation	
		Artificial reef	
	Beach nourishment	Sand scraping	Sheet 8
		Import sand to nourish the beach	
		Sand bypassing	
Coastal engineering  	**Structures to assist with sand retention**	Rock groynes	Sheet 9
		Geo-bag groynes	
	Structures to dissipate energy offshore	Offshore breakwater	Sheet 10
		Floating breakwater	
		Submerged breakwater	
	Last line of defence structures	Exposed seawall (with living sea wall panels)	Sheet 11
		Buried seawall	
	Structures to minimise flooding	Dykes	Sheet 12
		Levees	

5. How can we adapt to future coastal hazards?

5.2 Determining adaptation actions

A range of adaptation actions have been identified to enable a strategic approach to coastal hazard adaptation across the TSIRC islands and to ensure the goals and aspirations of the community are achieved (Section 2.3). A suite of priority actions across the five themes (Table 5) have been defined at a regional and community scale as part of the adaptation response pathway.

The program of priority actions for each location has been informed by a suite of decision making processes and tools. The decision making process for determining recommended adaptation options for the Zenadth Kes Coastal Hazard Adaptation Strategy is illustrated in Figure 5.

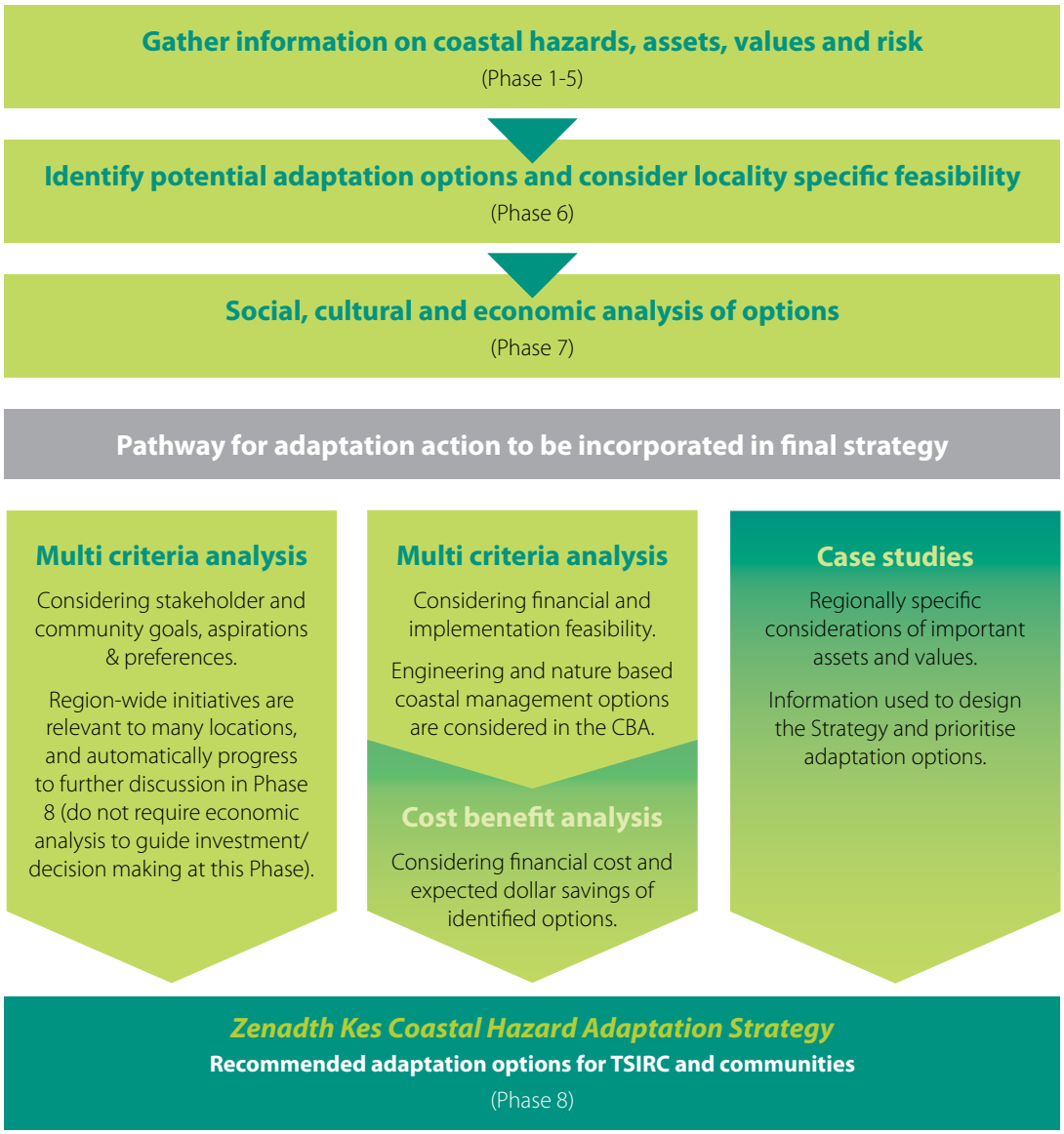


Figure 5. *Decision making process for the identification of final adaptation options for the Zenadth Kes Coastal Hazard Adaptation Strategy*

Multi Criteria Analysis

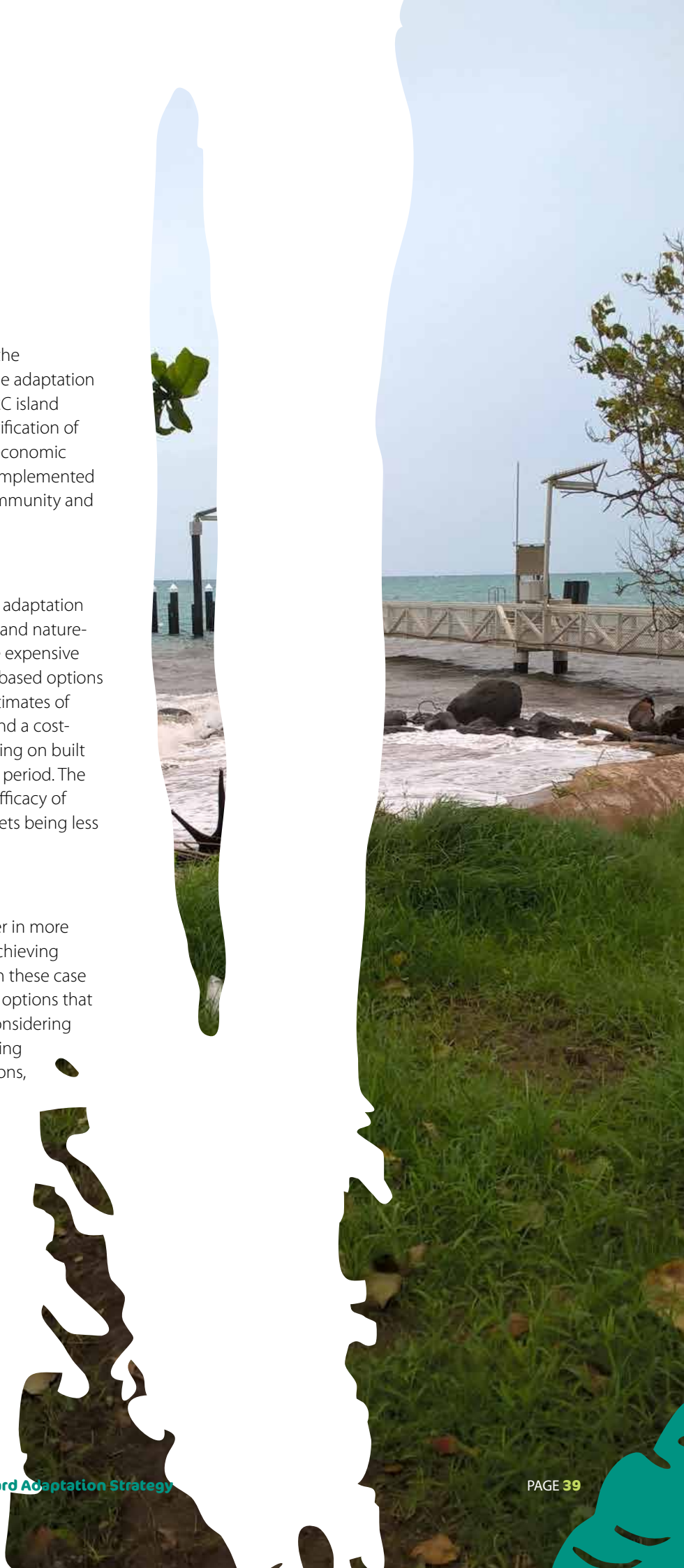
A Multi Criteria Analysis (MCA) considered the effectiveness of each action in achieving the adaptation objectives as well as feasibility for each TSIRC island community. This process enabled the identification of some actions that were subject to further economic analysis. It also shows that some actions if implemented would provide good value to the TSIRC community and help to achieve the adaptation objectives.

Cost Benefit Analysis

A cost benefit analysis considered different adaptation approaches, including coastal engineering and nature-based options. Coastal engineering is more expensive but offers greater protection, while nature-based options are cheaper but provide less protection. Estimates of costs and effectiveness have been made, and a cost-benefit analysis has been conducted, focusing on built assets and indirect damages over a 30-year period. The analysis considers the costs, benefits, and efficacy of each approach, with benefits to natural assets being less certain.

Supporting case studies

Two case studies were also used to consider in more detail the importance of certain assets in achieving the adaptation objectives. Information from these case studies helps to explore certain adaptation options that could be considered in the future. When considering options, they have been considered assuming current liveability thresholds and expectations, which may be subject to change as communities adapt. Advancements in technology may also influence the types and feasibility of options that become available to our communities.



5. How can we adapt to future coastal hazards?

CASE STUDY 1:

Housing relocation and revised transport options for Iama Island

One option proposed to reduce risk and inundation of housing is to relocate residents to lower risk areas on their islands, however there is limited suitable land. For many of the Torres Strait islands, native title extends across the entire island, with some exclusions for public infrastructure such as airstrips. Airstrips across the Torres Strait are typically owned by Torres Strait Island Regional Council. Airstrip land is already cleared and level, and therefore could be converted to housing relatively easily.

This particular case study looks at relocating housing on Iama Island. Iama was chosen because it has a high number of houses at risk while the airstrip is largely low risk (see Table 6). Erub and Mer could also be potential candidates.

Table 6. Risk of storm tide inundation by 2100 for houses and airstrip for all communities

Island	No. houses at med/high risk of storm tide inundation by 2100	Percentage of airstrip at med/high risk of storm tide inundation by 2100
Saibai	82	100%
Boigu	59	100%
Masig	59	59%
Iama	54	9%
Warraber	42	36%
Mabuiag	39	38%
Erub	36	0%
Mer	31	0%
Badu	13	3%
Arkai	1	23%
Poruma	no data	48%
Kirriri	4	no airstrip
Dauan	3	no airstrip
Ugar	0	no airstrip
Wug	0	no airstrip

Table 7. Risk of storm tide inundation for private houses and airstrip on Iama over 2020, 2050, and 2100

Asset type		Private house	Airstrip
Total		63	54,736 m^2
2020	Medium	33 (52%)	437 m^2 (1%)
	High	9 (14%)	316 m^2 (1%)
2050	Medium	21 (33%)	1,253 m^2 (2%)
	High	28 (44%)	592 m^2 (1%)
2100	Medium	12 (19%)	3,901 m^2 (7%)
	High	42 (67%)	754 m^2 (1%)

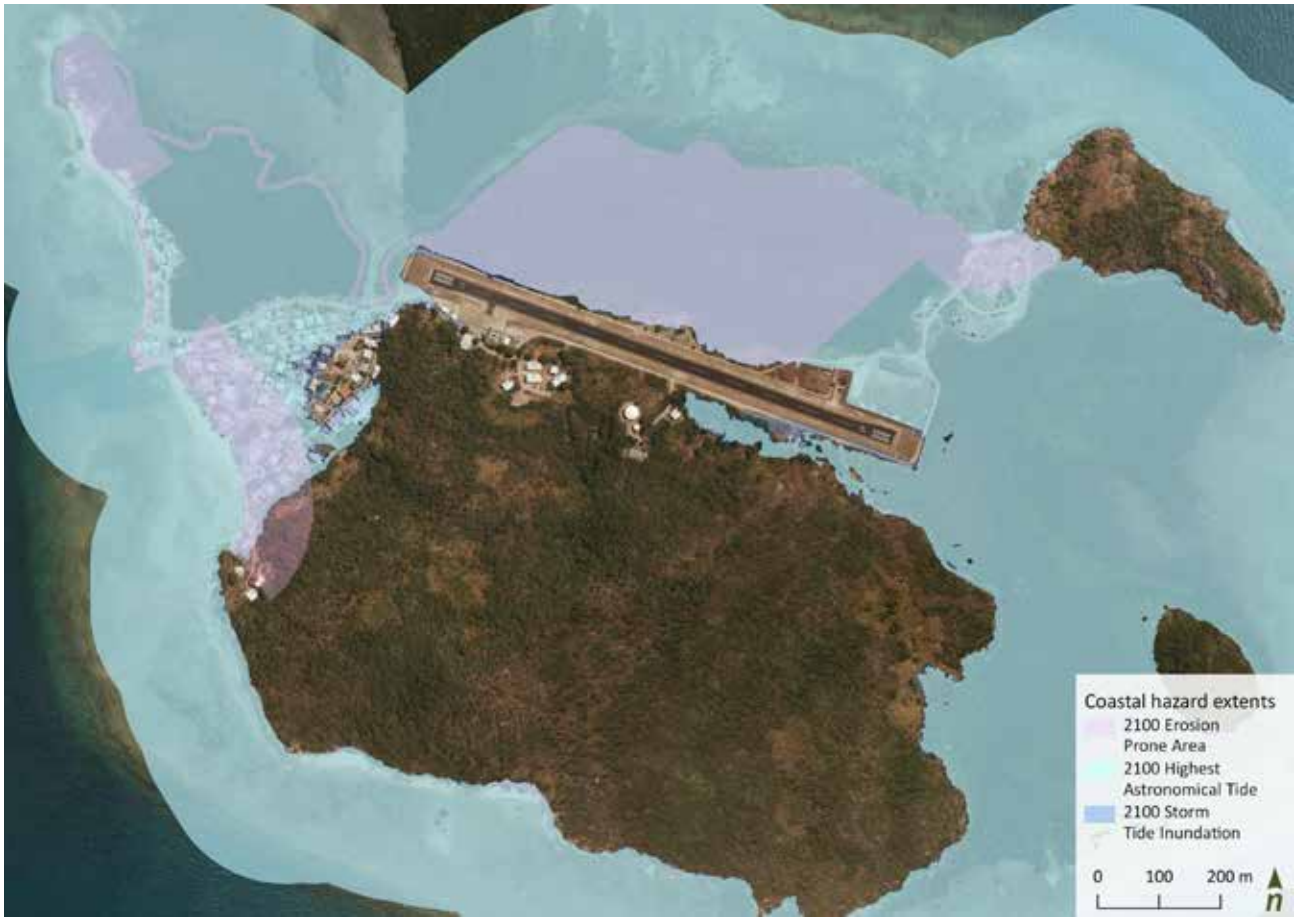


Figure 6. *Iama Island with airstrip and coastal hazard extent for the 2100 planning horizon (Google Earth, 2023)*

The current airstrip on Iama has the potential to accommodate over 80 houses, along with other facilities like schools, health centres, and churches. However, there are significant challenges that need to be addressed:

- Relocating or building new homes is costly, especially considering the high expenses of transporting materials to the Torres Strait. The estimated cost of building 63 new homes is over $42 million.
- Moving houses away from the water's edge can also negatively impact the livelihoods, cultural identities, and social connections of the island communities.
- Without an airstrip on Iama Island, travel time and difficulty would greatly increase, requiring boat travel to nearby islands and then plane travel to Horn Island. Shortening the existing airstrip could accommodate around 30 relocated homes but would come with potential public safety and health considerations, as well as limitations on passenger and cargo capacity. It may also require the introduction of alternative air transport methods like seaplanes or helicopters and could restrict landings in challenging weather conditions.

5. How can we adapt to future coastal hazards?

CASE STUDY 2: SAIBAI COMMUNITY ADAPTATION

Saibai Island in the Torres Strait is a low-lying mud island that will be significantly affected by climate change. In 2021, the island had 340 residents, with 82 private houses at high risk of storm tide inundation. Considering the potential impacts, four radical options are explored:

- full coastal defence
- floating village
- planned relocation
- supporting private adaptation

Full coastal defence

A full coastal defence strategy would require continuous upgrades and maintenance of the concrete seawall to surround all the houses and infrastructure on Saibai, to prevent seawater entering. This approach would allow residents to remain on Saibai.

However, island life would change significantly. As sea levels rise and inundation becomes more frequent, the beaches, cemetery, salt marshes and mangroves outside the wall are expected to become increasingly underwater. This will change the ecology and cultural values of these sites. There must also be consideration of the structures trapping rainwaters causing floods within the protection, as well as groundwater infiltration through the porous mud substrate.

The cost of a full coastal defence strategy is estimated at a capital cost of $42 M, with ongoing maintenance of $800 K per annum. A breach of the wall could result in flooding of homes and infrastructure and require extensive pumping to remove seawater.

Floating village

To reduce the risk while remaining in the same location, another option is to raise or float housing and infrastructure so that it is less likely to be inundated.

Houses that are raised above the sea are not a new concept. Houseboats are relatively common in sheltered waters in Australia, and floating villages can be found across Southeast Asia. With climate change, there has been increasing interest in expanding their use with examples found in various locations including the Netherlands and Maldives. An example of a water dwelling prototype is shown in Figure 7.

There are a range of considerations in developing floating cities: legality of tenure, construction modularity to reduce costs and construction times, accessibility, power supply, supply and distribution of goods, waste management, overshadowing of the seabed, mooring stability and flexibility of design to accommodate future needs. A further challenge for Saibai would be to find a transport solution to and from Saibai, as the existing airstrip would not be available. Seaplanes or a floating airstrip may be required.

The smaller size of the Saibai community may also mean that household scale solutions to key floating city challenges are viable. For example, household sized desalination and wastewater treatment solutions as used on boats are already available, and solar and battery storage options are also potentially feasible. These solutions may also be more resilient than centralised power and water solutions.

As with the full coastal defence option, this option would significantly change the way of life of the Saibai community but allow them to remain at the island.

Planned relocation

Planned relocation is a potential adaptation option for Saibai Island (and other TSIRC communities). Under this option, the Saibai community would be relocated to a less exposed location. The new location must be carefully chosen, taking into account factors such as elevation, accessibility, and availability of resources that can support the community's livelihoods and cultural practices. New locations on Saibai may be feasible, however the new development would need to incorporate aspects described in the floating village option.

However, it is important to note that relocating can disrupt lifestyles, livelihoods, and cultural traditions. It has also been expressed clearly from communities that relocation is not an acceptable option, noting that culture cannot adapt unless the people are on Country. That being said, some residents and future generations may revisit this option.

Important considerations for planned relocation include:

- Identifying a suitable location
- Impacts on the destination community
- Impacts on non-relocating individuals
- Legal and institutional framework
- Disruption of livelihoods
- Cultural preservation
- Social networks and community cohesion.

Private adaptation

All the available options for the Saibai community are costly and will have significant impacts on their lives and livelihoods. Community engagement and broad support are essential to progress with a preferred option.

Supporting private adaptation provides flexibility and empowers individuals to make their own decisions. However, the Torres Strait Islands' socio-economic disadvantage suggests that private adaptive capacity may be low, making developing it a challenging task.

Lack of economic resources and information can limit a community's ability to identify alternatives to planned relocation. Reducing these constraints allows for exploring a wider range of options and can potentially reduce the need for high-cost government interventions.

Supporting private adaptation faces challenges when there are different views within the community regarding when, how, and if to adapt. Governments must determine the level of support to provide, considering individual risk tolerance. The case of Wittenoom, a town contaminated by asbestos, illustrates a government winding down the town and providing support for resettlement due to health risks.

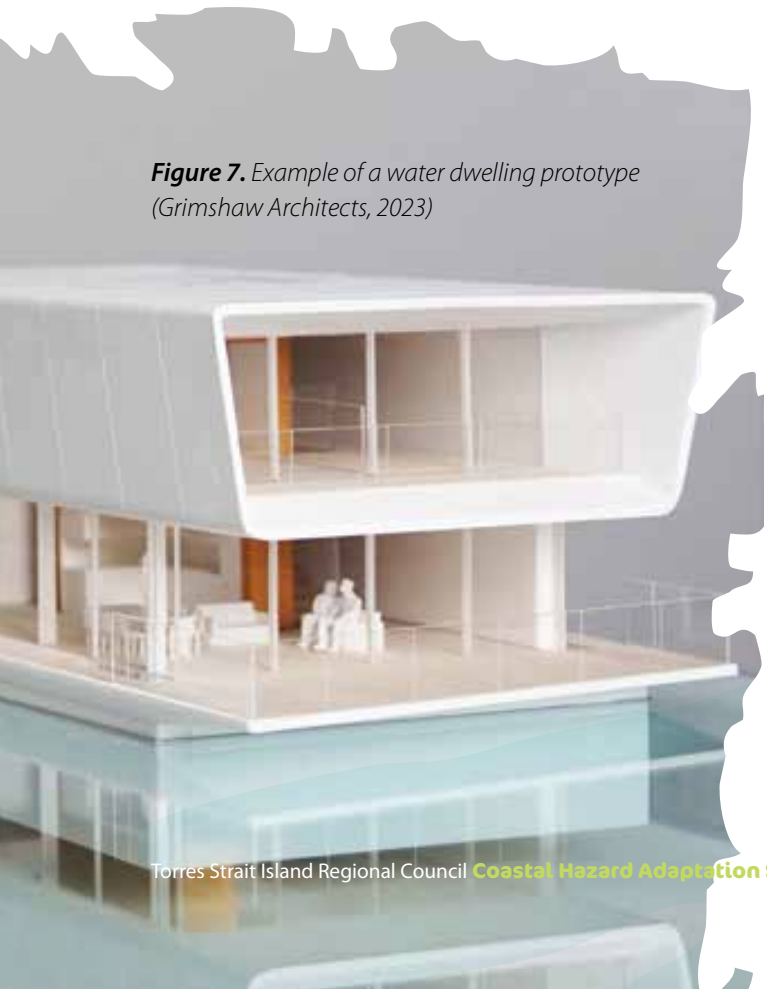


Figure 7. *Example of a water dwelling prototype (Grimshaw Architects, 2023)*

6. Coastal hazard adaptation actions

Coastal hazard adaptation in the Torres Strait is a collaborative and ongoing endeavour involving local communities, local government, and state and national agencies. It's a holistic approach that combines scientific insights, traditional knowledge, and community engagement to enhance resilience against the escalating threats posed by climate change.

The following section provides an overview of the adaptation actions that form the Zenadth Kes Coastal Hazard Adaptation Strategy. It includes council-wide actions, as well as the actions for each community, which are contained in the community profiles.

Council wide actions include broad strokes approaches that are best suited for implementation by TSIRC as a local government. They also include actions that are applicable across the island communities.

The community profiles provide a more detailed action plan, specific for each island community. Within each profile is:

- an overview of each island and community
- a summary of exposure and risk to coastal hazards,
- an indication of the adaptation response over multiple planning horizons
- a map of key management areas
- Community specific actions, which complement the council wide actions. Actions identified for present day should be considered priority with an aim to be implemented in the next 5 – 10 years
- Adaptation pathways that support decision making now and into the future.

6.1 Council-wide adaptation actions

The *Zenadth Kes Coastal Hazard Adaptation Strategy* priority actions across the council area include a range of actions relevant to the five themes identified for the plan:

- Council-wide initiatives to enhance custodianship
- Planning updates
- Resilient built infrastructure
- Nature based coastal management
- Coastal engineering.

Priority 5 – 10 year actions for each of these themes are summarised in the tables below, with some additional information available in Supplement A. Adaptation response and actions specific to each community are provided in the community profiles.

THINGS TO KEEP IN MIND

Work with the community to communicate and spread knowledge about climate change, coastal hazards, and adaptation. Use a grass roots approach to build education into smaller projects.

Weave culture into adaptation actions and planning. Cultural Knowledge with Western Science.

It is about leading and facilitating adaptation and change within each of the respective communities. Actions should involve community as much as possible including construction, maintenance and upgrading infrastructure.

Listen to the community. Nothing about us, without us.

STAYING IN YUMPLA HOME AND YUMPLA CULTURE

Culture needs to evolve in place – culture cannot survive outside of place, you need to be on Country to make things happen and retain the culture.

Need to consider the transition of land use type and relocating assets within island communities, working with and updating Master Plans.

Consider the feasibility of transitioning to an adjacent island, or currently uninhabited areas of current island, taking advantage of the opportunity for innovative design and sustainable and resilient development.

WORKING WITH NATURE

Zaget Torateti – Work that considers the right time and method, based on cultural knowledge of the seasons, winds, and natural environment.

Any adaptation that involves working with nature should enact Zaget Torateti, informed by community knowledge holders, Elders and leaders.

AILAN-IFY - DESIGN FOR RESILIENCE

In the Torres Strait, we all answer to King Salt! All designs, buildings, and infrastructure must live with this reality and be Ailan-ified.

This involves incorporating traditional settlement patterns and dwelling designs.

Working with community knowledge holders, Elders and leaders is critical to determine appropriate design.

Look out for crocodiles!

Credit to Councillor Nona for these ideas

6. Coastal hazard adaptation actions

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1a	Establish a coastal resilience officer position within Council who will have responsibility over implementing the Zenadth Kes CHAS. This position will support Council's Climate Change Adaptation and Environment Committee and work closely with communities, across council and with other state and commonwealth agencies, streamlining and facilitating collaboration and effective implementation of adaptation actions.	$$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1b	Seek co-funding/resources for further initiatives through grants and stakeholder partnerships.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1d	Promote coastal custodianship in the youth and future generations with community coast care events. These should weave in cultural knowledge and the idea of Zaget Torateti. They can also include art, communication, and science programs focused on coastal resilience.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1e	Establish and implement a dune and foreshore protection and maintenance program incorporating Zaget Torateti, access management, and community education. Support local communities in implementing this program.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.1. Community stewardship	C1.1f	Develop a dune and wetland vegetation seed bank for vegetation restoration efforts, involving Traditional Owners, Indigenous Land and Sea Rangers and schools.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2a	Develop a Zenadth Kes CHAS - Communication and Engagement Strategy. This will support Council in working with communities to raise awareness of and implement their Community Adaptation Plans. This will use creative and innovative communication channels, leveraging emerging community leaders and content creators. It will outline the appropriate level and protocols of engagement and consultation needed for a range of adaptation actions. Ideally, this communication and engagement strategy should not stand alone but be integrated with Council's existing engagement policies and practices so that its relevance for all current and future development and supporting community resilience is continuously acknowledged.	$	Ongoing	High

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2b	Develop locally and culturally appropriate educational materials about coastal processes, climate change, monitoring and adaptation with a focus on nature based management and innovative and island-appropriate design and development. Integrate these materials into the implementation of the Zenadth Kes CHAS - Communication and Engagement Strategy (action C1.2a).	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2c	Work with organisations like the TSRA, CSIRO, Universities, Non-Profits, and the Torres Strait Climate Centre of Excellence to support further research and innovation into coastal hazard and climate change adaptation.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2d	Continue to advance partnerships and collaboration with Traditional Owners to further consider needs and aspirations for Aboriginal and Torres Strait Islander People in coastal hazard adaptation.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.2. Education and knowledge sharing	C1.2e	Promote cross-sector partnerships and initiatives to enhance resilience and strategic adaptation for transport infrastructure, including boating infrastructure.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3a	Develop a tailored integrated monitoring and reporting program to inform future adaptation. Incorporates actions C1.3b-h.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3b	Undertake drone survey (elevation and aerial imagery) monitoring of beaches.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3c	Undertake underwater coral reef surveys to map the extent and condition. Explore the use of photogrammetry to create detailed 3D models of reefs.	$$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3d	Establish a network of water level gauges throughout the TSIRC regions. Train community members to operate and maintain them.	$$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3e	Undertake regular coastal protection structure condition assessments.	$	Ongoing	High

6. Coastal hazard adaptation actions

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3f	Establish a monitoring program for sites of cultural significance that measures indicators such as spiritual/social value, archaeological value, physical condition, and protection of sites.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3g	Establish a system of Citizen Science photo monitoring points (CoastSnap, Fluker Post or similar) at beaches in the area.	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3h	Create a platform/process with Council for monitoring data storage and management	$	Ongoing	High
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3i	Undertake detailed sediment supply and transport studies for coral cay islands and lagoons.	$$	Within 5 years	Medium
1. Council-wide initiatives to enhance custodianship	1.3. Monitoring	C1.3j	Review and further examine the sediment dynamics around TSIRC communities and the shoreline including: · Geomorphic assessment · Hydrodynamic modelling · Shoreline Erosion Management Plan. Linked to C1.3i	$	Ongoing	High
2. Planning updates	2.1. Land use planning	C2.1a	Submit updated Erosion Prone Area layers to State Government for formal update to the existing State-wide mapping.	$	Immediate	High
2. Planning updates	2.1. Land use planning	C2.1b	Use the updated Erosion Prone Area and storm tide mapping and outcomes of the Zenadth Kes CHAS in current and future Planning Scheme and Master Plan updates to inform decisions on development areas and strategic land use planning.	$	Ongoing	High
2. Planning updates	2.1. Land use planning	C2.1c	Consider implications (within Council) of the Strategy for future development approvals and conditions, including: · Approval conditions for lots of undeveloped land, and · Implications for future development approvals and conditions.	$	Ongoing	High
2. Planning updates	2.2. Disaster management	C2.2a	Use the updated Erosion Prone Area and storm tide mapping, risk assessment and economic implications to update the TSIRC Local Disaster Management Plan. Ensure local community input is used to inform the updated plan.	$	Within 5 years	Medium
2. Planning updates	2.2. Disaster management	C2.2b	Review the long-term adequacy of evacuation and shelter facilities and evacuation routes, including evacuation by land and sea.	$	Ongoing	High

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1a	Review at-risk infrastructure (from CHAS data outputs) and embed risks into current asset management plans/Master Plan (this could include 'betterment' at critical asset refurbishment/renewals points).	$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1b	Review access road renewals and upgrades (prioritisation), and upgrade design requirements and timing of upgrades.	$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1c	Produce "Resilient Housing and Development Guidelines and Designs" tailored to the Torres Strait Islands. This should cater to all island types. Community knowledge holders, elders and leaders should be heavily consulted for this process.	$$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1d	Consult with utility providers on future services and upgrades, and implications of coastal hazard areas.	$	Ongoing	High
3. Resilient built infrastructure	3.1. Increasing infrastructure resilience	C3.1e	Audit stormwater assets in areas subject to erosion and inundation, and develop plan to upgrade in line with refurbishment/renewals points.	$$	Ongoing	High
3. Resilient built infrastructure	3.2. Relocate infrastructure	C3.2a	Develop "Priority Asset Relocation and Redesign Guidelines" to assist communities in developing island specific relocation strategies. Community knowledge holders, Elders, other leaders and young people should be heavily consulted for this process. Factors to consider include: Approvals Native Title Hazards Master Plan Town Planning	$	Immediate	High

6. Coastal hazard adaptation actions

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1a	Support local communities in re-establishing, rehabilitating, or protecting coastal dunes	$	Ongoing	High
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1b	Support local communities in re-establishing, rehabilitating, or protecting mangroves	$	Ongoing	High
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1c	Support local communities in re-establishing, rehabilitating, or protecting coral reefs	$	Ongoing	High
4. Nature-based coastal management	4.1. Dune, mangrove and reef protection and enhancement	C4.1d	Scope the feasibility and priority locations for natural reef enhancement activities, requiring comprehensive knowledge of the latest scientific findings and methodologies to ensure effective implementation and multiple benefit outcomes.	$$	Within 5 years	Medium
4. Nature-based coastal management	4.2. Living shorelines	C4.2a	Develop a detailed "Living Shorelines Design and Implementation Plan" to prioritise and support the communities where a living shoreline has been determined as a feasible option.	$$	Within 5 years	Medium
4. Nature-based coastal management	4.2. Living shorelines	C4.2b	Develop a detailed "Artificial Reef Design and Implementation Plan" to prioritise and support the communities where an artificial reef has been determined as a feasible option.	$$	Within 5 years	Medium
4. Nature-based coastal management	4.3. Beach nourishment	C4.3a	Develop a detailed "Beach Nourishment Design and Implementation Plan" to prioritise and support the communities where beach nourishment or sand management has been determined as a feasible option.	$$	Within 5 years	Medium

Adaptation theme	Adaptation option	Action ID	2023 Priority strategic actions (completed within 5 – 10 years)	Indicative cost	Timing	Priority
5. Coastal engineering	5.1. Structures to reduce coastal hazards	C5.1a	Continue to implement the Seawall Project.	$$$	Ongoing	High
5. Coastal engineering	5.1. Structures to reduce coastal hazards	C5.1b	Continue to monitor and maintain existing coastal and flood protection structures.	$$$	Ongoing	High
5. Coastal engineering	5.1. Structures to reduce coastal hazards	C5.1c	Audit coastal and flood protection assets, and develop plan to upgrade where needed.	$	Ongoing	High

6. Coastal hazard adaptation actions

Arkai (Moa Kubin)

Community overview

Community	English name	Cluster	Type
Arkai	Moa (Kubin)	Western	Continental volcanic and granitic rock island

Arkai (Kubin Community) is one of the two townships on Moa. It is located on the south western coast and has an estimated population of 156 people (ABS, 2021). The other township, Wug (St Pauls) is located on the eastern coast of the island, with the townships connected via an inland road.

Moa, located in the western island cluster and approximately 170 km^2 in size, can be classified as a continental island with geology similar to that found on mainland Australia. The majority of the community live in the main township, predominately located on an elevated headland adjacent the coast. The elevation of this headland generally exceeds +5 m Australian height datum (AHD); however this elevation falls away towards the aerodrome to the north. The position of the township on the south-western corner of Moa and an elevated headland to the east provides protection from strong seasonal winds and waves from the south east.

Some of the key infrastructure in Arkai include:

- Airport
- Regional council office
- State school (years pre prep to 7)
- Health centre with permanent nurse
- IBIS grocery stores
- Indigenous Arts Centre
- Sporting Facilities - outdoor multipurpose courts, sports field
- Motel - four rooms
- Refuel facility
- Council workshop/ compound
- SES shed
- Water plant reservoirs/ filtration collection wells
- Power station
- Barge ramp
- Pier (small craft and passengers only)

Risk

The Arkai (Moa Kubin) community is currently considered low risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy.

Coastal hazards risk profile for Arkai (Moa Kubin) from present day to 2100

Arkai (Moa Kubin) Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Low	Low
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	Low	Medium

Adaptation response

A strategic adaptation response has been developed for Arkai to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Arkai is to avoid creating new assets in hazard areas and maintain current assets, with the approach being implemented in the present day and into 2050. By 2100, increased risk will trigger the adaptation response to "monitor" through observing changes in individual asset's capacity to withstand hazards and reviewing risk.

Adaptation response profile for Arkai (Moa Kubin)

Present day	2050	2100
Avoid (and maintain)	**Avoid (and maintain)**	**Monitor (look and learn)**

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Arkai are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Arkai community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


Main Beach
0
100
200 m
n
Torres Strait
Cape York

6. Coastal hazard adaptation actions

Arkai (Moa Kubin)

MAIN BEACH

Overview of assets and values at risk

Main Beach

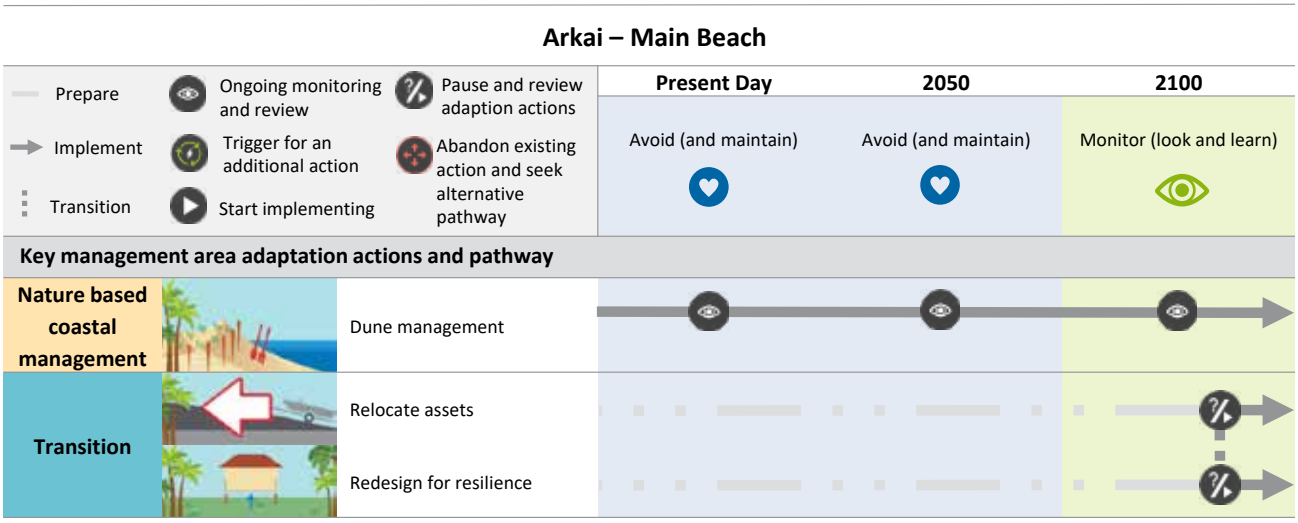
- This area is not at risk due to permanent inundation due to sea level rise or storm tide inundation as most infrastructure is built well back from the coast. The beach area is however, in a coastal erosion zone.
- Key assets in the coastal erosion zone which could be impacted in the future include the aerodrome (north western end of the runway) and the cemetery.

Main Beach at Low Point

- The study found this area is not at risk of inundation from sea level rise or storm tide but may be impacted by coastal erosion.

Pathway description

The initial adaptation action for the Main Beach of Arkai / Moa (Kubin) avoiding and maintaining the present-day landscape through dune management. As time progresses, the community should lead ongoing custodianship and



JETTY AREA

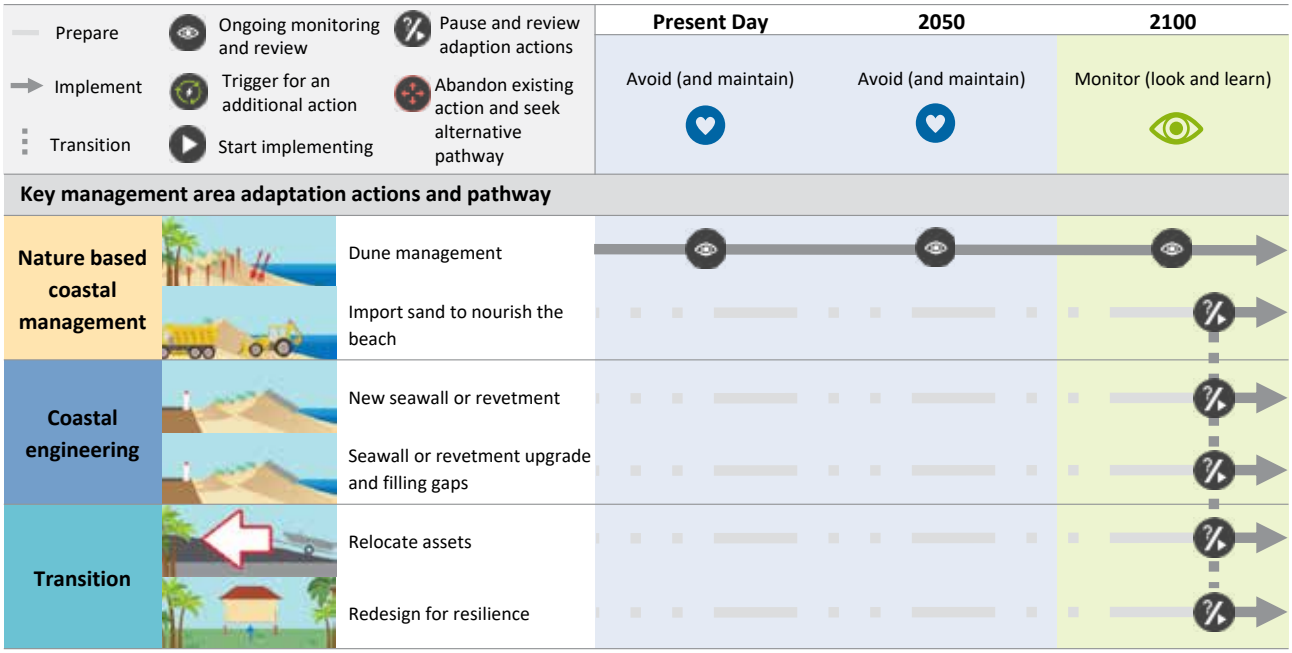
Overview of assets and values at risk

- The jetty area is in the centre of what was once a small bay on the western side of the headland.
- The bay has been split in two by the jetty creating two small beaches either side. No significant erosion had occurred at these locations during previous studies, however there are concerns of inundation to the north towards the aerodrome.
- At the jetty area, the erosion is limited however there are concerns about inundation.
- The community reports the barge landing is unusable at times due to the strong currents.

Pathway description

The initial adaptation pathway for the Jetty Area on Arkai / Moa (Kubin) involves avoiding and maintaining the present-day landscape through dune and vegetation management. While the risk profile is not expected to increase significantly, trigger points may be reached initiating a transition to actively managing coastal hazards by importing sand to nourish the beach, repairing existing revetments and sea walls or constructing a new seawall. As time progresses, the community should lead ongoing custodianship and monitoring and, in the meantime, avoid new development in hazard-prone areas.

Arkai – Jetty Area



6. Coastal hazard adaptation actions

Arkai (Moa Kubin)

TOWNSHIP

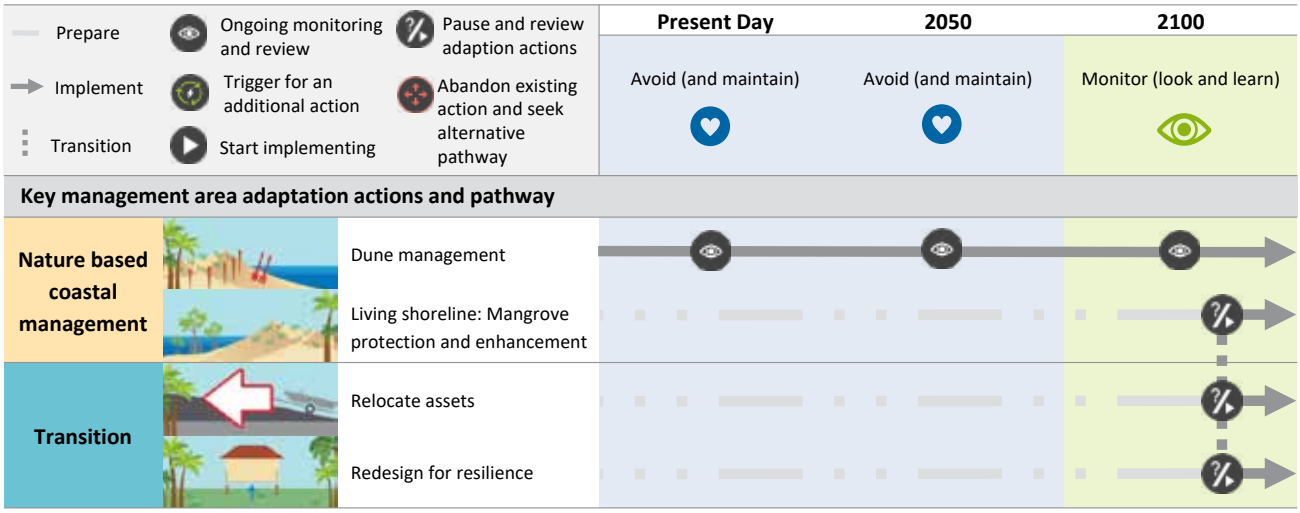
Overview of assets and values at risk

- There are a few houses, the motel and the airport building in vulnerable locations. They are however, in a generally low risk category.
- Future inundation could impact sewer infrastructure.
- Other important infrastructure is well set back from the shoreline.

Pathway description

In the Township of Arkai / Moa (Kubin), the pathway begins maintaining the present-day landscape through dune management. As trigger points are reached, the community can progress to actively manage the area with mangrove protection and enhancement. As time progresses, the community should lead ongoing custodianship and monitoring and, in the meantime, avoid new development in hazard-prone areas.

Arkai – Township



Arkai Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Arkai1.1a	See Council wide actions. Consider how these actions can be effectively used in Arkai.	
1.2. Education and knowledge sharing		
Arkai1.2a	See Council wide actions. Consider how these actions can be effectively used in Arkai.	
1.3. Monitoring		
Arkai1.3a	See Council wide actions. Consider how these actions can be effectively used in Arkai.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Arkai2.1a	See Council wide actions. Consider how these actions can be effectively used in Arkai.	
Arkai2.1b	Consider establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait.	$$
2.2. Disaster planning		
Arkai2.2a	See Council wide actions. Consider how these actions can be effectively used in Arkai.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Arkai3.1a	See Council wide actions. Consider how these actions can be effectively used in Arkai.	
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Arkai1.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Arkai4.2a	Explore potential for a living shoreline to establish mangroves in the Township KMA.	$$
4.3 Beach nourishment		
Arkai4.3a	Monitor beach profiles in the Jetty Area KMA and, if extensive erosion occurs, consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Arkai4.1.a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Arkai5.3a	As part of the adaptation pathway in the Jetty Area KMA, consider the construction of a coastal protection structure north of the Jetty to protect the access road. This action should not occur before Arkai4.3a is considered.	$$$

6. Coastal hazard adaptation actions

Badu

Community overview

Community	English name	Cluster	Type
Badu	Mulgrave	Western	Continental volcanic and granitic rock island

Badu, located in the western island cluster, has one of the largest communities within the Torres Strait region with an estimated population of 704 people (ABS, 2021). The island can be classified as a continental island with geology similar to that found on mainland Australia and is just over 100 km^2 in size.

The majority of the community live in the main township (Township 1) on the eastern side of the island, which is bracketed between an elevated headland to the south, and a relatively low lying area to the north. The location of Township 1 on the south-eastern corner of the island provides a level of protection from strong seasonal winds and waves as it is sheltered by Mua Island to the east. The main beach at Badu is approximately 2 km long, split into two compartments by a rocky reef in the vicinity of Church Street. There is a non-engineered seawall spanning the majority of the beach.

There is a small collection of properties on the western side of the island (Township 2) that have previously experienced coastal erosion, with evidence that local residents have attempted to build informal coastal protection structures with available materials.

Some of the key infrastructure in Badu include:

- Airport
- TSIRC office
- Tagai State School (Years Pre prep to 7)
- Health centre with permanent doctor
- Two grocery stores
- Badu Arts Centre
- Sporting Facilities - indoor and outdoor multipurpose courts, Sport Stadium
- Badu Island Foundation - Motel with 6 rooms
- Qld Police Services
- Barge ramp
- Power station
- Pier (small craft and passengers only)
- SES shed
- Water plant reservoirs/ filtration collection wells
- Aragun Child Care Centre

Risk

The Badu community is currently considered low risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy.

Coastal hazards risk profile for Badu from present day to 2100

Badu Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Low	Low
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	Low	Medium

Adaptation response

A strategic adaptation response has been developed for Badu to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Badu is to avoid creating new assets in hazard areas and maintain current assets, with the approach being implemented in the present day and into 2050. By 2100, increased risk will trigger the adaptation response to "monitor" through observing changes to individual asset's capacity to withstand hazards and reviewing risk.

Adaptation response profile for Badu

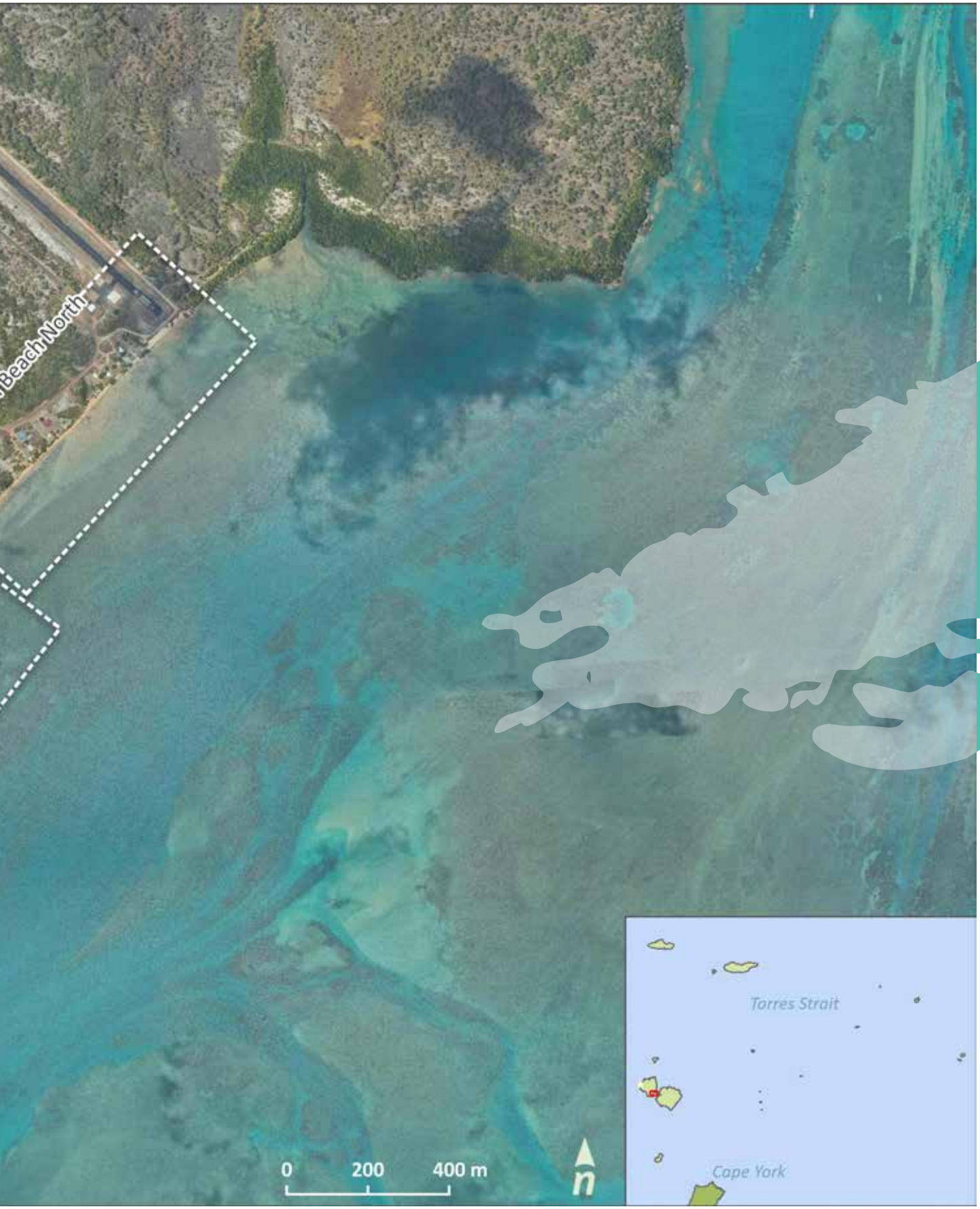
Present day	2050	2100
Avoid (and maintain)	**Avoid (and maintain)**	**Monitor (look and learn)**

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Badu are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Badu community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions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Cape York

6. Coastal hazard adaptation actions

Badu

MAIN BEACH NORTH

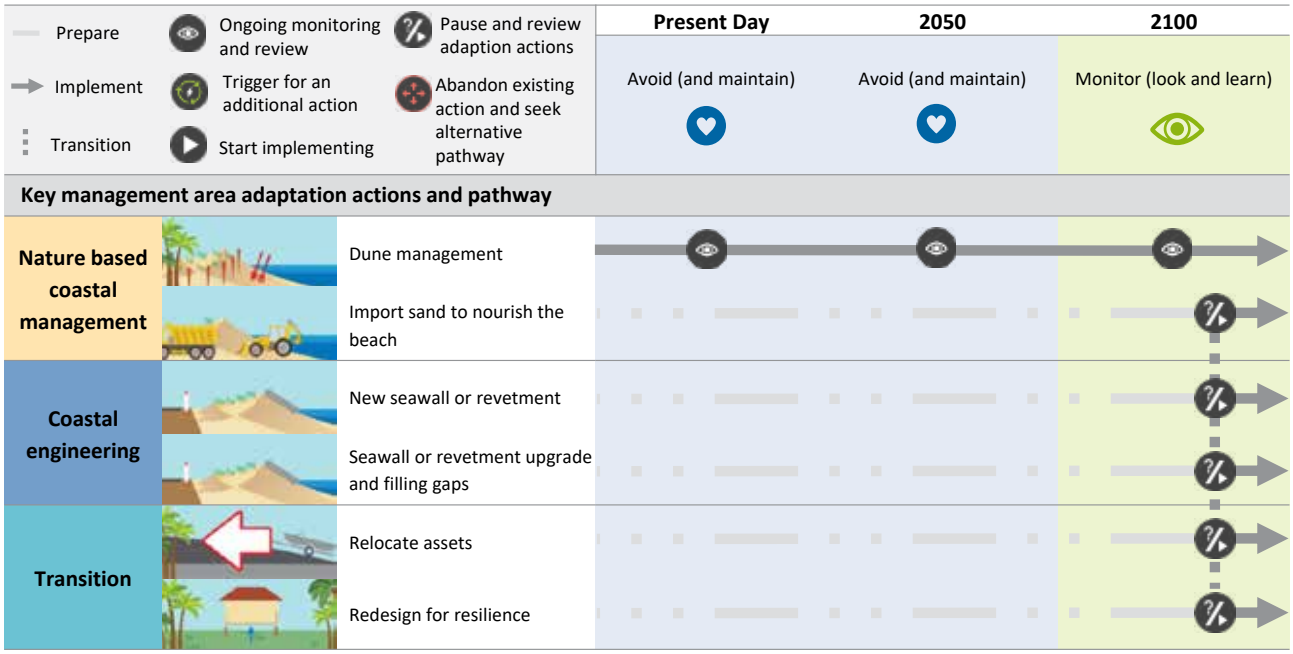
Overview of assets and values at risk

- The northern part of the main beach has several significant assets. The church is located in the centre behind a low rocky headland and there are a number of homes grouped together in the centre of this section of beach.
- At the northern end there is some localised erosion in the vicinity of a natural drainage outlet and around the end of the aerodrome.
- There is concern these assets could be impacted by both coastal erosion and inundation. The area is relatively low-lying, with open vegetation area.
- Attempts at informal erosion control by residents using coconuts in nets or discarded building material has largely been unsuccessful.
- There are several small streams along this section which cause erosion and scour behind the seawalls.

Pathway description

At Badu's Main Beach North, the adaptation pathway starts with dune management. As trigger points are reached, the community may progress to importing sand for beach nourishment or engage in constructing bunds, levees, ground raising with drainage, seawalls or revetments. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Badu – Main Beach North



MAIN BEACH SOUTH

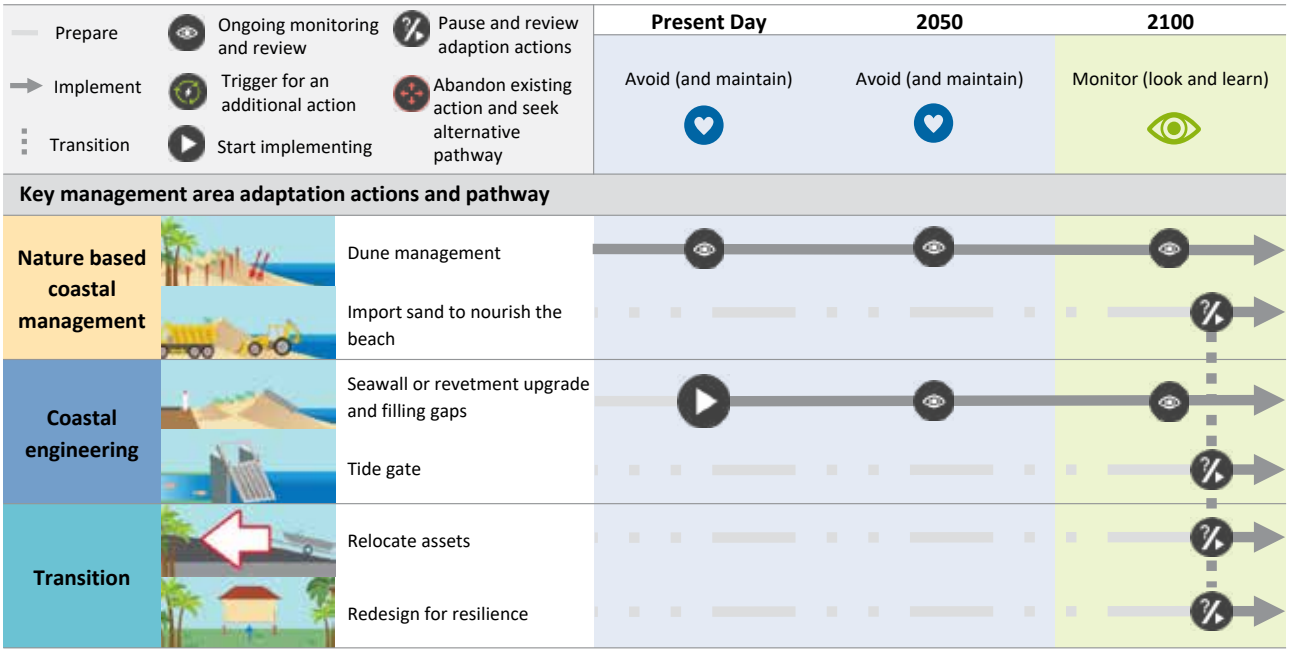
Overview of assets and values at risk

- There is a non-engineered sea wall along main beach, south of Church Street. There are several breaks in the seawall, and at some of these breaks, the adjacent beach is beginning to erode towards the township.
- Key community assets identified along this stretch of beach are the old fish factory and the cemetery which is of key concern as it is a culturally significant site.
- At the northern end of this section, a drainage channel empties onto the beach. The channel is considered critical during storm events as it drains the low-lying areas around the township.
- Where the beach has no protection structure, previous erosion is evident, but the vegetation indicates it has not occurred recently.

Pathway description

The adaptation pathway for Badu's Main Beach South begins with dune management. As trigger points are reached, the community may progress to importing sand for beach nourishment or perform seawall and revetment upgrades. If further action is needed, new tide gates can be constructed. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Badu – Main Beach South



6. Coastal hazard adaptation actions

Badu

ARGAN BEACH

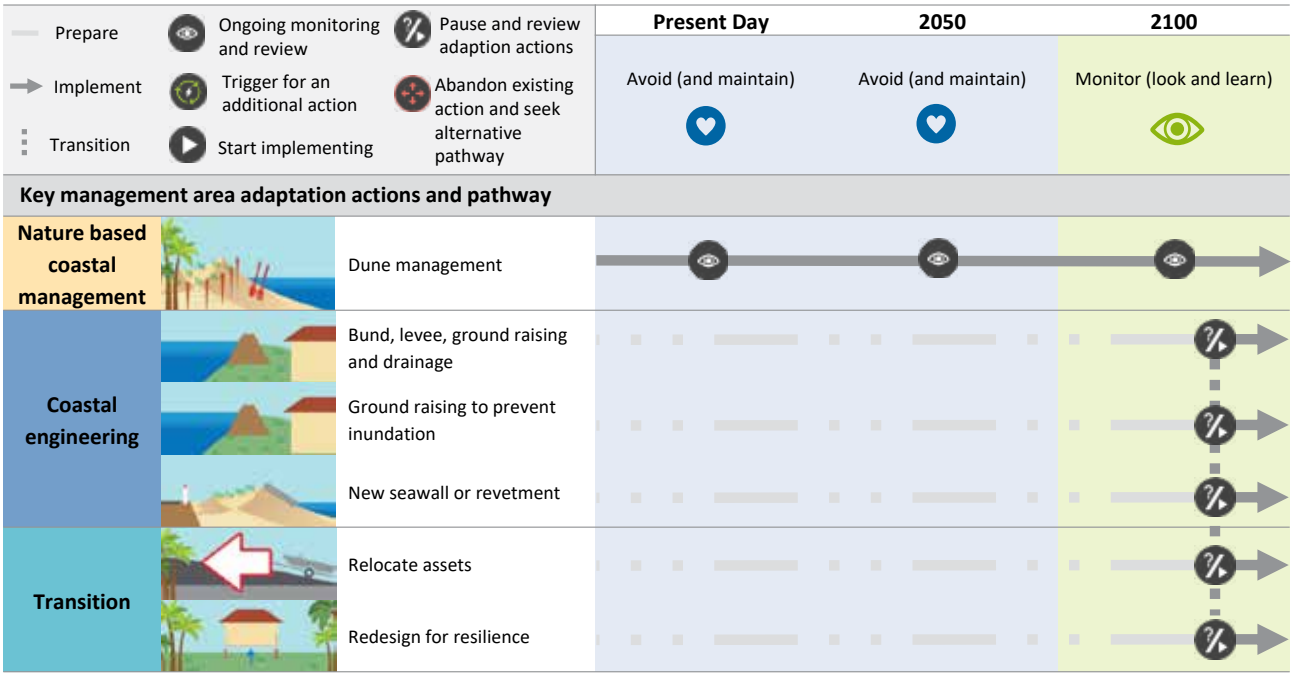
Overview of assets and values at risk

- There are a few homes on the western side of the island at Argan Beach where the shore is exposed to wind and wave conditions. Some homes have experienced erosion and residents have tried to build informal protection structures using palm fronds and other available materials.

Pathway description

For Badu's Argan Beach, the initial adaptation action is dune management. Upon reaching trigger points, the pathway can include constructing bunds, levees, ground raising with drainage, seawalls or revetments. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Badu – Argan Beach



Badu Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Badu1.1a	See Council wide actions. Consider how these actions can be effectively used in Badu.	
1.2. Education and knowledge sharing		
Badu1.2a	See Council wide actions. Consider how these actions can be effectively used in Badu.	
1.3. Monitoring		
Badu1.3a	See Council wide actions. Consider how these actions can be effectively used in Badu.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Badu2.1a	See Council wide actions. Consider how these actions can be effectively used in Badu.	
Badu2.1b	Consider establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait.	$$
2.2. Disaster planning		
Badu2.2a	See Council wide actions. Consider how these actions can be effectively used in Badu.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Badu3.1a	See Council wide actions. Consider how these actions can be effectively used in Badu.	
Badu3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to erosion in the Main Beach North KMA.	$$
Badu Community Action Plan		**Indicative cost**
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Badu4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.3 Beach nourishment		
Badu4.3a	Consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets such as houses in Main Beach North KMA and the cemetery in Main Beach South KMA. Supplement with dune restoration and access management, see action Badu4.1.a.	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Badu5.3a	Continue to monitor and maintain existing coastal protection structures in KMA Main Beach South, near the barge ramp, and in front of airstrip, and develop plan to upgrade where needed.	$$
Badu5.3b	As part of the adaptation pathway in the Main Beach North KMA and Main Beach South KMA, consider the construction of a coastal protection structure to protect exposed houses and cemetery. This action should not occur before Badu3.1b, Badu4.1a and Badu4.3a are considered.	$$$

6. Coastal hazard adaptation actions

Boigu

Community overview

Community	English name	Cluster	Type
Boigu	Talbot	Northern	Low lying mud island

Boigu is one of three islands located in the northern cluster of the Torres Strait islands (Saibai, Boigu and Dauan), and is also one of two flat mud islands found in the region. The island is approximately 90 km^2, with an approximate population of 199 people (ABS, 2021) who generally live in the main township on the north side of the island.

Boigu is generally low lying, as can be expected due to its geological composition, with mangroves covering the majority of the island. The township is of similar elevation to the rest of the island, however its location to the north offers some protection from wind and wave conditions due to the close proximity to Papua New Guinea (PNG) and smaller adjacent islands to the east and west. The island has been formed by an accumulation of mud and silt deposited on old coral platforms, however active coral growth is likely suppressed by the impact of fluvial discharges from the nearby rivers in PNG. Most of the sediments that make up the island are likely derived from fluvial sources rather than calcareous sources (TSIRC 2020a).

Some of the key infrastructure in the Boigu township include:

- Airport
- Regional Council Office
- State School (Years Pre Prep to 6)
- Health Centre with permanent nurse
- Two grocery/ convenience stores (IBIS and Tai pan)
- Sporting Facilities - School rugby league oval
- Council guest house
- Council workshop / compound
- Water plant reservoirs / filtration collection wells
- De-SAL water plant
- Power station
- Barge ramp
- Pier (small craft and passengers)
- Sewerage treatment plan
- Landfill site

Risk

The Boigu community is presently at very high risk from storm tide inundation, high risk from tidal inundation, and low risk from erosion. Tidal inundation risk is expected to increase by 2100 and while erosion poses less risk at present, it also expected to increase by 2100. The low risk from erosion is due to the recently built seawall. The medium to long term erosion risk gets progressively higher as the seawall deteriorates with age. Without maintenance and eventually an upgrade, the erosion risk will increase. However, Council's ongoing coastal protection works program has been occurring in parallel with development of this Strategy. New works, such as the new seawall construction, have the potential to reduce the risk once constructed.

Coastal hazards risk profile for Boigu from present day to 2100

Boigu Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Medium	High
Tidal inundation	High	Very High	Very High
Storm tide inundation	Very High	Very High	Very High

Adaptation response

A strategic adaptation response has been developed for Boigu to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Boigu is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. By 2050, without further action, the coastal hazard risk profile for Boigu may become too high and some active management options will no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating current assets to lower risk areas. A strategic decision will need to be made in consultation with the local community and consider the values of the Boigu area. The 'transition' adaptation pathway approach continues to be appropriate in 2100.

Adaptation response profile for Boigu

Present day	2050	2100
Actively manage 	**Transition and change** 	**Transition and change** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Boigu are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Boigu community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions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Cape York

6. Coastal hazard adaptation actions

Boigu

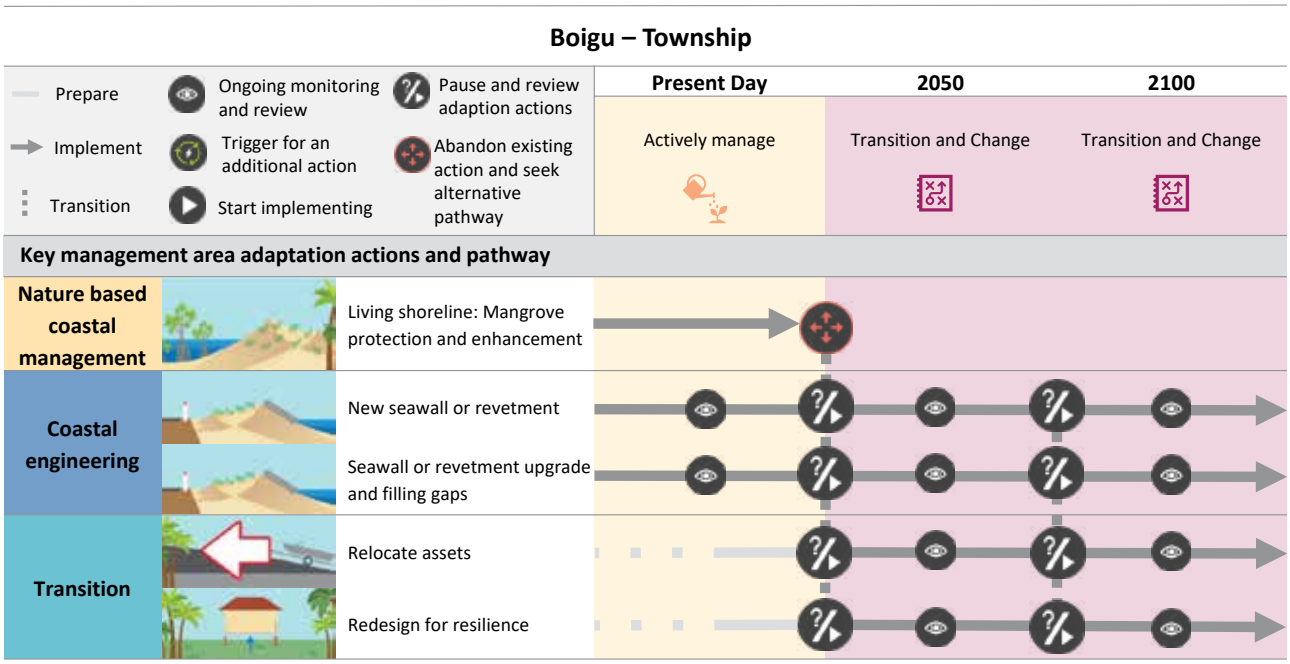
TOWNSHIP

Overview of assets and values at risk

- The township has an engineered seawall in place to protect the area from coastal erosion (see image on page 68). Before this was installed, there was an area between the barge ramp and jetty that was in a state of disrepair.
- Wall material has been lost due to wash back, resulting in a lowering of the crest height.
- This allows more waves to overtop the wall causing further lowering of the crest.
- It is well protected from erosion but will potentially be inundated by storm tides now and may be impacted more frequently into the future.

Pathway description

In Boigu Island's Township, active management can involve the protection and enhancement of living shorelines, specifically focusing on mangrove protection at two key locations. By 2050 the risks to coastal hazards are expected to be high, triggering the township transition into a "transition and change" pathway approach. The community can opt to build or upgrade seawalls and revetments or fill gaps in existing defences to further secure the area from erosion and inundation. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.



MANGROVE AREA IN FRONT OF CEMETERY

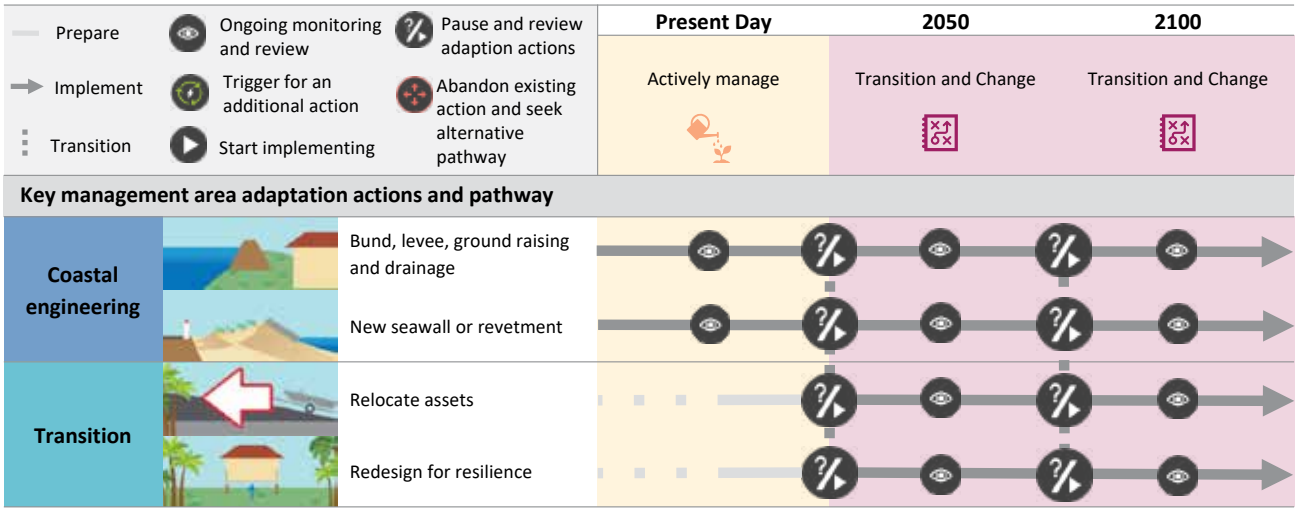
Overview of assets and values at risk

- The cemetery is located at the eastern end of the township and is somewhat protected from erosion by a mangrove forest. The presence of the mangroves suggests it is a lower energy environment, which is supported by the orientation of the area (north-west facing coastline).
- The community has previously raised concerns over inundation of the cemetery during king or storm tides and the study found the northern section of the aerodrome is prone to erosion in the long term.
- The landfill site is also currently experiencing inundation.

Pathway description

The adaptation pathway for the Mangrove Area in front of the Cemetery on Boigu Island begins with an active management approach. This may include installing a bund or levee, ground raising draining or constructing a new seawall or revetment to provide protection to the landward area. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Boigu – Mangrove Area in front of Cemetery



6. Coastal hazard adaptation actions

Boigu Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Boigu1.1a	See Council wide actions. Consider how these actions can be effectively used in Boigu.	
1.2. Education and knowledge sharing		
Boigu1.2a	See Council wide actions. Consider how these actions can be effectively used in Boigu.	
1.3. Monitoring		
Boigu1.3a	See Council wide actions. Consider how these actions can be effectively used in Boigu.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Boigu2.1a	See Council wide actions. Consider how these actions can be effectively used in Boigu.	
Boigu2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Boigu where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Boigu2.2a	See Council wide actions. Consider how these actions can be effectively used in Boigu.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Boigu3.1a	See Council wide actions. Consider how these actions can be effectively used in Boigu.	
Boigu3.1b	Investigate opportunities to extend the airstrip east.	$$$
4. Nature based coastal management (see adaptation pathways for timing)		
4.2 Living shorelines		
Boigu4.2a	Explore potential for a living shoreline to establish mangroves in the Township KMA.	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Boigu5.3a	Upgrade and extend the sea wall North of the Township KMA.	$$$
5.4 Structures to minimise flooding		
Boigu5.4a	Extend the bund wall around the south east side of the township, including around waste facilities and cemetery.	$$$
Boigu5.4b	Protect and enhance creek biodiversity and vegetation communities by installing tide gates at the creek mouths to the east and west of the township. This can also protect the community against flooding impacts.	$$$

6. Coastal hazard adaptation actions

Dauan

Community overview

Community	English name	Cluster	Type
Dauan	Mt Cornwallis	Northern	Continental volcanic and granitic rock island

Dauan is one of three islands in the northern cluster of Torres Strait islands (Saibai, Boigu and Dauan). Dauan is under 5 km^2 in size, with a population of 131 people (ABS 2021) living towards the northern edges of the island. The majority of the township is focussed on the north eastern side of the island, protected from ocean waves by Saibai to the east and Papua New Guinea (PNG) to the north.

Dauan is a steep island, rising to 295 m above sea level and mainly comprising granitic rock. The properties on the island are generally located in comparatively low-lying areas along the coastal fringe. The islands key infrastructure is generally sufficiently distanced from the beach such that risk due to coastal hazards is minimal.

Some of the key infrastructure in the Dauan township include:

- Helipad
- Regional council office
- State Primary School (years prep to 7)
- Health centre with permanent nurse
- Two grocery stores
- Sporting Facilities - Outdoor Sport Field, basketball court.
- Guesthouse (six rooms)
- Council workshop/ compound
- Water plant reservoirs/ filtration collection wells
- Power station
- Barge ramp
- Pier (small craft and passengers only)

Risk

increasing within the planning horizon of this strategy. Erosion is a greater risk with some assets located in erosion prone areas.

Coastal hazards risk profile for Dauan from present day to 2100

Dauan Risk Profile	Present Day	2050	2100
Open coast erosion	Medium	Medium	High
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	Low	Low

Adaptation response

A strategic adaptation response has been developed for Dauan to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Dauan is to "monitor" through observing changes to individual asset's capacity to withstand hazards and reviewing risk, with the approach being implemented in the present day and into 2050. By 2100, increased risk will trigger the adaptation response to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions.

Adaptation response profile for Dauan

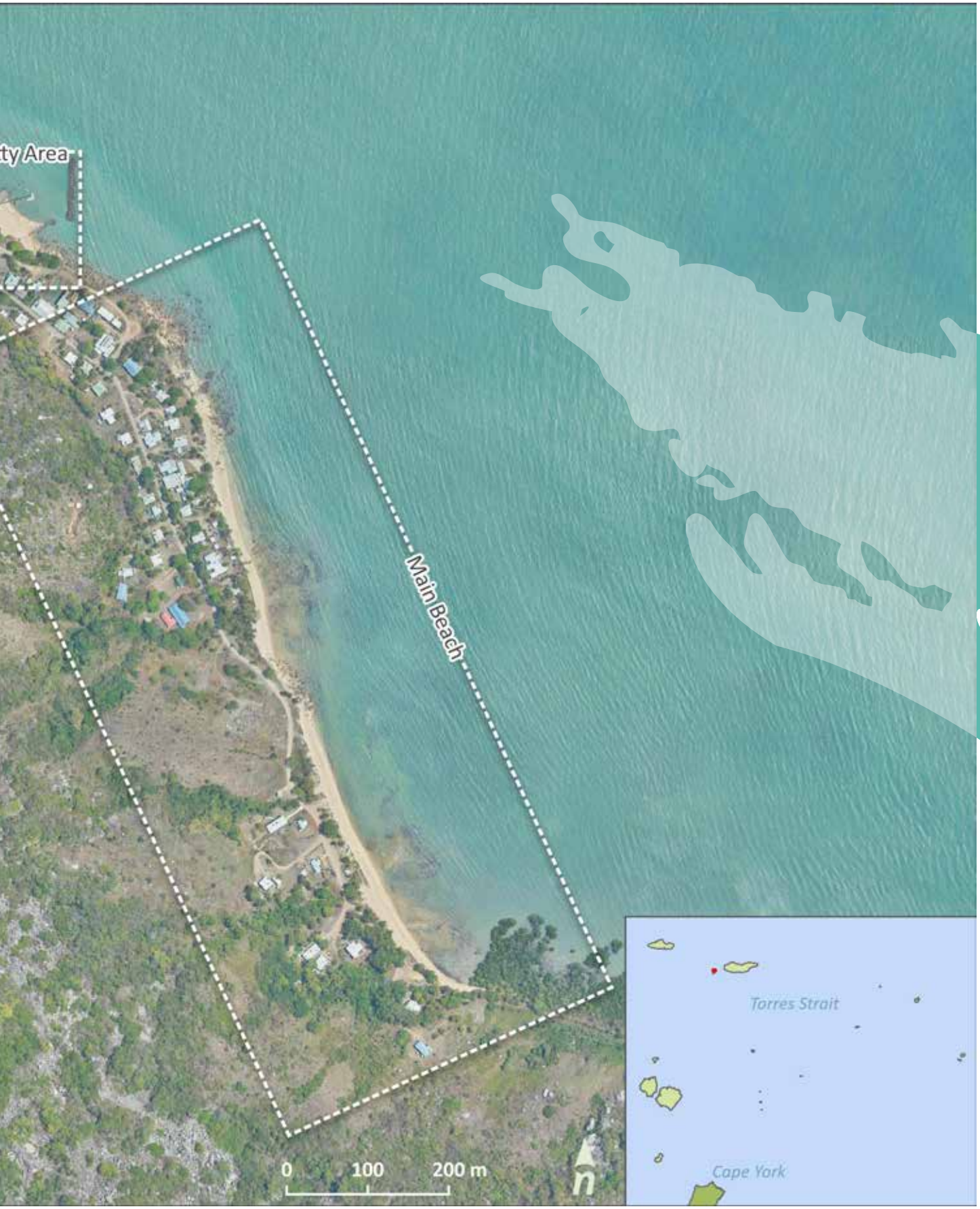
Present day	2050	2100
Monitor (look and learn)	**Monitor (look and learn)**	**Actively manage**

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Dauan are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Dauan community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


ty Area
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Torres Strait
Cape York

6. Coastal hazard adaptation actions

Dauan

MAIN BEACH

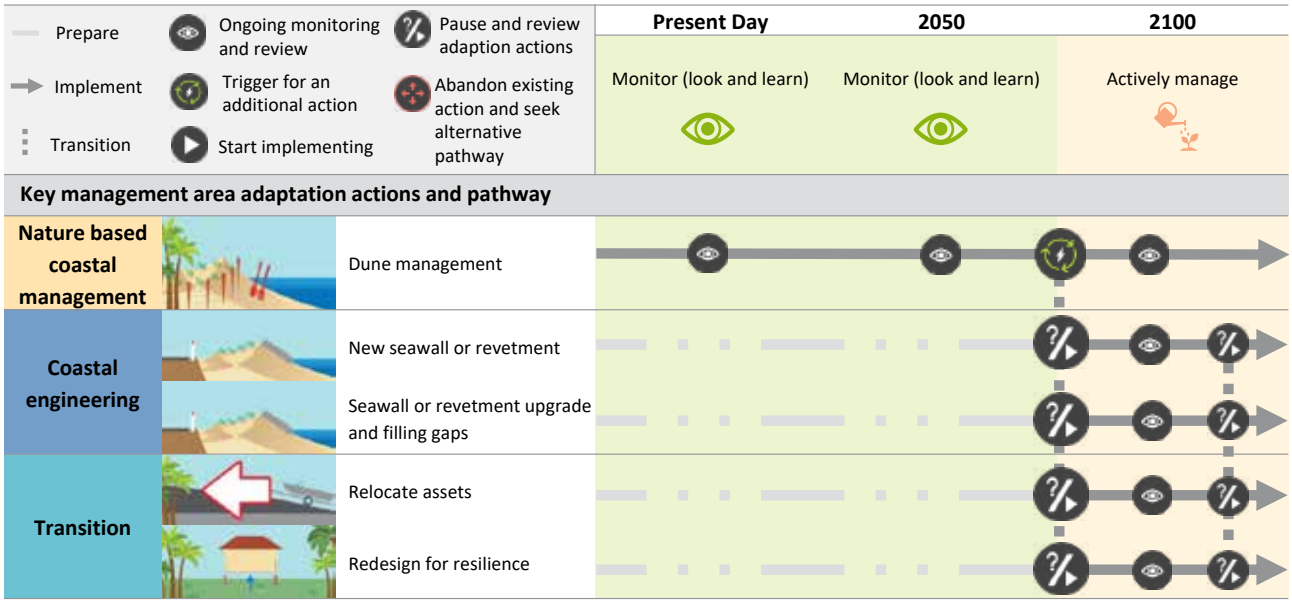
Overview of assets and values at risk

- The beach in front of the township transitions from a small bay to the south into an exposed beach towards the northern end.
- A rock outcrop separates the northern and southern sections of beach.
- Houses generally begin to the north of the rock outcrop, where some erosion has been experienced and residents have used available material to try and reinforce the beach to varying degrees of success.
- There is an informal seawall located at the southern half of the main beach.
- The community identified some areas that were affected by coastal hazards, where the damage is predominately from stormwater runoff scouring out beaches and streams.

Pathway description

At Dauan Island's Main Beach, initial adaptation actions involve active dune management using vegetation management techniques. As trigger points are reached, the adaptation pathway will transition into an active management approach where existing seawalls and revetments can be upgraded and gaps filled to enhance coastal defences. If needed, new seawalls or revetments can be built to provide further protection. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Dauan – Main Beach



JETTY AREA

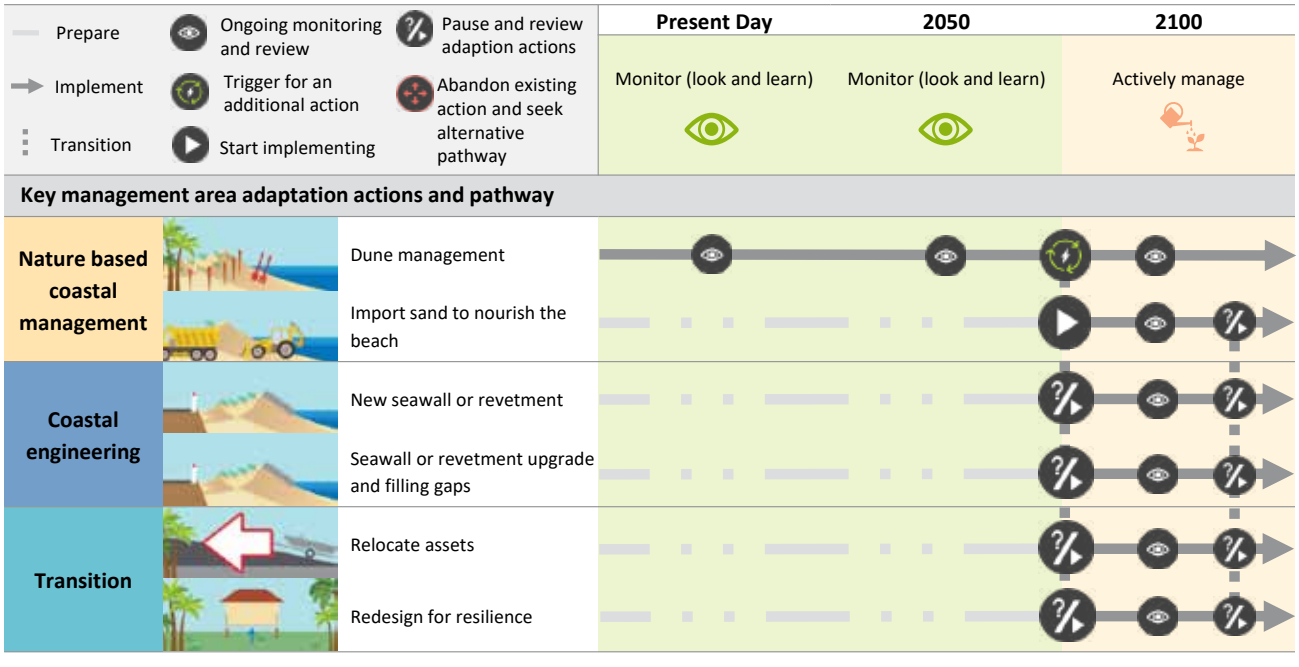
Overview of assets and values at risk

- The jetty area has two small bays, separated by the barge ramp.
- The beaches do not experience significant erosion, except for scour from stormwater runoff.
- There is a low profile groyne of unknown design at the south end of the bay leading out to an offshore detached breakwater of unknown, design. The breakwater is in place to reduce the prevailing short period easterly wave activity affecting jetty and barge operations.
- The study found the area could be subject to future inundation.
- There are service buildings which may be inundated during high tides, permanent inundation or storm tides in the future.
- The jetty may be occasionally inundated with higher sea levels and is within the coastal erosion zone.

Pathway description

For the Jetty Area on Dauan Island, initial adaptation actions involve active dune management using vegetation management techniques. As trigger points are reached, the adaptation pathway will transition into an active management approach. At this stage the community can import sand to nourish the beach. If needed, existing seawalls and revetments can be upgraded and gaps filled to enhance coastal defences or new seawalls and revetments can be built to provide further protection. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas..

Dauan – Jetty Area



6. Coastal hazard adaptation actions

Dauan

HELIPAD AREA

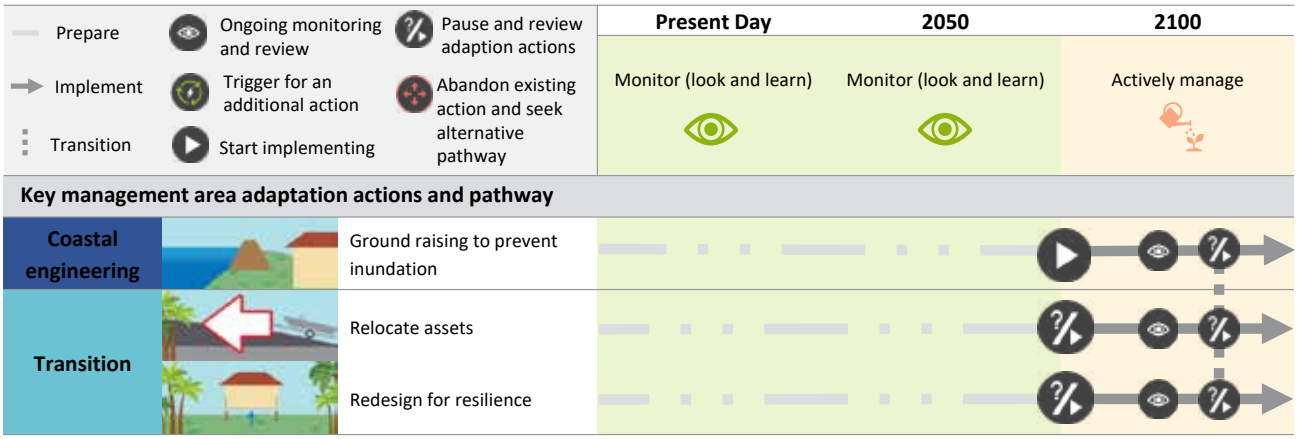
Overview of assets and values at risk

- The study found this area could be vulnerable to coastal hazards.
- This area is unlikely to experience erosion however there's potential for inundation at the cemetery.

Pathway description

The initial adaptation pathway for the Helipad Area on Dauan Island is to "monitor" the hazards and prepare for future risks. As trigger points are reached, the adaptation pathway will transition into an active management approach. Ground raising can be implemented at three strategic locations to prevent inundation. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Dauan – Helipad Area



Dauan Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Dauan1.1a	See Council wide actions. Consider how these actions can be effectively used in Dauan.	
1.2. Education and knowledge sharing		
Dauan1.2a	See Council wide actions. Consider how these actions can be effectively used in Dauan.	
1.3. Monitoring		
Dauan1.3a	See Council wide actions. Consider how these actions can be effectively used in Dauan.	
Dauan1.3b	Partnering with a university institution and utilising citizen science for monitoring understake an investigation into the drivers of sand accumulation in mangrove and offshore areas.	$

Dauan Community Action Plan		Indicative cost
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Dauan2.1a	See Council wide actions. Consider how these actions can be effectively used in Dauan.	
Dauan2.1b	Consider re-establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait	$$
2.2. Disaster planning		
Dauan2.2a	See Council wide actions. Consider how these actions can be effectively used in Dauan.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Dauan3.1a	See Council wide actions. Consider how these actions can be effectively used in Dauan.	
Dauan3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to erosion in the Main Beach KMA.	$$
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Dauan4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Dauan4.2a	Explore potential for a living shoreline to establish mangroves in front of the road leading to the Helipad Area KMA.	$$
4.3 Beach nourishment		
Dauan4.3a	Monitor beach profiles in the Jetty Area KMA and, if extensive erosion occurs, consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Dauan4.1.a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.2 Structures to dissipate energy offshore		
Dauan5.2a	Explore option for an additional breakwater in front of the Jetty to protect from NE winds/waves	$$$
5.3 Last line of defence structures		
Dauan5.3a	As part of the adaptation pathway in the Jetty Area and Main Beach KMAs, consider the construction of a coastal protection structure to protect exposed houses. This action should not occur before Dauan3.1b, Dauan4.1a and Dauan4.3a are considered.	$$$

6. Coastal hazard adaptation actions

Erub

Community overview

Community	English name	Cluster	Type
Erub	Darnley	Eastern	Continental volcanic and granitic rock island

Erub, located in the eastern cluster of Torres Strait is lands, is home to approximately 326 people (ABS, 2021). It is a volcanic island just under 6 km^2 in size, generally surrounded by reef. As the main township is located on the south-western edge of the island, coastal erosion risk is increased by the movement of currents and waves around the island which are predominately caused by the Sager winds (south-east trade winds). The Kuki (north-west winds) can also lead to waves refracting around the island. The wave conditions are reduced in some areas by the extensive fringing reefs extending to the southeast of the island.

Most residential property is located along the southern coastline, with additional infrastructure around the aerodrome to the north-east. The majority of the island is above +5m Australian Height Datum (AHD), including the aerodrome. However, the residential properties and supporting infrastructure is in close proximity to the coastal fringe, which is at increased risk to coastal hazards.

Some of the key infrastructure on Erub includes:

- Airport
- Regional council office
- State school (years pre-prep to 6)
- Health centre with permanent nurse
- One grocery store (IBIS)
- Sporting facilities - very large indoor and outdoor multipurpose courts, rugby league oval
- Demountable accommodation - 15 rooms, adjacent to airport
- Guest house - 5 rooms
- Council workshop/ compound
- Water plant reservoirs/ filtration collect ion wells
- Power station
- Barge ramp
- Pier (small craft and passengers only)
- Sewer treatment plant

Risk

The Erub community is presently at low to medium risk from inundation and high risk from erosion, with many of the mapped assets located in the coastal fringe. The inundation risk is expected to increase however the topography of the island may provide more elevated areas to relocate assets which can help to reduce this risk.

Coastal hazards risk profile for Erub from present day to 2100

Erub Risk Profile	Present Day	2050	2100
Open coast erosion	High	High	High
Tidal inundation	Low	Medium	High
Storm tide inundation	Medium	High	High

Adaptation response

A strategic adaptation response has been developed for Erub to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Erub is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. The adaptation approach is to be implemented from present day and also moving forward into 2050 and 2100.

Adaptation response profile for Erub

Present day	2050	2100
Actively manage 	**Actively manage** 	**Actively manage** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Erub are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Erub community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions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Cape York

6. Coastal hazard adaptation actions

Erub

MAIN BEACH

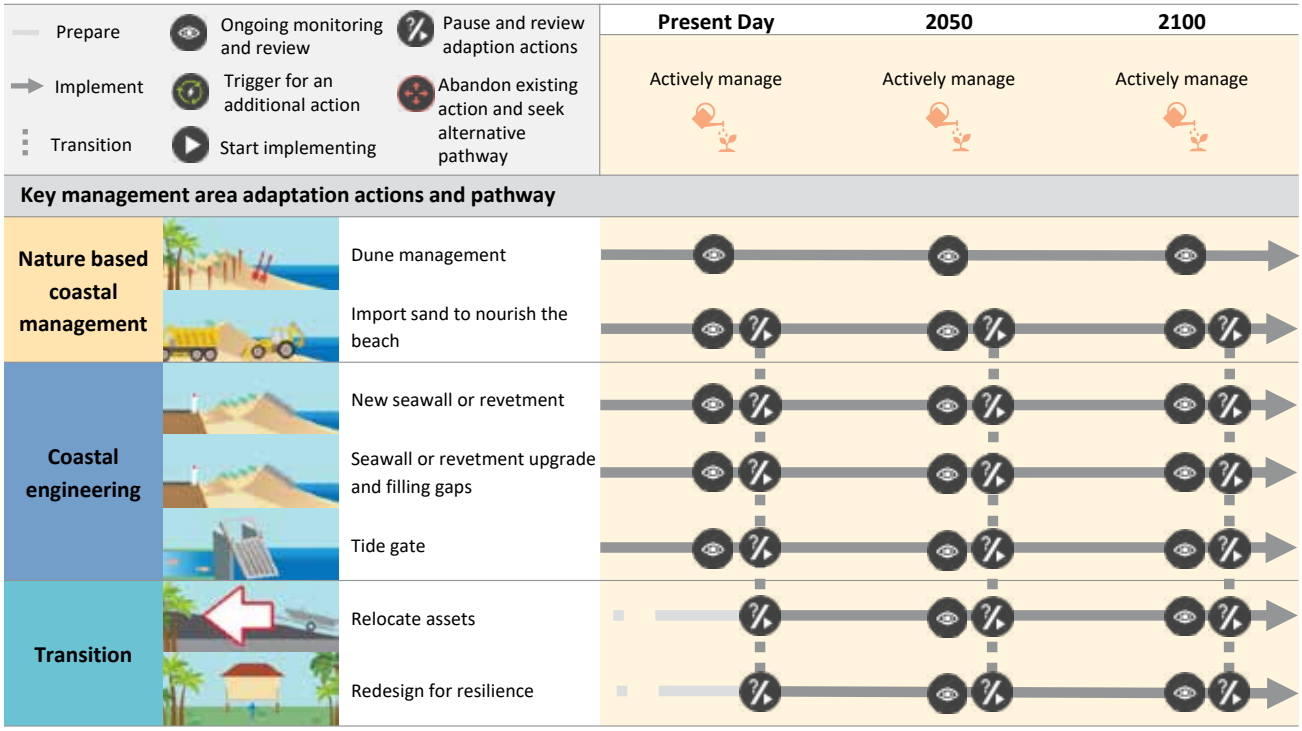
Overview of assets and values at risk

- The Main Beach faces southeast and there is evidence of erosion in the past.
- There have been attempts at erosion control in the past using available materials.
- Evidence of inundation at high tides is apparent and the study found this area may also be impacted under permanent inundation due to sea level rise and storm tide inundation in the future.
- Specific areas the community has expressed concerns about in the past are the main community beaches in front of Egrue, and Isem.
- Residents have expressed concern about an old rubbish dumping site they say is now experiencing erosion east of Isem Village. The community is concerned about the environmental impacts of erosion at the site.

Pathway description

At Erub Island's Main Beach, initial active management actions can focus on dune management using vegetation management techniques in three key locations. As trigger points are reached, the community can import sand to nourish the beach to compliment dune management at the three strategic locations. In addition, existing seawalls and revetments can be upgraded and gaps filled, or new sea walls or revetments can be constructed to provide further protection. If needed, tide gates can be installed at two locations for additional protection. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Erub – Main Beach



JETTY AND BARGE RAMP AREA

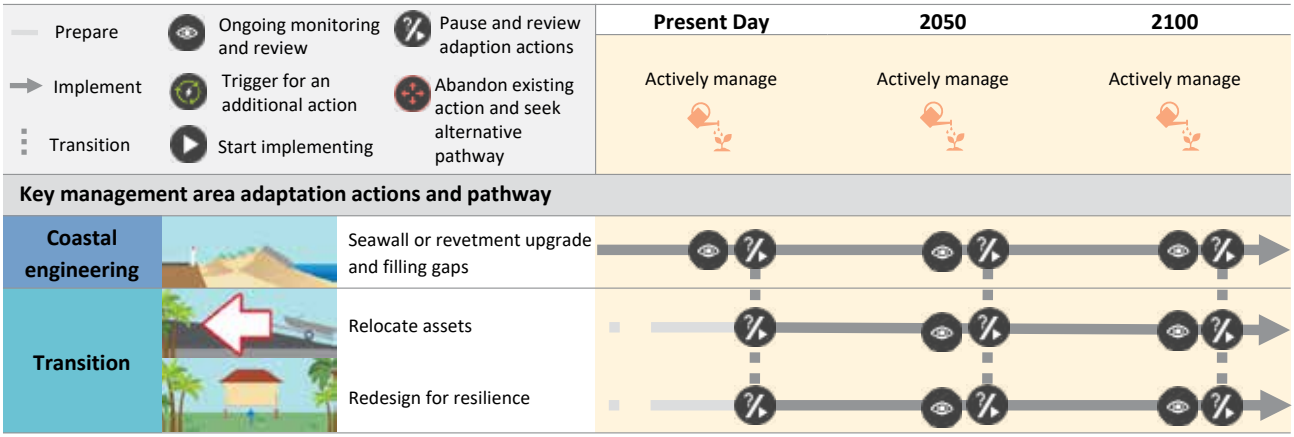
Overview of assets and values at risk

- Adjacent to the landing is Jetty Beach, which has some small buildings along its length.
- This area experiences inundation and erosion during large tides.
- This area of beach has also had significant historical issues with scour erosion from streams and surface water runoff.
- This type of erosion can move sand out of the beach system and impact sediment balance.
- The study found barge and jetty area may be impacted due to sea level rise inundation and storm tide inundation in the future.

Pathway description

In the Jetty and Barge Ramp Area on Erub Island, active management can involve upgrading existing seawalls and revetments and filling gaps to provide better coastal protection against hazards. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Erub – Jetty and Barge Ramp Area



6. Coastal hazard adaptation actions

Erub

ROAD TO MAIN BEACH

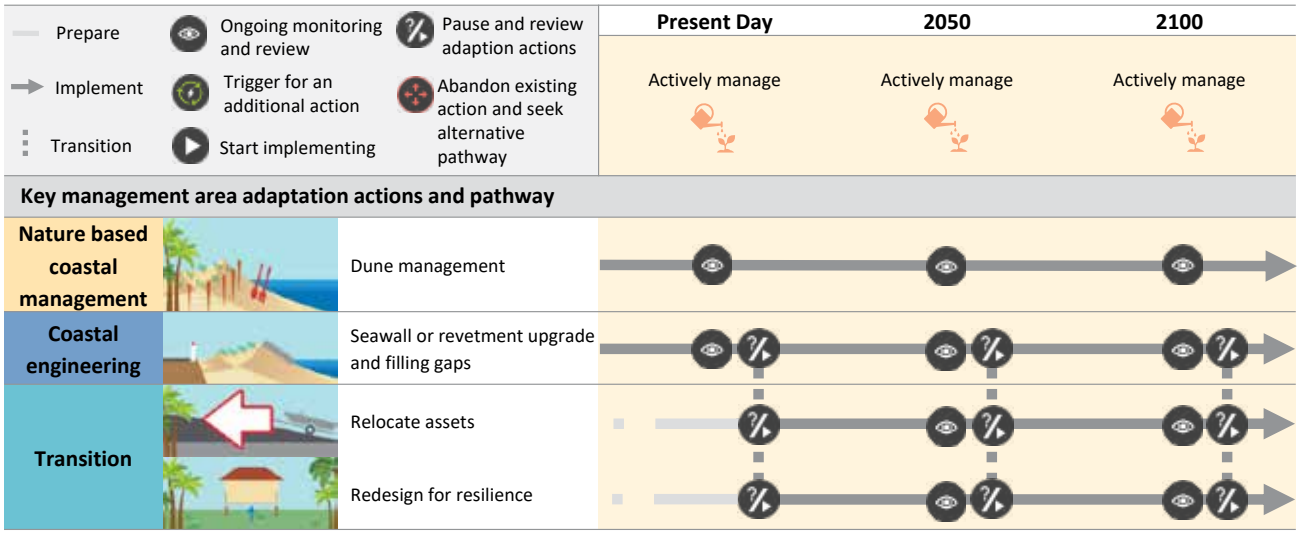
Overview of assets and values at risk

- There has been a history of erosion of the beach adjacent to the road, threatening transport infrastructure and connectivity along the coastline.

Pathway description

In the Road to Main Beach area on Erub Island, initial actions can involve dune management using vegetation management techniques. As trigger points are reached, the community can opt to upgrade existing seawalls or revetments and fill gaps to further secure the area from erosion and inundation. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Erub – Road to Main Beach



NORTH TOWNSHIP

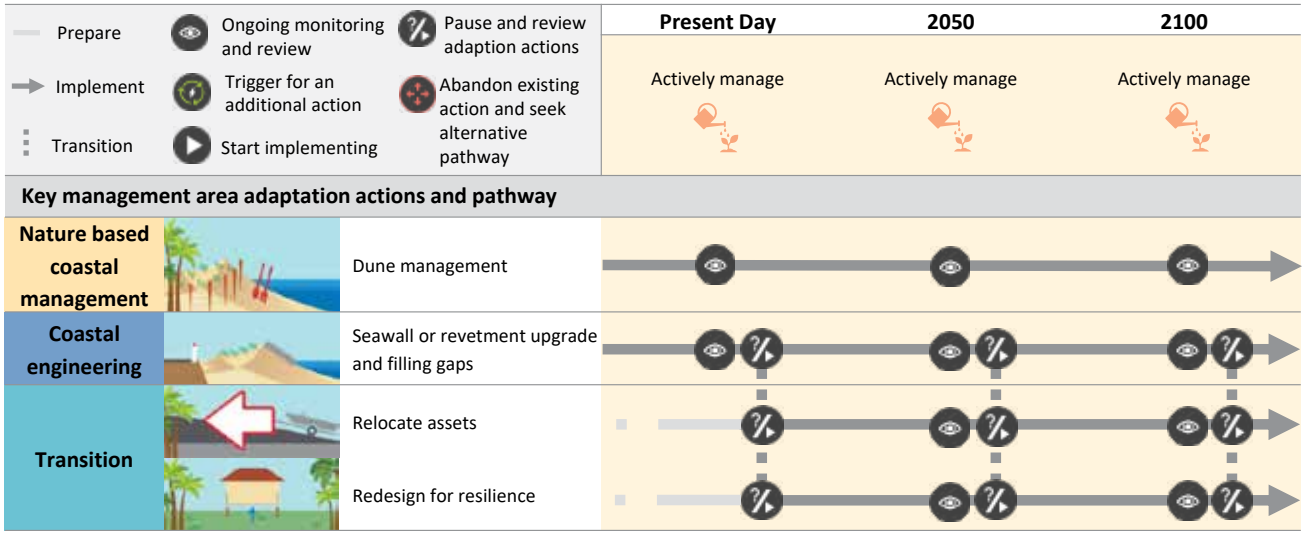
Overview of assets and values at risk

- The sewer infrastructure, although inland, could be vulnerable to sea level rise inundation and storm tide inundation in the future.
- Residents have expressed concern about an old rubbish dumping site they say is now experiencing erosion east of Isem Village. The community is concerned about the environmental impacts of erosion at the site.

Pathway description

In the North Township on Erub Island, initial efforts can centre on dune management through vegetation management at two locations. As trigger points are reached, the community can opt to upgrade existing seawalls or revetments and fill gaps to further secure the area from erosion and inundation. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Erub – North Township



6. Coastal hazard adaptation actions

Erub Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Erub1.1a	See Council wide actions. Consider how these actions can be effectively used in Erub.	
1.2. Education and knowledge sharing		
Erub1.2a	See Council wide actions. Consider how these actions can be effectively used in Erub.	
1.3. Monitoring		
Erub1.3a	See Council wide actions. Consider how these actions can be effectively used in Erub.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Erub2.1a	See Council wide actions. Consider how these actions can be effectively used in Erub.	
Boigu2.1b	Consider re-establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait	$$
2.2. Disaster planning		
Erub2.2a	See Council wide actions. Consider how these actions can be effectively used in Erub.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Erub3.1a	See Council wide actions. Consider how these actions can be effectively used in Erub.	
Erub3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to erosion in the Main Beach and North Township KMAs.	$$

Erub Community Action Plan		Indicative cost
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Erub4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Erub4.2a	Explore feasibility of an artifical reef to enhace fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Erub4.3a	Monitor beach profiles in the Main Beach, Road to Main Beach, and Jetty and Barge Area KMAs and consider beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Erub4.1.a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Erub5.3a	As part of the adaptation pathway in the Main Beach, Road to Main Beach, and Jetty and Barge Area KMAs, consider the construction of a coastal protection structure to protect exposed houses. This action should not occur before Erub3.1b, Erub4.1a and Erub4.3a are considered.	$$$

6. Coastal hazard adaptation actions

Iama

Community overview

Community	English name	Cluster	Type
Iama	Yam	Central	Continental volcanic and granitic rock island

Iama is part of the central cluster of the Torres Strait islands. The island is approximately 2 km^2 in size, with the population of 275 people (ABS, 2021) generally focussed in the main township on the western side of the island. The island is a continental type island that has mangrove forests extending to the north and east. Smaller islands to the northeast and east are connected by mangrove forests. There is a continuous fringing reef surrounding the island (broken only by the barge ramp access), which mitigates coastal erosion along some of the coastline. Much of the undeveloped interior of the island is steep, with construction activities inherently difficult due to the slope and geology.

Key infrastructure on Iama includes:

- Airport
- Regional council office
- State school (years pre-prep to 7)
- Health centre with permanent nurse
- IBIS grocery store
- Sporting facilities - indoor and outdoor multipurpose courts, rugby league oval
- Guest house - five rooms
- Augustine Lodge - five rooms
- Barge ramp
- Workshop facility
- Power station
- Pier (small craft and passengers only)
- SES shed
- Library
- Water plant reservoirs/filtration collection wells
- Landfill site

Risk

Iama is presently considered at medium-high risk from coastal hazards. Existing protection structures mitigate the threat from erosion however they will need to be upgraded in the future to maintain their function. Risk from storm tide inundation is high and expected to increase substantially in the medium to long term. Council's ongoing coastal protection works program has been occurring in parallel with development of this Strategy. New works, such as the seawall planned for 2023/24, have the potential to reduce the risk once constructed.

Coastal hazards risk profile for Iama from present day to 2100

Iama Risk Profile	Present Day	2050	2100
Open coast erosion	Medium	High	High
Tidal inundation	Medium	High	Very High
Storm tide inundation	High	Very High	Very High

Adaptation response

A strategic adaptation response has been developed for Iama to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Iama is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. By 2050, the coastal hazard risk profile for some parts of Iama may become too high and some active management options may no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating current assets to lower risk areas. A strategic decision will need to be made in consultation with the local community and consider the socio-economic, cultural and environmental values of the Iama area. The 'transition' adaptation pathway approach will continue to be implemented in 2100.

Adaptation response for Iama

Present day	2050	2100
Actively manage 	**Transition and change** 	**Transition and change** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Iama are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Iama community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


East Island
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6. Coastal hazard adaptation actions

Iama

NORTHERN TOWNSHIP

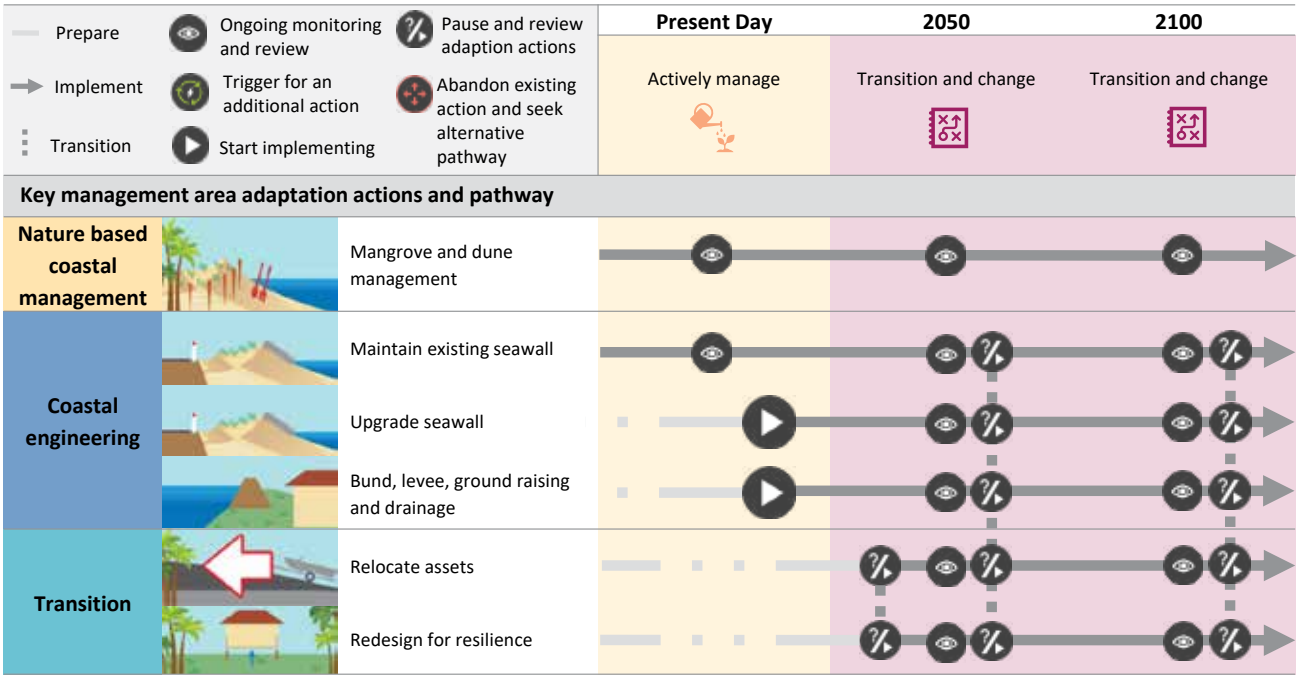
Overview of assets and values at risk

- The northern end of the beach has a seawall of unknown design in place that is in a state of disrepair. At the northern termination of the seawall, erosion of the adjacent beach is causing washout from behind the seawall.
- There has also been concern over the seawall near the desalination plant (adjacent to barge ramp).
- Residents also commented during previous consultations that, during king tides, inundation can occur from the eastern side of the spit, as well as overtopping the seawall itself.
- Possible engineering solutions to assist with this are introducing a wave return wall to the northern seawall, with an earth embankment constructed on the eastern side to protect from inundation. Top up of the seawall near the desalination plant was also suggested during previous consultation.

Pathway description

In the northern township on Iama, initial actions can involve dune and mangrove management to increase natural resilience. Trigger points have been reached and there are plans in place to upgrade the existing seawalls and revetments, as well as a bund surrounding most of the township. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Iama – Northern Township



CENTRAL TOWNSHIP

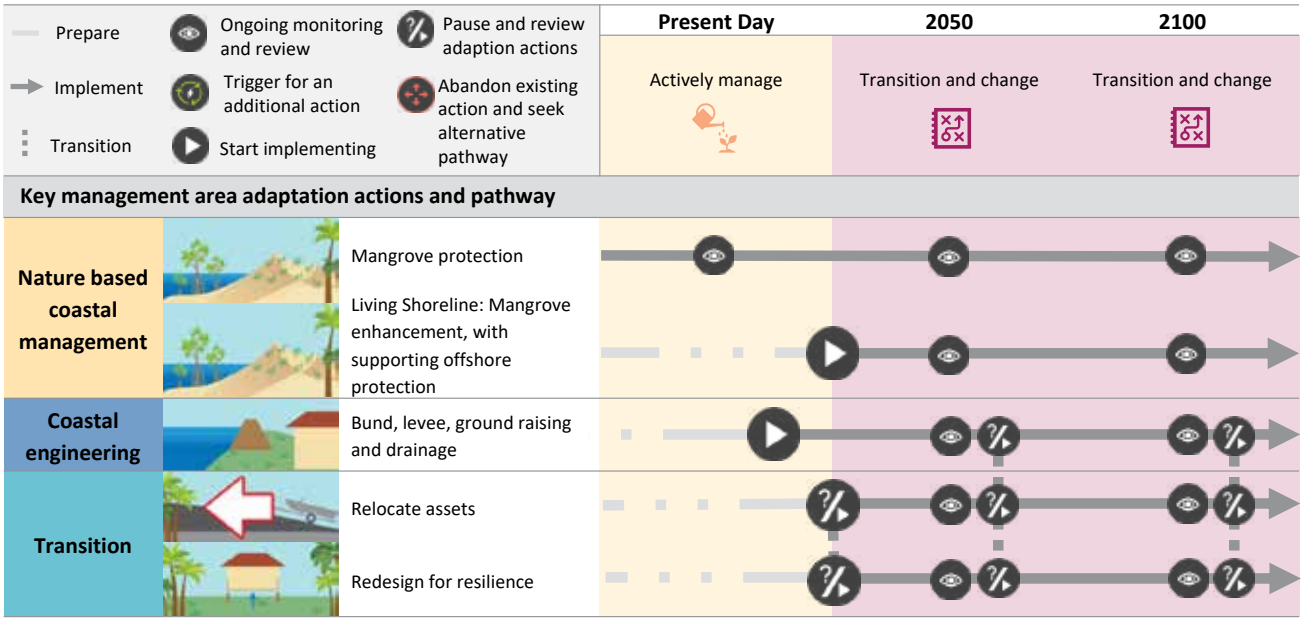
Overview of assets and values at risk

- The back of the village has experienced inundation during king tides and storm tides in the past and now has a double line of defence. The low seawall (unknown design) facing the mangroves is considered the first line of defence to stop the majority of high tides running up onto the road.
- The second line is a seawall along the road installed to protect the community during king tides. The 'high tide' boat ramp is located here because of the protected location; however, the area is extremely low-lying and does not have substantial freeboard during a high tide. The high tide boat ramp is being increasingly used during rough conditions, as the community has advised the breakwater (unknown design) protecting the barge ramp (also community boat ramp) is not very effective. This is a safety issue for the community as small craft navigating around the northern spit, particularly at night, is hazardous.

Pathway description

In Iama's central township, initial actions can focus on mangrove management. Trigger points have been reached and there are plans in place to construct a bund surrounding most of the township. Another option would be to establish a living shoreline – a hybrid approach that constructs protection and fosters the establishment and enhancement of mangroves. This may offer additional protection from inundation from the east, reducing the burden on the planned bund, however this might affect the utility of the boat ramp. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Iama – Central Township



6. Coastal hazard adaptation actions

Iama

SOUTHERN TOWNSHIP

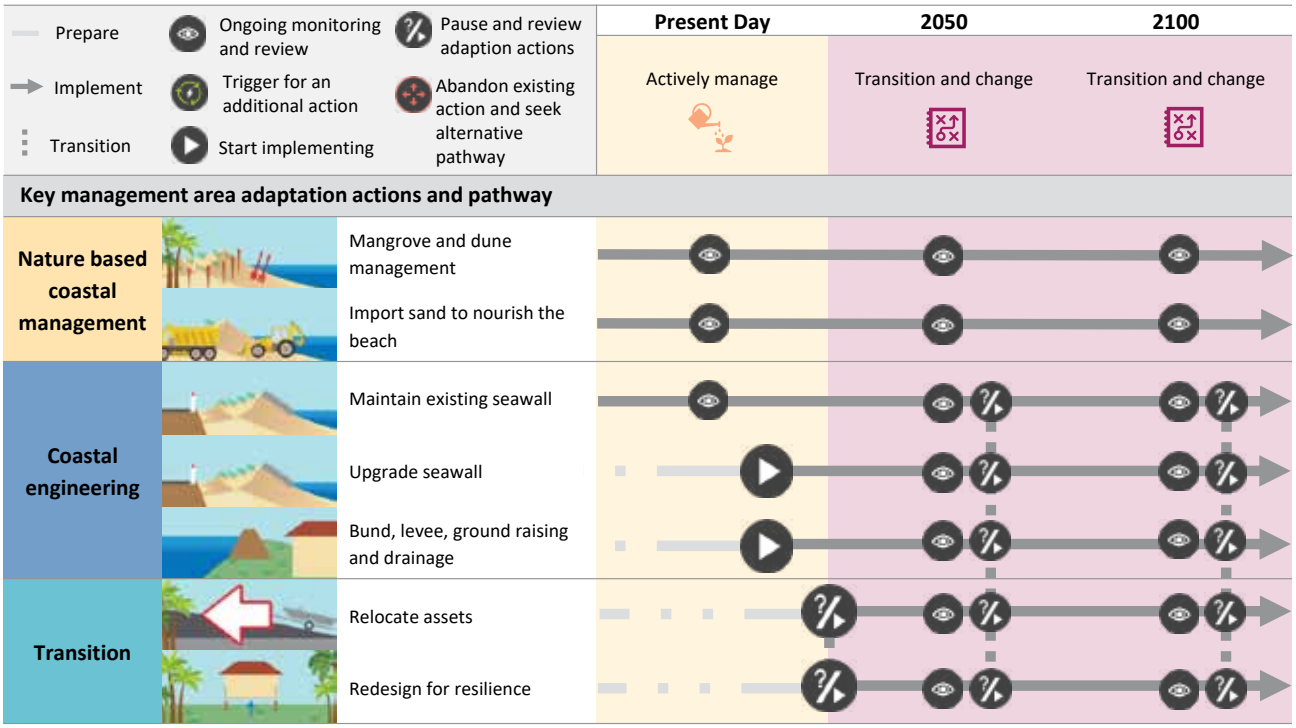
Overview of assets and values at risk

- An improvised non-engineered seawall and an offshore breakwater have protected the southern beach from erosion processes to some extent.
- The key infrastructure being protected is the road along the shore leading to several residences at the southern end of the beach. Residents report the beach fluctuates throughout the year depending on the seasonal winds.

Pathway description

In the southern township on Iama, initial actions can i nvolve dune management to increase natural resilience. Trigger points have been reached and there are plans in place to upgrade the existing seawalls and revetments, as well as a bund surrounding most of the township. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Iama – Southern Township



EAST ISLAND

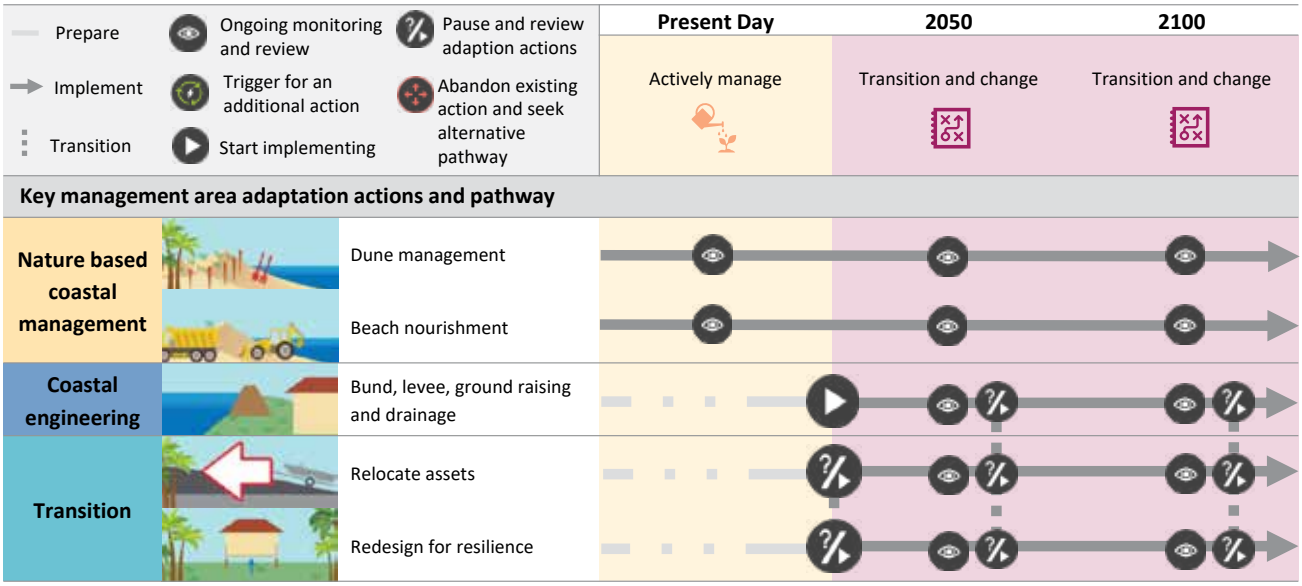
Overview of assets and values at risk

- This area is currently inundated during king tides and storm surges. This is a concern to the community as the infrastructure is at risk of being damaged during each monsoon season.
- The service area also leads to the sports stadium and eastern end of the aerodrome.
- With predicted increased inundation due to sea level rise and increased storm tide levels, this corridor may provide a path for water to impact further inland.

Pathway description

At Iama's east island, the adaptation pathway begins with dune management on the beach. As trigger points are reached, the community can import sand to nourish the beach and manage erosion. For inundation, the community can implement ground raising measures along the roads and for key critical infrastructure. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Iama – East Island



6. Coastal hazard adaptation actions

Iama Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Iama1.1a	See Council wide actions. Consider how these actions can be effectively used in Iama.	
1.2. Education and knowledge sharing		
Iama1.2a	See Council wide actions. Consider how these actions can be effectively used in Iama.	
1.3. Monitoring		
Iama1.3a	See Council wide actions. Consider how these actions can be effectively used in Iama.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Iama2.1a	See Council wide actions. Consider how these actions can be effectively used in Iama.	
Iama2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Iama where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Iama2.2a	See Council wide actions. Consider how these actions can be effectively used in Iama.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Iama3.1a	See Council wide actions. Consider how these actions can be effectively used in Iama.	
Iama3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to hazards in the Southern, Northern and Central Township KMAs.	$$

Iama Community Action Plan		Indicative cost
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Iama4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Iama4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Iama4.3a	Monitor beach profiles in the Southern Township, Northern Township and East Island KMAs and consider beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Iama4.1.a.	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Iama5.3a	Maintain and upgrade the sea wall in the Southern Township, Northern Township KMA, and near the barge ramp.	$$$
5.4 Structures to minimise flooding		
Iama5.4a	Proceed with plans to construct bunds around the township, cemetery, and East Island infrastructure.	$$$

6. Coastal hazard adaptation actions

Kirriri

Community overview

Community	English name	Cluster	Type
Kirriri	Hammond	Southern	Continental volcanic and granitic rock island

Kirriri is located in the southern cluster of Torres Strait islands, to the west of Waibene (Thursday Island). The island is approximately 15 km^2 and has a population of approximately 261 people (ABS, 2021). Kirriri can be classified as a continental type is land with geology similar to that found on mainland Australia.

The majority of the community live in the main township, which is located in a narrow valley between two areas of high elevation. To the north the landscape rises to over 150 m above sea level. To the south of the township the peak elevation is lower, at just over 100 m above sea level.

The main beach adjacent the township is approximately 900 m long, runs in a north -south orientation, and has a non -engineered seawall running the entirety of its length. North of the main beach, the coastal strip extends approximately 1.3 km along bays and small headlands.

Key infrastructure on Kirriri includes:

- Regional council office
- Catholic primary school (years pre -prep to year three)
- Child day care facility
- Small convenience store
- Sporting facilities – indoor and outdoor multi-purpose courts, rugby league oval
- Council workshop/compound
- SES shed
- Water plant reservoirs/filtration collection wells
- Power station
- Barge ramp
- Pier (small craft and passengers only)
- Refuel facility (solar powered) diesel and petrol

Risk

The Kirriri community is currently considered medium to low risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy. Some assets in the community are at risk from erosion but protected from non-engineered structures which will lose efficacy over time leading to an increased risk from erosion.

Coastal hazards risk profile for Kirriri from present day to 2100

Kirriri Risk Profile	Present Day	2050	2100
Open coast erosion	Medium	Medium	High
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	Low	Medium

Adaptation response

A strategic adaptation response has been developed for Kirriri to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Kirriri is to "monitor" through observing changes to individual asset's capacity to withstand hazards and reviewing risk, with the approach being implemented in the present day and into 2050. By 2100, increased risk will trigger the adaptation response to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions.

Adaptation response profile for Kirriri

Present day	2050	2100
Monitor (look and learn) 	**Monitor (look and learn)** 	**Actively manage** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Kirriri are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Kirriri community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


Northern Township
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Torres Strait
Cape York

6. Coastal hazard adaptation actions

Kirriri

NORTHERN TOWNSHIP

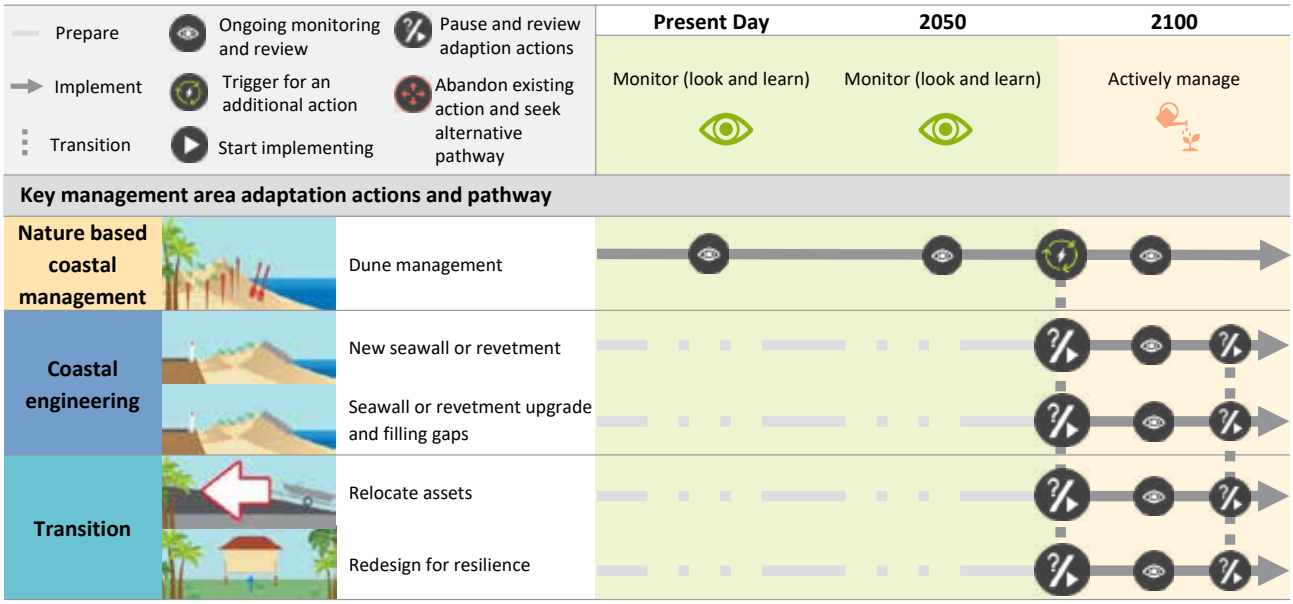
Overview of assets and values at risk

- The northern beaches have several residences and informal structures, with the shoreline broken up into several bays between rocky headlands.
- The majority of the beaches have informal seawalls, but most are in a state of disrepair and are of varying elevation.
- The large stream discharging just north of Raehome point is the largest along the eastern side of the island.
- The study shows that, to the north of Raehome Point, there is a mixture of erosion and accretion with one erosion hotspot where it appears that there has been some clearing of the mangrove fringe.
- Previous reports have indicated that the community are aware that the non-engineered seawall has caused the adjacent beach slope to be very low and flat. This has resulted in loss of beach amenity such that there is no dry beach area during high tides. However, the seawall has halted the natural erosion processes, and has maintained the shoreline in its current location.

Pathway description

In Kirriri's Northern Township, the adaptation pathway begins with dune management. As trigger points are reached, the community can opt to upgrade existing seawalls and revetments, filling gaps for added protection against coastal hazards. The trigger points will also be a chance to consider relocating structures or redesigning them for resilience. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Kirriri – Northern Township



SOUTHERN TOWNSHIP

Overview of assets and values at risk

- This area has experienced erosion along most of its length except for a small area at the southern end.
- There is a small non-engineered seawall along the length of the beach, however, without adequate maintenance and strengthening measures, it is unlikely to be an effective erosion protection measure for the town into the future.
- This low structure does not offer significant protection from high water levels or inundation, and due to the seawall, the beach is very low and flat and generally does not have any dry sand during high tides. Concern has previously been expressed in regard to further inundation or erosion of the cemetery towards the northern end of the beach.
- The study shows an overall erosion trend along the town beach south of Raehome Point with some minor accretion at the southern end, indicating an overall loss of sand under the influence of easterly waves and tidal currents and the presence of the seawall.

Pathway description

In the Southern Township on Kirriri, the adaptation pathway begins with dune management. As trigger points are reached, the community can opt to upgrade existing seawalls and revetments, filling gaps for added protection against coastal hazards. The trigger points will also be a chance to consider relocating structures or redesigning them for resilience. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Kirriri – Southern Township

Prepare
Implement
Transition
Ongoing monitoring and review
Trigger for an additional action
Start implementing
Pause and review adaption actions
Abandon existing action and seek alternative pathway

Key management area adaptation actions and pathway		Present Day	2050	2100
		Monitor (look and learn)	Monitor (look and learn)	Actively manage
Nature based coastal management	Dune management			
Coastal engineering	New seawall or revetment			
	Seawall or revetment upgrade and filling gaps			
Transition	Relocate assets			
	Redesign for resilience			

6. Coastal hazard adaptation actions

Kirriri Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Kirriri1.1a	See Council wide actions. Consider how these actions can be effectively used in Kirriri.	
1.2. Education and knowledge sharing		
Kirriri1.2a	See Council wide actions. Consider how these actions can be effectively used in Kirriri.	
1.3. Monitoring		
Kirriri1.3a	See Council wide actions. Consider how these actions can be effectively used in Kirriri.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Kirriri2.1a	See Council wide actions. Consider how these actions can be effectively used in Kirriri.	
Kirriri2.1b	Consider establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait.	$$
2.2. Disaster planning		
Kirriri2.2a	See Council wide actions. Consider how these actions can be effectively used in Kirriri.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Kirriri3.1a	See Council wide actions. Consider how these actions can be effectively used in Kirriri.	
Kirriri3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to erosion in the Northern and Southern Township KMAs.	$$

Kirriri Community Action Plan		Indicative cost
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Kirriri4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.3 Beach nourishment		
Kirriri4.3a	Consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Kirriri4.1.a.	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Kirriri5.3a	Continue to monitor and maintain existing coastal protection structures and develop plan to upgrade where needed.	$$
Kirriri5.3b	As part of the adaptation pathway in the Northern KMA, consider the construction of a coastal protection structure to protect exposed houses. This action should not occur before Kirriri3.1b, Kirriri4.1a and Kirriri4.3a are considered.	$$
5.4 Structures to minimise flooding		
Kirriri5.4a	Assess the need for and feasibility of a bund along the western side of the Southern Township KMA near where potential residential expansion is being considered.	$$

6. Coastal hazard adaptation actions

Mabuiag

Community overview

Community	English name	Cluster	Type
Mabuiag	Jervis	Western	Continental volcanic and granitic rock island

Mabuiag is situated in the eastern is land cluster of the Torres Strait. It has an estimated population of 253 people (ABS 2021), and an area just over 6 km^2. Mabuiag is a continental type is land with geology similar to that found on mainland Australia, comprising the main island with the township and numerous smaller surrounding islands. The island is hilly in nature, with the township and associated infrastructure located on the coastal fringe to the east and northeast .

The majority of the community live in the main township. Due to the location of the township it is somewhat protected from strong seasonal winds and waves by offshore islands and reefs. The main beach adjacent to the township is approximately 2 km in length, separated into two compartments by an ephemeral waterway. The coastal fringe consists of a low, wide coastal plain. There is geological evidence that the area used to be a reef structure. It is likely that the wide coastal plain was formed by accretion of the coastal strip over a long period.

Key infrastructure on Mabuiagi includes:

- Airport
- Regional council office
- State School (Years Pre-prep to year 6)
- Health Centre with permanent nurse
- Two grocery stores
- Ngalpun Ngulaygaw Lag Resource Centre
- Sporting Facilities – outdoor rugby league oval, undercover basketball court
- Community police services
- Council workshop / compound
- Water plant reservoirs / filtration collection wells
- Power station
- Sewerage treatment plant
- Barge ramp
- Pier (small craft and passengers only)

Risk

The Mabuiag community is currently considered low risk from coastal hazards, with the risk from storm tide expected to increase to high risk within the medium to long term planning horizon of this strategy. The erosion risk is expected to increase somewhat to in the medium to long term.

Coastal hazards risk profile for Mabuiag from present day to 2100

Mabuiag Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Medium	Medium
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	High	High

Adaptation response

A strategic adaptation response has been developed for Mabuiag to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Mabuiag is to avoid creating new assets in hazard areas and maintain current assets. By 2050, increased risk will trigger the adaptation response to focus on actively managing identified risks, through a range of initiatives including education, nature based and structural engineering solutions. The 'actively manage' adaptation pathway approach will continue to be implemented into 2100.

Adaptation response profile for Mabuiag

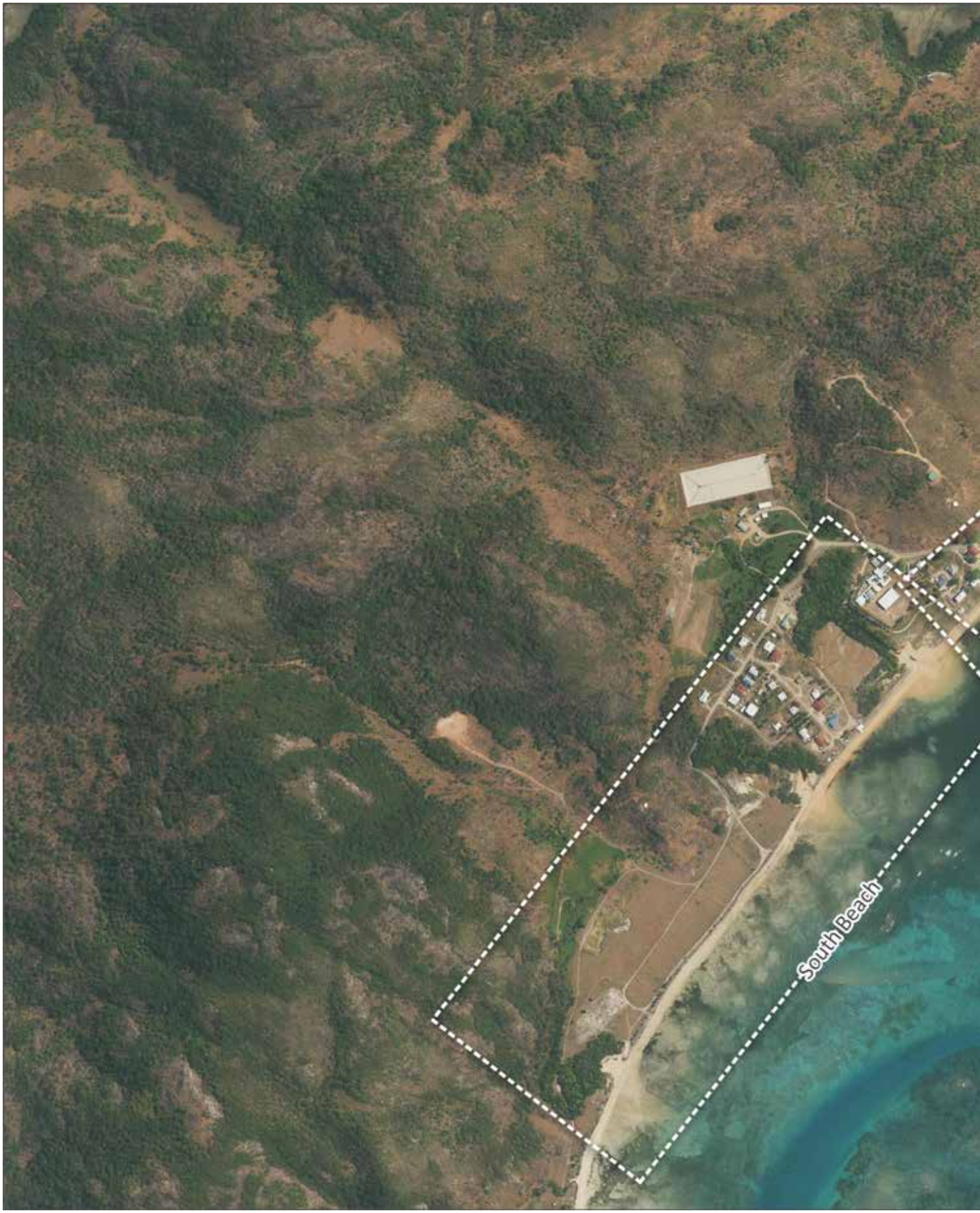
Present day	2050	2100
Avoid (and maintain)	**Actively manage**	**Actively manage**

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Mabuiag are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Mabuiag community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions




North Beach Aerodrome
North Beach
0 100 200 m
n
Torres Strait
Cape York

6. Coastal hazard adaptation actions

Mabuiag

NORTH BEACH

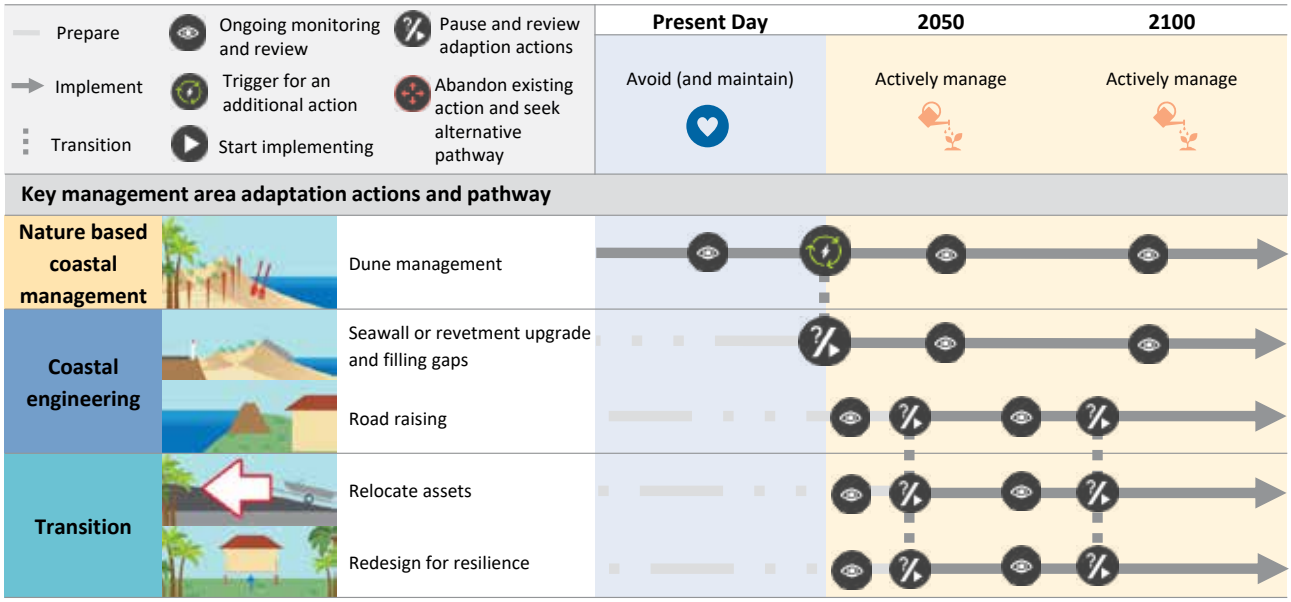
Overview of assets and values at risk

- This is the section of beach north of the creek which enters the beach near the water supply reservoir. This beach has significantly more coastal protection works compared to the south due to the location of the township.
- The seawalls here are of unknown design and in various states of disrepair. The seawalls form part of the community infrastructure, as they are often a gathering point in the afternoons and evenings.
- During previous consultation, the only erosion concern held by the community was the erosion of the road leading to the barge ramp.
- The study found the township was unlikely to be impacted by coastal erosion but was at risk in the longer term from permanent inundation due to sea level rise and storm tide inundation.

Pathway description

At Mabuiag's North Beach, the adaptation process starts with dune management and maintenance of the existing informal seawalls. As the situation evolves, the community can upgrade and fill gaps in existing seawalls or revetments. To address inundation, the community can selectively raise roads to preserve access. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Mabuiag – North Beach



NORTH BEACH AERODROME

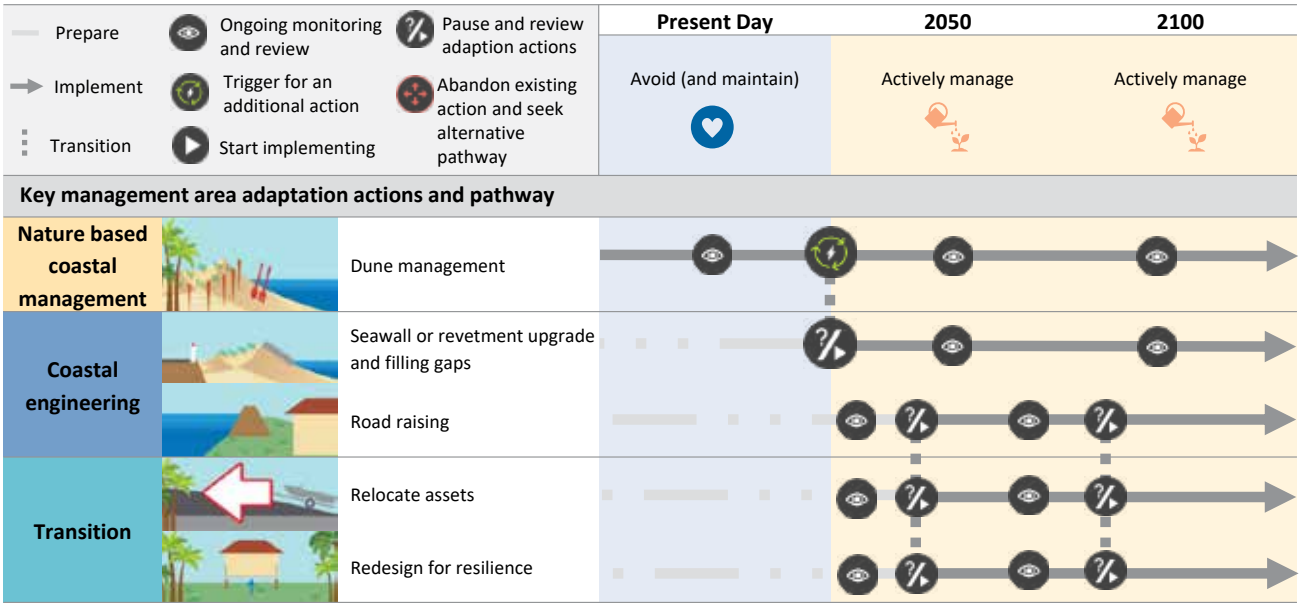
Overview of assets and values at risk

- This end of the beach has a creek that enters the beach system, fanning out onto the reef flat.
- Various seawalls, which are largely in disrepair, are protecting the road to the barge ramp area and the end of the runway.

Pathway description

In the north beach aerodrome area of Mabuiag, initial actions can involve maintaining the existing seawall. As trigger points are reached, upgrading existing seawalls and revetments, filling gaps, can be undertaken to enhance coastal protection and ground raising of certain access roads to prevent inundation. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Mabuiag – North Beach Aerodrome



6. Coastal hazard adaptation actions

Mabuiag

SOUTH BEACH

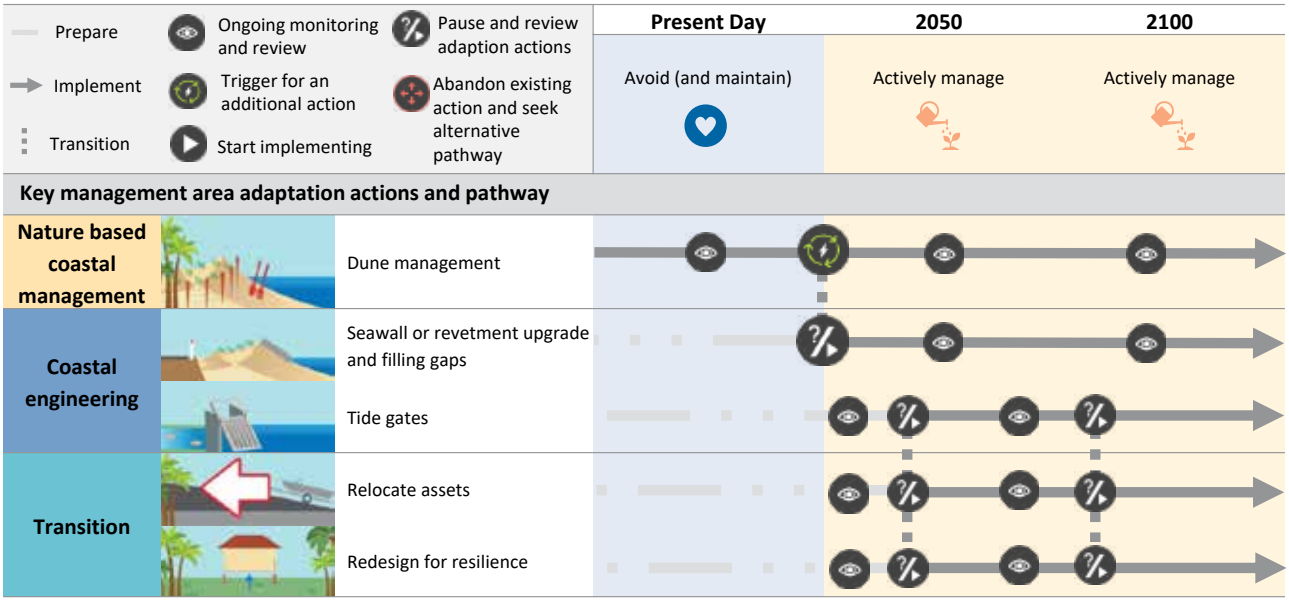
Overview of assets and values at risk

- This end of the beach has several creeks that enter the beach system, creating large fan deltas onto the reef flat. During significant flood events, sand is brought from inland areas out onto the reef flat. Storm events and winds distribute the sand back onto the beach.
- Some erosion of the dune system is present along the southern half of the beach.
- There are no seawalls present on this section of beach.

Pathway description

At Mabuiag's South Beach, the adaptation pathway begins with dune management. As trigger points are reached, for example when the cemetery is encroached by erosion or inundation, the community can begin to actively managed the hazards by importing sand to nourish the beach, constructing a bund or new seawalls or revetments. Another option to mitigate inundation is to install tide gates in the creeks. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas

Mabuiag – South Beach



Mabuiag Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Mabuiag1.1a	See Council wide actions. Consider how these actions can be effectively used in Mabuiag.	
1.2. Education and knowledge sharing		
Mabuiag1.2a	See Council wide actions. Consider how these actions can be effectively used in Mabuiag.	
1.3. Monitoring		
Mabuiag1.3a	See Council wide actions. Consider how these actions can be effectively used in Mabuiag.	

Mabuiag Community Action Plan		Indicative cost
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Mabuiag2.1a	See Council wide actions. Consider how these actions can be effectively used in Mabuiag.	
Mabuiag2.1b	Consider establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait.	$$
2.2. Disaster planning		
Mabuiag2.2a	See Council wide actions. Consider how these actions can be effectively used in Mabuiag.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Mabuiag3.1a	See Council wide actions. Consider how these actions can be effectively used in Mabuiag.	
Mabuiag3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to erosion and inundation in the North Beach and South Beach KMAs.	$$
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Mabuiagi4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.3 Beach nourishment		
Mabuiag4.3a	Consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Mabuiag4.1.a.	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Mabuiag5.3a	Continue to monitor and maintain existing coastal protection structures in the North Beach and Aerodrome KMAs and develop plan to upgrade where needed.	$$
Mabuiag5.3b	As part of the adaptation pathway in the North Beach KMA, consider the construction of a coastal protection structure to protect exposed houses. This action should not occur before Mabuiag3.1b, Mabuiag4.1a and Mabuiag4.3a are considered.	$$$
5.4 Structures to minimise flooding		

6. Coastal hazard adaptation actions

Masig

Community overview

Community	English name	Cluster	Type
Masig	Yorke	Central	Coral Cay

Masig is part of the central island cluster and is home to approximately 283 people (ABS, 2021). The heavily vegetated island is a tear-drop shaped coral cay generally below +5 m AHD in elevation.

The island is located on a platform reef that varies in width from the northern to the southern side. On the southern side the reef flat is extensive, extending over 1,000 m from the shoreline at the widest point. The reef flat on the northern side of the island is much narrower, being slightly over 100 m in width at its narrowest point. This is a key consideration when investigating coastal processes along the respective shorelines.

The island's shape suggests alongshore current acting from west to east. This is supported by the accretion and erosion trend at the barge ramp (accretion of sediment on the western side), and by the long 'tail' of the island extending east.

Key infrastructure on Masig includes:

- Airport
- Regional council office
- State school (years p re-prep to year 7)
- Health centre with permanent doctor and two nurses
- Three grocery stores (IBIS and two Mini-marts)
- Reef pilots station
- Post Office agency
- Centrelink agency
- Motel Lowatta Lodge
- Councill workshop / compound
- SES shed
- Water plant reservoirs/ filtration collection wells
- Power station
- Sewerage treatment plant
- Barge ramp
- Pier (small craft and passengers only)

Risk

The Masig community is currently considered low to medium risk from coastal hazards. Sand management activities around the barge ramp could reduce the risk to residences. However the culturally significant cemetery in the south of the island is in the erosion hazard zone. Risk from storm tide and tidal sea level rise is expected to increase to high/very high risk within the medium to long term planning horizon of this strategy. Council's ongoing coastal protection works program has been occurring in parallel with development of this Strategy. New works, such as the soon to be constructed seawall/bund to the north and south, have the potential to reduce the risk once constructed.

Coastal hazards risk profile for Masig from present day to 2100

Masig Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Low	Medium
Tidal inundation	Low	High	Very High
Storm tide inundation	Medium	High	Very High

Adaptation response

A strategic adaptation response has been developed for Masig to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Masig is to "monitor" through observing changes to individual asset's capacity to withstand hazards and reviewing risks. In 2050, the increasing inundation risks will trigger the adaptation pathway into active management, which will involve actively managing identified risks through a range of initiatives, including education, nature based and structural engineering solutions. By 2100, the coastal hazard risk profile for Masig will become to high and some active management options will no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating current assets to lower risk areas. A strategic decision will need to be made in consultation with the local community and consider the socio-economic, cultural and environmental values of the Masig area.

Adaptation response profile for Masig

Present day	2050	2100
Actively manage 	**Actively manage** 	**Transition and change** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Masig are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Masig community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


North Township
South Township
0
100
200 m
n
Torres Strait
Cape York

6. Coastal hazard adaptation actions

Masig

BARGE RAMP AREA

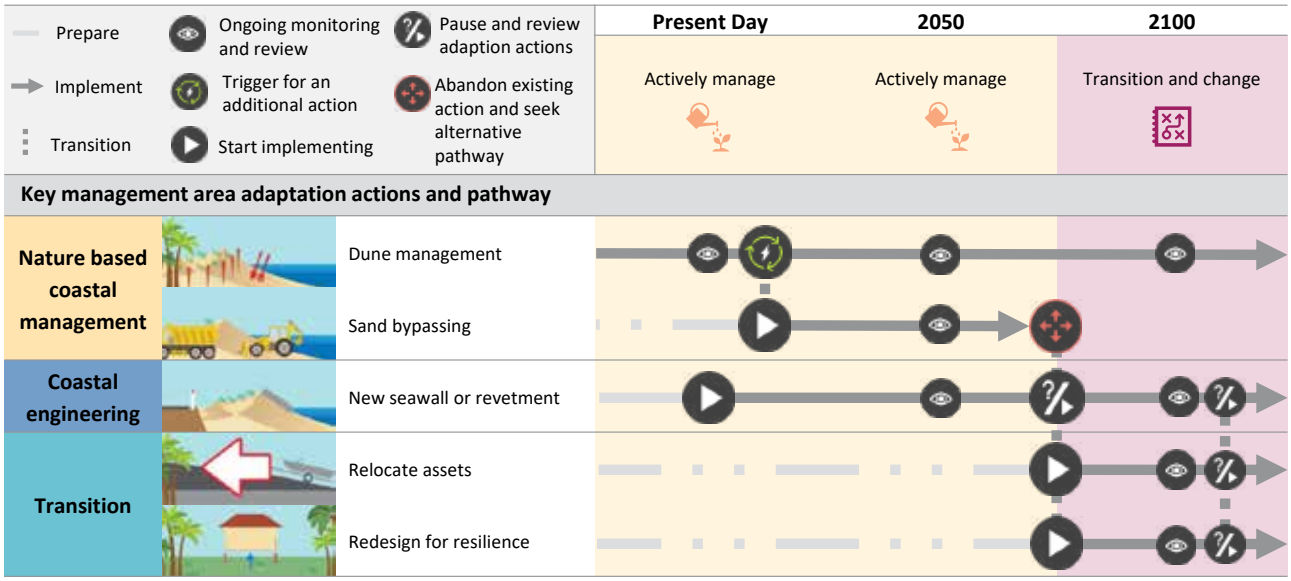
Overview of assets and values at risk

- The barge ramp has caused considerable erosion to the down drift (eastern) side of the groyne.
- The barge ramp has caused an accretion of sand on the western side, and corresponding erosion on the eastern side. This is as expected due to the longshore currents from west to east.
- Active sand nourishment has been undertaken historically by residents to help protect their homes from erosion, and could lessen impacts from coastal hazards in future if undertaken again.

Pathway description

In the Masig Island Barge Ramp Area, the adaptation pathway begins with nature-based dune management on either side of the barge ramp. By 2050, the risks to coastal hazards are expected to be high, triggering the township into an "Active management" pathway approach. Within the barge ramp management area this may involve constructing new seawalls or revetments at two sites, plans have already been prepared for structures on eastern side of the barge ramp. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Masig – Barge Ramp Area



NORTHERN TOWNSHIP

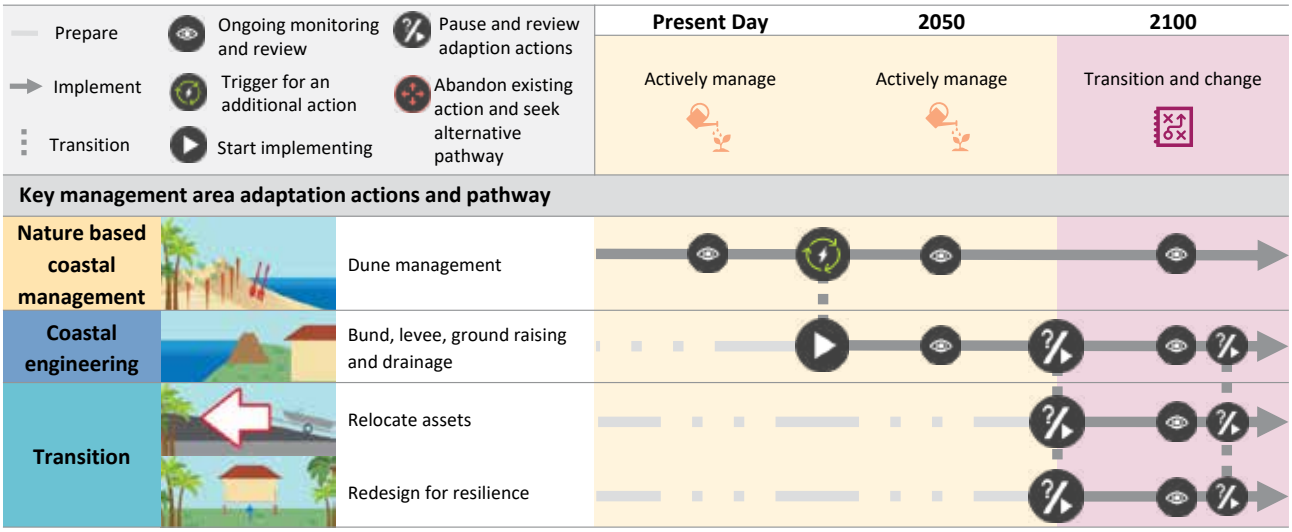
Overview of assets and values at risk

- The township extends out to the northern beach where some residences are located adjacent to the top of the beach.
- The beach is low along the entire shoreline and the study found these homes may suffer from inundation during storm tides in the future.
- Some debris is evident along the beach. It is unknown if it has been placed by residents in an informal attempt to reduce erosion of the foreshore.

Pathway description

In Masig Island's North Township, the adaptation pathway starts with nature-based dune management. By 2050, the risks to coastal hazards are expected to be high, triggering the township into an "Active management" pathway approach. Within the North township management area this may involve installing bunds, levees, ground raising and drainage infrastructure, for which plans are already in place. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Masig – North Township



6. Coastal hazard adaptation actions

Masig

SOUTH TOWNSHIP

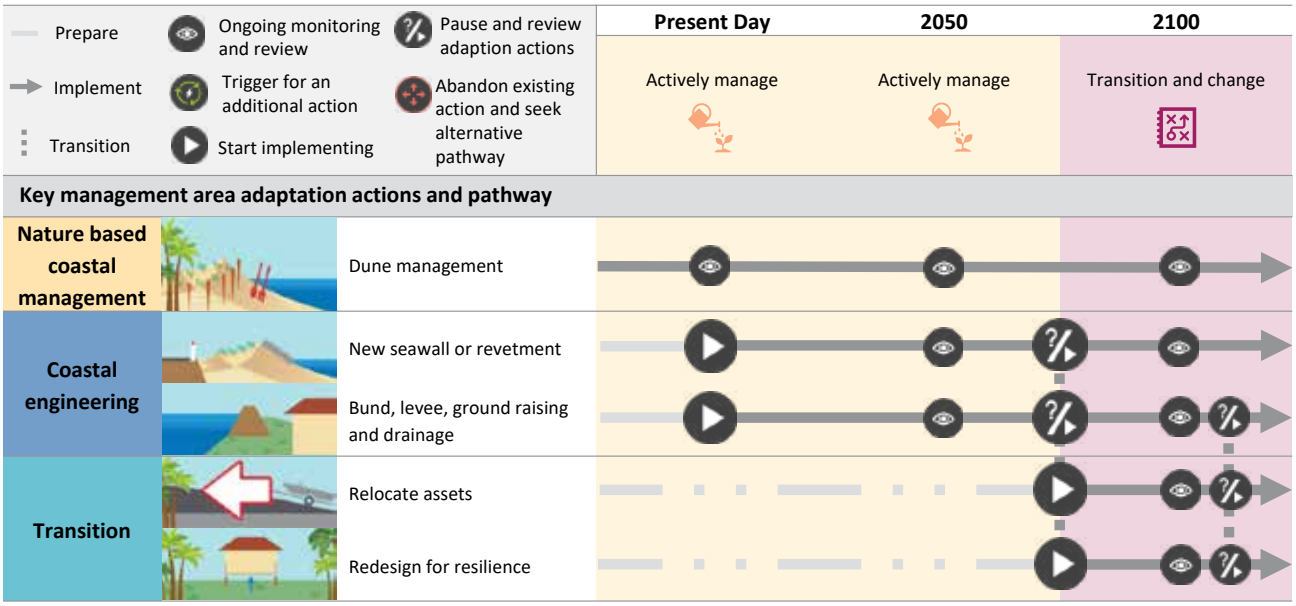
Overview of assets and values at risk

- The area has several buildings and structures located at the top of the beach.
- The shoreline is also low and flat on this side of the island, extending out onto the reef platform.
- The study indicates this area may be at risk from permanent inundation due to sea level rise and/or storm tide inundation but is not in an erosion prone area.
- The eastern end of the island, the 'tail', has been suffering from erosion on the southern side while the dunes build up on the north.
- The infrastructure of concern is the road travelling along the southern dune and the few residences located at the eastern end of the island.
- The south west corner of the island is uninhabited. The community have reported that there is erosion occurring at this location.

Pathway description

In the South Township of Masig Island, the adaptation pathway starts with nature-based dune management. By 2050, the risks to coastal hazards are expected to be high, triggering the township into an "Active" management pathway approach. Within the South township management area this may involve installing bunds, levees, ground raising and drainage infrastructure, for which plans are already in place. If further action is needed, new seawalls or revetments can be constructed in front of the airstrip. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas.

Masig – South Township



Masig Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Masig1.1a	See Council wide actions. Consider how these actions can be effectively used in Masig.	
1.2. Education and knowledge sharing		
Masig1.2a	See Council wide actions. Consider how these actions can be effectively used in Masig.	
1.3. Monitoring		
Masig1.3a	See Council wide actions. Consider how these actions can be effectively used in Masig.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Masig2.1a	See Council wide actions. Consider how these actions can be effectively used in Masig.	
Masig2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Masig where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Masig2.2a	See Council wide actions. Consider how these actions can be effectively used in Masig.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Masig3.1a	See Council wide actions. Consider how these actions can be effectively used in Masig.	
Masig3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to hazards in the North and South Township KMAs.	$$
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Masig4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Masig4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Masig4.3a	Monitor beach profiles around the island and consider sand backpassing around the barge ramp or beach nourishment to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Masig4.1.a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Masig5.3a	Maintain and upgrade the sea wall in the Barge Ramp Area.	$$
Masig5.3b	As part of the adaptation pathway in the South Township KMA, consider the construction of a coastal protection structure to protect key assets. This action should not occur before Masig3.1b, Masig4.1a and Masig4.3a are considered.	$$$
5.4 Structures to minimise flooding		
Masig5.4a	Proceed with plans to construct bunds around the township.	$$
Masig5.4b	Consider the raising of access roads around the airstrip and barge ramp.	$$$

6. Coastal hazard adaptation actions

Mer

Community overview

Community	English name	Cluster	Type
Mer	Murray	Eastern	Continental volcanic and granitic rock island

Mer is located in the eastern is land cluster and has a population of approximately 406 people (ABS, 2021). The volcanic island is just over 4 km^2 in size, with the maximum elevation of the island over 200 m above sea level. As the island is volcanic in nature the majority of the island is elevated above -+5 m AHD, however the township is generally located along the coastal strip below this level and is therefore exposed to coastal hazards. While the township is positioned on the coastal fringe, significant infrastructure (the aerodrome) and newer construction of key infrastructure (the school) is generally inland. Other key infrastructure includes public utilities (electricity, water, waste).

Seasonal Sager winds approach the island from the south-east between May and December. The positioning of the main township in the lee of the highest peak (a ridgeline that is the remnants of a volcanic crater} means that they are relatively sheltered from the south easterly winds. There is a fringing reef surrounding much of the island, the most notable exception being in the area adjacent to the south-westerly extent of the township. There are two large islands to the south-west which offer additional protection from wind generated waves.

Key infrastructure on Mer incudes:

- Airport
- Regional council office
- State school (years Pre-prep to year 7), with large sporting oval
- Hea lth centre with two permanent nurses
- IBIS grocery store
- Large facilities from old school
- Motel
- Water plant reservoirs/ filtration collection wells
- Power station
- Barge ramp

Risk

The Mer community is currently considered low risk from inundation coastal hazards, and high risk from erosion. The risk from inundation does not significantly increase within the planning horizon of this strategy. The risk from erosion remains high, mainly due to the proximity of assets to the erodible sections of coast.

Coastal hazards profile for Mer from present day to 2100

Mer Risk Profile	Present Day	2050	2100
Open coast erosion	High	High	High
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	Medium	Medium

Adaptation response

A strategic adaptation response has been developed for Mer to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Mer is to "monitor" through observing changes to individual asset's capacity to withstand hazards and reviewing risk. By 2050, increased risk will trigger the adaptation response to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. The active management adaptation approach will continue being implemented in 2100..

Adaptation response profile for Mer

Present day	2050	2100
Monitor (look and learn) 	**Actively manage** 	**Actively manage** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Mer are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Mer community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


North East Beach
Las Beach
Torres Strait
Cape York
0
200
400 m
n

6. Coastal hazard adaptation actions

Mer

CHURCH AND HOSPITAL AREA

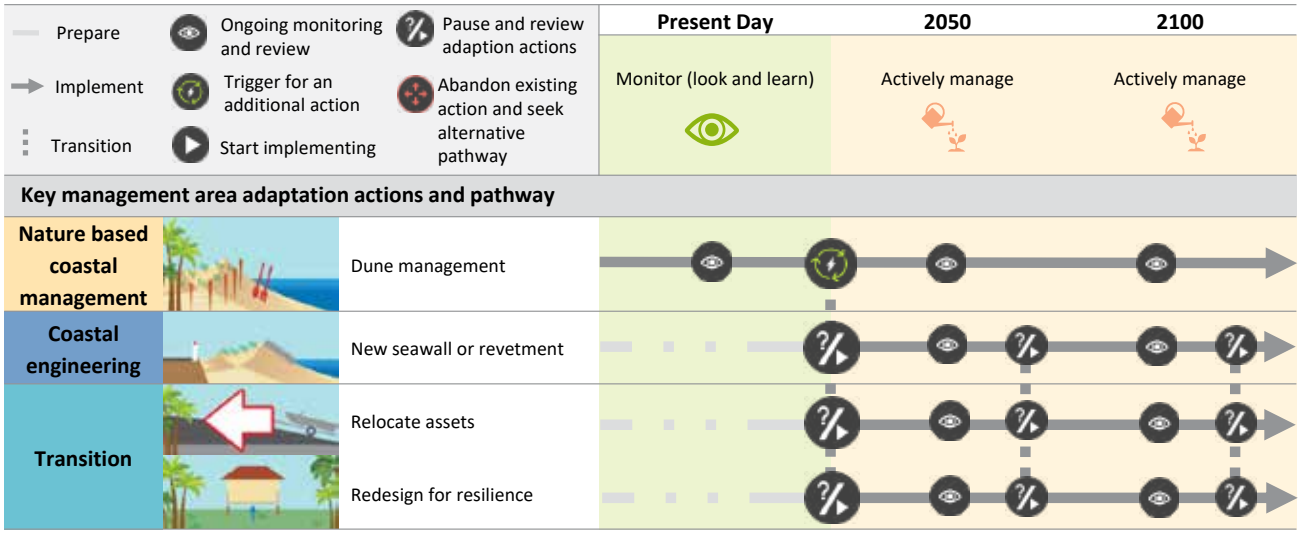
Overview of assets and values at risk

- In the past there has been evidence of wave over wash, over the beach berm in front of the church.
- The study found this area was at further risk of inundation from sea level rise and storm tide as well as coastal erosion.

Pathway description

In the Church and Hospital Area of Mer, the adaptation pathway begins with dune management. As trigger points are reached, the community can actively manage coastal hazards by constructing new seawalls or revetments to further protect the area from both erosion and inundation, redesigning assets for resilience, or relocating assets out of hazard areas. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Mer – Church and Hospital Area



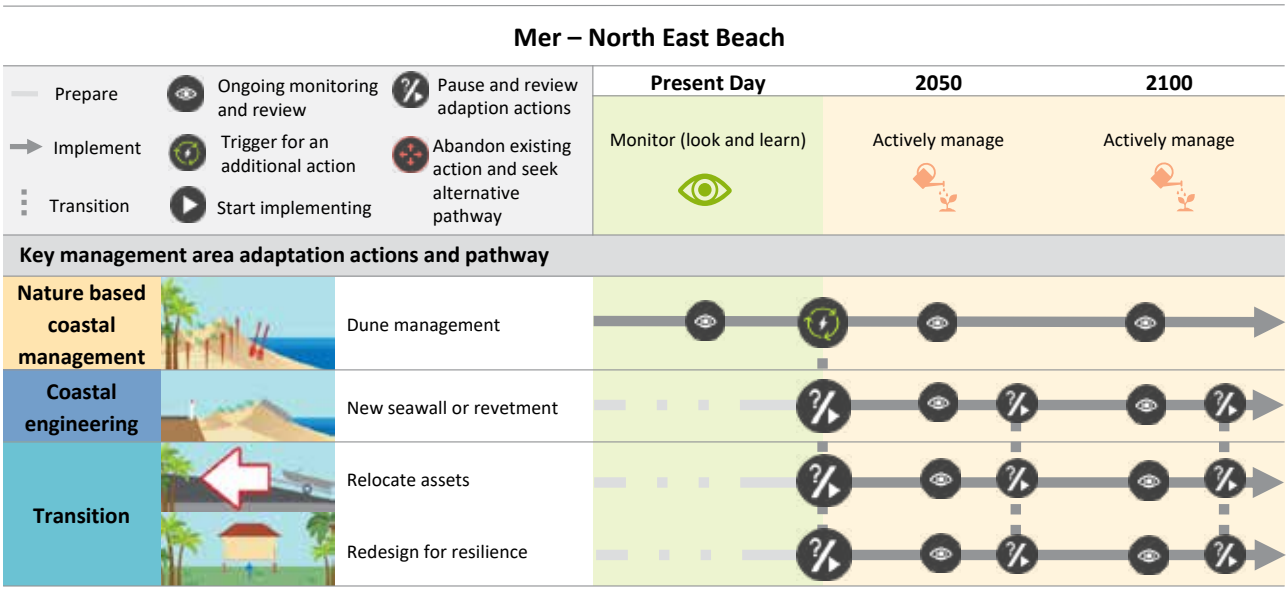
NORTH EAST BEACH

Overview of assets and values at risk

- It was identified that several areas had evidence of existing erosion or may become prone to erosion in the future, which may impact the cemetery and homes in that area.
- The north-eastern end of the community has several residences that are experiencing coastal erosion. The erosion is believed to be caused by the currents moving around the island, causing sediment movement back towards the cuspate spit in the centre of the northern beach.
- Residents have used available materials to attempt to protect the beach from erosion. There is evidence of underlying rock as the sand level has dropped and this may act as a barrier to further erosion or may exacerbate the existing erosion in the future depending on its exposure and extent.

Pathway description

At Mer's north east beach, the adaptation pathway begins with dune management. As trigger points are reached, the community can actively manage coastal hazards by constructing new seawalls or revetments to further protect the area, redesigning assets for resilience, or relocating assets out of hazard areas. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.



6. Coastal hazard adaptation actions

Mer

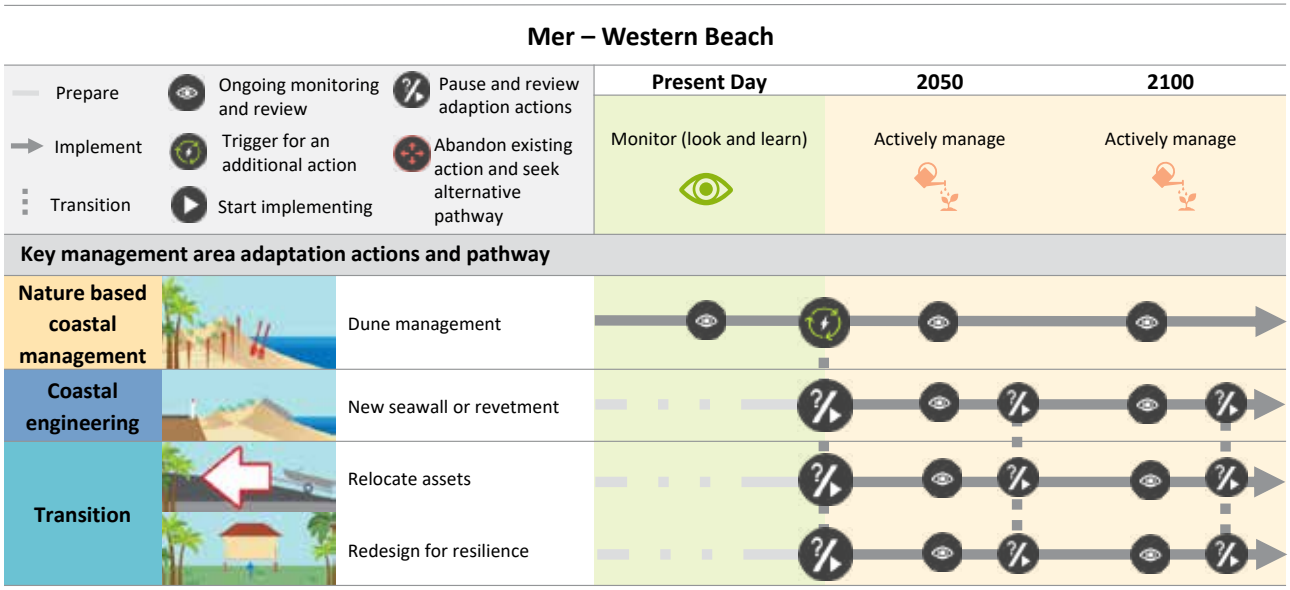
WESTERN BEACH

Overview of assets and values at risk

- The beach between the barge ramp and the desalination plant drops quickly into a deep channel and does not have a reef fringe in this location.
- There have been several attempts by locals to use available materials to create informal barriers on the beach to slow erosion.
- The beach also has a rock platform exposed at lower tides.
- The desalination plant is close to the foreshore and has no protection. This is critical community infrastructure within the coastal erosion zone.

Pathway description

For the western beach of Mer, the adaptation pathway begins with dune and foreshore management. Specific critical assets such as the desalination infrastructure may require engineered protection structures. As trigger points are reached, the community can actively manage coastal hazards by constructing new seawalls or revetments to further protect the area, redesigning assets for resilience, or relocating assets out of hazard areas. Moving forward, the community will need to decide whether to continue to maintain and upgrade any new protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.



Mer Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Mer1.1a	See Council wide actions. Consider how these actions can be effectively used in Mer.	
1.2. Education and knowledge sharing		
Mer1.2a	See Council wide actions. Consider how these actions can be effectively used in Mer.	
1.3. Monitoring		
Mer1.3a	See Council wide actions. Consider how these actions can be effectively used in Mer.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Mer2.1a	See Council wide actions. Consider how these actions can be effectively used in Mer.	
Mer2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Masig where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Mer2.2a	See Council wide actions. Consider how these actions can be effectively used in Mer.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Mer3.1a	See Council wide actions. Consider how these actions can be effectively used in Mer.	
Mer3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to erosion in the Western Beach, Church and Hospital, and North East Beach KMAs.	$$
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Mer4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Mer4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Mer4.3a	Monitor beach profiles around the island and consider beach nourishment to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Mer4.1a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Mer5.3a	As part of the adaptation pathway in the Western Beach, Church and Hospital, and North East Beach KMAs, consider the construction of a coastal protection structure to protect exposed assets. This action should not occur before Mer3.1b, Mer4.1a and Mer4.3a are considered.	$$$

6. Coastal hazard adaptation actions

Poruma

Community overview

Community	English name	Cluster	Type
Poruma	Coconut	Central	Coral Cay

Poruma, located in the central island cluster, is a low-lying coral cay which is home to approximately 164 people (ABS, 2021). The long narrow shape is distinctive of this island type in the Torres Strait region and suggests a strong west to east longshore current driving the growth of the island. Poruma is approximately 0.5 km^2 in size, making it one of the most densely populated Torres Strait islands.

Vegetation on the island is predominantly low grasses and coconut trees. The island is a typical coral cay, having developed on the north western side of the platform reef about 3000 years ago (JCU, 2010). The morphology of the island is relatively flat, with a beach rock substrate and a high dune system on the southern shoreline providing protection from Sager winds (southeast seasonal winds). These winds are the main drivers of the formation of the cay, and small seasonal variations in the strength and direction of the Sager winds will affect the shape and orientation of the cay resulting in cycles of erosion and accretion of the beaches, particularly at the eastern and western ends of the island.

Key infrastructure on Poruma includes:

- Airport (including helipad)
- Council office
- State school (year pre-prep to year 6)
- Health centre with permanent nurse
- Two grocery stores
- Sporting facilities - multipurpose outdoor court, sports oval
- Council workshop/compound
- SES shed
- Water plant reservoirs/filtration collection wells
- Ergon power station
- Barge ramp with small pier
- Seafood (Crayfish) factory
- Landfill site

Risk

The Poruma community is presently considered low to high risk from inundation and very high risk from erosion. There are existing and planned coastal protection structures around the island to address this risk. The risk from storm tide inundation is expected to increase to high risk in the medium to long term planning horizons of this strategy.

Coastal hazards risk profile for Poruma from present day to 2100

Poruma Risk Profile	Present Day	2050	2100
Open coast erosion	Very high	Very high	Very high
Tidal inundation	Low	Medium	Medium
Storm tide inundation	High	High	Very high

Adaptation response

A strategic adaptation response has been developed for Poruma to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Poruma is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. By 2050, the coastal hazard risk profile for Poruma will become too high and some active management options will no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating or redesigning current assets to lower risk. A strategic decision will need to be made in consultation with the local community and consider the values of the Poruma area. The 'transition' adaptation pathway approach will continue to be implemented in 2100.

Adaptation response profile for Poruma

Present day	2050	2100
Actively manage 	**Transition and change** 	**Transition and change** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Poruma are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Poruma community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


Eastern Spit
Torres Strait
Cape York
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6. Coastal hazard adaptation actions

Poruma

JETTY AND NORTH TOWNSHIP

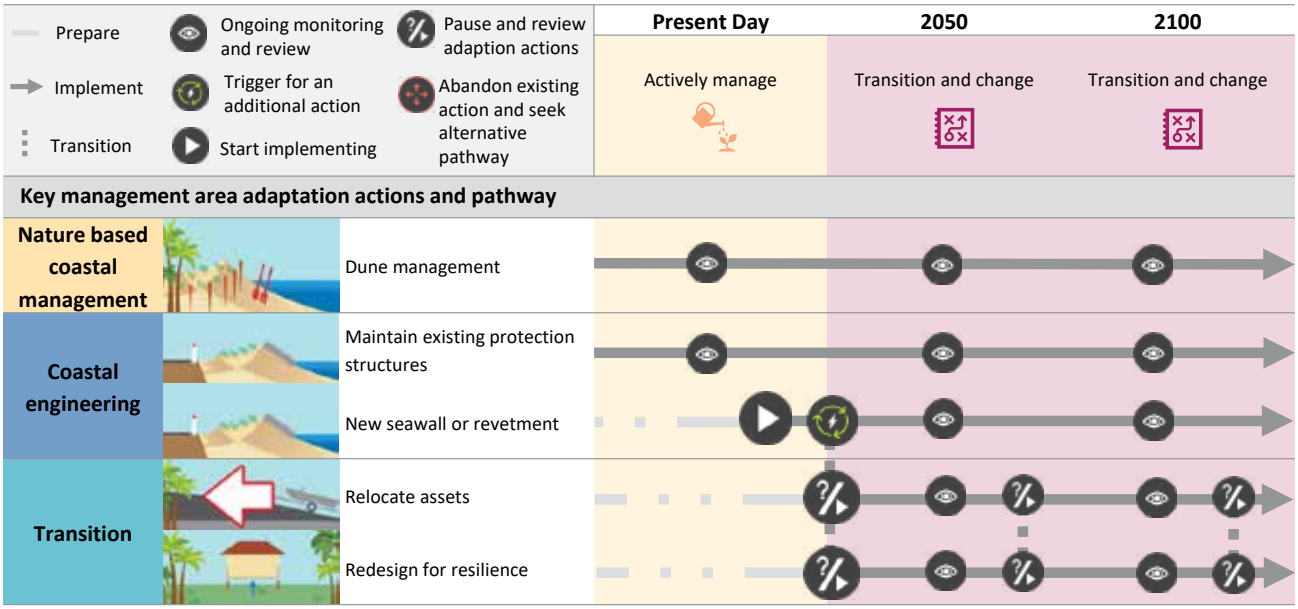
Overview of assets and values at risk

- This area is protected from erosion by the revetment, but water does inundate the area during king tides and storm tides.
- Previously, the community wanted the wall to be repaired and extended slightly seawards near the barge ramp groyne to provide more room for the foreshore road. These works were completed in 2021.
- The community also said previously it wanted to investigate installing a culvert or pilling of the barge ramp when it is due for replacement, to reinstate natural sand movement in the area.

Pathway description

In Poruma's jetty and north township, the adaptation pathway begins with dune management and maintaining the existing structures around the jetty. The community is already actively managing coastal hazards by the recent construction of a seawall that protects the buildings and north end of the airstrip. Moving forward, the community will need to decide whether to continue to maintain and upgrade the protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and coral island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Poruma – Jetty and North Township



EASTERN SPIT

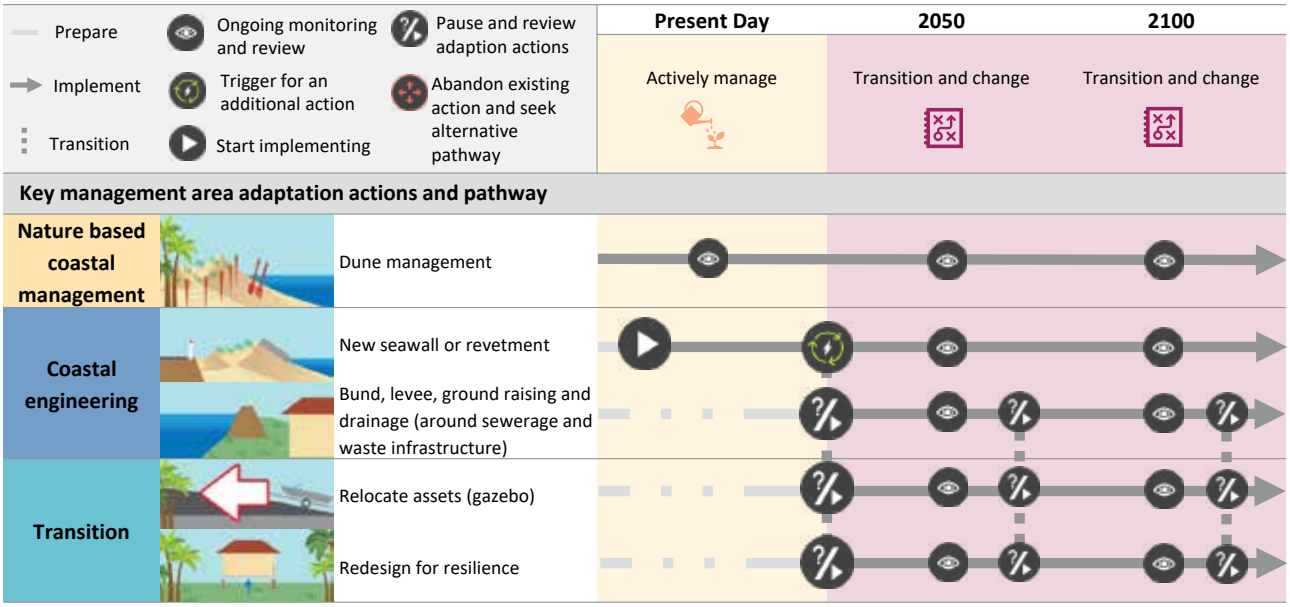
Overview of assets and values at risk

- The area is currently subject to erosion, permanent inundation from sea level rise and storm tide.
- The study indicates the sewerage and waste infrastructure at the Eastern end, NE of aerodrome and the gazebo could be at risk in the future.
- Previously the community said it would re-locate the gazebo or rebuild a movable gazebo further inland if necessary.
- GSC seawall has recently been constructed to mitigate erosion impacting the sewerage and waste infrastructure.
- The community previously said it wanted hazardous materials in waste pits to be managed appropriately because it may move because of erosion.
- The community also wants Council to remove the concrete rubble placed on the beach and for future dumping of more rubble to be discouraged.

Pathway description

For the eastern spit of Poruma, the initial adaptation strategy includes dune management including removing concrete rubble, preventing more from being disposed, and fostering native dune vegetation regeneration. In response to sea level rise, new seawalls or revetments, bunds, ground raising, and drainage are planned for construction to further protect the sewerage and waste infrastructure. The community has also noted that the gazebo can be relocated or redesigned to be moveable. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Poruma – Eastern Spit



6. Coastal hazard adaptation actions

Poruma

SOUTHERN BEACH

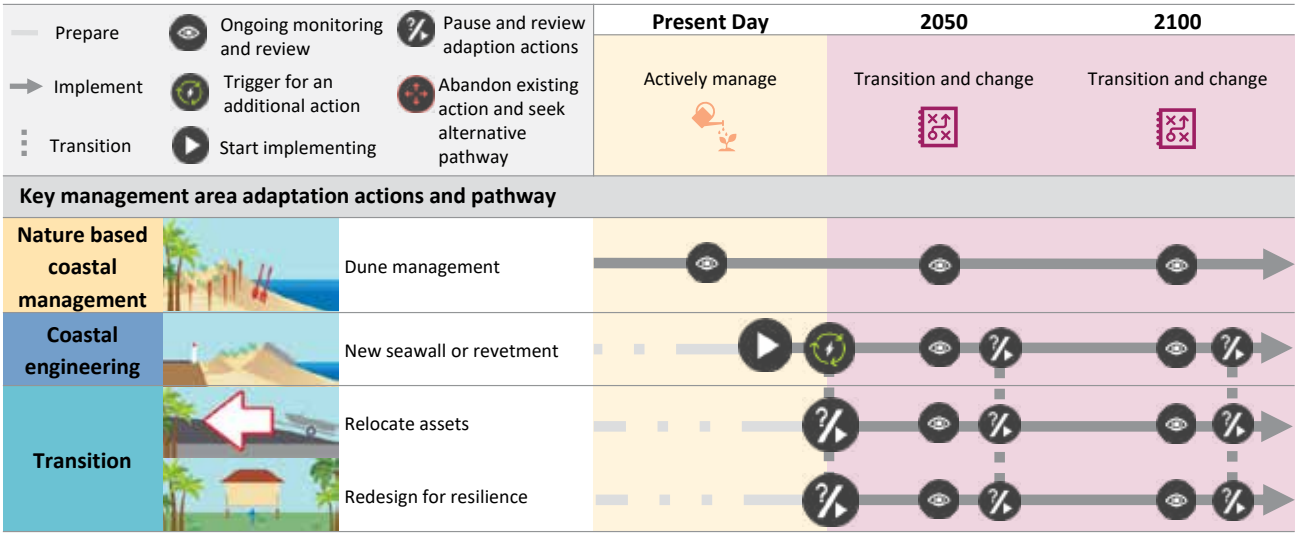
Overview of assets and values at risk

- This has a high dune system protecting the area from seasonal weather changes, permanent inundation and storm tide.
- The beach is however, experiencing erosion at the eastern end. Materials (tyres) have been used as informal attempts to mitigate erosion.
- Previously, the community wanted to monitor the erosion and take further action if it got worse.
- The community wants to see a management plan in place to avoid blowouts, limit tracks and maintain vegetation.
- The community says large tyres protecting part of the dune were removed some years ago. They worked well and would like tyres or a similar considered for future protection of that area.

Pathway description

At Poruma's southern beach, initial actions involve dune management. Moving forward, the community will need to decide whether to construct protection structures, relocate or redesign assets. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone zones.

Poruma – Southern Beach



WESTERN SPIT

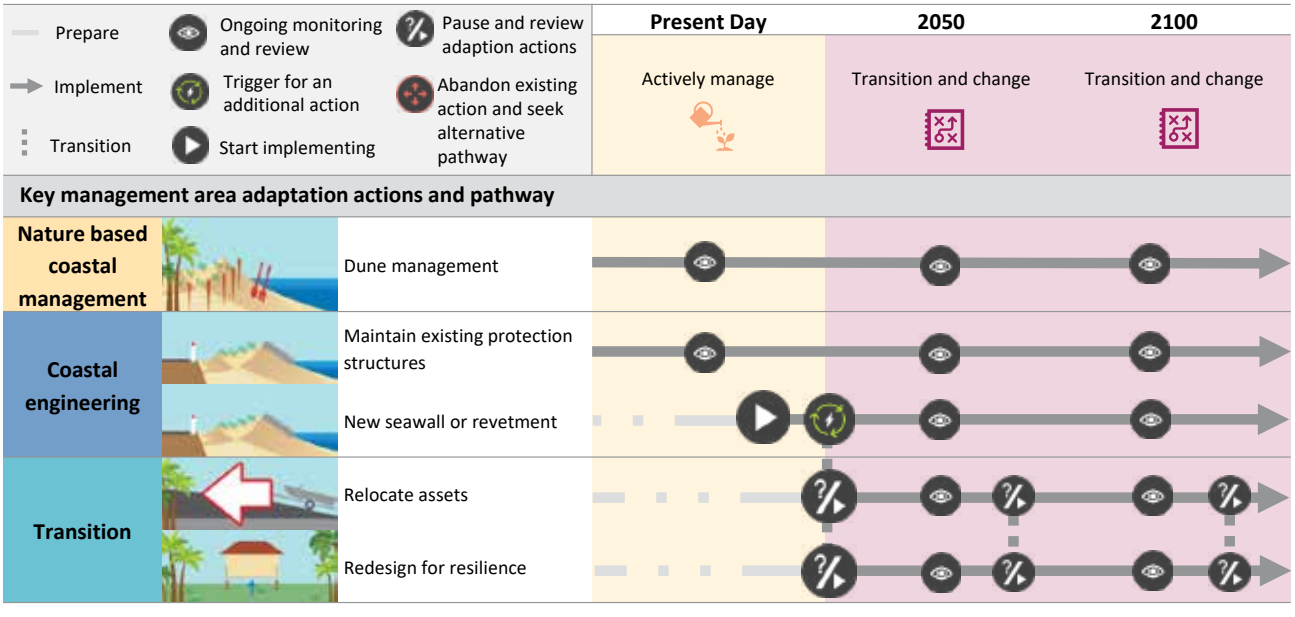
Overview of assets and values at risk

- This area has been eroding for many seasons, particularly on the southern side. Geotextile Sand Containers (GSCs), often referred to as sandbags, were installed in 2016 to protect the resort but erosion is likely to continue around the ends of the GSC wall in the future. Erosion may also impact the township if the erosion continues.
- The resort and township are both impacted by storm tides now and may be impacted more frequently in the future.
- Previously, the community has said it wants to stop the erosion as soon as possible. GSC seawalls are planned for this area to mitigate erosion. Stages 2 and 3 are expected to be completed by the end of 2020 and Stages 4 and 5 in 2021.
- The community also understands with a seawall there is unlikely to be dry sand in front when the tide is above the level of the reef flat.
- The community agrees revegetating the sand spit on the north west corner will help stabilise sand accumulation in this area.

Pathway description

For the western spit of Poruma, the adaptation pathway begins with dune management and maintaining the existing geobag structures. There are plans for the community to actively manage coastal hazards by constructing a new seawall extension that will offer additional protection. Moving forward, the community will need to decide whether to continue to maintain and upgrade the protection structures, relocate or redesign assets. Input into this decision will involve consideration of sea level rise, and coral island geomorphology and sediment dynamics. Ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Poruma – Western Spit



6. Coastal hazard adaptation actions

Poruma Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Poruma1.1a	See Council wide actions. Consider how these actions can be effectively used in Poruma.	
Poruma1.1a	Remove concrete rubble from Eastern Spit KMA and discourage future dumping.	
1.2. Education and knowledge sharing		
Poruma1.2a	See Council wide actions. Consider how these actions can be effectively used in Poruma.	
1.3. Monitoring		
Poruma1.3a	See Council wide actions. Consider how these actions can be effectively used in Poruma.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Poruma2.1a	See Council wide actions. Consider how these actions can be effectively used in Poruma.	
Poruma2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Poruma where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Poruma2.2a	See Council wide actions. Consider how these actions can be effectively used in Poruma.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Poruma3.1a	See Council wide actions. Consider how these actions can be effectively used in Poruma.	
Poruma3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to hazards in all KMAs.	$$

Poruma Community Action Plan		Indicative cost
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Poruma4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Poruma4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Poruma4.3a	Monitor beach profiles around the island and consider sand backpassing around the barge ramp or beach nourishment to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Poruma4.1.a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Poruma5.3a	Continue to monitor and maintain existing coastal protection structures and develop plan to upgrade where needed.	$$
Poruma5.3b	Proceed with plans to construct coastal protection structures to prevent erosion and inundation in the Jetty and North Township KMA in front of houses and the airstrip.	$$$
5.4 Structures to minimise flooding		
Poruma5.4a	Consider construction of a bund around the waste facilities in the Eastern Spit KMA.	$$$

6. Coastal hazard adaptation actions

Saibai

Community overview

Community	English name	Cluster	Type
Saibai	Saibai	Northern	Low lying mud island

Saibai is one of three islands located in the northern cluster of the Torres Strait islands (Saibai, Boigu, and Dauan), and is also one of two flat mud islands found in the region. The island is just under 110 km^2 in size, with an approximate population of 340 people (ABS 2021) generally living in the main village on the northwest side.

Saibai is generally low-lying, as expected due to its geological composition, with mangrove forest on the outer edges of the island. The interior comprises a salt marsh environment with sparse vegetation. The township is of similar elevation to the rest of the island; however, its location to the north offers some protection from wind and wave conditions due to its proximity to Papua New Guinea (PNG). The island has been formed by an accumulation of mud and silt deposited on old coral platforms; however, active coral growth is likely suppressed by the impact of fluvial discharges from nearby rivers in PNG. Most of the sediments that make up the island are likely derived from fluvial rather than calcareous sources.

Key infrastructure on Saibai includes:

- Airport
- Regional council office
- Tagai Campus School (Years pre-prep to year 6)
- Health Centre with two permanent nurses
- IBIS grocery store
- Council workshop/compound
- SES shed
- Water plant reservoirs/filtration collection wells
- Power station
- Sewer plant
- Landfill site
- School accommodation
- Telecom tower
- Guest house
- Barge ramp
- Pier (small craft and passengers only)
- Saibai Community Development Corporation
- Customs office
- Rangers/customs shed
- Community centre
- Holy Trinity Church
- Cemetery
- Fuel bowser

Risk

The Saibai community is presently at very high risk from storm tide inundation, high risk from tidal inundation, and low risk from erosion. The low risk from erosion is due to the recently built seawall. The medium to long term erosion risk gets progressively higher as the seawall deteriorates with age. Without maintenance and eventually an upgrade, the erosion risk will increase. The Saibai community is very familiar with this risk which provides an element of resilience, however high risk conditions have been severe enough in the past to force a mass migration to the Northern Cape York Peninsula in Bamaga and Seisia, which occurred in the late 1940s (Saibai to Bamaga, 2000).

Coastal hazards risk profile for Saibai from present day to 2100

Saibai Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Medium	High
Tidal inundation	Very high	Very high	Very high
Storm tide inundation	Very high	Very high	Very high

Adaptation response

A strategic adaptation response has been developed for Saibai to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Saibai is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. By 2050, the coastal hazard risk profile for Saibai will become too high and some active management options will no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating current assets to lower risk areas. A strategic decision will need to be made in consultation with the local community and consider the values of the Saibai area. The 'transition' adaptation pathway approach will continue to be implemented in 2100.

Adaptation response profile for Saibai

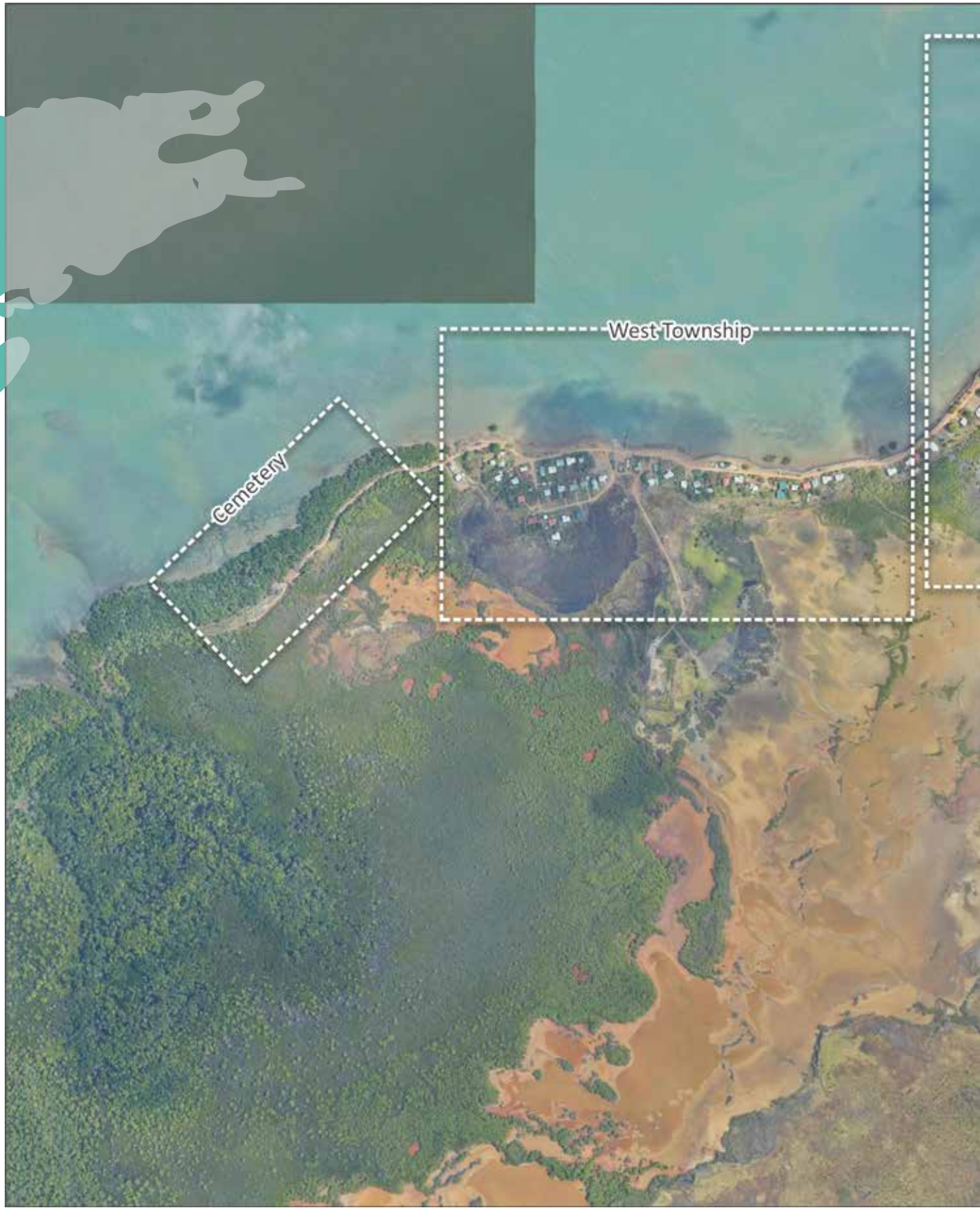
Present day	2050	2100
Actively manage	**Transition and change**	**Transition and change**

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Saibai are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Saibai community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions

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Torres Strait
Cape York

6. Coastal hazard adaptation actions

Saibai

WEST AND NORTH EAST TOWNSHIP AREAS

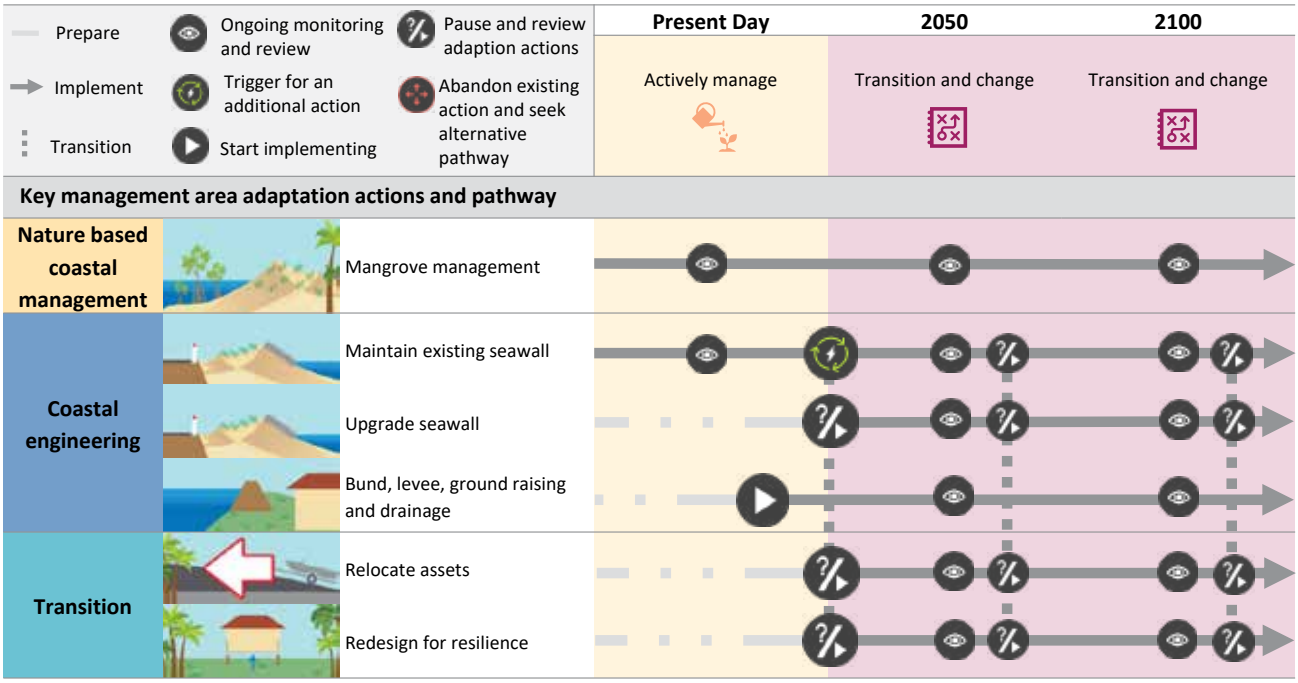
Overview of assets and values at risk

- The Saibai community already experiences significant issues with inundation during high tides and storm tides, and there is evidence of erosion along the shoreline.
- Majority of the township is forecast to be inundated by storm tides in present day conditions and this will occur more frequently as time goes on.
- The cemetery is protected by a bund wall so does not flood, however the access road, does, and it is eroding away.
- The new seawall along the length of the township includes a wave return wall to reduce wave overtopping during storm events.
- This seawall protects the township from storm tide inundation, but further work is required to determine whether the wall will be high enough to provide protection in the future.
- It is likely the seawall will need to be raised at some point in the future to provide the same level of protection as it does now.
- The community is very concerned about water inundating homes. This comes from low lying land from behind the township and rainfall mainly during monsoon season. Water can take 3-4 days to drain away from some homes.
- The forecast rise in sea level will make this worse in the future.

Pathway description

For the Township of Saibai, initial actions include maintaining the existing coastal protection structures supplemented by management. There are plans in place for bunds, ground raising and drainage to mitigate inundation. Once these protection measures are in place, the community will be faced with a decision to continue to maintain, and upgrade this infrastructure, or to develop a more detailed action plan involving relocating or redesigning the township for increased resilience, noting the cultural sensitivity of this decision. Relocating or redesigning the township should involve significant planning, consultation and innovation.

Saibai – Township



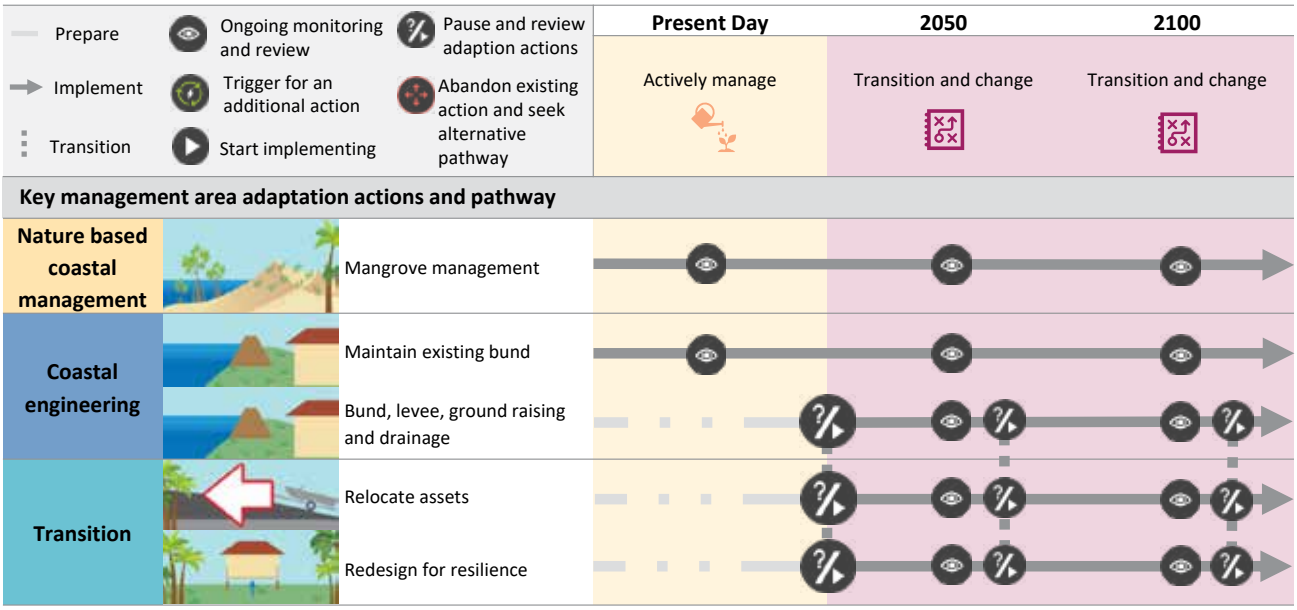
CEMETERY

Overview of assets and values at risk

Pathway description

In the Cemetery area of Saibai, the initial adaptation pathway for addressing coastal hazards involves actively managing the area through the maintenance of existing of bunds. As the community reaches trigger points, decisions will be made to determine the most desirable course of action, which may involve upgrading the infrastructure, developing a more detailed action plan involving relocating or redesigning the cemetery for increased resilience, noting the cultural sensitivity of this decision.

Saibai – Cemetery



6. Coastal hazard adaptation actions

Saibai Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Saibai1.1a	See Council wide actions. Consider how these actions can be effectively used in Saibai.	
1.2. Education and knowledge sharing		
Saibai1.2a	See Council wide actions. Consider how these actions can be effectively used in Saibai.	
1.3. Monitoring		
Saibai1.3a	See Council wide actions. Consider how these actions can be effectively used in Saibai.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Saibai2.1a	See Council wide actions. Consider how these actions can be effectively used in Saibai.	
Saibai2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Saibai where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Saibai2.2a	See Council wide actions. Consider how these actions can be effectively used in Saibai.	

Saibai Community Action Plan		Indicative cost
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Saibai3.1a	See Council wide actions. Consider how these actions can be effectively used in Saibai.	
4. Nature based coastal management (see adaptation pathways for timing)		
4.2 Living shorelines		
Saibai4.2a	Explore potential for a living shoreline to establish mangroves in the Township KMA.	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Saibai5.3a	Continue to monitor and maintain existing coastal protection structures and develop plan to upgrade where needed.	$$
5.4 Structures to minimise flooding		
Saibai5.4a	Proceed with plans to extend the bund wall around the south east side of the township, including around identified expansion areas cemetery.	$$$

6. Coastal hazard adaptation actions

Ugar

Community overview

Community	English name	Cluster	Type
Ugar	Stephen	Eastern	Continental volcanic and granitic rock islands

Ugar is part of the eastern island cluster of the Torres Strait. The island is 0.4 km^2 and has a population of around 69 people (ABS, 2021). It is a volcanic type island and therefore is relatively elevated with the majority of the island 20 to 30 m above sea level. Ugar is situated within a large reef system just over 25 km^2 in size, which provides protection from significant waves and currents, mitigating the wave energy that reaches the shoreline.

While the majority of the island is over 5 m above sea level, including the sites where the school, health centre and services are located, there are a number of buildings including the IBIS store, church, and barge ramp located on the north eastern facing beach.

Key infrastructure on Ugar includes::

- Helipad
- Regional council office
- State school (years pre-prep to year 7)
- Guest house (5 rooms)
- Barge ramp
- Pier (small craft and passengers)
- Council workshop/compound
- Sporting facilities – indoor and outdoor multipurpose courts
- IBIS store
- Anglican Church
- Water facility
- Health centre
- Telstra phone tower
- Ergon power facility
- Landfill site
- TSIRC units (three units) include the school, health centre, helipad, and public utilities infrastructure (electricity, water, waste).

Risk

The Ugar community is currently considered low to medium risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy. The risk from erosion is expected to increase to high with the effects of a groyne potentially causing downdrift erosion to the west of the barge ramp. There are also some culturally significant sites such as the old cemetery that have experienced erosion and are at higher risk.

Coastal hazards risk profile for Ugar from present day to 2100

Ugar Risk Profile	Present Day	2050	2100
Open coast erosion	Medium	Medium	High
Tidal inundation	Low	Low	Medium
Storm tide inundation	Low	Medium	Medium

Adaptation response

A strategic adaptation response has been developed for Ugar to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Ugar is to "monitor" through observing changes to individual asset's capacity to withstand hazards and reviewing risk, with the approach being implemented in the present day and into 2050. By 2100, increased risk will trigger the adaptation response to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions.

Adaptation response profile for Ugar

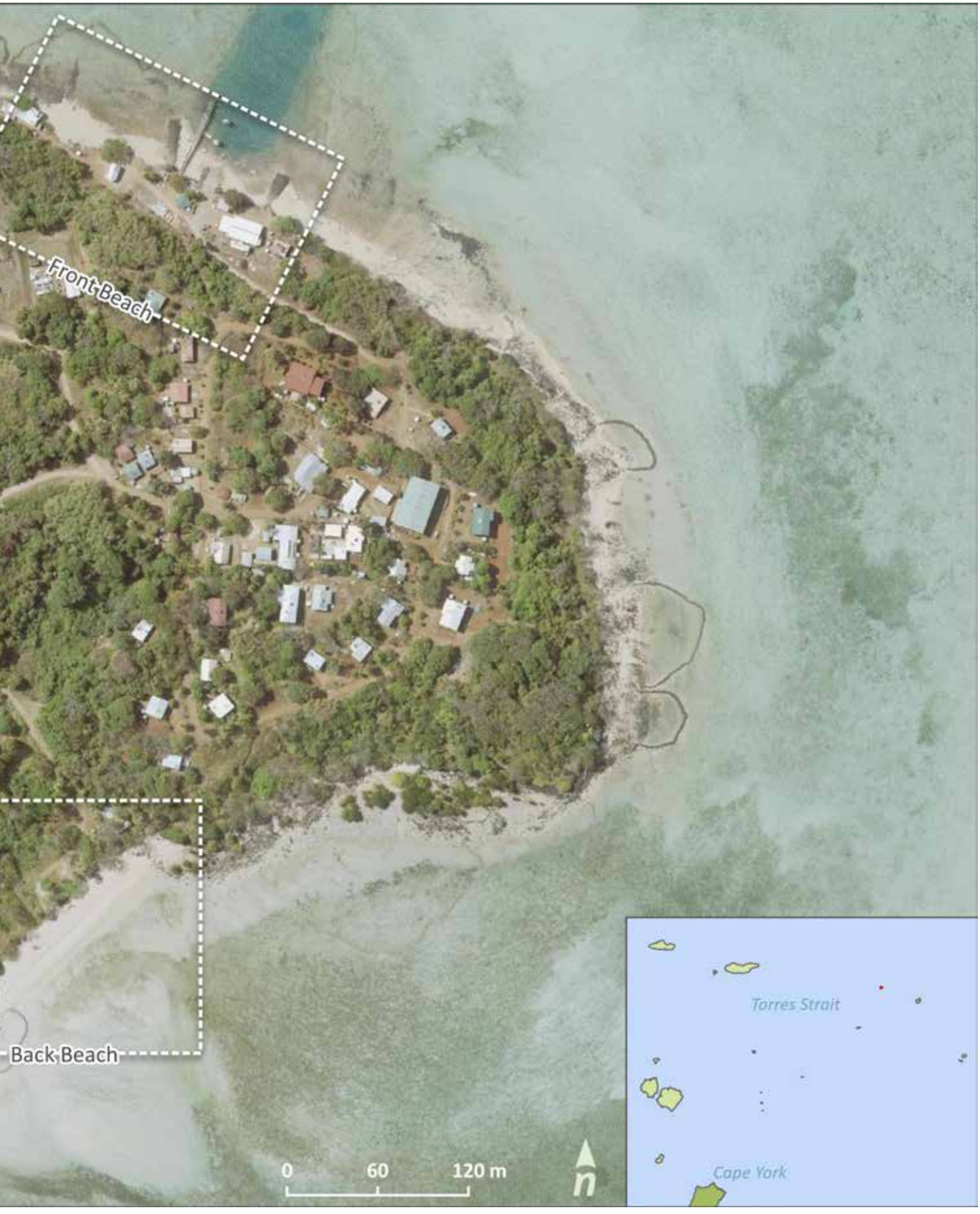
Present day	2050	2100
Monitor (look and learn) 	**Monitor (look and learn)** 	**Actively manage** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Ugar are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Ugar community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


Front Beach
Back Beach
0
60
120 m
n
Torres Strait
Cape York

6. Coastal hazard adaptation actions

Ugar

FRONT BEACH

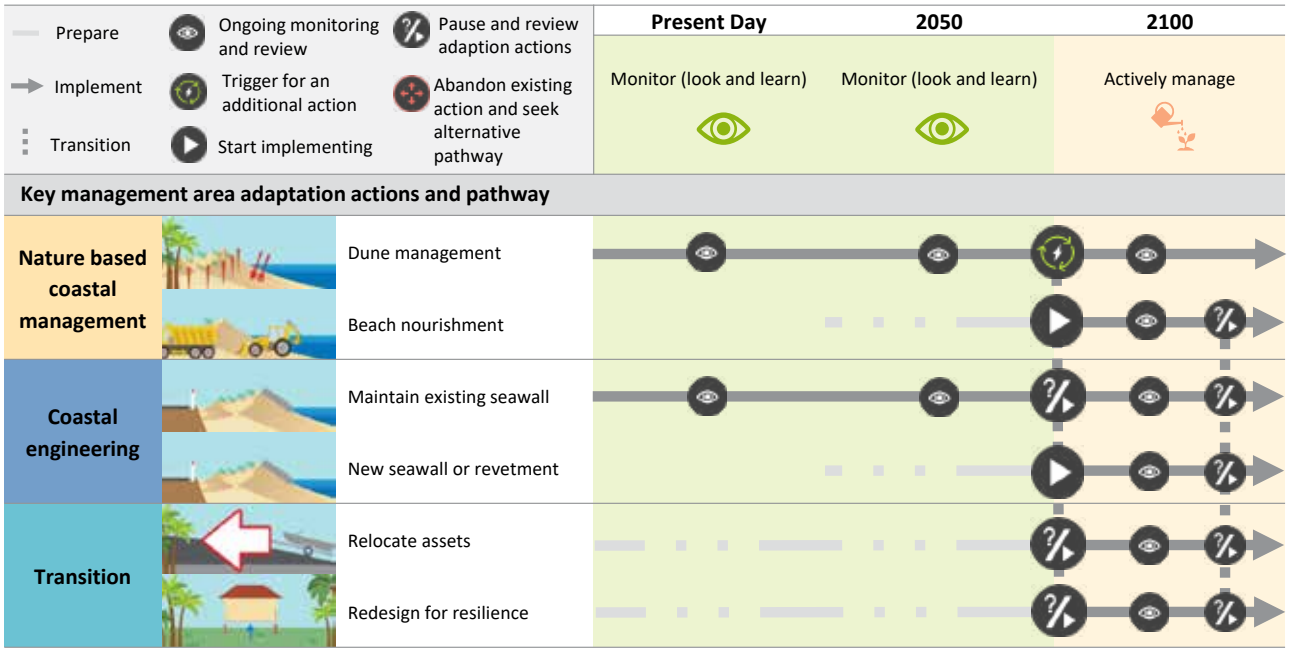
Overview of assets and values at risk

- This has the barge landing, an IBIS store, church and a residence on the low coastal fringe.
- Due to the apparent longshore movement of sand from east to west around the island, the bay in front of the church is eroding as it is down drift of the groyne at the western end of the barge ramp facility.
- It is unknown whether the dredged section of the reef flat has caused any changes to the island.
- Known protection works on the island include:
  - Rock groynes at barge ramp
  - Seawall of unknown origin in front of some structures along the main beach
- At this stage, there are no planned works.

Pathway description

In the Front Beach area of Ugar, the adaptation pathway starts with maintaining existing coastal protection and dune management. As trigger points are reached, the community can actively manage erosion by importing sand for beach nourishment, or constructing new seawalls or revetments. Decisions will be made at each trigger point to determine the best course of action, which may involve developing a more detailed action plan or relocating assets. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.

Ugar – Front Beach



BACK BEACH

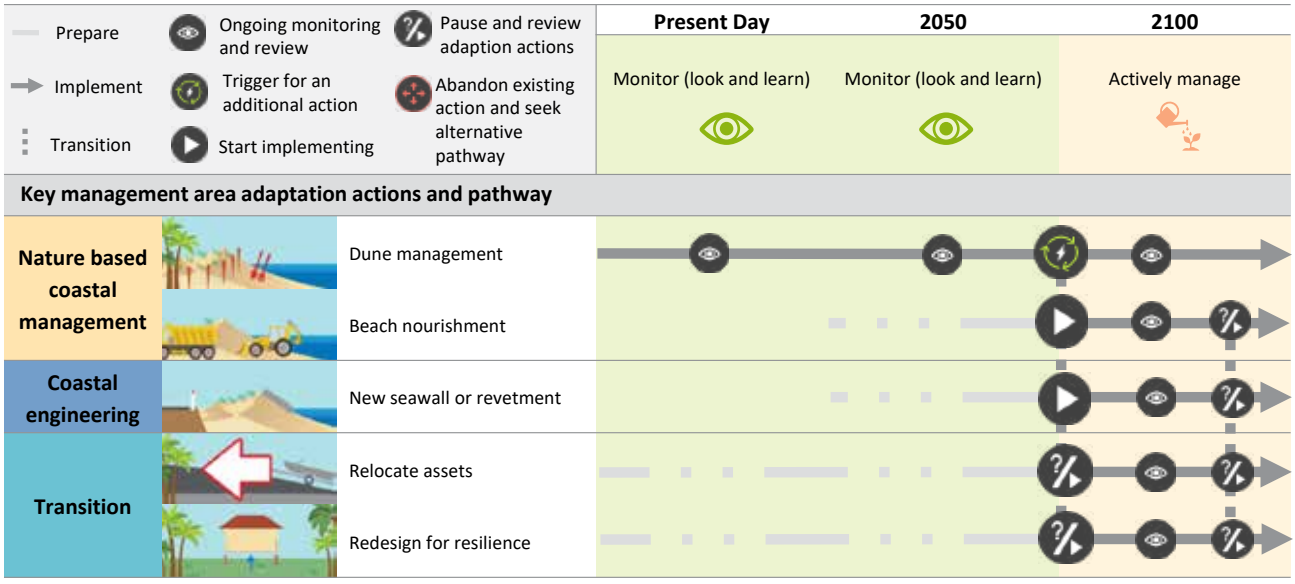
Overview of assets and values at risk

- Facing the southeast there is one house and an old cemetery located on the coastal fringe.
- The residents of the house have experienced erosion in the past, and efforts to mitigate this have been made by using available materials in an informal attempt at mitigating erosion (i.e. tyres and large logs).
- The old cemetery is a culturally significant site. Local residents say it has previously been disturbed by erosion that has exposed graves.
- There are no formal erosion control measures on the back beach, and none are planned currently.

Pathway description

For the Back Beach area of Ugar, the initial adaptation pathway involves dune management to protect the areas in front of the residential building and cemetery. As the community reaches trigger points, they can actively manage erosion by importing sand for beach nourishment or constructing a new seawall. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets while avoiding new development in hazard-prone areas.

Ugar – Back Beach



6. Coastal hazard adaptation actions

Ugar Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Ugar1.1a	See Council wide actions. Consider how these actions can be effectively used in Ugar.	
1.2. Education and knowledge sharing		
Ugar1.2a	See Council wide actions. Consider how these actions can be effectively used in Ugar.	
1.3. Monitoring		
Ugar1.3a	See Council wide actions. Consider how these actions can be effectively used in Ugar.	
Ugar1.3b	Undertake targeted monitoring of rocky cliffs around the island. This can be aligned with action C1.3a and C1.3b.	$
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Ugar2.1a	See Council wide actions. Consider how these actions can be effectively used in Ugar.	
Ugar2.1b	Consider establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait	$$
2.2. Disaster planning		
Ugar2.2a	See Council wide actions. Consider how these actions can be effectively used in Ugar.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Ugar3.1a	See Council wide actions. Consider how these actions can be effectively used in Ugar.	
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Ugar4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Ugar4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Ugar4.3a	Monitor beach profiles in the Front Beach KMA and, if extensive erosion occurs, consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Ugar4.1a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Ugar5.3a	Continue to monitor and maintain existing coastal protection structures and develop plan to upgrade where needed.	$$

6. Coastal hazard adaptation actions

Warraber

Community overview

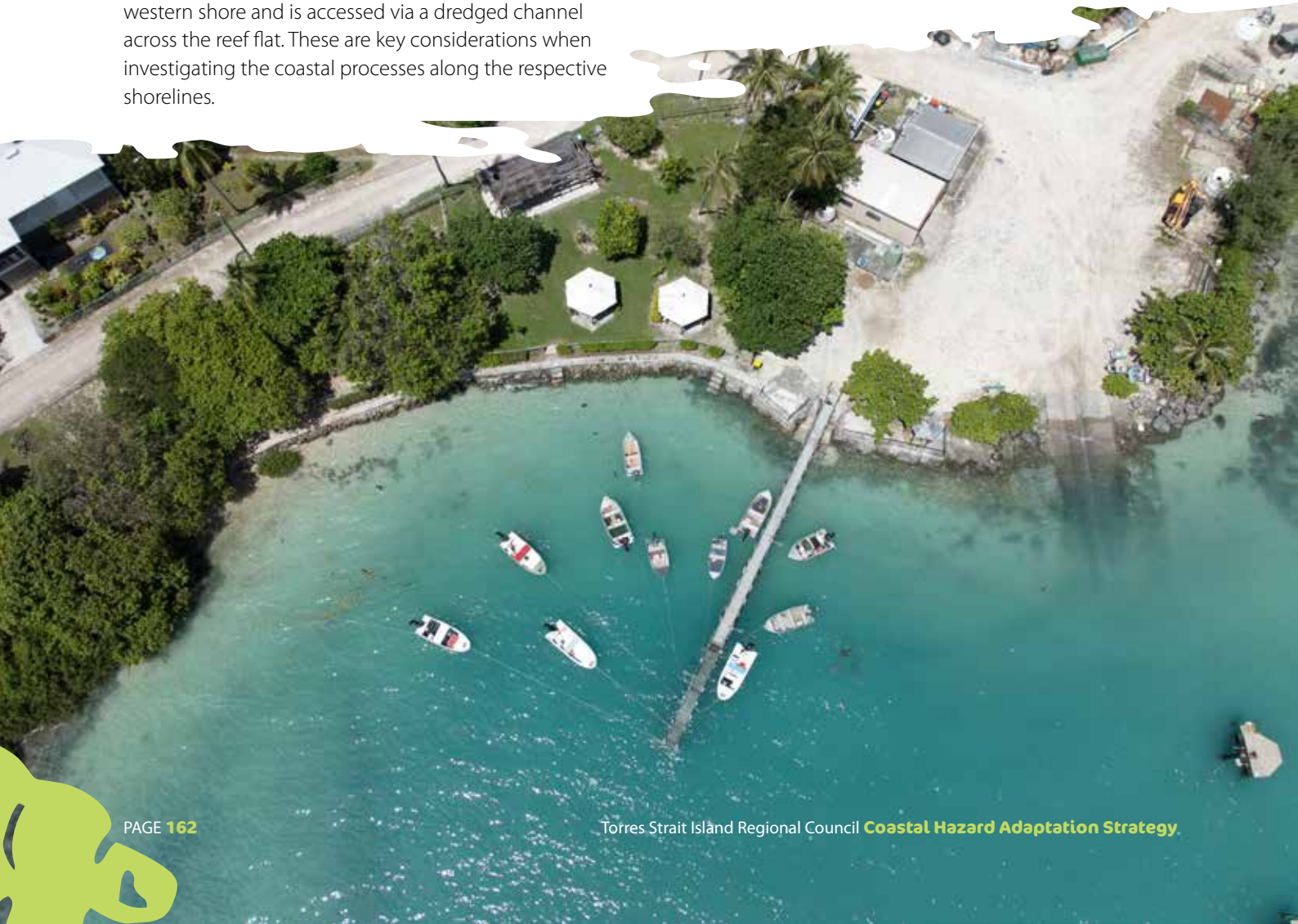
Community	English name	Cluster	Type
Warraber	Sue	Central	Coral Cay

Warraber is part of the central island cluster and is part of three sister islands in the Warraber group (Warraber, Burrar (Bet) Islet, and Guijar (Poll islet)). This island is the only inhabited island in the group and is home to 287 people (ABS, 2021). Warraber is a low-lying coral cay which is just under 0.8 km^2 in size and is generally less than +5 m AHD above sea level.

The western half of Warraber is higher and older and is thought to have established approximately 3000 years ago with the island subsequently expanding to the south and east (JCU, 2010). Much of the north western shore is comprised of beach rock, with little loose sediment accumulation above reef flat level. The island is located on a platform reef that extends south and east from the island. The island's barge ramp is located on the north western shore and is accessed via a dredged channel across the reef flat. These are key considerations when investigating the coastal processes along the respective shorelines.

Key infrastructure on Warraber includes:

- Airport
- Regional council office
- State school (years pre-prep to year 7)
- Health centre with permanent nurse
- IBIS grocery stores
- SES shed
- Water plant reservoirs/filtration collection wells
- Power station
- Sewerage treatment plant
- Barge ramp
- Pier (small craft and passengers only)
- Accommodation facilities at resort
- Guest house facilities (electricity, water, waste).



Risk

The Warraber community is presently considered low risk for erosion and tidal inundation, in part due to the existing seawall offering protection. However, the community is presently at high risk from storm tide inundation with that risk expected to increase within the medium to long term planning horizons for this strategy.

Any approved upgrades to coastal protection structures will mitigate risk and therefore these classifications should be revisited following their construction.

Coastal hazards risk profile for Warraber from present day to 2100

Warraber Risk Profile	Present Day	2050	2100
Open coast erosion	Low	Medium	Medium
Tidal inundation	Low	Medium	Very high
Storm tide inundation	High	Very high	Very high

Adaptation response

A strategic adaptation response has been developed for Warraber to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the present day adaptation response for Warraber is to actively manage identified risks, through a range of initiatives including education, nature based and structural engineering solutions. By 2050, the coastal hazard risk profile for Warraber will become too high and some active management options will no longer be feasible (due to economic or other factors), triggering a change into a 'transition' adaptation approach. At this time a broad range of adaptation options exist including engineering options, transition of current land use and relocating current assets to lower risk areas. A strategic decision will need to be made in consultation with the local community and consider the values of the Warraber area. The 'transition' adaptation pathway approach will continue to be implemented in 2100.

Adaptation response profile for Warraber

Present day	2050	2100
Actively manage 	**Transition and change** 	**Transition and change** 

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Warraber are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Warraber community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


Northern Seawall
Eastern Shoreline
Torres Strait
Cape York
0
90
180 m
n

6. Coastal hazard adaptation actions

Warraber

EASTERN SHORELINE

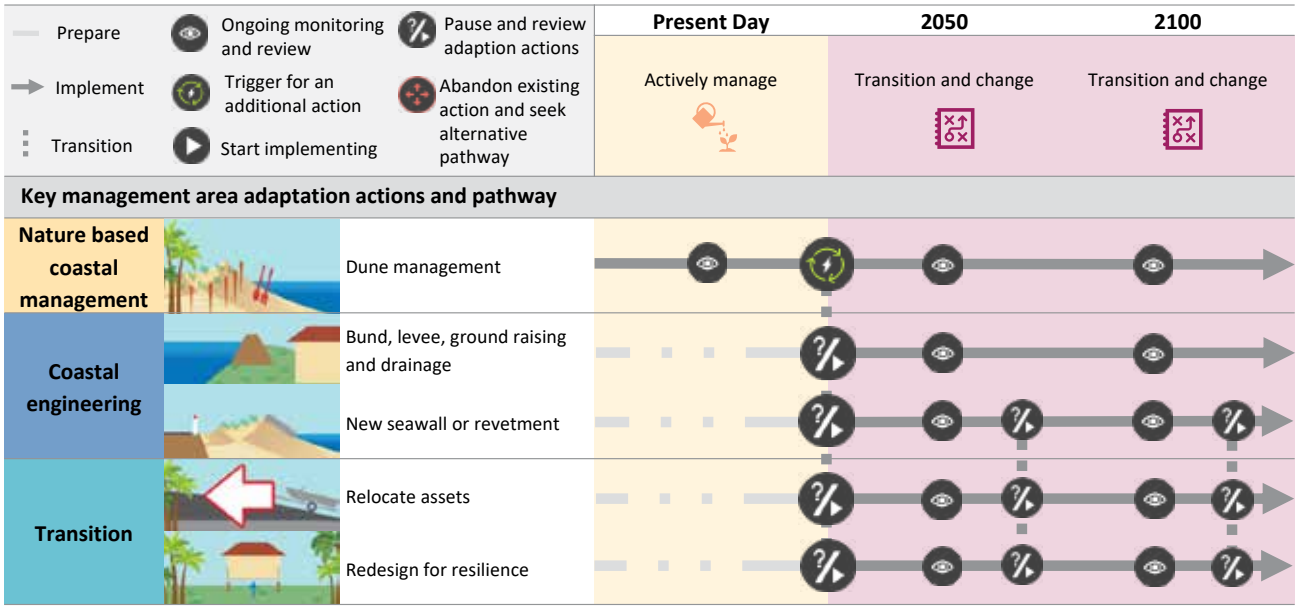
Overview of assets and values at risk

- Previous studies have indicated that the eastern end of the island appears to be accreting, which had been assessed further in a long-term assessment. Young growth on the dunes suggests that the currently occurring accretion is relatively new.

Pathway description

For the eastern shoreline area of Warraber, the initial adaptation pathway involves avoiding and monitoring coastal hazards through dune management. As the community reaches trigger points, they must decide to protect or relocate assets. Bunds and levees and ground raising and drainage measures can prevent inundation, A new seawall or revetment may be constructed to protect exposed assets. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets. In the meantime, the community should avoid new development in hazard-prone areas

Warraber – Eastern Shoreline



NORTHERN SEAWALL

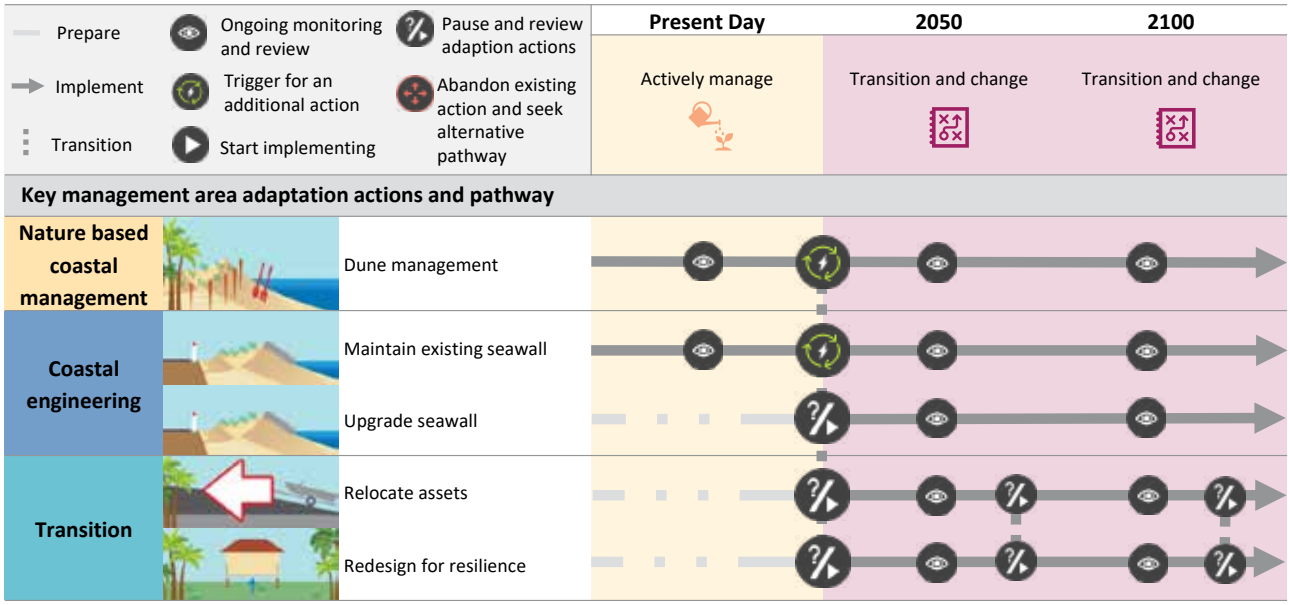
Overview of assets and values at risk

- The township is protected by a seawall extending from the barge ramp facility for approximately 270 metres. It then deteriorates into a rock wall built on unknown material for a further 175 metres. At the end of the rock wall informal attempts at erosion control have been made with tyres east of this point.
- There is funding approved for an upgrade to the seawall, however design is yet to commence.

Pathway description

For Warraber's northern seawall area, initial actions involve maintaining and filling gaps in the existing seawall or revetments. Decisions will be made at each trigger point to determine the best course of action, which may involve upgrading the structure or developing a more detailed action plan for transitioning to a new land use. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets while avoiding new development in hazard-prone areas.

Warraber – Northern Seawall



6. Coastal hazard adaptation actions

Warraber

SOUTH WEST BEACH

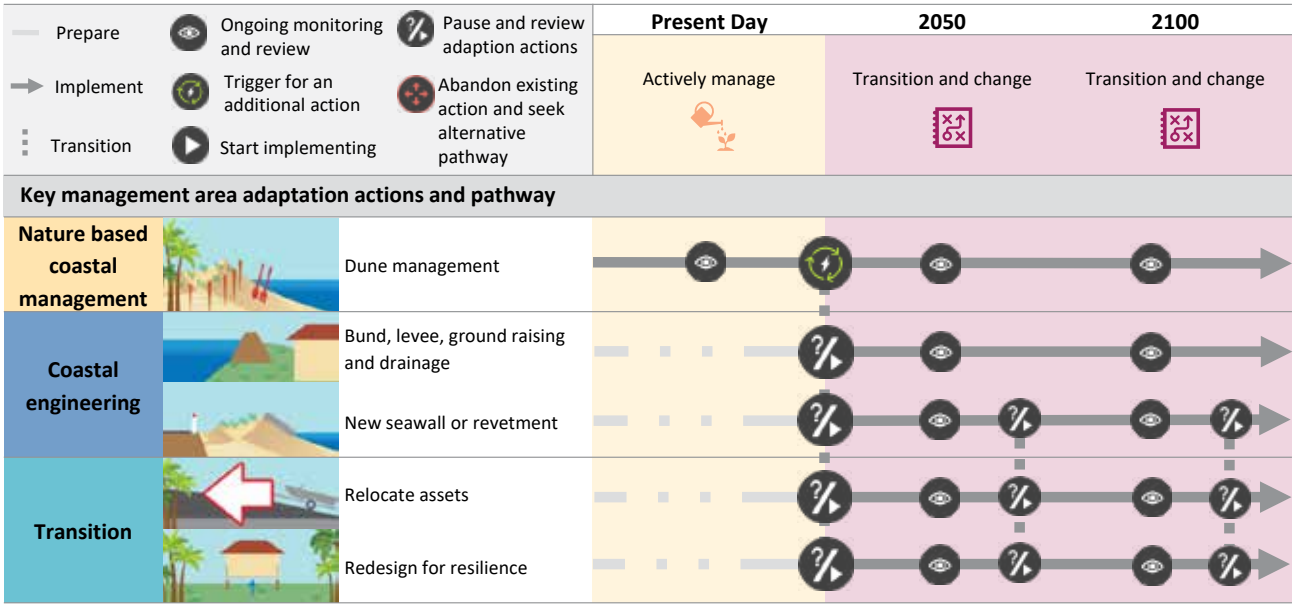
Overview of assets and values at risk

- The southwest shoreline is experiencing different wave conditions to other areas of the island, which is driving erosion of the southern coast and depositing the sand onto the western spit.
- Charts of the waters around the island show a large spit extending away from the reef flat to the west as well as the visible bank.

Pathway description

In the South West Beach area of Warraber, initial actions involve dune management, especially in the areas in front of the critical water reservoir and infrastructure. As the community reaches trigger points, bunds can be built to protect the assets from inundation and a new seawalls or revetments can be constructed to prevent erosion. As time progresses, the community should lead ongoing custodianship and monitoring with the option to revisit the option of relocating or redesigning assets.

Warraber – South West Beach



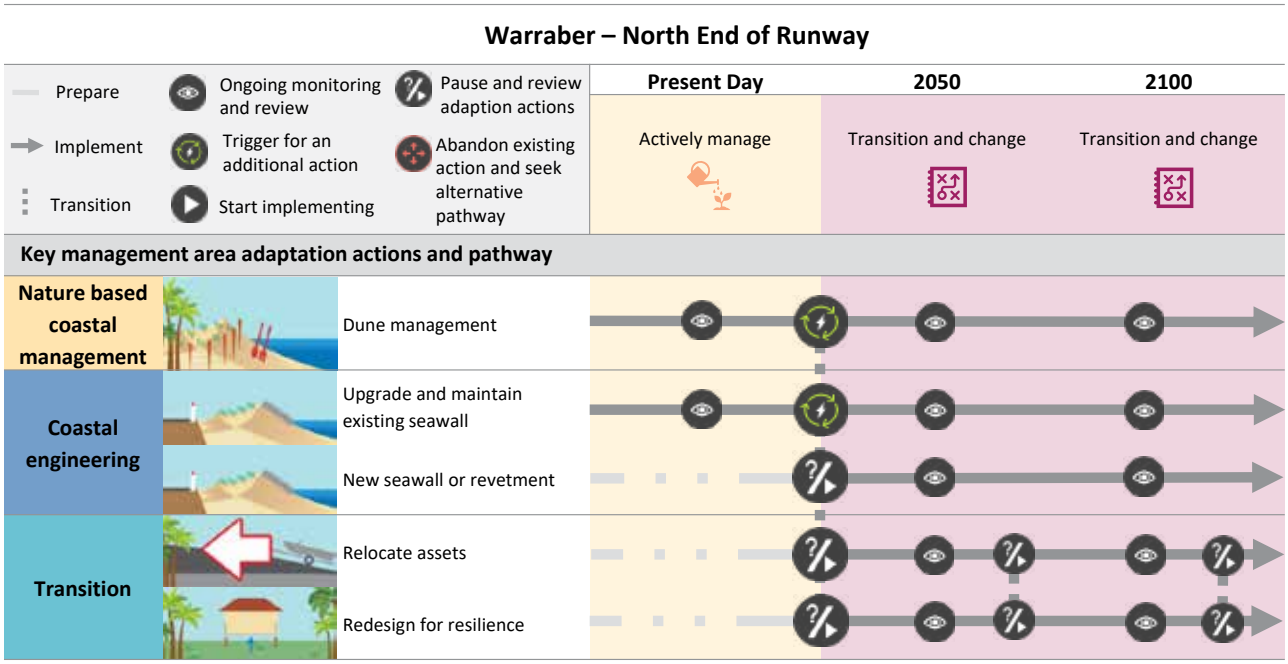
NORTH END OF RUNWAY

Overview of assets and values at risk

- The known and planned protection works for Warraber are listed below:
  - Seawall along northern beach, extending west and east from barge landing
  - Rock groynes associated with landing
  - Rock wall in poor condition, extending from eastern seawall
  - Informal controls i.e. tyres,
- Planned upgrade to seawall has approved funding.

Pathway description

In the north end of runway area of Warraber, initial actions include maintaining existing coastal protection structures as well as dune management at the adjacent dunes to the west. As trigger points are reached, the community may adapt by constructing a new seawall extension to protect the road that provides access to the water reservoir and upgrading the existing seawalls. Decisions will be made at each trigger point to determine the best course of action, which may involve developing a more detailed action plan or relocating the road. Throughout the process, ongoing custodianship and monitoring should be maintained, avoiding new development in hazard-prone areas.



6. Coastal hazard adaptation actions

Warraber Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Warraber1.1a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
1.2. Education and knowledge sharing		
Warraber1.2a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
1.3. Monitoring		
Warraber1.3a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Warraber2.1a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
Warraber2.1b	Develop a "Priority Asset Relocation and Redesign Strategy" involving significant community consultation and input. This should identify potential new settlement zone on Poruma where a staged relocation of assets can occur. This plan should explore the opportunity for a "Floating Community", or an "Above Water Community".	$$
2.2. Disaster planning		
Warraber2.2a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	

Warraber Community Action Plan		Indicative cost
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Warraber3.1a	See Council wide actions. Consider how these actions can be effectively used in Warraber.	
Warraber3.1b	Consider relocation or redesign for resilience of buildings (in line with the Resilient Housing and Development Guidelines and Designs from action C3.1c) exposed to hazards in all KMAs.	$$
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Warraber4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.2 Living shorelines		
Warraber4.2a	Explore feasibility of an artificial reef to enhance fringing reef resilience, bolstering natural sediment supply and dissipating wave energy.	$$
4.3 Beach nourishment		
Warraber4.3a	Monitor beach profiles around the island and consider sand backpassing in the Eastern Shoreline KMA or beach nourishment to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Warraber4.1a	$$
5. Coastal engineering (see adaptation pathways for timing)		
5.3 Last line of defence structures		
Warraber5.3a	Continue to monitor and maintain existing coastal protection structures and develop plan to upgrade where needed.	$$
Warraber5.3a	As part of the adaptation pathway in the North End of Runway and South West Beach KMAs, consider the construction of a coastal protection structure to protect the water reservoir and its access road. This action should not occur before Warraber3.1b, Warraber4.1a and Warraber4.3a are considered.	$$$
5.4 Structures to minimise flooding		
Warraber5.4a	Consider construction of a bund around the south east of the island.	$$$

6. Coastal hazard adaptation actions

Wug (Moa Kubin)

Community overview

Community	English name	Cluster	Type
Wug	Moa (St Pauls)	Western	Continental volcanic and granitic rock island

Wug (St Pauls) is one of two townships on Moa. It is located on the eastern coast and has an estimated population of 278 people (ABS 2021). The other township, Arkai (Kubin), is located on the southern coast of the island, with the townships connected via an inland road.

Moa, located in the western island cluster and approximately 170 km^2 in size, is a continental type island with geology similar to that found on mainland Australia. The majority of the community lives in the main township, located between two headlands. The elevation of the township is relatively low-lying compared to the elevated interior, with properties immediately adjacent to the shoreline below +5 m Australian height datum (AHD). The position of the township on the eastern side of the island means it is exposed to seasonal winds approaching from the southeast (Sager winds).

Key infrastructure in Wug includes:

- Helipad at football ground with airport nearby at Kubin
- Regional council office
- State school (years pre-prep to year 7)
- Health centre
- IBIS grocery store
- Sporting facilities – outdoor multipurpose courts, rugby league oval
- Motel - six rooms
- Water plant reservoirs/filtration collection wells
- Power station
- Barge ramp
- Pier (small craft and passengers only)
- Council workshop/compound
- Guest house facilities
- Landfill site

Risk

The Wug (Moa St Pauls) community is currently considered low to medium risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy.

Coastal hazards risk profile for Wug (Moa St Pauls) from present day to 2100

Wug (Moa St Pauls) Risk Profile	Present Day	2050	2100
Open coast erosion	Medium	Medium	Medium
Tidal inundation	Low	Low	Low
Storm tide inundation	Low	Medium	Medium

Adaptation response

A strategic adaptation response has been developed for Wug to guide decision making over multiple planning horizons from present day to 2100. Based on the risk assessment and risk profiles for each hazard across the planning horizons, the adaptation response for Wug is to "monitor" through observing changes to individual asset's capacity to withstand hazards and review ongoing risk. This adaptation approach is to be implemented in the present day, 2050 and 2100.

Adaptation response profile for Wug (Moa St Pauls)

Present day	2050	2100
Monitor (look and learn)	**Monitor (look and learn)**	**Monitor (look and learn)**

Adaptation pathways and priority actions

Key Management Areas (KMAs) have been defined based on which areas are most at risk, as well as feedback from community leaders and are mapped below. Tailored adaptation pathways for each key management area on Wug are presented in the following pages.

Building on the outcomes of the risk assessment, adaptation response, and input from community leaders, specific priority adaptation actions have been developed to protect and enhance assets and coastal values in the Wug community, as well as enhance community stewardship and improve decision-making. These actions are designed to progress the community along its adaptation pathways.

6. Coastal hazard adaptation actions


0
200
400 m
n
Torres Strait
Cape York

6. Coastal hazard adaptation actions

Wug

MAIN BEACH NORTH

Overview of assets and values at risk

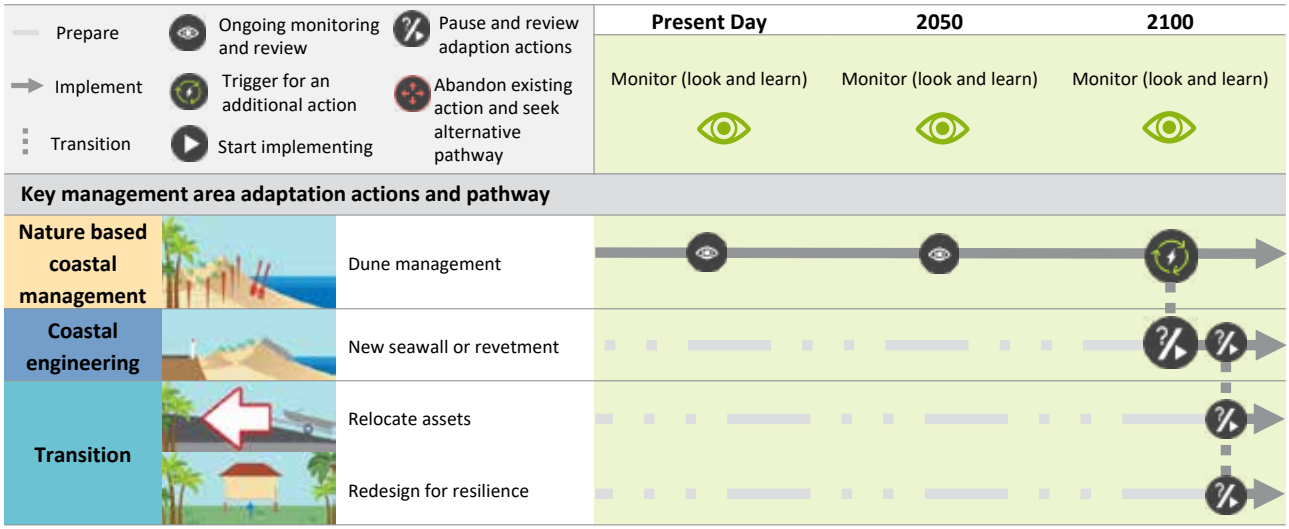
This is the area of beach north of Slaveka Street.

- Key infrastructure at risk includes the old cemetery, the new cemetery, areas of erosion along the Esplanade Road and erosion in the northern corner.

Pathway description

In the Main Beach North area of Wug / Moa (Wug), the initial adaptation pathway involves avoiding and monitoring coastal hazards through dune management. While the risk profile is not expected to increase significantly, trigger points may be reached initiating a transition to actively managing coastal hazards by implementing bunds, levees, and ground raising measures to prevent inundation of areas north of the beach near the cemetery. Additionally, new seawalls or revetments may be constructed as needed. As time progresses, the community should lead ongoing custodianship and monitoring and, in the meantime, avoid new development in hazard-prone areas.

Wug – Main Beach North



MAIN BEACH SOUTH

Overview of assets and values at risk

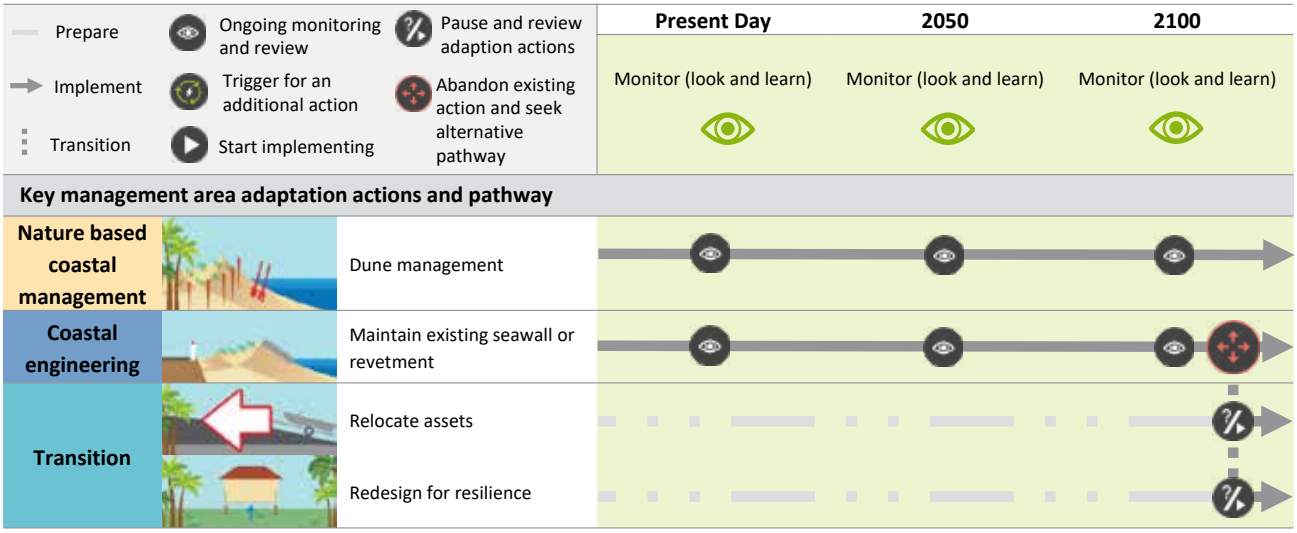
This is the area of beach south of Slaveka Street.

- Along the southern half of the beach, the beach berm is not as high and the areas behind are relatively low- lying.
- In several places the dunes are eroding, and there are concerns of inundation of the areas behind. The boat ramp next to the jetty is also in disrepair and is considered a hazard by the community.
- There is also evidence of erosion of dunes in the south, inundation of the material storage area, and deterioration of the boat ramp.

Pathway description

For the Main Beach South area of Wug / Moa (Wug), the initial adaptation pathway involves avoiding and monitoring coastal hazards through dune management and maintaining the existing coastal protection structures near the barge ramp. As time progresses, the community should lead ongoing custodianship and monitoring and, in the meantime, avoid new development in hazard-prone areas. of relocating or redesigning assets while avoiding new development in hazard-prone areas.

Wug – Main Beach South



6. Coastal hazard adaptation actions

Wug Community Action Plan		Indicative cost
1. Council-wide initiatives to enhance custodianship (Priority actions to be implemented within 10 years, and ongoing)		
1.1. Community stewardship		
Wug1.1a	See Council wide actions. Consider how these actions can be effectively used in Wug.	
1.2. Education and knowledge sharing		
Wug1.2a	See Council wide actions. Consider how these actions can be effectively used in Wug.	
1.3. Monitoring		
Wug1.3a	See Council wide actions. Consider how these actions can be effectively used in Wug.	
2. Planning updates (Priority actions to be implemented within 10 years, and ongoing)		
2.1. Land use planning		
Wug2.1a	See Council wide actions. Consider how these actions can be effectively used in Wug.	
Wug2.1b	Consider establishment of a stone quarry to provide materials for coastal protection throughout the Torres Strait.	$$
2.2. Disaster planning		
Wug2.2a	See Council wide actions. Consider how these actions can be effectively used in Wug.	
3. Resilient built environment (Priority actions to be implemented within 10 years, and ongoing)		
3.1. Maintaining and improving infrastructure		
Wug3.1a	See Council wide actions. Consider how these actions can be effectively used in Wug.	
4. Nature based coastal management (see adaptation pathways for timing)		
4.1 Dune, mangrove and reef protection and enhancement		
Wug4.1a	Identify degraded dunes in all Key Management Areas. Protect and enhance them using local knowledge and Zaget Torateti, including the use of native dune plants, and other stabilising vegetation. Manage access for an appropriate time period to allow vegetation to establish.	$
4.3 Beach nourishment		
Wug4.3a	Monitor beach profiles in the Main Beach North KMA and, if extensive erosion occurs, consider small scale beach nourishment or sand scraping to enhance degraded dunes in front of key assets. Supplement with dune restoration and access management, see action Wug4.1a	$$

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8. Glossary

Adaptation	Adaptation is adjusting to actual or expected conditions and events. Adaptation can have good or bad outcomes and should be guided by understanding the desired state of being. Good adaptation to coastal hazards means taking action to reduce risk and increase resilience.
Resilience	Resilience is the ability for something to withstand stress and continue to function and recover from damage. Resilience applies to the coastal environment as well as the community. Resilience happens when coastal ecosystems are clean and healthy, and when the community is prepared and safe for coastal hazards.
Coastal Hazards	Coastal hazards are when natural coastal processes threaten local values, properties, or our local way of life. Some coastal hazards include storm tide inundation, erosion, and tidal inundation.
Storm tide inundation	Storm tide inundation is when big storms cause temporarily higher water levels leading to flooding of normally dry land. Storm tide inundation is often accompanied by big waves and strong winds which together can cause widespread destruction.
Erosion	Erosion is when coastal forces such as waves, winds, tides and currents remove sand from the beach and move it offshore. This can cause the shoreline position to move landwards. Big erosion events can threaten buildings, roads and important cultural areas.
Tidal inundation	Tidal inundation is when normal astronomical tides cause flooding of low-lying coastal land. Areas exposed to tidal inundation are expected to periodically flood. With global average sea levels expected to rise, areas effected by tidal inundation are also expected to increase.
Likelihoods	Likelihoods are words to describe how common or rare an event is. Likely events are expected to happen regularly and multiple times within the average lifespan. Possible events are expected to happen every so often and a few times in the average lifespan. Rare events are unusual and might occur once or twice in the average lifespan.
AEP	Annual Exceedance Probability, or AEP, is the likelihood that certain conditions will occur in a given year. AEP values are based on computational modelling that considers measured coastal data and multiple thousands of simulated scenarios.
Planning horizons	Planning horizons are points in the future for which strategic decisions are made. This Strategy considers planning horizons of present day (2020), 2050, and 2100.
Risk	Risk is the possibility of loss, damage, or injury. In a coastal context, risk arises from exposure to coastal hazards such as storm tide inundation, and erosion. Risk can be measured by considering both the likelihood and consequence of loss, damage, or injury.
Avoid (and maintain)	Prevent new risks from occurring and avoid placing new development or assets in coastal hazard areas.
Monitor (look and learn)	Watch for any changes to the coast that might indicate a change in the risk; collect and record information about important cultural sites and places in a culturally appropriate manner.
Actively manage	Proactively manage or reduce the risk of coastal hazards through a range of adaptation options including custodianship, care for country, and in some cases, physical intervention.
Transition and change	Gradually change what an area is used for. This might include relocating buildings or assets to an area that is safe from coastal hazards.

Supplement A

Adaptation actions – summary sheets

Supplement B

Coastal hazard mapping

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