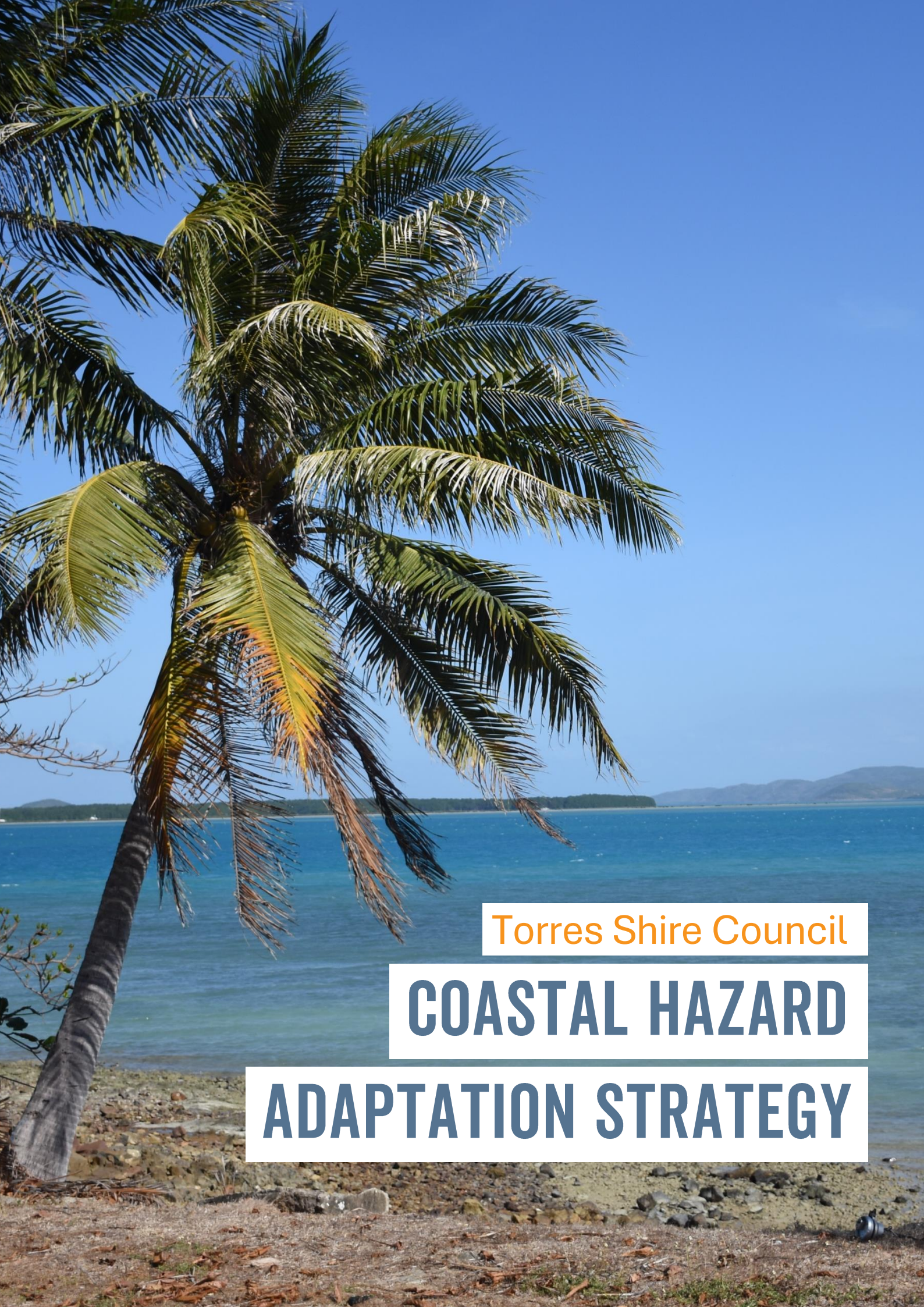


Torres Shire Council

COASTAL HAZARD ADAPTATION STRATEGY

ACKNOWLEDGMENT OF COUNTRY

We respectfully acknowledge the Traditional Owners of the Kaiwalagal area, the Kaurareg people and traditional owners of Zenadth Kes. We pay respect to their Elders, past, present, and emerging and acknowledge their continued connection to the land and waters of this area.

We acknowledge all Aboriginal and Torres Strait Islander peoples as the traditional custodians of this Country. We recognise and honour their ancient cultures, and their connection to land, sea and community.

CONTENTS

1.0 INTRODUCTION

Torres Shire Council (Council), with the support of the QCoast2100 program, has developed a Coastal Hazard Adaptation Strategy. This Strategy will help us to better understand emerging coastal hazard risks and proactively manage the impacts of those risks on our community, environment, cultural values, infrastructure, liveability and essential services. This Strategy is designed to strengthen our community both now and into the future (to 2100) so that our children and their children can maintain their connection to Land and Sea Country.

Torres Shire is a culturally and physically unique part of Queensland. With its history extending back over 40,000 years, when Torres Strait Islander and Aboriginal people first came to the Torres Strait, it is today a place of great diversity - environmentally, economically, socially and culturally. Our region's landscape is highly variable, with rocky headlands separating sandy beaches through to rocky shorelines and broad mangrove areas.

Our coastal landscape is always changing, being shaped by natural processes like wind, tides and currents and changing sea levels. The continual cycles of sand loss (erosion), rebuilding (accretion) of the shoreline, and flooding of coastal areas by sea water during 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 negatively impact on infrastructure, access, services, our lifestyle and the economy.

Building the resilience of our coastline and community is one of our top priorities. To achieve this, we need to understand how our coast is being affected by coastal hazards today and how our coast might change in the future under the influence of a changing climate. We can then proactively plan, prepare and respond to those coastal hazard risks over time.

This Strategy has been informed by the best available science and was a collaborative effort with members of our community, who have shared their experiences and knowledge to help us understand what is important to them.

CONTEXT & APPROCH

This Strategy has been developed under QCoast2100, a state-wide coastal hazard adaptation program supported by the Queensland Government and Local Government Association of Queensland (LGAQ). QCoast2100 assists Councils to proactively plan for long-term coastal resilience and minimise the risk of coastal hazard impacts on communities and valuable assets such as roads, utilities, parks, natural areas and heritage places.

PURPOSE

The Strategy is a risk and change management initiative. It provides an understanding of current and future coastal hazard risks, including how the coast might change or be impacted in the future, and what we can do to proactively plan, prepare, and respond to these risks over time to improve our resilience to coastal hazards.

This strategy outlines the:

- coastal values of the region;
- current and future coastal hazard risks, nominally to the year 2100;
- short, medium and long-term actions to avoid, reduce and adapt to the social, cultural, economic, and environmental risks associated with coastal hazards; and
- recommended approaches to consider in managing our coastline.

The Strategy is underpinned by extensive stakeholder input and the best available science, engineering, and other studies. It forms the foundation to strengthen the resilience of our coast and community and facilitates informed decision-making.

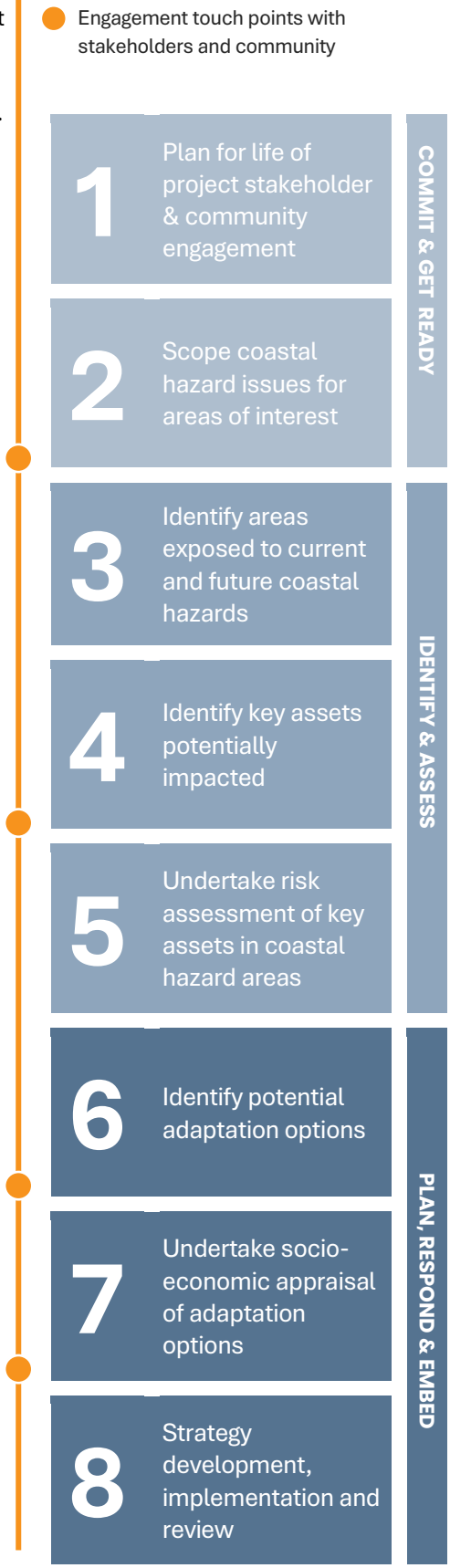
We all have a role to play in maintaining our resilience to coastal hazards and this document is the start of a broader discussion to assist all of us when responding to the impacts of a changing coast.

PROCESS

The Strategy was developed through an eight-phase process as outlined in the *QCoast2100 Minimum Standards and Guidelines*. The process has included technical studies and engagement. The outputs of this work have:

- Identified existing coastal hazard exposure and how this exposure may change in the future under the influence of rising sea levels;
- Assessed the vulnerability of and risk to natural and built assets through a comprehensive data and spatial analysis process;
- Identified priorities by distinguishing between urgent and future risks;
- Engaged with the community to understand preferred approaches to adaptation and develop potential approaches to adapt to coastal hazards;
- Assessed the viability of adaptation approaches through stakeholder engagement and multi-criteria analysis; and
- Informed the development of implementation planning (timing, staging and sequencing) of preferred adaptation options over time.

Figure 1. CHAS structure - phases and engagement touch points



ALIGNING WITH OUR CORPORATE STRATEGIES

The Strategy is a non-statutory document that provides a high-level plan for the future management of coastal hazards through to 2100 and involves identifying regionally focused priority areas and actions. The identification of more detailed localised planning and the implementation of physical works will occur through annual operational programs such as asset management and shoreline erosion management planning.

Just like our coastal environment, the Strategy will evolve as new information, observations and technologies become available. The Strategy will be reviewed periodically to align it with leading practice and community expectations.

The Strategy, and supporting technical work, form an important part of Council's long-term planning and strategic framework and will inform and influence a range of other Council strategies, plans, policies, and future decision making. Key Council documents that should be updated (where required) to align with, integrate and embed coastal hazard risk considerations from the Strategy include:

- Torres Shire Planning Scheme 2022
- TSC Corporate Plan 2018-2023
- TSC Operational Plan 2023-2024
- Torres Strait Local Disaster Management Plan 2020
- Local Government Infrastructure Plan

2.0 WHY DO WE NEED A STRATEGY?

Our coastal zone is dynamic and always changing. Many of us are familiar with coastal change having observed beach erosion, shifting sands and periodic inundation of low-lying areas from high tides and storm events. These natural processes are referred to as coastal hazards when they impact on how we use and enjoy our coastal areas.

Coastal hazard impacts can occur quickly during significant storm events or develop slowly, over several years in response to long term natural coastal processes. These impacts can result in temporary or permanent changes to our coastline, affecting our region's natural beauty and places of cultural and ecological significance as well as our community's infrastructure – our roads, services, drainage, homes, businesses and utilities.

The extent of coastal land vulnerable to coastal hazards, as well as the consequences of these coastal hazards, are expected to increase in the future as sea levels rise. Climate change is also expected to increase the severity, frequency and risk associated with coastal hazards over time. This Strategy focuses on three coastal hazards that affect our coastline – storm tide inundation, coastal erosion and sea level rise.

STORM TIDE INUNDATION:

Storm tide is the temporary water level that results from the combination of normal tides and a storm surge from severe weather such as cyclones or strong winds. If a storm surge coincides with higher tides, the resulting storm tide and waves can submerge the open coastline or inundate land behind the open coastline through the overflow of waterways, estuaries and drains that connect to the ocean.

Our coast is exposed to storm tide inundation along our low-lying sandy foreshores and wetlands. A number of important environmental and social assets of the Torres Shire islands are vulnerable to storm tide inundation in the years to come including settlement areas, a significant portion of the Wasaga township, Thursday Island Hospital, fringes of the Star of the Sea Aged Care site, beaches and essential infrastructure (roads, water supply and sewerage assets, electrical, and transport infrastructure).

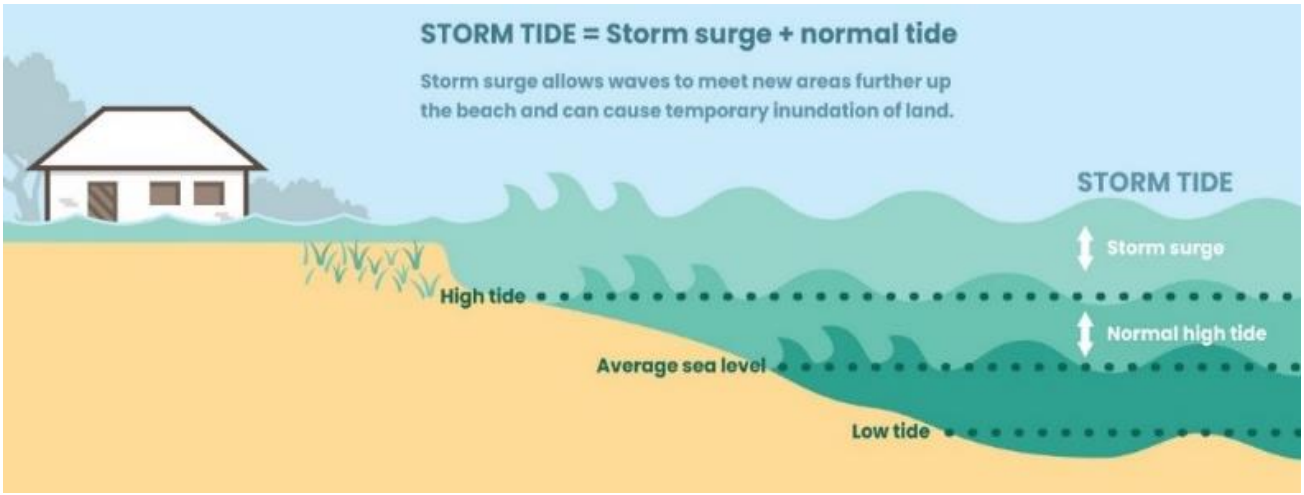


Figure 2. Storm-tide inundation process

COASTAL EROSION:

Coastal erosion is the temporary or permanent loss of coastal land, beaches or dunes by wave or wind action, tidal currents, water flows or sea level rise. Coastal erosion is often associated with extreme weather such as coastal storms, but many coastal foreshores also naturally undergo cycles of erosion and accretion (build up) over weeks and years.

Amongst the islands of Torres Shire, many of the assets at risk of storm tide inundation are also at risk of coastal erosion. Additional physical assets at extreme risk of current or future erosion hazard across all islands include cemeteries and boating facilities (such as ports, jetties/wharves, barge landings and boat ramps). On Thursday Island, all of Waiben Esplanade, the Waste Transfer Station site on Aplin Road, Tagai State College and the James Cook University site are at extreme risk.

Natural and cultural assets at risk of coastal erosion include significant trees, all beach areas, estuaries, coastal reserves, middens, memorials, stone circles, caves and story places.

SEA LEVEL RISE:

Sea level rise is not a distinct process causing impact on its own, but rather, increases the extent of land subject to other coastal processes (including forecast (usual) tidal inundation, coastal storm inundation, coastal erosion and shoreline recession)[1].

A projected rise in mean (average) sea level of 0.8 metres by the year 2100 has been adopted as a planning benchmark by the Queensland Government based on climate modelling. If effective coastal adaptation strategies are not implemented, this increase could result in permanent sea water inundation of low-lying areas and exposure of the places we love and value such as our beaches, parks, important community infrastructure like roads and drainage, and private assets.

In Torres Shire, several key assets are projected to be exposed to sea level rise between now and 2100. These include beach areas, esplanades and foreshore areas, environmental and culturally significant areas, settlement areas, boating facilities, cemeteries and essential infrastructure (trunk roads, electrical, water, sewer and storm water assets).

Figure 3. Process of coastal erosion and sea level rise

[1] Insurance Council of Australia (2021), *Climate Change Impact Series: Actions of the Sea and Future Risks*.

3.0 OUR COAST

> The Torres Shire Council area comprises approximately 890 km^2 (excluding marine area) of land within the Torres Strait Region. This includes portions of the northernmost part of the Australian mainland, the majority of the Kaiwalagal Group of islands and multiple smaller islands dispersed within the Strait.

Torres Shire presently plays a integral administration and service role for the Torres Strait and Cape York regions. This is anchored by the main settlement and administrative centre in the region, Waibene Island (Thursday Island), which is located approximately 27 kilometres northwest of Cape York. The land area administered by Council comprises 15 islands and portions of Cape York Peninsula:

- Albany Island
- Teran Island (Dayman)
- Zuna Island (Entrance)
- Gealug Island (Friday)
- Pali lug Island (Goods)
- Ngurupai Island (Horn)
- Little Adolphus Island
- Mori Island (Mount Adolphus)
- Tarilag Island (Packe)
- Yeta Island (Port Lihou)
- Tuined Island (Possession)
- Muralag Island (Prince of Wales)
- Waibene Island (Thursday)
- Turtlehead Island
- Mawai Island (Wednesday)

This Strategy is focused on the main settlement areas of the five (5) inhabited islands of the Torres Shire: Thursday Island (Waibene), Horn Island (Ngurupai), Prince of Wales Island (Muralug), Friday Island (Gealug) and Entrance Island (Zuna).

OUR STORY

> The Kaurareg People are acknowledged as the traditional owners of the Kaiwalagal islands on which Torres Shire Council administers local government responsibilities.

The first inhabitants of the Torres Strait migrated from Indonesia approximately 70,000 years ago. The islands are home to rich Indigenous culture, diverse multiculturalism and a unique history marked by significant events including migration, colonialism, war, industry, missionaries and trade.

The coastal zone continues to be integral to the livelihoods, customs and spiritual beliefs of the Torres Strait Islander people, who maintain a strong connection to land and sea country.

Many of our culturally significant areas are located close to, on, or within the beach and estuarine waterways and continued access to these areas is critical for community well-being.

Council acknowledges that the traditional knowledge systems and practices of First Nations People are a major resource for, and integral to, adapting to climate change. This Strategy seeks to integrate such knowledge with existing coastal practices and technical information to increase the effectiveness of coastal hazard adaptation.

OUR COASTAL LANDSCAPE

> As a group of predominantly island-based communities, our coastal landscape is one of our most valuable natural assets. Sandy beaches, wetlands, estuarine waterways, rocky outcrops and mangrove areas characterise much of our coastal zone, along with small residential settlements.

Our natural foreshores, beaches and coastal vegetation support important habitat areas for our native plants and animals. Torres Shire is home to over 2,485 species of native animals, plants and fungi including 543 native wildlife species, 43 rare or threatened plant species and 35 rare or threatened animal species. Estuarine, riverine and palustrine wetlands and their connection to the coast are equally essential, supporting large extents of protected ecosystems.

Approximately 339 km^2 (38%) of our region comprises wetland habitat including 274 km^2 of mangroves (30.6% of the total land area)[2].

The coastal landscape and natural areas support a variety of places that hold special cultural, environmental and economic values to residents and visitors.

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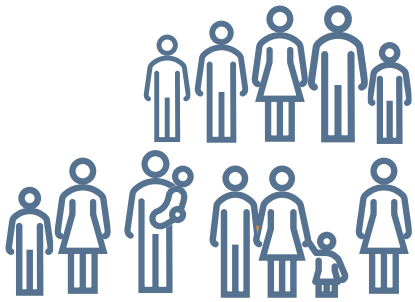
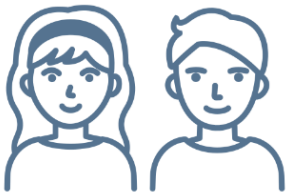
[2]Department of Environment and Science (2013), *Torres Local Government Area — facts and maps, WetlandInfo*, accessed 19 September 2023. Available at: https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/lga-torres/

COMMUNITY SNAPSHOT



3,421 PEOPLE IN 2021[3]



MEDIAN AGE OF 30 YEARS[3]

69%

POPULATION IDENTIFY AS ABORIGINAL OR TORRES STRAIT ISLANDER[3]

-0.1%

ANNUAL GROWTH RATE OVER THE PAST 10 YEARS[4]

196

BUSINESSES[5]

7.8%

POPULATION WAS BORN OVERSEAS[3]

The coastal landscape has cultural, social and economic significance for the local community who value the protection and sustainability of the Land and Sea Country. Important environmental features of the Torres Shire coastline include:

- diverse coastal landscapes including sandy beaches and estuaries;
- highly ecologically significant freshwater and intertidal wetlands, seagrass and mangrove forests;
- endangered or vulnerable wildlife (terrestrial and marine) who depend on the ocean and coastal zone for food, breeding and protection; and
- highly diverse coral reefs forming the northern extent of the Great Barrier Reef.

Locals and tourists alike value easy access to water-based activities and the natural, unspoiled environment that can be enjoyed along the coastline and around waterways and estuaries. Some of our favourite ways to use coastal places are boating and fishing and foreshore recreational activities such as camping and swimming. As a result, coastal dependent infrastructure, particularly supporting recreational activities, is important for maintaining our community's way of life.

Our response to coastal hazards today will have a direct impact on the strength of lifestyle opportunities and attractiveness of visiting or living on the coast in the future.

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[3] Australian Bureau of Statistics (2023), 2021 Census All persons QuickStats: Torres Local Government Area, accessed 12 September 2023. Available at: https://www.abs.gov.au/census/find-census-data/quickstats/2021/LGA36950

[4] Queensland Government Statistician's Office, Queensland Treasury (2023), *Queensland Regional Profiles: Resident Profile: Torres (S) Local Government Area*. Available at https://statistics.qgso.qld.gov.au/qld-regional-profiles

[5] Australian Bureau of Statistics (2023), *Region Summary: Torres*, accessed 12 September 2023. Available at: https://dbr.abs.gov.au/region.html?lyr=lga&rgn=36950

4.0 BUILDING RESILIENCE TOGETHER

> Looking after our coast now and into the future is a shared responsibility which involves everyone – local, Queensland and Australian governments, Traditional Owners, business owners, property owners, residents and the broader community.

To develop the Strategy, we reached out to the community and industry stakeholders, business and tourism groups, and Councillors through a range of engagement activities. This process helped us to understand key features, locations, experiences and values associated with the coast to inform and frame our plan for the future.

Engagement feedback highlights that our coastal environment underpins a diversity of environmental, social and cultural values, and supports lifestyle and recreational opportunities unique to Torres Shire. Easy access to the coast for recreational activities such as boating, camping, swimming, diving and fishing is an extremely important lifestyle value for residents and visitors alike. We appreciate the natural coastal environment and connecting with nature.

All input and feedback received has assisted in shaping the direction of technical investigations underpinning the Strategy and the identification of priority adaptation actions for Torres Shire.

COMMUNITY VALUES ENGAGEMENT
NOVEMBER 2020

12 planned community events

15 meetings with key stakeholders

52 survey responses

ADAPTATION APPROACHES ENGAGEMENT
JULY 2022

27 people engaged at pop up

33 people engaged at the Tagai State College Careers Day

9 Targeted conversations with key stakeholder groups

2 social media post with **15** interactions

FEEDBACK ON DRAFT COASTAL ADAPTATION PLAN
NOVEMBER 2023

27 people engaged at pop up

8 key stakeholder groups provided with key project documents

Project update sent to **7** key stakeholders

OUR COASTAL VALUES:

All of our beaches – every beach has a special purpose or meaning to people within the community.

Respecting and protecting the cultural connections between land, sea and people.

Recreational activities including fishing, camping, diving and hunting.

A healthy coastal environment including sea life, coastal vegetation, mangroves, reef systems and water quality.

The current and potential economic benefits that the coast generates for the community.

OUR COASTAL VULNERABILITIES:

Our community has observed the following changes to coastal areas:

- Damaging impacts on coastal marine ecosystems including plants (mangroves and seagrass) and animals (turtles and dugongs);
- Noticeable permanent changes to sandy beaches due to erosion;
- King tides and inundation, particularly affecting roads, boating facilities and other important social infrastructure;
- Increase in ocean temperature;
- Several recent coral bleaching events contributing to reef ecosystem decline;
- Increase in the presence of crocodiles in coastal recreational areas.

5.0 UNDERSTANDING THE RISK FROM COASTAL HAZARDS

We all have special places, features, qualities or memories of the coast that are important to us for different reasons – social, economic, environmental, cultural or personal. These elements of the coast are at risk when coastal hazards threaten to impact them. Risks can be either direct (e.g. road inundation) or indirect (e.g. inundation that isolates a community) and can be assessed across a range from low to extreme risk.

To identify current and future risks along our coast, we need to first understand the impacts of coastal hazards, including the areas affected and what the impacts are on our special places and important infrastructure. Coastal hazard modelling was used to assess the risk resulting from coastal hazards to our assets, key community values and our natural and urban areas over time. To determine risk, we followed the process outlined below:

1

Modelling exposure to coastal hazards

Updating Council's existing coastal hazard mapping based on the best available science.

2

Identifying assets and community values

Identifying land and assets along our coast that are exposed to coastal hazards and engaging with the community to understand what values (social, economic, environmental) should be considered as part of the strategy.

3

Calculating and mapping risk

Calculating the level of risk (low, medium, high, extreme) that coastal hazards pose to our community assets and values now and in the future.

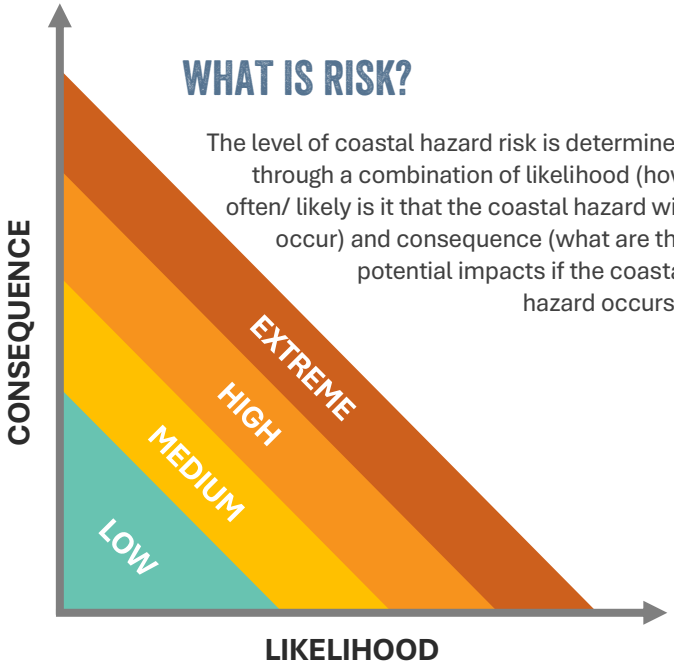
4

Evaluating risk

Understanding what a tolerable/ acceptable level of risk is and if there are any controls or mitigating actions currently in place or planned to minimise risk.

WHAT IS RISK?

The level of coastal hazard risk is determined through a combination of likelihood (how often/ likely is it that the coastal hazard will occur) and consequence (what are the potential impacts if the coastal hazard occurs).



RISK ASSESSMENT PROCESS

The outcome sought by risk-based planning is not to diminish development potential in coastal hazard risk areas, but rather, to better inform the planning process and create clear visibility on locations across the coast with lower and higher exposure to coastal hazard risks. This ensures:

- more vulnerable or sensitive land uses are located in less hazardous or lower risk areas;
- a proactive long-term approach for maintaining or reducing the exposure of existing and future coastal settlements to existing and future unacceptable risks;
- the resilient design of infrastructure and development in appropriate locations where the risk can be managed to an acceptable level; and
- a coordinated response with emergency management and other coastal hazard adaptation approaches.

Being aware of an increasing risk profile means we have time to prepare, respond and implement adaptation actions now and over the coming decades to mitigate reactive responses and avoid impacts before they occur.

WHAT AREAS AND ASSETS ARE AT RISK FROM COASTAL HAZARDS?

Coastal hazards have the potential to negatively impact our community, infrastructure, essential services and lifestyle today and long into the future.

The coastal location of our community makes us increasingly exposed to coastal hazards over time. This strategy focuses on our five key island settlement areas on Thursday Island (Waibene), Horn Island (Ngurupai), Prince of Wales Island (Muralug), Friday Island (Gealug) and Entrance Island (Zuna).

The coastal fringes of all these islands are within hazard extents, affecting part of the settlement areas on Waibene, Ngurupai, Muralug, Gealug and Zuna.

Of the five settled islands, Ngurupai is the most exposed to inundation hazards, with storm tide affecting a significant portion of the Wasaga settlement. Aside from direct impacts on the settlement area, key infrastructure of the Horn Island Jetty and Ferry Terminal, and Horn Island Airport runway and road to the airport are also affected by all coastal hazards now and into the future.

A notable portion of the commercial and industrial areas of Waibene are exposed to coastal hazards by 2100, with erosion hazards being the most dominant in this area.

Key community assets including the Thursday Island Hospital and fringes of the Star of the Sea aged care facility are exposed to erosion hazards, with both sites already tidally affected. By the 2100 future climate (0.8m of sea level rise) approximately 13% of the hospital site will be tidally inundated.

Buildings on Muralug, Gealug and Zuna are largely outside of hazard extents however, the land parcels on which they are located are progressively affected over time. Erosion hazards are the most significant on all of these islands.

Seawalls already exist along much of the Waibene shoreline however, the extent, condition and suitability of these walls and their effectiveness during major erosion has not been assessed. Elsewhere, intact dunes can accommodate some erosion but may be completely impacted by erosion in the future.

5.0 OUR STRATEGY FOR BUILDING A RESILIENT COAST

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. A tailored approach has been developed to guide decision making on identifying and selecting adaptation responses across Torres Shire's coastal areas.

Adaptation principles, whole of coast actions and local adaptation pathways have been developed to guide how we manage the risks from coastal hazards and enhance the resilience of our coastal areas and community. This is essential to ensure our communities today, as well as future generations, can continue to enjoy our coast and valued lifestyle.

OUR STRATEGY IS MADE UP OF THE FOLLOWING COMPONENTS:

- ADAPTATION PRINCIPLES AND HIERARCHY
- ADAPTATION APPROACHES
- WHOLE OF COAST ADAPTATION ACTIONS
- LOCAL ADAPTATION PATHWAYS
- IMPLEMENTATION PLAN

OUR ADAPTATION PRINCIPLES

> The development of this strategy and its implementation are underpinned by a set of principles and a hierarchy of preferred broad types of adaptation approaches ("adaptation hierarchy").

These principles have been developed based on best practice coastal hazard risk management, technical findings and community input which provided key insight into what types of adaptation responses the community thinks are acceptable to manage the projected impacts of coastal hazards.

The principles provide a foundation for considering the suitability of different adaptation actions and supporting consistent decision making for the implementation of the Strategy. The principles also establish Council's key responsibilities and the limits of these responsibilities.

The principles underpinning adaption in Torres Shire are:

1. Adaptation pathways retain and enhance the unique and iconic coastal identity, qualities and character of the Torres Strait region.
2. We build community awareness of risk and promote partnerships and collective action by involving stakeholders and our community when implementing adaptation pathways.
3. We prioritise adaptation responses in higher risk areas to keep people safe and limit future land use exposure in areas of unacceptable or intolerable risk.
4. We prioritise natural and soft solutions over hard engineering solutions where practicable.
5. Physical adaptation responses compliment their surroundings and achieve multiple public benefits. Fitting in with 'place' is important.
6. Future investment in community assets and infrastructure is 'risk informed' – we avoid investing in long design life or costly community assets and infrastructure in higher risk areas unless absolutely necessary and transition our priority assets out of higher risk areas.
7. Adaptation options comply with environmental regulations to protect natural coastal processes, ecological processes and wildlife habitats.

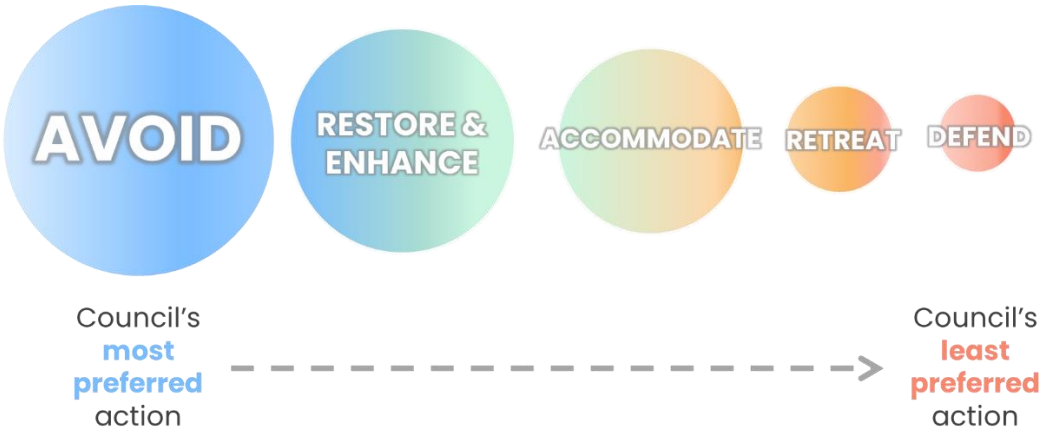
OUR ADAPTATION HIERARCHY

There are many actions we can use to respond to coastal hazards. These range from natural solutions like revegetation, to engineered solutions such as seawalls, to relocating assets out of vulnerable areas.

Together with the Adaptation Principles, our Adaptation Hierarchy helps us to choose which action/s will work best at a particular place or point in time. The most appropriate adaptation action is based on the values to be protected in a certain location as well as the social, environmental and economic costs of the options.

Overall, consultation feedback indicated a stronger preference for more natural solutions (i.e. foreshore and mangrove revegetation) or planning responses over hard engineering solutions and 'last line of defence' structures (like seawalls and groynes). As a result, natural responses which enhance the resilience of at-risk coastal areas will be prioritised in the short term over hard structures.

OUR ADAPTATION HIERARCHY



The hierarchy of preferred adaptation approaches, in order of highest to lowest preference is:

1. AVOID

Avoid placing new development in areas affected by coastal hazards.

2. RESTORE AND ENHANCE

Reinstate and enhance degraded natural coastal ecosystems – like stabilizing and revegetating coastal dunes and wetlands.

3. ACCOMMODATE

Maintain existing land uses but make existing and future buildings and infrastructure more resilient – build things 'higher and stronger' – and evacuation planning.

4. RETREAT

Withdraw, relocate or abandon existing buildings, structures and infrastructure in high-risk areas; let coastal ecosystems expand landward as sea levels rise.

5. PROTECT

Protect priority shorelines, infrastructure, and buildings from erosion and inundation through soft (beach nourishment) or hard (structures like seawalls or groynes) engineering solutions.

OUR ADAPTATION PATHWAYS APPROACH

> Pinpointing the timing of when coastal hazards may occur, or the rate of coastal change can be challenging. Adaptation planning using the pathways approach supports flexibility by allowing options to be adapted to changes in circumstances (e.g. new technology and knowledge) and community values, aspirations and risk appetite over time [6].

Adaptation pathways involve a sequence of adaptation actions (or combination of actions) to be implemented over time. When an adaptation action is implemented, it is used until it is no longer effective or viable to manage the risk or extent of change, at which time another option is used. This is called a "trigger point."

Due to the deep uncertainty and complexity associated with climate change, it is unlikely that only one adaptation action will be sufficient to respond to coastal hazard risk and exposure now and in the future. An adaptation pathway approach allows decisions makers to keep their options open, with the ability to change the timing of planned actions based on active monitoring of coastal hazard risks and associated triggers. This allows adaptation to be responsive and iterative, avoiding premature decisions that have the potential to prevent Council from implementing other, more effective options in the future.

The Strategy includes a range of adaptation actions that should be implemented across the whole coast, as well as some more specific, local adaptation pathways for key areas to support community values and address local risks.

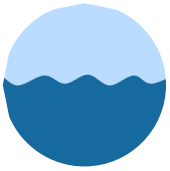
Adaptation actions and local adaptation pathways have been prepared based on short, medium and long-term priorities which are linked to projected sea level rise and indicative coastal hazard extent mapping for three planning timeframes – present day, 2050 (0.3m sea level rise) and 2100 (0.8m sea level rise).

TRIGGER POINTS

"Trigger points" are linked to a change in hazard exposure or associated risk. The implementation of actions relies on regular monitoring of coastal areas to understand when trigger points are approaching or have been reached. Trigger points can also be used in locations where hazards are not yet occurring but are likely to occur in the future.

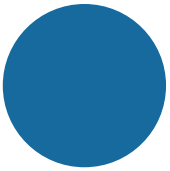
SHORT TERM

Current coastal hazard risk (0-0.3m sea level rise)



MEDIUM TERM

Coastal hazard risks around 2050 (0.3 m sea level rise)



LONG TERM

Coastal hazard risks around 2100 (0.8m sea level rise)

Local adaptation pathways and their associated actions will continue to be refined based on the best available science and community attitudes. Key factors we must consider when responding to coastal hazards and selecting suitable adaptation actions include:

MAXIMISING BENEFITS

Protecting what the community values about the coast and maximizing community benefit.

COST

Adaptation can be very expensive. We need to focus on low-cost solutions (like revegetation) wherever we can and be strategic about where and when we invest in high-cost shoreline protection.

TIMING

Identifying what needs protection now and in the future.

PROTECTING SPECIAL PLACES & ASSETS

Protecting important assets should not be at the expense of what we value and love.

[6] NCCARF (2017), *CoastAdapt: Climate change and sea-level rise based on observed data*. Available at: https://coastadapt.com.au/

ADAPTATION APPROACHES

Four adaptation approaches have been developed for Torres Shire. Each approach contains a suite of adaption actions which form the basis for our response to coastal hazard risk across different areas of our coast (local adaptation pathways).

1 Maintain and improve

The Maintain and Improve approach involves the continued use of a place or asset where the current coastal hazard risk profile is low. Actions underpinning this approach often include activities and programs which are already being undertaken such as community awareness raising, active management of natural areas and ecosystems and emergency response. Key to all approaches is regular monitoring to understand the extent of coastal change at the local level, and to identify when additional actions should be implemented.

While 'Maintain' actions do not always directly reduce or remove the risk of coastal hazards, they are important to build and strengthen the natural resilience of our coast and community over time. If, over time, the risk profile is observed to increase (as indicated by local trigger points), then the adaptation response may shift to **modify**.

2 Avoid

This approach seeks to avoid placing new development or assets in areas affected by coastal hazards. This may be achieved through appropriate land use planning and asset management. The preference is to ensure land uses in coastal hazard areas reflect the level of risk for coastal hazard impacts, while also being a use that maximises the economic, social, and environmental value to the region.

Any new development / infrastructure that is placed in coastal hazard areas will need to align with the *State Planning Policy 2017* and relevant approval requirements including necessary mitigation measures.

3 Modify

The Modify approach uses physical measures to accommodate and mitigate against coastal hazard risks to an acceptable or tolerable level. These actions include various engineering (soft and hard) options and hazard resilient design measures to protect or upgrade assets and reduce the impacts of coastal hazards.

If, over time, monitoring indicates the risk profile is increasing (as indicated by local trigger levels), and the modify option is no longer effective or efficient to accommodate or mitigate coastal hazards, then the adaptation response may shift to **planned transition**.

4 Planned Transition

The Planned Transition approach involves making a strategic decision to relocate assets from specific areas that have very high or intolerable exposure to coastal hazards and/or mitigation becomes infeasible (due to economic or other factors). This approach is intended to facilitate change in how we use and manage land in high or extreme risk areas and may involve a range of policy responses to reflect more 'risk-appropriate' land uses in hazard areas.

ADAPTATION ACTIONS

An adaptation action is a recommended response to assist in mitigating the impacts from coastal hazards. A range of adaptation actions have been developed to support a strategic approach to coastal hazard adaptation across Torres Shire and to achieve the goals and aspirations of the community. Adaptation actions have been developed for the inhabited islands of Torres Shire, as well as some specific coastal locations to support key community values and adequately address the local risk profile.

	COASTAL HAZARD ADAPTATION			
	REGION-WIDE ADAPTATION ACTIONS		LOCAL ADAPTATION PATHWAYS	
Adaptation response	**Maintain and Improve**	**Avoid**	**Modify**	**Planned Transition**
Adaptation options	Monitoring and planning initiatives to enhance adaptive capacity		Full suite of adaptation actions	
Timing	All timeframes		Refer to adaptation pathways	

A program of priority actions has been informed by an initial screening of options, as well as a multi-criteria analysis. Specific adaptation actions we have explored with our community and stakeholders include:

1 Maintain and improve

Maintain and Improve adaptation actions apply to all coastal areas within Torres Shire. These actions often encompass "common sense" measures, some of which are already being undertaken by Council, the community and other organisations. Maintain and Improve adaptation actions are fundamental to the success of the Strategy and underpin the implementation of all adaptation pathways.

Monitoring

Monitoring allows us to observe how coastal areas and their risk profiles change over time. This helps to determine if our current adaptation pathway is appropriate and effective or needs adjusting (i.e. a trigger point has been reached and an additional or alternative adaptation action is required).

Monitoring also improves our understanding of coastal processes and coastal hazards over time and can be used to support hazard and risk refinement. It covers a wide variety of activities and may involve examining the beach profile and conditions, mangrove/ dune vegetation extents and recession rates, dune stability, frequency of damage to beach access and other infrastructure, asset condition, frequency of tidal inundation, number of properties impacted by hazard events and habitat health, connectivity and availability etc.

Community awareness, education and partnerships

Building community understanding and awareness of coastal hazards and adaptation is essential for the successful implementation of this Strategy. Developing opportunities for community involvement in programs and activities which promote climate change adaptation, such as dune and wetland restoration and monitoring activities, can enhance stewardship of the coastline and assist in capacity building, while benefiting from traditional knowledge. It can also improve the community's resilience by empowering them to make informed choices about where and what to invest in.

Community awareness requires strong relationships between all levels of government, Traditional Owners, business, industry and the community, as well as ongoing education, information and messaging about

coastal hazards, risks, monitoring and adaptation. It can be promoted through targeted coastal hazard campaigns and communications materials including signage, events, newsletters and social media.

Enhance coastline and habitat resilience

Supporting and strengthening our natural coastal processes and ecosystems including native habitats, dune and wetlands areas can improve the protective function of coastal landforms and vegetation and assist in mitigating the risks associated with coastal hazards. Enhancing coastline resilience can also improve amenity and create opportunities to involve and educate the community to naturally manage coastal hazard risks and support monitoring activities. Using nature-based responses is preferred over hard engineering works, but may require some hard engineering support for establishment.

Ecosystem management can be achieved through habitat management programs such as dune revegetation and planting within and around wetlands and waterways. Particular consideration will be given to beach access management (discouraging unnecessary or informal pedestrian and vehicle access and formalising appropriate public paths) and the protection and management of turtle and shorebird nesting areas.

Emergency response (e.g. evacuation planning)

Monitoring and early warning systems, including evacuation strategies and community engagement, are essential mechanisms which can assist in keeping the community safe. Council, State Emergency Service, volunteers and local disaster management groups play a lead role in our emergency response. Council's Disaster Management Plan provides information on preparation, response and recovery to potential coastal hazard events.

2 Avoid

Avoid adaptation actions seek to prevent the development of new 'high value' or 'long-life' assets in areas at high risks from coastal hazards.

Planning responses

Implementing land use planning responses that are appropriate for the level of risk in coastal hazard areas enables informed, risked based decision making. Land use and development policy, zoning and development controls will be used to maintain the current risk profile in areas of acceptable and tolerable risk. Likewise, in coastal hazard areas where the risk is high or intolerable, land use planning tools will be used to reduce or avoid increasing the future risk exposure of people, buildings, community facilities and infrastructure.

Planning responses will build on current planning scheme requirements and may also involve the use of development controls such as coastal setbacks and planning processes such as master planning or trigger-based development approvals.

Particular focus will be on avoiding locating future vulnerable uses and people (e.g. new homes or accommodation) and reducing the future intensity of uses within high risk coastal hazard areas.

Hazard avoidance for new and replacement community infrastructure

Over time, Council or community infrastructure may come to the end of its design life (regardless of exposure to coastal hazard) and need to be replaced or upgraded to meet community needs.

Where this happens, it is important that care is taken to avoid locating new important community infrastructure with a long design life in hazard areas. This adaptation action may involve progressively locating the footprint of replacement infrastructure further landward (if appropriate or technically possible).

While planning a new asset, asset owners should consider its design life and location in relation to coastal hazards. Monitoring will be important to determine when an asset's relocation may be socially and economically acceptable.

3 Modify

Modify adaptation actions actively seek to alter our coastal environment through a range of engineering (soft and hard) options and hazard resilient design measures to protect assets and reduce coastal hazard risks affecting people and property.

While modify adaptation actions have the ability to reduce risk, it is important we think about the potential impacts or "flow on effects" these actions may have on amenity, beach access and ecological processes.

Coastal engineering (soft)

Soft engineering solutions can assist in protecting our beaches, foreshores, and riverfront areas from coastal hazards. Examples include:

- Dune construction and restoration – improving the function of existing coastal dunes or artificially constructing new dunes using imported sand from inactive sand sources
- Beach nourishment – maintaining existing beaches and dunes by manually placing extra sand on the beach from inactive sand sources
- Beach scraping – stabilising dunes and minimising further dune slumping by manually pushing a thin layer of sand from across the beach face (above high tide) towards the dunes (usually immediately following storm erosion).

These actions are intended to complement the existing function of our natural coastal areas and should only be implemented where and when it is environmentally appropriate to do so.

Coastal engineering (hard)

Hard engineering solutions can assist in protecting areas adjacent to foreshores and creek banks from coastal hazards. Examples include:

- Seawalls / scour protection – a rock or concrete wall or embankment constructed parallel to the beach or along the banks of a waterway to stop coastal erosion and limit inundation.
- Levees / dykes – an artificial barrier, often constructed of vegetation covered earth, to prevent inundation of landward areas.
- Groynes and artificial headlands – an artificial barrier constructed perpendicular to the beach to trap and hold beach sediments and increase beach width.
- Tide gates – permanent artificial barriers across narrow waterways to stop elevated water levels from moving to upstream areas.

Some of these approaches can be used in conjunction with ecosystem-based or soft-engineering responses.

Note: Where the shoreline has been modified by existing protection structures, no new coastal engineering (hard) adaptation actions are proposed. Existing structures are intended to be modified to be fit for purpose and align with current design standards. Private landowners are responsible for any private protection works.

Modify infrastructure and implement hazard resilient design

This action involves the continued use of our infrastructure, buildings and assets in areas where the coastal hazard risk is tolerable. Where any new or upgraded infrastructure or built assets are being developed, they should reflect hazard resilient design or be constructed to accommodate impacts.

Our key services such as our roads, water supply, electricity and telecommunications should be designed to remain operational during and after a coastal hazard event. This can be achieved by considering potential coastal hazards during the infrastructure design process and actions such as raising land levels, modifying

drainage networks or building on piles to increase the height of building floor levels, reducing exposure to temporary inundation.

Asset management and maintenance decisions should be informed by a complete understanding of coastal hazard risks. Asset owners must consider implications for the design life and resilience of assets to coastal hazards.

4 Planned Transition

In some specific places, if the coastal hazard risk profile is very high, and/or mitigation becomes impractical (due to economic or other factors), a strategic decision may be made to relocate or reposition assets.

Planned transition is often a costly, last resort option. It may occur gradually over time or, in some cases, as a rapid action in response to a threshold trigger or event.

Relocate important infrastructure and assets at risk

Critical Council or community assets, infrastructure and buildings that are in coastal hazard areas may be relocated to lower-risk areas or outside of the coastal hazard area when they reach the end of their useful life or need significant renovation to improve resilience (if the asset has a long-life design).

Monitoring will be important to determine when relocation may be socially and economically acceptable.

Accept the risk and embrace coastal processes

Embracing coastal processes without further intervention may be the most viable option in some instances. This includes:

- Accepting the loss of land affected by coastal hazards on unprotected shorelines.
- Allowing coastal dunes and habitats to migrate landward without intervention and accept there may be damage to or loss of infrastructure.

REGION-WIDE ADAPTATION ACTIONS

> This strategy includes a range of region-wide adaptation actions which are relevant to all coastal areas and seek to build on existing coastal hazard mitigation mechanisms and regulation. These adaptation actions fall within the '**Maintain and Improve**' and '**Avoid**' responses and are intended to be implemented over the short to medium term and continued over the lifetime of the strategy. Monitoring, as well as ongoing community education, will be fundamental to the implementation of all adaptation pathways.

Across Torres Shire, some key measures have already been implemented to manage present day coastal hazard risks and protect our coastal environment. These include, but are not limited to:

- land use planning responses embedded in the *Torres Shire Council Planning Scheme 2022* which seek to mitigate and avoid coastal hazard risks.
- coastal protection measures in the asset maintenance program.

Region-wide adaptation actions include:

REGION WIDE ADAPTATION ACTIONS		TIMING BASED ON SEA LEVEL RISE		
		SHORT TERM	MED TERM	LONG TERM
		0m	0.3m	0.8m
MAINTAIN AND IMPROVE				
	Monitoring			
	Community awareness, education and partnerships			
	Enhance coastline and habitat resilience			
	Emergency response (e.g. evacuation planning)			
AVOID				
	Hazard avoidance for new and replacement community infrastructure			
	Planning responses			

LOCAL ADAPTATION PATHWAYS

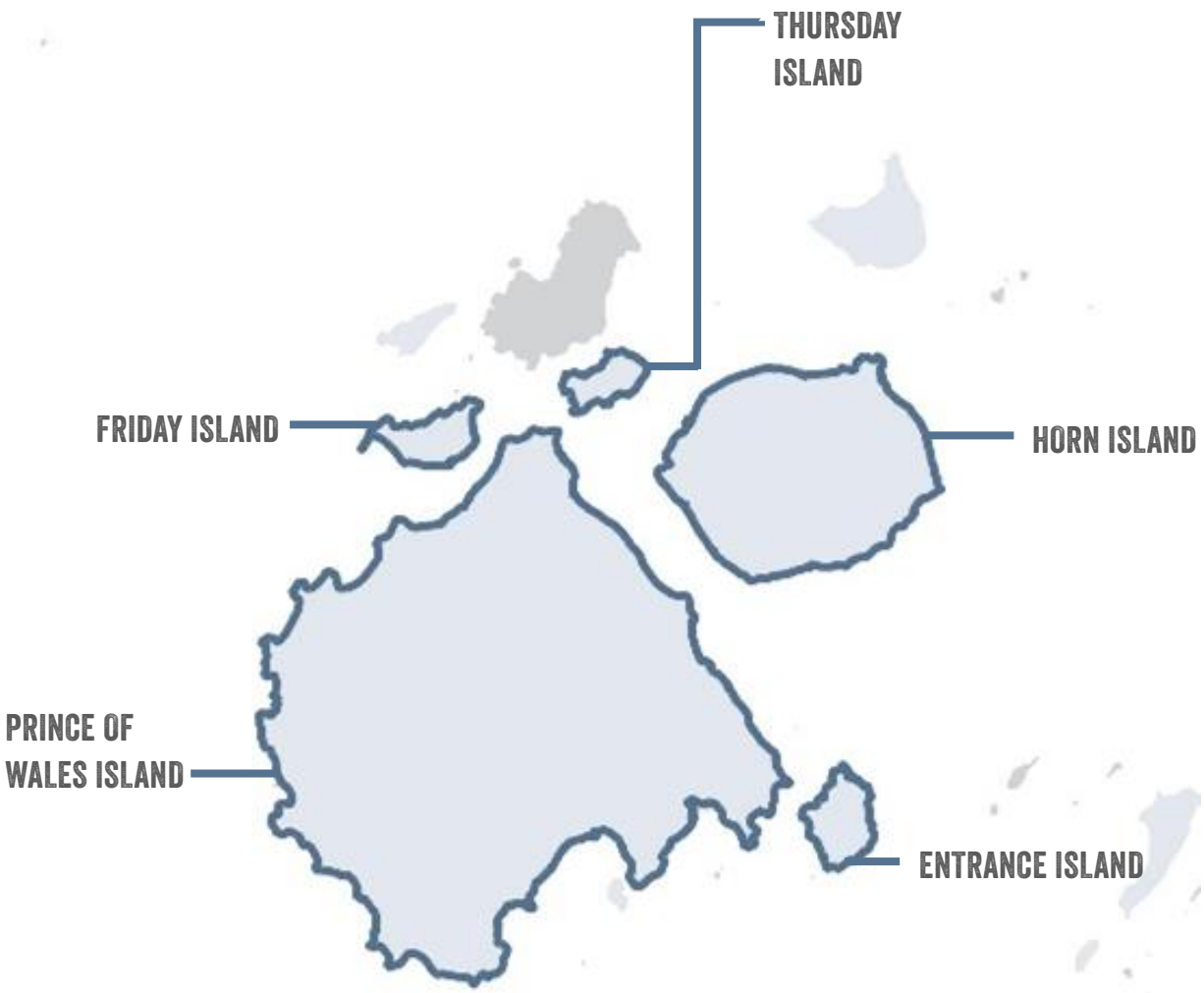
> Each locality is different and requires a unique set of adaptation pathways to respond to coastal hazards, support key community values and address the risk profile over time.

In addition to adaptation actions which apply to the Torres Shire coast, we have begun considering local adaptation pathways to support key community values, respond to the local risk profile and reflect best practice principles for coastal hazard risk management.

The actions seek to reflect that the community has a very strong connection to the land and sea interface, with many culturally important areas located close to, on or within the beach and estuarine waterways. Continued access to these areas is critical for community well-being.

The focus of the CHAS is on the coastal settlements of Torres Shire, namely:

- Waibene (Thursday Island) – entire coastline
- Ngurupai (Horn Island) – Wasaga township and the coastline seaward (north) of the airport
- Muralug (Prince of Wales Island) – Front Beach (Community of Muralug), Country Women's Beach, Collis Beach and Long Beach.
- Gealug (Friday Island) – Pearl farm site on the south-eastern corner of the Island, as well as three additional settlement sites on the northern and eastern coastlines.
- Zuna (Entrance Island) – Two settlement sites along the north-western coastline.



WAIBENE (THURSDAY ISLAND)

WAIBENE COASTAL AREA

Waibene is the most populous island within the Torres Shire Council area, with nearly 3000 residents recorded in the 2021 census. Approximately 350ha in area, the Island is the administrative centre for the broader Torres Strait region and is home to key community services such as primary health care, higher education, and government administration.

The Strategy focuses on the developed shoreline or where important infrastructure is located close to the coast, in a clockwise direction this essentially covers from Quarantine Jetty to Saila Tce.

WHAT'S IMPORTANT TO OUR COMMUNITY?

Residents and visitors to our community value Thursday Island for its commercial, transport and administrative function. The health care precinct around Thursday Island Hospital is a particularly critical asset not just for Torres Shire communities but also for communities in the broader Torres Strait region and on Cape York. Its location close to the water is also culturally important as it allows patients and their families to remain connected to the sea during their time at the facility.

The community values the natural coastal environment including the foreshore and beaches, combined with the ability to participate in many activities along the foreshore and in the water.

The island is also home to numerous places of indigenous and non-indigenous historical importance including significant trees, beaches, middens, memorials, historical buildings and streetscapes.

WAIBENE – OUR ASSETS AT RISK:

Storm tide inundation, sea level rise and erosion hazards all present a high risk to the many special places on Thursday Island. Places and infrastructure at risk from coastal hazards include:

BAYO BEACH

Industrial uses in the vicinity of Navy Wharf, and seaward of this, the unzoned "Port Land" are exposed to all hazards under all climates.

The coastal parkland is assessed as being at high risk from erosion and sea level rise from the present onwards.

MAIRU BEACH

Victoria Parade is exposed to sea level rise from the 2050 climate onwards.

"Port Land" and boating facilities (including ferry facilities) are at high to extreme risk from all hazards under all climates. Sediment loss due to minor erosion is also expected to occur over time.

FEDERAL BEACH

Sea level rise is expected to impact commercial uses in the Centre Zone along Victoria Parade.

Network infrastructure including road, sewerage (trunk pipes) and stormwater assets in the vicinity of Victoria Parade are exposed to coastal hazards under all climates.

HOSPITAL AREA

The Thursday Island Hospital site is heavily exposed to erosion hazards and is already tidally affected.

Aubrey Parade, Victoria Parade, the JCU site, and two sewer pump stations are also vulnerable to erosion hazards.

QUARANTINE JETTY TO LOBAN STREET

Aplin Road and the Waste Transfer Station site are presently exposed to erosion and sea level rise risks. Network infrastructure in the vicinity of this road, including pathways, trunk sewer pipes and stormwater assets are also exposed to coastal hazards from the present onwards.

Tagai State College, the Cemetery and the electricity substation may be at risk of future storm tide or erosion hazards.

The Kup Murri site is exposed to erosion and inundation risks.

BACH BEACH TO SAILA TERRACE

Aubrey Parade, a key state-controlled road, is vulnerable to erosion, as is the park area between the beach and the road.

LOBAN STREET TO 'STAR OF THE SEA'

Storm tide hazards will likely affect residential land parcels along Waiben Esplanade.

The 'Star of the Sea' aged care site is exposed to erosion hazards and is already tidally affected, although the existing buildings are elevated and not impacted.

Marine facilities and industrial land in this area are also exposed to all hazards.

Waiben Esplanade and sewerage is currently exposed to storm tide and will be affected by sea level rise in the future. Sewerage in this area is presently vulnerable to erosion hazards.

SADIES BEACH

Along the coastal fringe of the largely undeveloped eastern shoreline, the road and known and potential sites of cultural significance (such as trees, middens, etc.) are presently at high risk of erosion and sea level rise.

ALL OTHER AREAS

Known or potential important cultural artefacts, areas of environmental significance and coastal parkland may be exposed to coastal hazards in various locations around the island.

WAIBENE ADAPTATION PATHWAYS

The table below outlines the adaptation pathway and triggers for Waibene in response to coastal hazards and risks over time under a changing climate.

LOCAL ADAPTATION ACTIONS	TIMING BASED ON SEA LEVEL RISE SHORT TERM 0m	MID TERM 0.3m	LONG TERM 0.8m
SOUTHERN SHORELINE – BAYO BEACH			
Active dune and habitat management including vegetation planting and management	→	→	→
Hazard resilient design for new/upgraded infrastructure	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→
Adapt existing protection structures to be fit for purpose or offer higher levels of protection	→	→	→
Levees/dykes/low earthen bunds in parklands		→	→
SOUTHERN SHORELINE – MAIRU BEACH			
Active dune and habitat management including vegetation planting and management	→	→	→
Small scale beach nourishment	→	→	→
Seawall to protect road		→	→
SOUTHERN SHORELINE – FEDERAL BEACH			
Hazard resilient design for new/upgraded infrastructure	→	→	→
Small scale beach nourishment	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→
Levees/dykes/low earthen bunds in parklands		→	→
Seawall upgrades to protect esplanade and road		→	→
Wave attenuator		→	→
SOUTH-WESTERN SHORELINE – HOSPITAL AREA			
Hazard resilient design for new/upgraded public infrastructure	→	→	→
Levees/dykes/low earthen bunds	→	→	→
Seawall upgrades and extensions	→	→	→
Raising land levels (where practicable during redevelopment)	→	→	→
NORTH-WESTERN SHORELINE – QUARANTINE JETTY TO LOBAN STREET			
Active dune/ habitat management, vegetation and access management at Kup-Murri site	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→
Seawall to protect road and landward assets – Cook Esp and Aplin Rd	→	→	→

LOCAL ADAPTATION ACTIONS

TIMING BASED ON SEA LEVEL RISE

	SHORT TERM 0m	MID TERM 0.3m	LONG TERM 0.8m
WESTERN SHORELINE – BACH BEACH TO SAILA TERRACE			
Active dune and habitat management including vegetation planting and management	→	→	→
Mangrove rehabilitation at the northern end	→	→	→
Beach scraping, small scale beach nourishment	→	→	→
Hazard resilient design for new/upgraded public infrastructure	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→
Levees/dykes/low earthen bunds			→
Seawall to protect public assets			→
NORTH-EASTERN SHORELINE – LOBAN STREET TO 'STAR OF THE SEA'			
Hazard resilient design for new/upgraded infrastructure	→	→	→
Adapt existing protection structures to be fit for purpose or offer higher levels of protection	→	→	→
Localised raising of land levels		→	→
EASTERN SHORELINE – SADIES BEACH			
Active habitat management including vegetation planting and management	→	→	→
Hazard resilient design for new/upgraded road	→	→	→
ALL OTHER AREAS			
Allow foreshore recession (habitat loss)	→	→	→
Active dune and habitat management including vegetation planting and management	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→

*Options require further consideration and are subject to further detailed site investigations, business case, funding commitments, detailed design and statutory approvals. The lead up time is intended to be a trigger to provide sufficient time for further consideration and detailed investigations/funding commitments and approvals to be obtained.

NGURUPAI (HORN ISLAND)

NGURUPAI COASTAL AREA

Ngurupai is the second-most populous and second largest island within the Torres Shire Council area. The main settlement area of Wasaga is on the north-western frontage of the Island, closest to Waibene. Wasaga is generally very low-lying.

Ngurupai contains several important infrastructure assets that play a critical role in the community and support the broader region, including Horn Island airport, ferry terminal, public boating facilities, Port of Thursday Island (which includes wharf facilities on Ngurupai) and Loggy Creek Dam, a major water supply reservoir.

The coastal areas of Ngurupai close to infrastructure have been divided into four areas of focus: Wasaga north, Wasaga central, Wasaga south, and the Airport area.

WHAT'S IMPORTANT TO OUR COMMUNITY?

Residents and visitors to our community value Horn Island for its natural coastal environment including the foreshore, isolated beaches and extensive estuarine wetlands on the western and northern shoreline. These areas have environmental and cultural significance.

Wasaga is a very important connection point for the broader Torres Strait region, connecting water-based transport from within the region to Horn Island airport, which has regular passenger flights to and from Cairns, and charter flights to other Torres Strait islands and communities within the Northern Peninsula Area. The port area is heavily relied on by the local community for general transportation, subsistence and access to goods and services which are vital in supporting community wellbeing. Much of the port is already protected from erosion by seawalls, but some assets are still subject to inundation.

The community has high expectations around the ongoing function and protection of key infrastructure on Horn Island and as a result, adaptation options seek to build resilience and protect ongoing use.

NGURUPAI – OUR ASSETS AT RISK:

Sea level rise poses the greatest risk to Horn Island due to its low-lying nature, however, erosion and storm tide inundation still present risks to the community over time. The key places and infrastructure at risk from coastal hazards include:

WASAGA NORTH

Undeveloped industrial land on the northern side of Airport Road is significantly exposed to coastal hazards, with some parcels already partially inundated by present climate HAT.
The electricity substation site is presently exposed to storm tide inundation and is expected to be vulnerable to erosion hazards by 2050 and sea level rise by 2070.
The reserve used to facilitate beach access is exposed to all hazards.

AIRPORT AREA

Land zoned for airport purposes is exposed to intolerable risks, with the northern tip of the north-south runway already exposed to present-day tidal inundation. Erosion risks to airport land and the runway are assessed as extreme given the importance of this facility.

WASAGA CENTRAL

The unzoned “Port Land”, including ferry facilities and vehicle access to the jetty, is almost entirely exposed to all hazards including present-day tidal inundation.

Storm tide inundation presently affects undeveloped land zoned for residential purposes on Wees Street. Properties on Miskin Street may be affected in later years, from approximately 2070 onwards. Miskin Street itself is at risk of inundation from 2050 onwards.

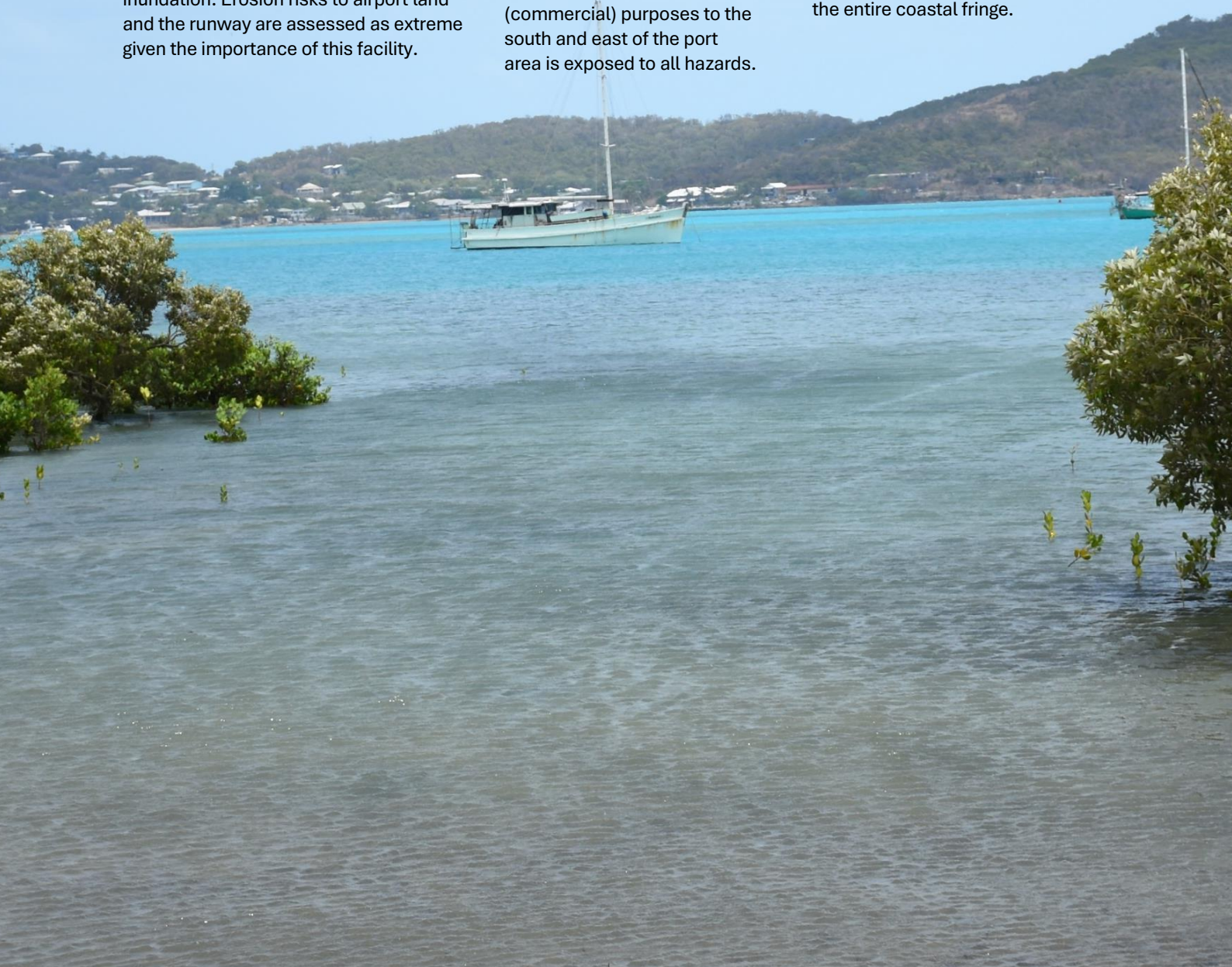
Land zoned for Centre (commercial) purposes to the south and east of the port area is exposed to all hazards.

WASAGA SOUTH

Sea level rise and associated inundation presents a threat to properties close to the coast as well as sewer pump stations and roads. Burials and other culturally significant artefacts that may exist outside of the cemetery plot area may also be exposed to coastal hazards.

ALL OTHER AREAS

Environmentally and culturally significant sites are at risk of all hazards under all climates around the entire coastal fringe.



NGURUPAI ADAPTATION PATHWAYS

The table below outlines the adaptation pathway and triggers for Wasaga north, Wasaga central, Wasaga south, Airport area; and all other areas on Ngurupai in response to local coastal hazards and risks over time under a changing climate.

LOCAL ADAPTATION ACTIONS	TIMING BASED ON SEA LEVEL RISE SHORT TERM 0m	MID TERM 0.3m	LONG TERM 0.8m
WASAGA NORTH			
Hazard resilient design for new/upgraded infrastructure	→	→	→
Levees/dykes/low earthen bunds	→	→	→
Relocate power station		→	→
WASAGA CENTRAL			
Hazard resilient design for new/upgraded infrastructure	→	→	→
Levees/dykes/low earthen bunds	→	→	→
Raise land levels during redevelopment		→	→
WASAGA SOUTH			
Freshwater and saltwater wetland restoration, active dune and habitat management including vegetation planting and management	→	→	→
Allow short-term foreshore recession	→	→	→
Land buy-back / land swap for beachfront parcels, relocate/re-inter exposed cultural artefacts	→	→	→
AIRPORT AREA			
Hazard resilient design for new/upgraded infrastructure	→	→	→
Raise runway land level,	→	→	→
Levees/dykes/low earthen bunds	→	→	→
ALL OTHER AREAS			
Allow foreshore recession (habitat loss)	→	→	→
Active dune and habitat management including vegetation planting and management	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→

*Options require further consideration and are subject to further detailed site investigations, business case, funding commitments, detailed design and statutory approvals. The lead up time is intended to be a trigger to provide sufficient time for further consideration and detailed investigations/funding commitments and approvals to be obtained.

MURALUG (PRINCE OF WALES)

MURALUG COASTAL AREA

Muralug is the largest of the Torres Shire islands and is home to several beachfront settlements on sandy beaches nestled between rocky outcrops. The largest settlements are on the lower hill slopes along the eastern shoreline at Muralug (known as Front Beach) and Country Women's Beach. Smaller clusters of dwellings at Collis Beach on the northern tip of the island and Long Beach on the north-western side of the island are on low coastal plains and beach ridges close to the primary dune system. The remainder of the island is in a relatively natural, well vegetated state.

The island is serviced by a barge landing at Front Beach and beach launching for private watercraft elsewhere.

The areas of focus for the Strategy on Muralug are Front Beach, Country Women's Beach, Collis Beach and Long Beach.

WHAT'S IMPORTANT TO OUR COMMUNITY?

A number of families live on Prince of Wales Island, however each property is self-sufficient as the island does not have networked facilities for electricity, water, waste and sewerage.

Residents and visitors to our community value Prince of Wales Island for its coastline, which consists of numerous small beaches interspersed with rocky outcrops, extensive mangrove stands and wetland areas which are vulnerable to impacts from rising sea levels. There are also waterfalls and swimming holes. While there is no development in these areas, they are highly valued by the community and popular for camping, swimming and day tripping. Coastal areas also contain sites of cultural importance including middens, stone circles, caves and story places.

FRONT BEACH AND COUNTRY WOMEN'S BEACH

The esplanade from Front Beach to Country Women's Beach is currently at risk from erosion and sea level rise.

The road at the barge ramp currently extends below HAT. Impacts on this road will affect access to the island helipad and the barge ramp.

Residential land at Country Women's Beach is relatively elevated and is therefore the least exposed to inundation risks.

COLLIS BEACH AND LONG BEACH

The seaward fringe of land and drainage lines along the west coast are exposed to all hazards. Areas that are popular for camping, swimming and day tripping are likely to be exposed.

The northern tip of the island near Collis Beach has potential non-indigenous heritage significance, including a historical pearling station site. Due to the environmental and cultural heritage significance of this land, it has been assessed as being at high risk from erosion and sea level rise under future climates.

ALL OTHER AREAS

The seaward fringe of land and natural waterways are exposed to all hazards under all climates. This includes environmentally and culturally significant sites.

MURALUG ADAPTATION PATHWAYS

The table below outlines the adaptation pathway and triggers for Front Beach, Country Women's Beach, Collis Beach and Long Beach and all other areas on Muralug in response to local coastal hazards and risks over time under a changing climate.

LOCAL ADAPTATION ACTIONS	TIMING BASED ON SEA LEVEL RISE SHORT TERM 0m	MID TERM 0.3m	LONG TERM 0.8m
FRONT BEACH			
Active dune and habitat management including vegetation planting and management	→	→	→
Hazard resilient design for new/upgraded infrastructure, including road and barge ramp upgrades	→	→	→
Allow foreshore recession	→	→	→
Seawall to protect road	→	→	→
COUNTRY WOMEN'S BEACH			
Active dune and habitat management including vegetation planting and management	→	→	→
Allow foreshore recession	→	→	→
Seawall to protect road			→
COLLIS BEACH AND LONG BEACH			
Coastal building lines/development setback	→	→	→
Active dune and habitat management including vegetation planting and management	→	→	→
Hazard resilient design for new/upgraded infrastructure	→	→	→
ALL OTHER AREAS			
Allow foreshore recession (habitat loss)	→	→	→
Active dune and habitat management including vegetation planting and management	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→

GEALUG (FRIDAY ISLAND) & ZUNA (ENTRANCE ISLAND)

GEALUG & ZUNA COASTAL AREA

Southeast of Muralug, Zuna contains two settlement areas on the western shoreline, one of which is a small private resort consisting of several buildings. Both are situated along small sandy pocket beaches fronted by wide intertidal flats and fringing reef.

Situated to the north of Muralug, Gealug is sparsely populated but contains a pearl farm and a small number of isolated buildings along the northern and eastern shorelines. Near the Pearl Farm on the south-eastern shoreline, the sandy dune system is perched on an outcropping rock shelf, while the eastern and northern shorelines consist of a series of sandy pocket beaches interrupted by rocky outcrops or headlands.

Access to both islands is via boat, but only the pearl farm on Gealug has a jetty. The remainder of both islands are in a natural, well vegetated state and contain areas of environmental significance.

WHAT'S IMPORTANT TO OUR COMMUNITY?

The Pearl farm on Gealug and resort on Zuna both attract visitors to the region. Coastal areas are important to the broader community and contain areas of high environmental significance (important wetlands and habitat areas). The whole of Zuna and areas of Gealug also contain potential sites of cultural heritage significance including fish traps and middens. Neither island contains other identified community assets.

GEALUG – OUR ASSETS AT RISK:

Gealug is mostly undeveloped, with the exception of the Pearl Farm and some isolated residential uses. Storm tide inundation, sea level rise and erosion hazards all present risks. The places and infrastructure at risk from coastal hazards include:

ISOLATED RESIDENTIAL USES

A small number of isolated buildings are situated along small sandy beaches located along the northern and eastern shorelines. All of these properties are at risk from erosion under the present climate and rising sea levels.

ALL OTHER AREAS

Sea level rise will have the greatest impact in low-lying areas adjacent to wetlands, such as along the southern and western coastline.

Almost all high significance wetlands are within the erosion hazard by approximately 2070 onwards. There are many significant habitat areas linked to these wetlands.

Heritage sites clustered along the eastern coastline include fish trap and midden sites, and the former Quarantine Station site. These sites are all exposed to coastal hazards under all climates.

ZUNA – OUR ASSETS AT RISK:

Zuna (like Gealug) is mostly undeveloped, with the exception of two settlement areas on the western shoreline. Storm tide inundation, sea level rise and erosion hazards all present risks. The places and infrastructure at risk from coastal hazards include:

WESTERN SHORELINE

The resort site consists of several buildings and a geotextile 'sausage' intended to limit erosion of the low-lying dune. Another lone building exists further to the north. Both sites are at high risk of erosion from the present day onward.

ALL OTHER AREAS

Sea level rise will have the greatest impact in low-lying areas adjacent to wetlands, such as along the western coastline. There are many significant habitat areas linked to these wetlands.

The entirety of this island is identified as having potential indigenous significance and as such, has been assessed as being at high risk from erosion and sea level rise under future climates.

GEALUG & ZUNA ADAPTATION PATHWAYS

The table below outlines the adaptation pathway and triggers for Zuna and Gealug in response to local coastal hazards and risks over time under a changing climate.

LOCAL ADAPTATION ACTIONS	TIMING BASED ON SEA LEVEL RISE SHORT TERM 0m	MID TERM 0.3m	LONG TERM 0.8m
ZUNA AND GEALUG ISLANDS			
Allow foreshore recession (habitat loss)	→	→	→
Active dune and habitat management including vegetation planting and management	→	→	→
Hazard resilient design for new/upgraded infrastructure	→	→	→
Relocate/re-inter exposed cultural artefacts	→	→	→

IMPLEMENTATION PLAN

A summary of implementation actions for region-wide strategic adaptation responses is provided in the Table below. The implementation plan focuses on short term actions to be delivered over the next decade.

STRATEGIC ADAPTATION ACTION	INDICATIVE PRIORITY IMPLEMENTATION ACTIONS (TO BE IMPLEMENTED WITHIN 5-10 YEARS)
MAINTAIN AND IMPROVE	
Monitoring Monitoring is essential for improving our understanding of coastal hazards and how coastal areas and their risk profiles change over time. This helps to determine if our current adaptation pathway is appropriate and effective or our response needs adjusting (i.e. a trigger point has been reached and an additional or alternative adaptation action is required).	• Support the ongoing operation of Torres Strait Regional Authority (TSRA) Ranger program. • In partnership with the TSRA Ranger program, establish and initiate a formal beach monitoring program. • Establish a photo monitoring program, led by the TSRA Rangers to capture images of key sites and locations to assist in monitoring key changes across the coast (beach profile, mangrove/ dune vegetation extents). • Source existing elevation and aerial imagery to further support coastal monitoring and analysis of changes to coastal environments over time. • Work with TSRA Land and Sea Rangers to document key measures for each cultural heritage site including spiritual/social value, archaeological value, physical condition, and protection measures. An example knowledge sharing initiative, such as the Cultural Heritage Assessment Report Cards currently in practice in the Mackay-Whitsunday-Isaac region, can help monitor significant sites and provide detailed information on the specific threats impacting them. • Develop protocols and a step by step procedure for when key cultural significant sites are exposed due to coastal processes • Work with the TSRA Rangers to identify the location and condition of all key coastal habitats across Torres Shire. Create a register to document the frequency and location of any habitat management activities being undertaken such as dune revegetation and planting within and around wetlands and waterways. • Work with the TSRA Land and Sea Rangers to align activities in Torres Shire with those elsewhere in the Torres Strait, particularly using the CHAS to cooperatively progress shared initiatives contributing to regional actions.
Enhance coastline and habitat resilience Supporting and strengthening our natural coastal processes and ecosystems including native habitats, dune and wetlands areas, can improve the protective function of coastal landforms and vegetation and assist in mitigating the risks associated with coastal hazards. Particular consideration will be given to the protection and management of turtle and shore bird nesting areas.	• Identify opportunities to facilitate access needs while reducing disturbance to dune and coastal systems through fencing, signage, and providing defined/formalised access points in the most appropriate locations. Minimising through-traffic across the dune system is critical to establishing native vegetation and strengthening the dune system. • Identify priority management areas and develop a Council endorsed plan for ecosystem management. The plan should focus on Bayo Beach, Mairu Beach, Main Beach, Bach Beach, Sadies Beach, Wasaga South, Front Beach, Country Women's Beach, Collis Beach and Long Beach. • Expand Council officer resources to facilitate dedicated support to coastal areas, habitats and ecosystems, and implementation of protection, maintenance and improvement measures.

STRATEGIC ADAPTATION ACTION	INDICATIVE PRIORITY IMPLEMENTATION ACTIONS (TO BE IMPLEMENTED WITHIN 5-10 YEARS)
 **Emergency response (e.g. evacuation planning)** Early warning systems, including evacuation strategies and community engagement, are important mechanisms which can assist in keeping the community safe. Council, State Emergency Service, volunteers and local disaster management groups play a lead role in our emergency response and keeping the community safe. Council's Disaster Management Plan provides information on preparation, response and recovery to potential coastal hazard events.	• Work with Torres Strait Island Regional Council to review and update the joint Torres Strait Local Disaster Management Plan with updated coastal hazard mapping and embed risk outcomes in emergency management and response planning.* • Monitor frequency and nature of emergency management responses and call outs.
 **Community awareness, education and partnerships** Building community understanding and awareness of coastal hazard adaptation is critical to the successful implementation of this Strategy. Being 'risk aware' can enhance stewardship of the coastline and assist in capacity building. It can also improve the community's resilience by empowering them to make informed choices about where and what to invest in. Council will strongly advocate for collaboration and partnerships with other stakeholders and community to share information and responsibility in delivering adaptation actions.	• Develop a standing agenda item for Local Disaster Management Group meetings to discuss the findings and implementation of the Strategy as well as ongoing monitoring and reporting activities. • Develop an engagement and communication plan, informed by Council's resources, budget and priority needs regarding information capture. The plan will facilitate knowledge sharing of hazards, adaptation and the role of coastal habitats and structure how information is shared between Council, external organisations and the community. • Identify new and existing networks to share and promote knowledge sharing and understanding of coastal hazard risks and adaptation – particularly with other similar nearby Councils such as Torres Strait Island Regional Council. • Promote coastal custodianship in the youth and future generations with community coast care events.* • Explore opportunities within Council to build internal capacity, understanding and awareness of coastal hazards, their impacts and implications for Council assets and operations. • Seek co-funding/resources for further initiatives through grants and stakeholder partnerships. • Continue partnerships with the TSRA Land and Sea Rangers program. • Encourage community participation in the selection and planting of vegetation used in habitat restoration activities, particular those relating to traditional 'bush foods'. • 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.* • Promote resilient homes within the community.

STRATEGIC ADAPTATION ACTION	INDICATIVE PRIORITY IMPLEMENTATION ACTIONS (TO BE IMPLEMENTED WITHIN 5-10 YEARS)
Avoid	
 **Hazard avoidance for new and replacement community infrastructure** Where the coastal hazard risk is tolerable, we can continue the ongoing use of infrastructure, buildings and assets. Where any new or upgraded infrastructure or built assets are being developed, they should reflect hazard resilient design or be constructed to accommodate coastal hazard impacts.	• Review at-risk infrastructure based on current and future coastal hazard risks and embed risks into current asset management plans. • Undertake a sand sourcing investigation to inform the feasibility of nourishment activities. • Liaise with external asset providers / entities about implications of coastal hazards for future services, new infrastructure and infrastructure upgrades. • Develop policies on private coastal protection works.
 **Planning and technical responses** Land use planning establishes certainty and clear expectations around development. Council will ensure its planning framework and land use controls only allow for risk appropriate land uses in hazard areas. Land use planning will build on current planning scheme requirements to reduce or avoid increasing the future risk and exposure of people, buildings, community facilities and infrastructure through the implementation of setbacks, hazard resilient design requirements and minimum floor planning levels.	• Integrate coastal hazard mapping and considerations into current and future planning schemes and all strategic planning processes to inform strategic land use planning. • Work with State Government to obtain recognition of the erosion hazards assessed in this document as declared Erosion Prone Areas. • Consider updated hazard mapping and risk assessment outcomes when deciding on new land use and development in hazard areas as part of the development assessment process. • Continue engagement with Traditional Owners to ensure native title rights and interests are appropriately reflected in development decisions and approval conditions.

* Collaboration with other agencies and organisations required for implementation

WHAT'S NEXT?

GOVERNANCE

Everyone has a role to play in maintaining and developing a resilient coastal community. While Council is primarily responsible for implementing adaptation actions relating to Council-managed public infrastructure and assets, successful adaptation will require collaboration and partnerships between Council, Federal and State Government agencies, Traditional Custodians, businesses, community organisations, private landowners and residents.

Council's ongoing role as the Strategy facilitator will involve informing, observing, planning and acting on coastal hazard management by:

- Data gathering and undertaking on-the-ground monitoring of areas affected by coastal hazards to understand changes and inform the implementation of adaptation options.
- Monitoring Council owned and managed assets affected by coastal hazards as part of operational management programs.
- Informing the community through information sharing and education.
- Updating the Torres Shire Council Planning Scheme to reflect the outcomes of the Coastal Hazard Adaptation Strategy and coastal hazard mapping which will provide policy guidance and planning controls for land use and development.
- Providing resilient community infrastructure and implementing adaptation actions to protect, maintain and manage Council owned land, assets and infrastructure.

It is important to note that Council is not responsible for managing coastal hazard impacts on areas not owned or managed by Council or non-Council owned public assets or property. Asset owners/entities are responsible for maintaining their assets in the context of relevant State and Council policy and statutory requirements.

IMPLEMENTATION

An implementation plan will be prepared to guide how Council will embed the Strategy across Council business areas, programs and processes. The implementation plan will provide details on:

- Council plans, policies, strategies, and processes to be updated or created to support action delivery.
- Indicative timeframes for delivery of whole of coast and locality-based actions
- Governance, processes, and resourcing.
- Monitoring and evaluation approaches.
- Partnership and collaboration opportunities with the community, stakeholders, other levels of government and external infrastructure providers.

REVIEW AND UPDATE

This Strategy will be reviewed regularly to inform land use and infrastructure planning and ensure technical information remains up to date. The strategy review process should consider:

- The success of actions delivered to date is based on factors such as the reduction and management of coastal hazard risk and community and stakeholder awareness, feedback and attitudes.
- New information and knowledge about climate change and coastal hazard risks including updated technical information (coastal hazard modelling, risk assessment, monitoring data or changes to coastal hazard indicators).
- Updates to State and/or Federal legislation, planning and policy frameworks relating to coastal hazards and their management.

RESOURCES

Department of Environment and Heritage Protection (2013). Coastal hazard technical guide: Determining coastal hazard areas. Available at https://www.qld.gov.au/__data/assets/pdf_file/0025/67462/hazards-guideline.pdf

Insurance Council of Australia (2021), *Climate Change Impact Series: Actions of the Sea and Future Risks*. Available at https://insurancecouncil.com.au/wp-content/uploads/2021/11/2021Oct_Actions-of-the-sea_Final.pdf

Local Government Association of Queensland, Department of Environment and Heritage Protection (2016), *Developing a Coastal Hazard Adaptation Strategy: Minimum Standards and Guideline for Queensland Local Governments*. Available at https://www.qcoast2100.com.au/downloads/file/55/minimum-standards-and-guideline

NCCARF (2017), *CoastAdapt: Climate change and sea-level rise based on observed data*. Available at: https://coastadapt.com.au/

Torres Shire Council (2021), *Torres Shire Council Coastal Hazard Adaptation Strategy – Engagement Summary Phase 3 & Phase 4*. Report by Reel Planning for Torres Shire Council.

Torres Shire Council (2021), *Torres Shire Council CHAS Phase 4: Asset Exposure to Hazards*. Report by BMT for Torres Shire Council.

Torres Shire Council (2021), *Torres Shire Council CHAS Phase 5 Risk Assessment*. Report by BMT for Torres Shire Council.

Torres Shire Council (2022), *Torres Shire Council Coastal Hazard Adaptation Strategy: Engagement Summary – Phase 6*. Report by Reel Planning for Torres Shire Council.

Torres Shire Council (2023), *Coastal Hazard Adaptation Strategy: Phase 6 – Options for Adaptation*. Report by BMT for Torres Shire Council.

Torres Shire Council (2023), *Coastal Hazard Adaptation Strategy: Phase 7 – Adaptation Options Assessment*. Report by BMT for Torres Shire Council.

Torres Shire Council (2023), *Torres Shire Council Coastal Hazard Adaptation Strategy: Engagement Summary – Phase 8*. Report by Reel Planning for Torres Shire Council.