OUR HEALTHY ENVIRONMENTS

Moreton Bay's Living Coast Plan

2023

QCoast2100

LIVING coast

Moreton Bay Regional Council

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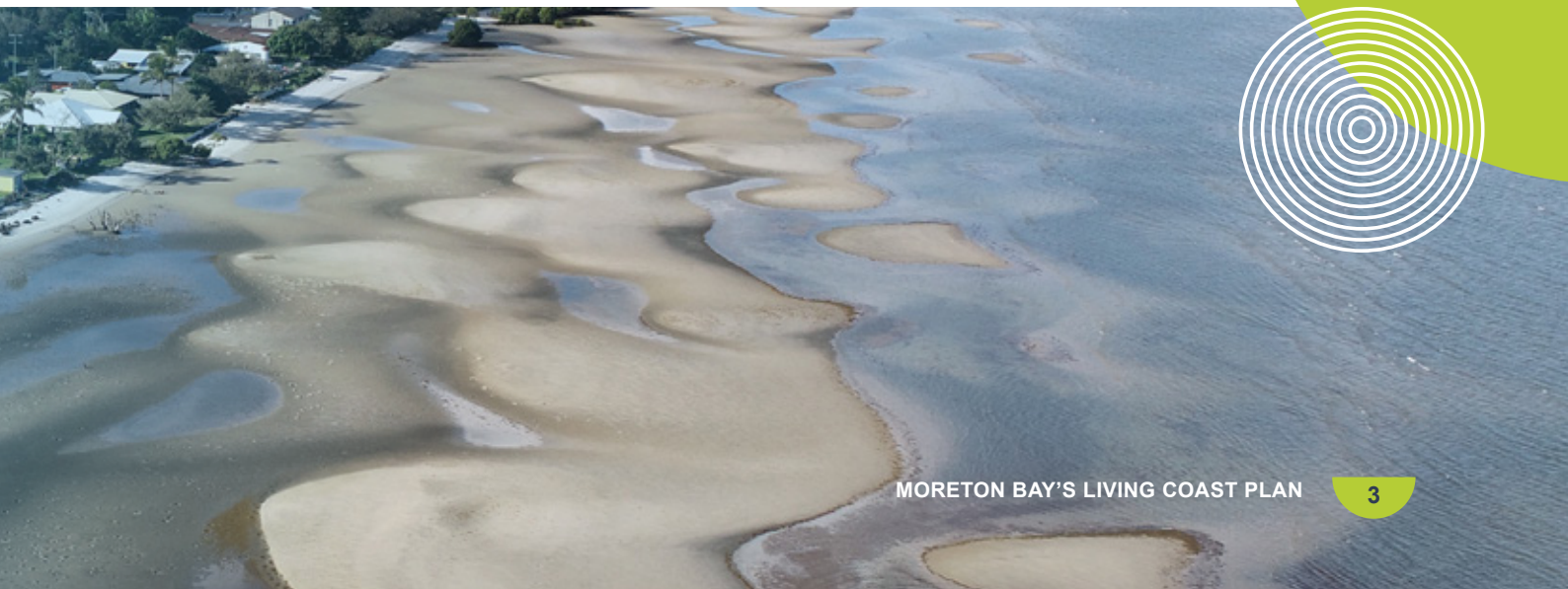


Acknowledgement

We acknowledge the Kabi Kabi, Jinibara and Turrbal Peoples as the Traditional Custodians of the lands and waterways of the Moreton Bay Region, and pay our respects to their Elders, past, present and emerging. We recognise that the Moreton Bay Region has always been a place of cultural, spiritual, social and economic significance to First Nations people.

We are committed to working in partnership with Traditional Custodians and other First Nations communities to shape a shared future that celebrates First Nations history and culture as an irreplaceable foundation of our region's collective identity.

Alignment with our vision

Moreton Bay's Living Coast Plan is helping to achieve our Corporate Plan 2022–2027 and realise our vision:

Our Moreton Bay. Amazing places. Natural spaces.

The strategic pillar this supports is:

OUR HEALTHY ENVIRONMENTS

Our Healthy Environments goal is that Moreton Bay will be renowned for its healthy natural and built environments that enhance our identity, support biodiversity and our sustainable lifestyles by 2033.

Read more about Council's Corporate Plan and the pillars that underpin it at:
moretonbay.qld.gov.au/Services/Reports-Policies/Corporate-Plan

Foreword

Situated to the north of Brisbane in South East Queensland, the Moreton Bay Regional Council (MBRC) coastal areas are home to the iconic waters of Moreton Bay (the region's namesake), rivers, creeks and estuarine areas.

Containing the Moreton Bay Marine Park and Bribie Island, internationally significant wetlands, seagrass meadows and sandy beaches, the region is a place of rich ecological value and scenic amenity.

Our region has been home to the Kabi Kabi, Jinibara and Turrbal Peoples for thousands of years. Today it is home to many communities from a wide range of cultural backgrounds with visitors from all parts of Australia and the world. Residents and visitors alike enjoy access to the coast and the associated coastal lifestyle.

Coastlines are dynamic, and ever-changing with each tide and storm event. Erosion and flooding by sea water (also referred to as tidal inundation and storm tide inundation) are natural processes that have shaped and will continue to shape the coast into the future.

These processes are referred to as coastal hazards when they impact on how we use and enjoy the coast. While much of the coastline is protected from coastal processes by Moreton Island and Bribie Island, the region still experiences erosion and inundation as a result of cyclones, offshore winds, and the wave climate. The eastern side of Bribie Island is the most exposed section of the coastline. Coastal hazard impacts are also predicted to increase with a changing climate.

The Queensland Government and Local Government Association of Queensland provided funding to Queensland's coastal councils to develop a strategic long-term approach to managing coastal hazards. With the funding awarded to Moreton Bay Regional Council, we have been able to develop Moreton Bay's Living Coast Plan.

The Living Coast Plan 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 Plan is designed to benefit the Moreton Bay community both now and into the future (to 2100) so that future generations can continue to enjoy the benefits of living in and visiting the Moreton Bay region.

1. Introduction

1.1 Our coastal landscape

The Moreton Bay Regional Council (MBRC) area covers 2,042 km^2 of land with 294 km of coastline and waterways. The region sits adjacent to Moreton Bay and stretches from Donnybrook in the north, to the northern bank of the Pine River in the south, and also includes southern Bribie Island (Figure 1).

The Traditional Custodians of this land are the Kabi Kabi, Jinibara and Turrbal Peoples, who value and maintain a strong connection to land and sea country.

The natural environment and distinct landscapes are the foundations of the Moreton Bay way of life. The landscape has been shaped by coastal processes over many thousands of years.

Sandy beaches, tidal inlets, rivers and estuarine areas, and wetlands characterise much of our bio-diverse coastline, along with residential settlements and urbanised foreshore areas. The region contains large areas of low-lying land and much of the urbanised foreshore has been protected with seawalls.

Figure 1. Moreton Bay Regional Council Local Government Area

1.2 QCoast 2100 Program

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.

MBRC was awarded funding through the QCoast 2100 program to undertake the Living Coast Plan and develop a strategy for the Moreton Bay region.

The Living Coast Plan has been:

- developed to proactively manage the impact of coastal hazards, now and into the future
- developed in consultation with stakeholders, and communities
- tailored to include the whole coastal landscape and its communities.

Purpose

The purpose of the Living Coast Plan is to:

- inform future decisions regarding the protection and management of our coast and foreshore areas
- inform future land use strategic planning
- guide the management of public utilities and facilities
- inform the management of areas of environmental and cultural significance
- foster collaboration and the shared custodianship of our coastline
- remain up to date based on implementation and new information.

Approach

The *Living Coast Plan* has been developed through an eight-phase process as outlined in the QCoast 2100 Minimum Standards and Guideline[1] (Figure 2).

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

- identify coastal hazard areas
- identify vulnerabilities and risks to assets
- engage with the community to understand important coastal values and priorities for the coast and the preferred approach to managing coastal hazards (known as adaptation)
- determine adaptation actions, costs, priorities, and timeframes for implementation.

Figure 2. QCoast 2100 process for developing a Coastal Hazard Adaptation Strategy

[1] (LGAQ and DEHP 2016)

1. Introduction

1.3 Engagement

Process

The Plan has been informed through consultation with key stakeholder groups and Moreton Bay region communities over a period of nearly two years in 2020-2022.

Engagement events and activities were undertaken in a range of virtual and in-person formats and included:

- Community surveys (12 November 2020 to 7 March 2021)
- 17 community drop-in sessions across coastal communities
- stakeholder workshops with the Community Reference Group and other stakeholders – December 2021 to January 2023 – to ensure outcomes reflect important coastal values and community priorities
- targeted briefings with key stakeholder groups, including a range of Councillors, Council CEO and Council departments
- two engagement summary reports that documented outcomes of engagement activities and how they have shaped the Living Coast Plan
- a four-week public comment period on the draft Living Coast Plan in November and December 2022.

Communication

A range of communication materials were produced during development of the Plan, including project updates, past coastal hazard videos, and a series of factsheets relevant to coastal hazard adaptation. The factsheets are accessible on the Living Coast Plan - Our coastal hazard adaptation strategy website and provided as Supplement A to the Plan.

Council's Living Coast Plan website was used for publicising the project, sharing information, and encouraging participation.

The engagement and communication process across all phases of the Plan development was informed by planning undertaken in Phase 1 and Phase 2.

Outcomes

All input and feedback has assisted in shaping the direction of technical investigations underpinning the Plan, and priority adaptation actions for the Moreton Bay region's coastline.

Additional outcomes included:

- a shared understanding of needs and opportunities in the adaptation planning process for the region's coastline
- appreciation of objectives for coastal management, and preferred approaches to adaptation.

1.4 Content of the Plan

The Living Coast Plan includes:

- Section 2: An overview of landscape features, values, history, and important elements of a resilient coastline for the Moreton Bay region.
- Section 3: An overview of coastal hazards, including erosion and inundation, areas that may be exposed to coastal hazards, and the implications of exposure including potential economic costs.
- Section 4: Moreton Bay Regional Council's approach to adaptation, including a framework for shared responsibilities, adaptation responses and options.
- Section 5: Priority adaptation actions across the region.
- Section 6: Local adaptation pathways for different communities.
- Section 7: How we will implement the plan.

2. Living Coast

2.1 Coastal landscape

Values

As the traditional home of the Kabi Kabi, Jinibara and Turrbal Peoples, the Traditional Custodians of the Moreton Bay region have a deep connection with country and continue to have a shared living culture with their environment. The coastal landscape, including freshwaters, tidal and coastal waters, have a high cultural significance for First Nations communities, who value the protection and sustainability of the land and sea (Country).

The coastal environment underpins a diversity of environmental, social and cultural values, and supports lifestyle and recreational opportunities unique to the Moreton Bay region.

Access to the coast is a strong lifestyle value, including boating, camping, and fishing, at beaches, waterways and national park areas.

Well known features of our coastline include:

- Moreton Bay Marine Park and Ramsar wetlands
- turtle nesting and habitat, fish habitat and dugong protection areas
- migratory shorebird roost habitat.

Key environmental features include:

- **coastal landforms** – including extensive tidal inlets, estuaries, coastal plains and sandy beaches.
- **vegetation communities and ecosystems** – including the wetlands, seagrass, mangroves and native dune vegetation.
- **significant and endangered species and environments** – including both land and marine environments.

Economy

The Moreton Bay region economy is underpinned by the construction, health care and social assistance, retail trade and manufacturing industries. These key industries are largely driven by the population growth of the Moreton Bay Local Government Area. Current population growth exceeds the Queensland average with Moreton Bay being the third fastest growing Queensland Local Government Area between 2011-2021.

While this population growth is benefitting our local economy, it is also putting extra pressure on our coastal system through increased infrastructure demands in residential, commercial, industrial, educational and entertainment uses.

Tourism contributes approximately $593 million annually to the local economy between both domestic day and overnight visitors. While this is contributing to our local economy, many tourism sites in our region sit on the coastline which is putting more stress on the region's coastal system. It is important that coastal hazards are identified in our region, and adaptations are made to improve the resilience of our community.

Environmental assets in the Moreton Bay region are areas of outstanding natural beauty. These are important to local residents as well as to regional and international tourists. The value of the Moreton Bay coastal and marine environment to fisheries, recreation and tourism is estimated to be in excess of $600 million a year.

COMMUNITY COASTAL PRIORITIES

Preserving scenic amenity (i.e. natural beauty)

Protecting and preserving the rich beauty of our coastal areas.

Preserving natural ecosystems

Coastal areas support unique biodiversity, including rare and endangered sea turtles, dugong and migratory shorebirds.

Providing safe and inclusive access to the foreshore and coast for everyone

Controlled and safe beach access.

Protecting cultural heritage (e.g. Indigenous and non-Indigenous customs, places, objects and practices)

Coastal areas have significant cultural heritage value and helps tell the story of our region.

Ensuring opportunities for sport and recreation

Residents and visitors enjoy camping, waterfront parks, fishing and boating, as well as walking, cycling and swimming.

Supporting commercial and business opportunities

The coastal environment provides ecotourism and eco-education opportunities, while working collaboratively with Traditional Custodians to manage the landscape.

2. Living Coast

2.2 Communities

The Living Coast Plan considers all parts of the Moreton Bay Region that are at risk from coastal hazards, including estuaries and waterways. Our coastal communities and places are unique, each having different experiences with coastal hazards and both current and future risk needs. Each community will have its own locally responsive adaptation journey. Figure 3 shows the communities grouped into sub-regions which are described below.

Bribie Island

Bribie Island is mainly residential estates, including canal estates and low to medium density housing areas, commercial areas, recreation areas and natural vegetation areas. Most Bribie Island residents live on the western side facing Pumicestone Passage, with only the Woorim community on the ocean facing eastern shore.

Pumicestone Passage

Pumicestone Passage communities are mainly small former fishing villages, now made up of low-density housing, nature-based recreation and limited commercial areas. The area is dominated by natural areas and waterways that drain into Pumicestone Passage.

Northern Moreton Bay

Northern Moreton Bay communities are generally low to medium density residential and commercial areas in small clusters surrounded by natural areas. Coastal living and recreational activities on the bay are popular in these communities.

South Deception Bay

South Deception Bay includes both well established and emerging residential areas, including the Newport canal estate, numerous recreation areas and commercial areas. The area also has some protected vegetation and wetlands. Easy access to infrastructure and coastal recreation areas make it a popular spot for families.

Peninsula and Pine River

The Peninsula and Pine River area is a well-established residential and commercial location. Tourists and day visitors are an important part of the local economy. There is a mix of housing types including low, medium and high density. The area includes the Dohles Rocks coastal community and the protected Hays Inlet environment.

Estuarine areas

Communities in the estuarine zone are not directly impacted by coastal erosion and are rarely affected by storm or tidal inundation. They may see increasing coastal hazard impacts based on projected sea level rise. It includes residential, commercial and industrial areas with a high growth rate.

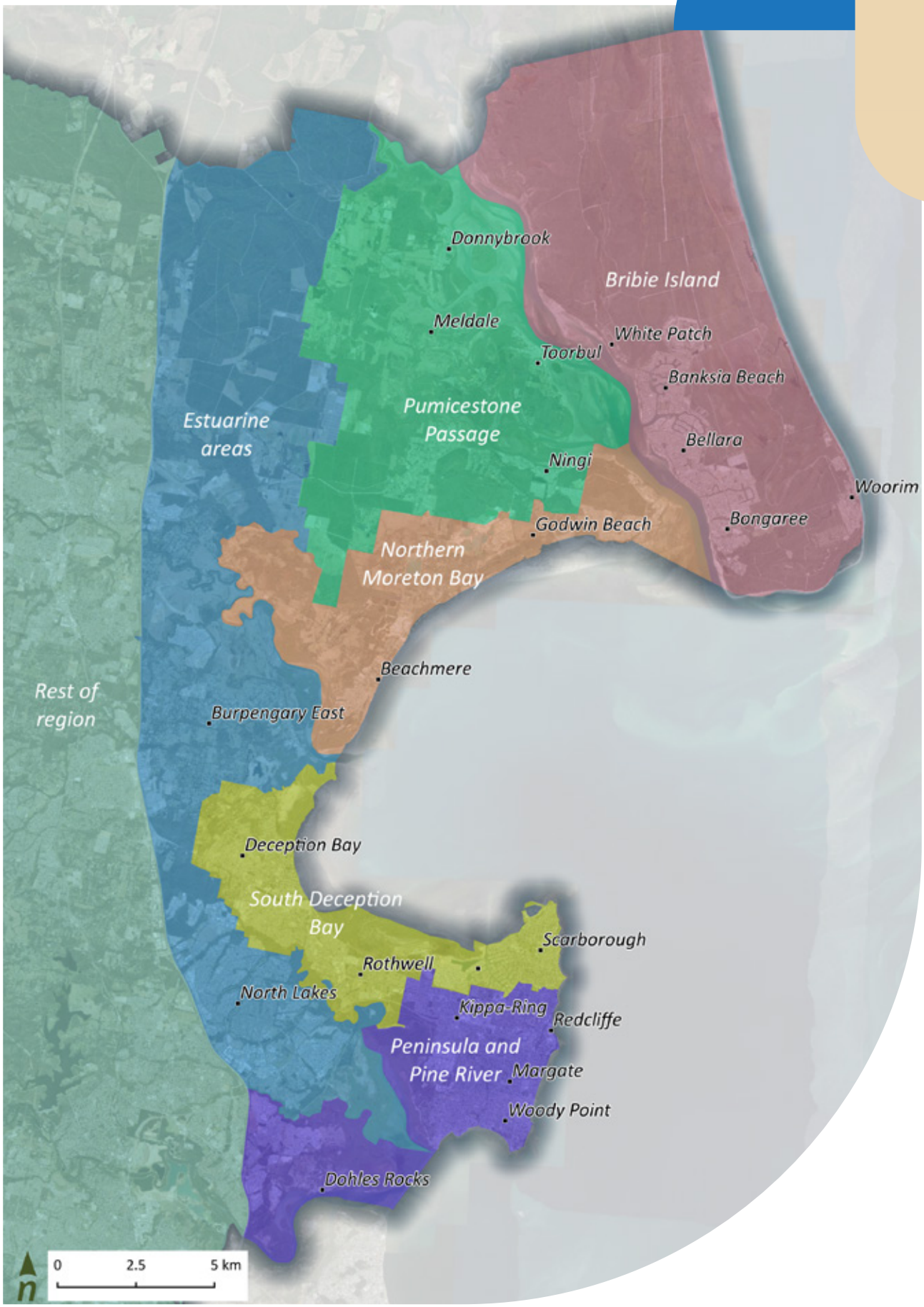


Figure 3. Reporting sub-regions for the Living Coast Plan

2. Living Coast

2.3 Towards a Resilient Coast

Change, resilience and adaptation

The coastline is a dynamic and picturesque part of the landscape, where the land meets the sea. One of the more challenging aspects of the coastal landscape is that it experiences constant, and often rapid change.

Wind and waves continually work to move sediment and shape the shoreline, and extreme weather events can periodically result in substantial erosion and inundation of coastal land. Looking back on past coastal hazard events in Moreton Bay, we know what works well in our region, as well as improving the way we manage the coast to strengthen our resilience and plan for future change.

A resilient coast has social, economic and environmental systems in place to avoid, manage or mitigate the impact of hazardous events or disturbances (e.g. coastal hazards). Resilience means the ability to respond or reorganise in ways that maintain the essential function, identity and values of a region, while also being able to proactively adapt to change.

For the Moreton Bay region, coastal hazard adaptation options have been developed in keeping with the character and values of our coastal communities.

Our community has told us what they value about our coastal areas:

- Natural and unique ecosystem values
- coastal living
- cultural values
- recreation opportunities
- access to infrastructure and facilities.

There is a strong community preference for considering nature-based solutions as the primary / initial pathway for coastal hazard adaptation.

Godwin Beach Environmental Reserve, Godwin Beach.

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.

Community resilience involves being prepared for coastal hazards and maintaining the capacity to respond to and manage impacts when they occur.

Resilience happens when coastal ecosystems can recover readily from disturbance and continue to support ecosystem functions more broadly.

3. Coastal hazards

3.1 Coastal hazards we experience

The coastal hazards which are the focus of the Living Coast Plan include:

- coastal erosion of the shoreline
- storm tide inundation
- inundation of low-lying coastal land from expanding tidal extents associated with sea level rise.

3.2 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 tropical cyclones, east coast lows and other severe weather events.

3.3 Coastal erosion

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

Short-term erosion

Erosion can occur as a temporary change, often associated with storm activity, and the beach will gradually rebuild (Figure 5). When a beach is stable, all the sand moved offshore during a storm eventually moves back onto the beach (potentially taking months to years). Short-term beach erosion does not result in a long-term loss of land.

Shoreline recession

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 coastal assets, depending on how close they are located to the shoreline.

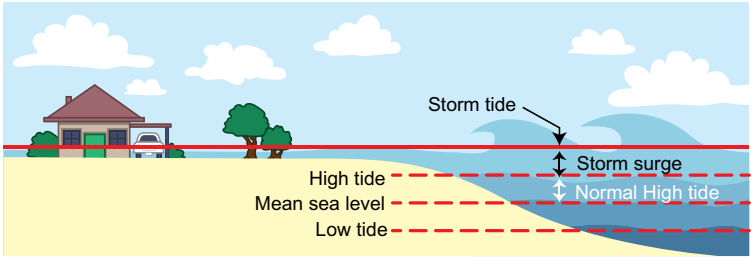


Figure 4. Components of storm tide

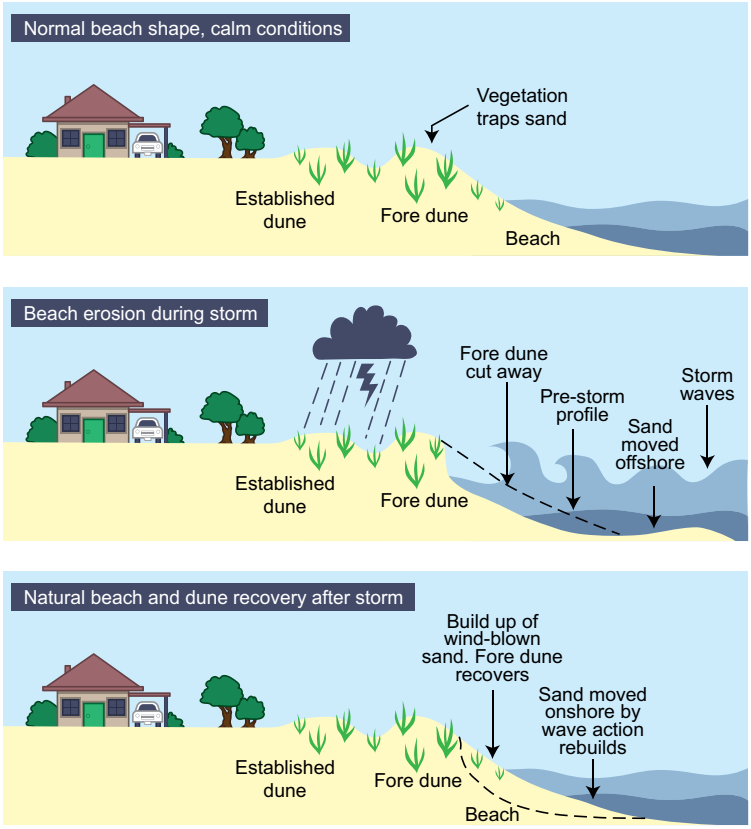


Figure 5. Natural short-term erosion and dune rebuilding process

3.4 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 can impact low lying areas. This can lead to increased damage especially if a high 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. The State Government also monitors actual sea level conditions through storm tide[2] and tidal gauges[3]. Real-time sea level data from gauges at Donnybrook and Scarborough is available online and graphically shows the predicted sea level compared to the current actual sea level.

3.5 Current and future exposure

Updated coastal hazard information

The Moreton Bay region's coastline occasionally experiences cyclone and storm events which can cause erosion and inundation. These coastal hazard impacts are predicted to increase with projected sea level rise. While much of the coastline is sheltered by Moreton Island and Bribie Island, the region still experiences erosion and inundation as a result of cyclones, offshore wind and the wave climate. King tides associated with storm and cyclone events also cause flooding. Coastal hazard impacts are predicted to increase with a changing climate and rising sea levels.

State-wide mapping of areas that may be prone to coastal hazards by 2100 - including erosion and storm tide inundation - are already publicly available for the entire Queensland coastline[4].

As part of the *Living Coast Plan*, the existing mapping for predicted storm tide and tidal inundation zones have been updated for the full coastline. These updates have been based on the best available technical data, and have included:

- application of the Queensland Government approach to determining coastal hazard areas
- a storm tide inundation study, including modelling.

Based on the state-wide approach to mapping, the erosion prone area (EPA) includes components of:

- **Open coast erosion**: A calculated component of open coast erosion potential. This includes a defined horizonal buffer.
- **Tidal areas**: Areas that may be prone to regular or permanent inundation by the Highest Astronomical Tide.

The mapped storm tide inundation area is an area that may be prone to temporary inundation driven by storm events.

As required by the Queensland Government, a projected sea level rise of 0.8 m by 2100 has been adopted for the Living Coast Plan (with 0.3 m by 2050).

[2] https://www.qld.gov.au/environment/coasts-waterways/beach/storm/storm-sites/scarborough

[3] https://www.qld.gov.au/environment/coasts-waterways/beach/tide-sites/donnybrook

[4] Refer to Queensland Spatial Catalogue – Qspatial qldspatial.information.qld.gov.au

3. Coastal hazards

Toorbul

DEFINING THE MORETON BAY REGION COASTAL ZONE – EROSION PRONE AREA (EPA)

- Extends 40 m landward of the plan position of the modelled present day HAT, except where approved revetments exist, in which case the line is measured 10 m landward of the upper seaward edge of the revetment. This combines tides, water levels, wave conditions and cyclones.
- The State Government defined EPA has been adopted and applied at the eastern side of Bribie Island, including Woorim, as it is the only section of the coastline exposed to open coast erosion.
- Permanent inundation due to sea level rise has been defined as part of the hydrodynamic modelling undertaken in the storm tide study.
- The present day HAT extent was used to define EPA for canal systems.

Planning horizons

The *Living Coast Plan* has assessed risk from coastal hazards for present day, 2050 and 2100. The likelihood of coastal hazards of being experienced, have also been assessed[5] (Table 1).

WHAT ARE PLANNING HORIZONS?

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

WHAT ARE 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.

WHAT IS ANNUAL EXCEEDANCE PROBABILITY (AEP)?

The Annual Exceedance Probability is the probability of a storm event occurring in a given year. The defined storm event for Queensland Government coastal hazard mapping is a 1% AEP. This means that in any given year there is a 1% chance of an event of that magnitude occurring or a 55% chance over an 80 year period.

[5] Likelihoods are defined by Annual Exceedance Probabilities (AEPs) which indicate the probability that an event will occur in any given year.

Table 1. Likelihood of occurrence scenarios

Likelihood of occurrence	Hazard AEP	Planning horizons
Storm tide inundation		
Likely	5 % 1 in 20	Present day, 2050, 2100
Possible	1 % 1 in 100	Present day, 2050, 2100
Rare	0.1 % 1 in 1000	Present day, 2050, 2100
Tidal inundation		
Almost certain		Present day, 2050, 2100

Relevant maps are provided in Supplement B of this Plan.

Erosion prone area and storm tide inundation zones do not represent a predicted loss of coastal land. Mapped hazard areas 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, mitigated or managed through adaptation planning.

FUTURE IMPACTS

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

Coastal erosion:

- increased water levels will accelerate coastal erosion
- sediment transport patterns may be altered by shifts in wave direction, triggering changes to the form and location of shorelines
- low-lying land may be permanently inundated
- increased cyclone and storm activity will escalate the severity of coastal erosion events.

Storm tide inundation:

- sea level rise will increase the apparent severity and frequency of storm tide inundation and will cause inundation to occur further inland
- increased cyclone and storm intensity will add to the magnitude of storm tide events and the extent of inundation.

Source: Coastal Hazard Technical Guideline (DEHP 2013)

3. Coastal hazards

3.6 How do coastal hazards impact our region

How we identified potential impacts

Coastal hazards have the potential to negatively impact Moreton Bay communities, infrastructure, essential community services such as water supply, and our lifestyle today and long into the future. Localised impacts can be significantly exacerbated when localised flooding caused by heavy rainfall and dam releases occurs at the same time coastal hazards are being experienced.

As part of the *Living Coast Plan*, technical assessments have been used to determine the coastal hazard risk for a range of assets that exist in communities. 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. The risk assessment has included analysis of:

- data on infrastructure assets (drainage, sewerage, electricity, telecommunications, stormwater, water supply, and roads)
- information on houses and other buildings
- coastal protection structures such as sea walls and other beach and foreshore assets such as boat ramps
- cultural heritage sites and sites of cultural and historical significance
- environmental overlays.

Extensive spatial analysis has been undertaken to assess which assets (or portion of assets) are exposed to the coastal hazard scenarios.

Exposure and risk information is captured for each asset or land parcel and summarised for different asset types and localities, to inform the Plan as well as asset management planning and disaster management.

Assets and values are within coastal hazard areas

The mapped coastal hazard extents indicate areas and assets that may be exposed to different hazards now, and / or in the future.

For the Moreton Bay region, there is a range of land and asset types, as well as cultural resources that are likely to experience increased exposure to erosion and inundation by 2100.

The potential impact or consequence of exposure provides an appreciation of the relative risk of coastal hazards, as presented in the following section.

Define risk

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

A risk assessment matrix (Table 2) and consequence table (Table 4) have been developed based on leading practice approaches incorporating multiple likelihoods of storm tide and tidal inundation events. Consideration of risk acceptance is provided for each risk category Table 3).

To complete the risk assessment:

- the likelihood of exposure (likely, possible, rare) was determined for each asset / land parcel, for erosion, storm tide inundation, and tidal inundation from projected sea level rise
- 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 (very low, low, medium, high, very high) based on the likelihood and consequence for each asset / land parcel, separately for erosion and inundation
- actions including infrastructure to provide protection from coastal hazards have been considered when assigning risk (residual risk).

Oyster Point, Scarborough

Table 2. Risk matrix for the MBRC CHAS

Inundation risk		Consequence					
Likelihood	**AEP**	**Insignificant**	**Minor**	**Moderate**	**Major**	**Extreme**	**Catastrophic**
Unlikely	0.1% (1 in 1000-year ARI*)	Very low	Low	Low	Medium	Medium	High
Possible	1% (1 in 100-year ARI*)	Low	Low	Medium	Medium	High	Very High
Likely	5% (1 in 20-year ARI*)	Low	Medium	High	High	Very High	Very High
Almost Certain	HAT inundation	Medium	High	Very High	Very High		

Table 3. Tailored risk tolerance categories

Risk	Action required	Acceptance / Risk tolerance
Very High	Immediate and/or ongoing action is needed to eliminate or reduce risk to acceptable levels.	Unacceptable / intolerable
High	Short-term action is needed to eliminate or reduce risk to acceptable levels.	Tolerable
Medium	Short to longer term action is needed to eliminate or reduce risk to acceptable levels.	Tolerable / acceptable
Low	Manage the risk as part of current operations and provide for periodic maintenance.	Acceptable
Very low	Accept risk	

3. Coastal hazards

Consequence	Place, planning and sustainability		
	Property and infrastructure	**Economy and growth**	**Public safety**
Catastrophic	Widespread major damage or loss to properties or infrastructure. MBRC assets and infrastructure >$25 million. Region-wide total value >$250 million. Partial recovery/repair may take many years.	Regional economic decline, widespread business failure and impacts on state economy. One or more major industries (e.g. tourism, agriculture, mining) within the MBRC region threatened.	Loss of lives and/or permanent disabilities.
Major	Major damage or loss to properties or infrastructure. MBRC assets and infrastructure >$10 million. Region-wide total value >$100 million. Full recovery/repair may take many years.	Lasting downturn of local economy with isolated business failures and major impacts on regional economy. A minor industry or whole sector of the MBRC region put at risk.	Widespread serious injuries/illnesses & hospitalisation.
Moderate	Moderate - major damage to properties or infrastructure. MBRC assets and infrastructure >$1 million. Region-wide total value >$10 million. Full recovery/repair may take less than 1 year.	Significant impacts on local economy and minor impacts on regional economy. Group of businesses in one sector or locally within the MBRC region put at risk.	Isolated serious injuries/illnesses and/or multiple minor injuries / illnesses.
Minor	Minor damage to properties or infrastructure. MBRC assets and infrastructure >$100,000. Region-wide total value >$1 million.	Individually significant but isolated impacts on local economy. Inconvenience to a group of businesses in one sector or locally within the MBRC region.	Minor and isolated injuries and illnesses.
Insignificant	Minimal damage to properties or infrastructure. MBRC assets and infrastructure <$100,000. Region-wide total value <$1 million.	Minor short-term impact on local economy. None to minimal impact or inconvenience to single business.	Negligible injuries or illnesses.

	Community wellbeing and culture		Environment
	Services, wellbeing and culture	**Traditional Owner values**	**Environmental values**
	Widespread semi-permanent impact (more than a month) to highly utilised community services, wellbeing, or culture of the community with no suitable alternatives.	Severe and widespread, permanent impact on one or more sites of indigenous significance, including loss of land, connection to land, and ability to continue traditional practices. Recovery unlikely.	Widespread, irreversible damage to aquatic and/or terrestrial ecosystems. Permanent loss of one or more species with potential to lead to collapse. Full/partial recovery may take more than 10 years.
	Major widespread long-term (less than a month) disruption to well-utilised services, wellbeing, or culture of the community with very few alternatives available.	Severe and widespread semi-permanent impact on one or more sites of indigenous significance, including loss of land, connection to land, and ability to continue traditional practices. Full recovery may take many years.	Widespread, long-term reversible or local irreversible, damage to aquatic and/ or terrestrial ecosystems. Significant reduction in one or more species. Full recovery may take 3 - 10 years.
	Minor medium-to long-term (less than a week) or major short-term disruption to moderately utilised services, wellbeing, or culture of the community with limited alternatives.	Substantial impact on one or more sites of indigenous significance. Full recovery may take 1 -2 years.	Localised, medium term reversible damage to aquatic and/or terrestrial ecosystems. Moderate reduction in one or more species. Full recovery may take 1 -2 years.
	Small to medium short-term disruption (less than a 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, contained and reversible short-term impact on sites of indigenous significance. Full recovery may take less than 1 year.	Localised minor reversible damage to aquatic and/or terrestrial ecosystems. Temporary reduction in one species. Full recovery may take less than 1 year.
	Very small short-term disruption (less than an hour) to services, wellbeing, finances, or culture of the community with numerous alternatives available.	No impact to sites of indigenous significance.	No measurable adverse impact to aquatic and/or terrestrial ecosystems. No noticeable species reduction.

3. Coastal hazards

Assets are at risk

Outputs from the risk analysis were mapped for all localities across the region, to review the distribution of assets / land at risk from coastal hazards. At risk assets are inclusive of any assets with a medium to very high risk of adverse impacts from coastal hazards[6].

Risk is largely associated with storm tide inundation and increasing tidal area hazards. Potential erosion risk is limited to localised areas.

Buildings and infrastructure

A small number of buildings are likely to be at low risk from erosion and tidal inundation in the present day to 2100. However, there are a number of buildings at risk of storm tide inundation in the present day in Banksia Beach, Bellara, Bongaree, Toorbul, Meldale, Godwin Beach, Beachmere, Newport, Kippa-Ring, Clontarf, Deception Bay, Rothwell, Griffin and Scarborough. This includes houses, aerodrome buildings, public amenities, accommodation facilities, retirement village buildings, emergency services, and community, sports and recreation facilities. The number of and risk to these buildings will increase by 2100.

Environment

The risk assessment identified that significant areas or proportions of environmental assets and values are at risk from exposure to open coast erosion and increased salinity to both surface and ground water dependant ecosystems. Changing hydrological regimes into the future will affect essential or endangered wildlife habitats, mangroves, swamps, and high ecological significance wetlands.

Endangered and essential habitats for vulnerable wildlife areas have been identified as Moreton Bay Ramsar sites, Buckley's Hole Conservation Park, Godwin Beach Reserve, Beachmere Conservation Park, Deception Bay Conservation Park and Hays Inlet Conservation Park. Buckley's Hole Conservation Park, Godwin Beach Reserve and Beachmere Conservation Park are most at risk of coastal hazards in the present day and with risk increasing significantly by 2100.

Planning scheme zones

There are a number of planning scheme zones that have increased exposure to coastal hazards. This includes a small portion of environmental management and conservation, rural, recreation and open space, extraction industry, general residential and rural residential zones which are at risk of erosion by 2100. A notable increase in risk from tidal inundation is expected from present day to 2100.

There is similarity in some of the assets exposed to tidal area inundation compared to those exposed to storm tide, however, the risk level is often lower when the consequence of temporary inundation is not as significant as permanent tidal exposure.

Communities

Our understanding of coastal hazard risk for assets and land across our region provides a basis to begin targeting our adaptation response and actions.

For the purposes of the Plan, the Moreton Bay region includes six reporting sub-regions (Table 5), with key coastal localities within each region. Adaptation effort, response and actions in the Plan are tailored to the location's specific needs.

Change in risk profile

The emerging risk profile from present day to 2100 is not linear. There is a notable increase in the risk profile for all hazards and asset types from 2050 to 2100. This indicates that there is a good opportunity to undertake adaptation over the coming decades, in a way that can mitigate the predicted increase in risk before it occurs and avoid the associated impacts.

[6] Relative to all assets in the coastal zone

Our natural values and environmental assets

Our coastal ecosystems can help to protect us from the impacts of coastal hazards, however there are many other reasons why these places are important to us. These environmental areas provide ecological value, recreational value, and cultural value (Figure 6). For many of us, our affinity for these places gives them an intrinsic value that is difficult to quantify.

CASE STUDY: Environmental values of Moreton Bay's coastal areas

Ecological value

Our coastline contains a variety of habitat types which support a huge diversity of species, some of which are considered Vulnerable or Endangered in Queensland. This is recognised and protected as part of the Moreton Bay Marine Park.

The wetlands and mudflats of Moreton Bay are internationally significant. Ramsar wetlands support migratory shorebird species that rely on traditional stopover habitat around the globe to feed and rest on their journey to their breeding grounds in the northern hemisphere.

Migratory species in our region include eastern curlews (Endangered), bar-tailed godwits (Vulnerable), grey tailed tattlers, red-necked stints, ruddy turnstones and sandpipers. Our shorelines are also home to resident shorebirds such as the Australian pied oystercatcher, bush stone-curlew and beach stone-curlew (Vulnerable) which nest above the high tide mark of beaches and rocky shorelines.

Two important coastal habitats are the mangrove forests fringing our shorelines, and the seagrass beds found in clear, shallow waters. Seagrasses are a primary food source for dugong and green sea turtles (both Vulnerable), which are protected species. Resident dolphin populations live in our region and frequent seagrass and mangrove habitat to hunt for food.

Moreton Bay hosts two species of dolphin, the Indo-Pacific bottlenose dolphin and the Australian humpback dolphin (Vulnerable). Green sea turtles also nest along our sandy shores, primarily along the western sides of Bribie Island. Our region is the southernmost extent of dugong population along the east coast.

The value of the Moreton Bay coastal and marine environment to fisheries, recreation and tourism is estimated to be in excess of $600 million a year.

Recreational value and liveability

Much of the wildlife, vegetation and landforms supported by our coastal environment also contributes to the recreational and aesthetic value of these spaces. We use these spaces for walking, swimming, exercising, kayaking, birdwatching, fishing, boating, and scenic amenity.

Many of us live in Moreton Bay because we have access to these beautiful natural environments. Whether it's kayaking around Hays Inlet, a walk, run or bike ride along the Redcliffe Esplanade, or some birdwatching at the Godwin Beach Environmental Reserve or Buckley's Hole Conservation Park, we often choose these activities to see and experience the incredible natural environments and wildlife. These values are also enjoyed by residents of adjoining Local Government Areas.

The improved liveability that Moreton Bay's natural coastal environments provide may make it a more attractive area to live compared to that of Moreton Bay's non-coastal areas.

Maintaining these environmental assets into the future will ensure that the values associated with them will remain or grow. This may have economic implications where effective management of these assets / values results in continued growth in property values.

There are many ways in which environmental areas can be monitored, managed and restored to protect the values above. Specific actions would need to consider the relevant ecosystem types, which values are prioritised for protection, and alignment with broader Council objectives.

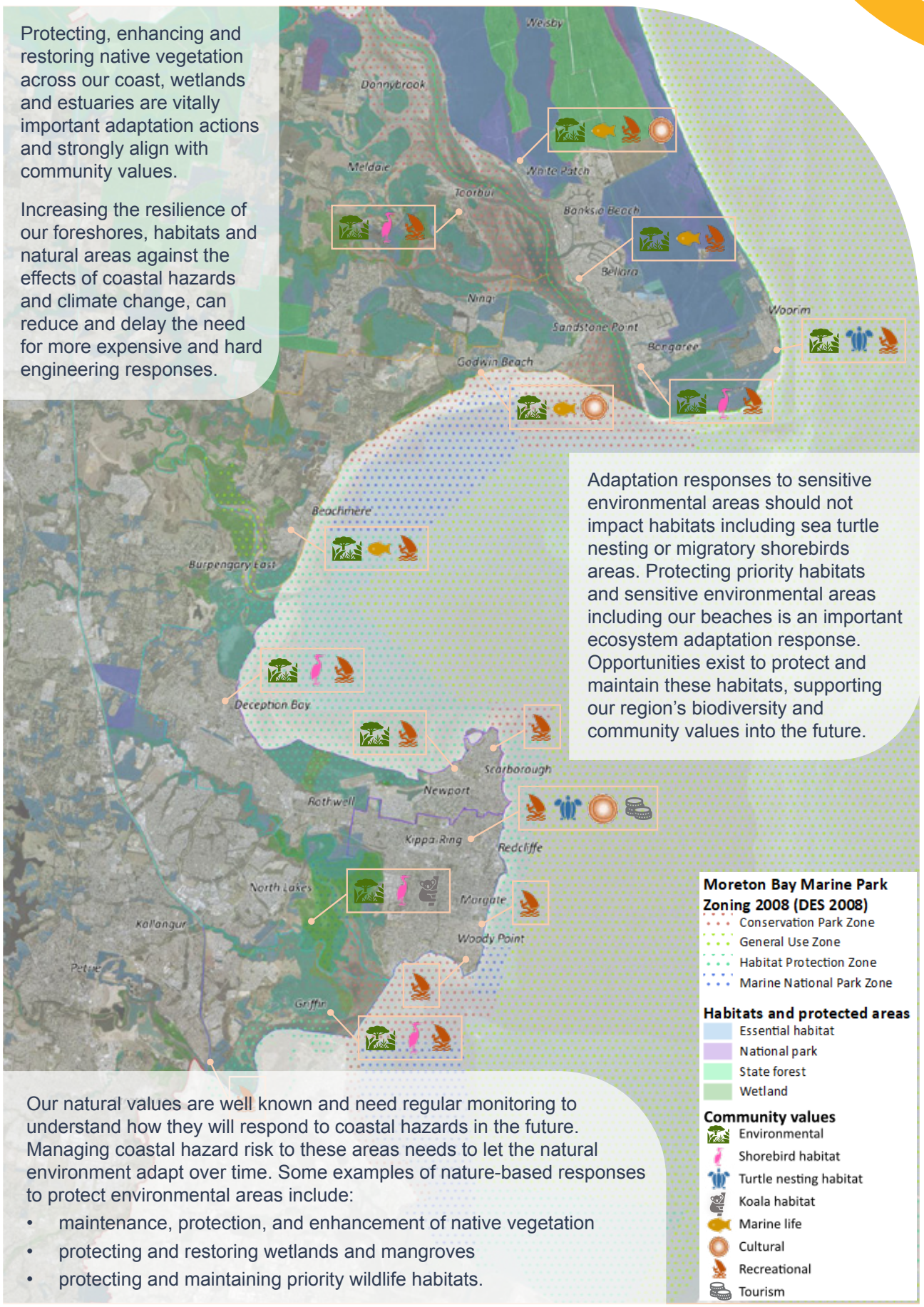
3. Coastal hazards

Environmental values of Moreton Bay's coastal areas

- Nesting habitat for sea turtles
- nursery habitat to support commercial and recreational fisheries
- mangroves and seagrass as habitat and as buffers against storm surges
- habitat for migratory and resident shorebirds
- places to walk and exercise, swim and play
- places for recreation – fishing, boating, kayaking, birdwatching
- supports improved liveability
- connection to Country and cultural wellbeing
- home to culturally important places

Protecting, enhancing and restoring native vegetation across our coast, wetlands and estuaries are vitally important adaptation actions and strongly align with community values.

Increasing the resilience of our foreshores, habitats and natural areas against the effects of coastal hazards and climate change, can reduce and delay the need for more expensive and hard engineering responses.



Adaptation responses to sensitive environmental areas should not impact habitats including sea turtle nesting or migratory shorebirds areas. Protecting priority habitats and sensitive environmental areas including our beaches is an important ecosystem adaptation response. Opportunities exist to protect and maintain these habitats, supporting our region's biodiversity and community values into the future.

Our natural values are well known and need regular monitoring to understand how they will respond to coastal hazards in the future. Managing coastal hazard risk to these areas needs to let the natural environment adapt over time. Some examples of nature-based responses to protect environmental areas include:

- maintenance, protection, and enhancement of native vegetation
- protecting and restoring wetlands and mangroves
- protecting and maintaining priority wildlife habitats.

3. Coastal hazards

CASE STUDY: Threat to koala habitat and coastal hazards at Hays Inlet

Occupying a variety of landscapes, koalas can be found in bushland, rural zones and fragmented urban spaces. Koalas have a highly selective diet, and require certain climate conditions, vegetation, groundwater, and the presence of other koalas to create suitable habitat. Often these favourable conditions are found in the coastal zone. Connectivity between habitat areas is also important to allow free movement of individual koalas and support genetic diversity in the population. Highly fragmented habitat, such as near urban areas, limits the ability of koalas to respond to climate or habitat threats safely.

It is important for us to protect koalas as they are both culturally significant for many First Nation peoples and form an integral part of Australian identity. However, koala populations have been declining in recent decades as the quantity of suitable habitat diminishes. Current populations face threats from human impacts, urbanisation, coastal hazards, bushfires and climate change.

The Hays Inlet region currently supports 207 hectares of koala habitat. This habitat adds $32.3 million of value to the economy. This habitat area is surrounded by built-up urban spaces and coastal bodies of water that restrict the permeability of koala migration. Koalas occupying Hays Inlet are faced with rising tides from sea level rise, and constraints impacting their ability to migrate inland. According to modelled sea level rise changes in these areas, Hays Inlet may see a nearly 70% decrease in potential and available koala habitat decrease by 2100 with most of this land becoming tidal (Figure 7).

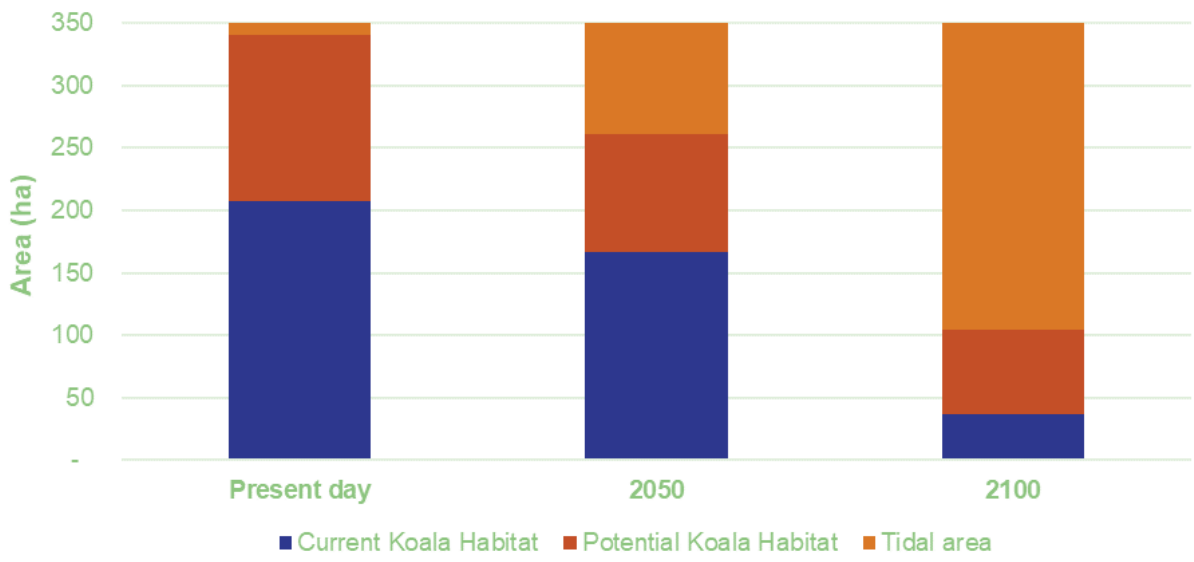


Figure 7. Change in available koala habitat for Hays Inlet between present day and 2100

Figure 7 shows the potential impact that coastal hazards can have on our environmental areas. Problems arise when urban areas impact the ability of the environment to relocate or adapt. Our community places high value on the environment and the wildlife it supports, highlighting the need to protect and plan for future management of these areas.

Table 5. Reporting sub-regions and adaptation needs

Reporting sub-regions	Key localities	Implications for adaptation
Bribie Island	- Woorim - Bongaree - Bellara - Banksia Beach - White Patch - Welsby	Bribie Island is connected to the mainland via Bribie Island Bridge. There are canal estates at Banksia Beach and Bongaree and many of the communities are located along the coast. Woorim is our region's only ocean facing beach. There are a large number of built assets, natural assets and land zoning areas within the coastal hazard area. The Bribie Island community highly values living on the coast and accessing the natural environments.
Pumicestone Passage	- Ningi - Toorbul - Meldale - Donnybrook	Pumicestone Passage is made up of small coastal villages whose residents value access to the coastline for water-based recreation. The communities in this reporting sub-region have smaller populations than other coastal areas. Pumicestone Passage has less built assets at risk from coastal hazards than other areas. A large portion of the assets with the greatest risk are the natural assets and environmental zoned areas. Tidal inundation poses the greatest risk to the natural and built assets in this sub-region.
Northern Moreton Bay	- Sandstone Point - Godwin Beach - Beachmere	Residents highly value access to the coast and its natural areas, and the associated coastal lifestyle in this area. Northern Moreton Bay has a large number of built assets within the coastal hazard zone. This area is exposed to significant coastal erosion. In this sub-region assets and infrastructure are also vulnerable to storm tide and tidal inundation.
South Deception Bay	- Deception Bay - Rothwell - Newport - Scarborough	South Deception Bay is vulnerable to coastal hazards. Residents in this sub-region value access to coastal areas for recreation. The Redcliffe Aerodrome is located within the coastal zone of this area. Existing seawalls protect a significant length of South Deception Bay's coastline.
Peninsula and Pine River	- Kippa-Ring - Redcliffe - Margate - Woody Point - Clontarf - Dohles Rocks (Griffin)	Peninsula and Pine River is protected from open coast erosion but vulnerable to storm tide and tidal inundation. There is a high number of built assets within the coastal zone. Residents highly value access to the high-quality recreation areas and natural environments.
Estuarine areas	- North Lakes - Burpengary East	Estuarine areas are low-lying areas. In these areas assets and infrastructure may be affected by coastal hazards during extreme events.

3. Coastal hazards

Cost of no intervention

In the absence of intervention / adaptation, there are economic costs associated with coastal hazards.

Economic analysis is important for determining the best approach to coastal hazard adaptation for different localities. Economics is used in several ways including to:

- Value assets and key industries
- define a base case (cost of no action)
- assess adaptation options.

After assigning values to key infrastructure and natural assets, the foundational step of an economic assessment in coastal hazard adaptation is to define a base case (Figure 8). This means determining the potential economic costs or losses associated with coastal hazards (and no additional adaptation / intervention, i.e. business as usual). This becomes the baseline for a cost-benefit assessment of implementing adaptation options.

The base case for the Moreton Bay region has been determined by examining the likelihood and consequence ($ damage) of coastal hazard impacts on assets, and at different timeframes (e.g. present day, 2050 and 2100).

Five key components of damages have been considered for the base case:

1. **Damage to buildings and facilities** – Buildings and facilities include public and private buildings, and structures such as swimming pools and sports centres, among others. This is the financial cost of repairing or replacing these assets.
2. **Damage to transport infrastructure** – Transport assets include roads, pathways, 4WD tracks, bridges and railway tracks. This is the financial cost of repairing or replacing these assets and can also trigger other economic losses where access to key sites is lost.
3. **Natural asset damages** – Land, environmental and cultural assets include natural assets such as wetlands, coastal forests, urban parks, and livestock grazing areas. This is the lost value from a reduction in the extent of these assets.
4. **Indirect damages** – Indirect damages include factors such as displaced tourism activity, emergency costs and alternative accommodation that occur as a result of direct damages to buildings and facilities and transport infrastructure.
5. **Intangible damages** – Intangible damages include factors such as stress, anxiety, injury, and loss of life that occur as a result of direct and indirect damages to buildings and facilities and transport infrastructure.

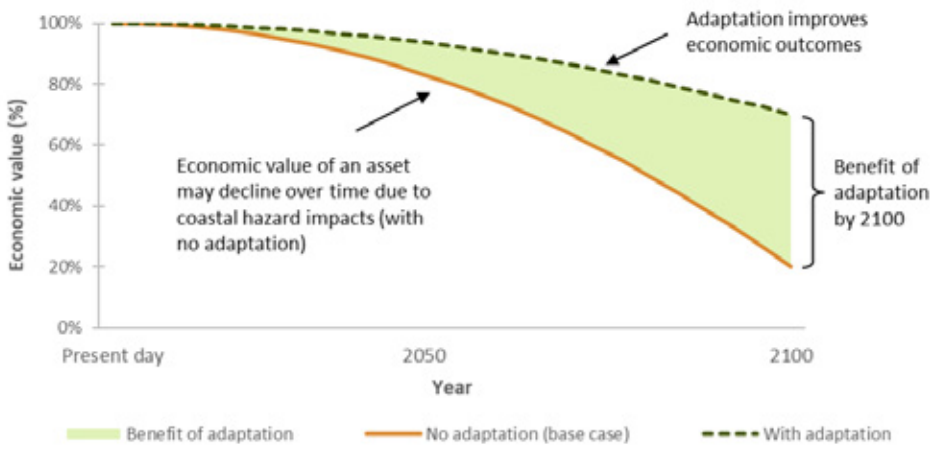


Figure 8. Economic base case and benefit of adaptation

For the Moreton Bay region, the present day average annual damages (AAD) associated with combined coastal hazard impacts on built assets is estimated to be in the order of $42 million (Figure 9).

In the absence of adaptation, this may increase up to $110 million (AAD) by 2050 and over $468 million (AAD) by 2100.

The majority of the potential damages are associated with increases in the tidal area due to sea level rise. A large proportion of present potential damages are associated with storm tide inundation. Across all time periods, the majority of potential damages are associated with coastal hazard impacts on buildings and facilities (a mix of private and public, but predominantly private assets).

Strategic adaptation can assist to avoid, mitigate and manage the impacts and potential economic damage associated with coastal hazards.

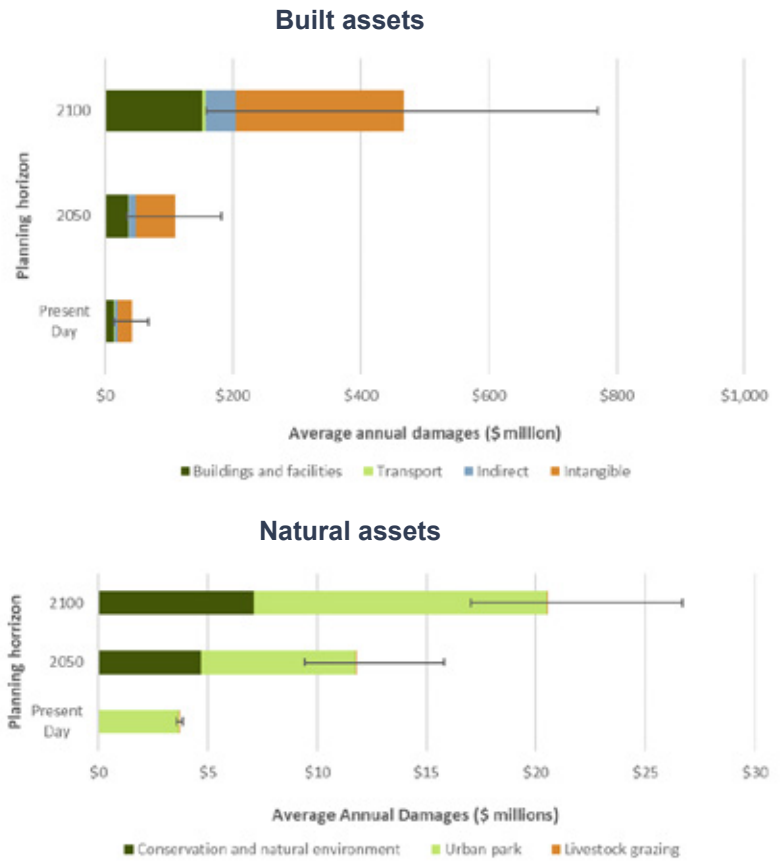


Figure 9. Potential average annual damages from coastal hazards base case for built assets (top) and natural assets (bottom)

Woorim Beach, Woorim

Economic impacts on natural assets and coastal hazards for natural assets may include:

- Loss of wetland services
- deepening of seagrass habitat, potentially restricting habitat range
- erosion and inundation of turtle beach habitat areas
- loss of fish habitat impacting recreational values
- loss of tourism value through loss of natural assets

The present day average annual damages (AAD) associated with coastal hazard impacts on natural assets is assumed to be minor for wetland ecosystems (relative to future planning horizons). The current existence of wetlands within the tidal area is unlikely to cause any issues within a reasonable range of depths. In the absence of adaptation, this is likely to increase up to $20.5 million by 2100.

4. How we can adapt

4.1 Framework

Shared roles and responsibilities

Moreton Bay Regional Council recognise a shared responsibility for the management of coastal hazard risk; shared by Council, other land managers and private landowners.

Council's primary responsibility is the maintenance and protection of Council land and assets, and to inform statutory planning.

Objectives for the Moreton Bay region's coast, as informed by consultation with stakeholders and the community, include to:

- **Inform** – Council will make available to all stakeholders (including public and private land and asset owners) the outcomes of relevant Council-led investigations on coastal hazard risk, planning and adaptation options
- **Observe** – Council will actively observe / monitor coastal hazard risk for Council owned land and assets. For land and assets owned or managed by others, Moreton Bay Regional Council may, as part of everyday activities, observe a risk from coastal hazards and notify the relevant landowner / manager
- **Plan** – Council will develop strategic planning measures to mitigate the risk of coastal hazard impacts on Council owned land and assets, and to inform appropriate land use planning across the region
- **Act** – Council will implement strategic planning measures to mitigate the risk of coastal hazard impacts on Council owned land and assets, and to inform appropriate land use planning across the region.

Initiatives in the Plan also seek to enable and support private owners to proactively manage coastal hazard impacts on their property in accordance with the Plan and in consultation with Council.

A balanced approach

Coastal hazards are experienced with varying degrees of impact across the Moreton Bay region. When future coastal hazards occur, their potential impact will be experienced differently by our coastal communities. A balanced adaptation pathway is required as our coastal communities build their resilience to coastal hazards. This is done by:

- Assigning a strategic adaptation response to different localities, to guide decision making with a pathways approach across present day, intermediate and 2100 planning horizons
- Assessing the range of adaptation options suitable in different locations to help avoid, mitigate, and manage the risk of coastal hazards
- Developing a Plan for coastal adaptation, with prioritised actions over a 10 year timeframe.

A tailored approach has been developed to guide decision-making on adaptation response and options across the Moreton Bay region coastal zone.

Adaptation objectives

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

Objectives for the Living Coast Plan, as informed by consultation with stakeholders and the community, include to:

- retain the natural beauty of the coast
- limit adverse impacts on scenic amenity
- protect important ecosystems
- protect freshwater and tidal waterways and wetland habitats that support our special and diverse wildlife such as dolphins, dugongs, and migratory shorebirds
- protect residential areas and key assets
- protect significant, protected, and sensitive areas (environment and biodiversity)
- retain sandy beaches
- maintain access to the coast, including the beach, the water, and foreshore.

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

Redcliffe Beach, Redcliffe

4. How we can adapt

Adaptation response

The tailored framework for the Living Coast Plan includes four adaptation responses – Avoid (and maintain), Monitor (look and learn), Actively manage, and Transition and change (Table 6).

The framework builds on best practice approaches and incorporates new advances in adaptation language – with adaptation responses determined for each Moreton Bay community and for each time frame (planning horizon) (Table 8).

Avoid (and maintain existing environment)

The general first principle is to avoid placing new development or assets in coastal hazard areas. Any new development or infrastructure in coastal hazard areas is in accordance with State Planning Policy, approval requirements, and includes necessary mitigation measures.

It is also important to avoid creating new risk or increasing existing risk. Maintaining infrastructure in accordance with the asset management plans 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 the risks by observing changes and regularly reviewing whether these changes represent an increasing risk approaching a local limit, known as look and learn. The 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 shift to active management.

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

Actively manage

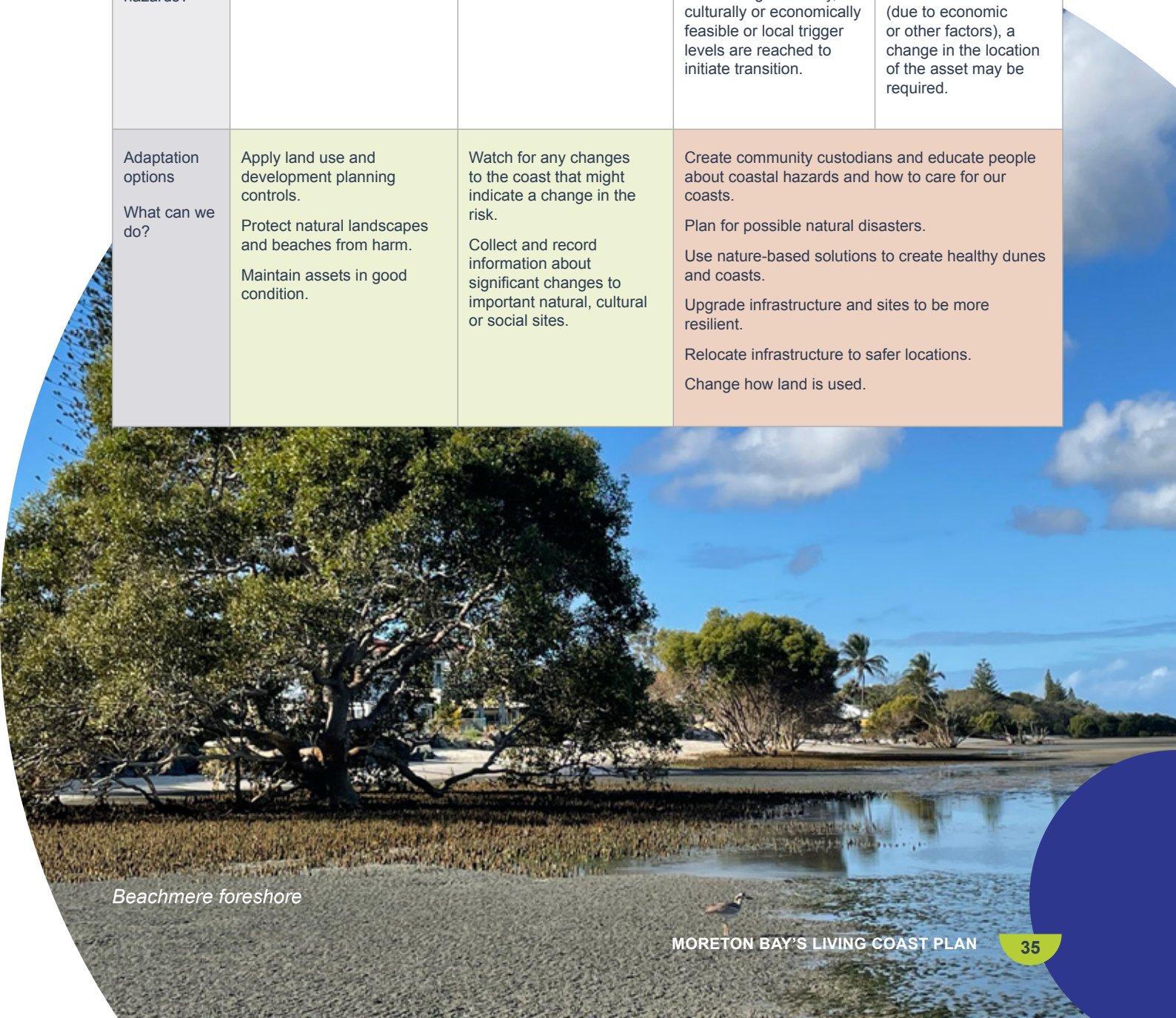
At localities where coastal hazard risks have been identified, the adaptation response is to proactively manage the risk through implementing a range of adaptation options. Adaptation options will be tailored to each locality, incorporating site-specific processes, community input, and statutory planning considerations. If, over time, the risk profile is observed to increase (as indicated by local trigger levels), and active management becomes unfeasible (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

For specific assets that experience intolerable risk, where the coastal hazard risk profile is very high, and active management becomes unfeasible (due to economic or other factors), a change in the location of the asset may be required. 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.

Table 6. Adaptation framework for Moreton Bay

	Coastal hazard adaption			
	Avoid (and maintain)	**Monitor (look and learn)**	**Actively manage**	**Transition and change**
Adaptation response How do we respond and adapt to coastal hazards?	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.	For specific assets that are experiencing intolerable risk, where the coastal hazard risk profile is very high, and active management becomes unfeasible (due to economic or other factors), a change in the location of the asset may be required.
Adaptation options What can we do?	Apply land use and development planning controls. Protect natural landscapes and beaches from harm. Maintain assets in good condition.	Watch for any changes to the coast that might indicate a change in the risk. Collect and record information about significant changes to important natural, cultural or social sites.	Create community custodians and educate people about coastal hazards and how to care for our coasts. Plan for possible natural disasters. Use nature-based solutions to create healthy dunes and coasts. Upgrade infrastructure and sites to be more resilient. Relocate infrastructure to safer locations. Change how land is used.	



Beachmere foreshore

4. How we can adapt

Adaptation options

Six themes of adaptation options have been defined for the Plan, with a range of options that relate to avoiding, mitigating and managing the risk of coastal hazards. The themes are:

1. Region-wide initiatives to enhance custodianship
2. Planning updates
3. Maintaining and improving infrastructure
4. Environmental protection, maintenance and enhancement
5. Coastal engineering and nature-based solutions
6. Coastal engineering

The range of common adaptation options across these themes are described in Table 7. More detailed descriptions of the options are provided in Supplement C to the Plan, along with preliminary screening of the relevance of options to different localities.

Table 7. Adaptation options by theme

Theme	Adaptation options	Description	Supplement C summary sheet number
Region-wide initiatives to enhance custodianship	Community custodianship	Developing programs and partnerships to enhance custodianship of the coastline	Sheet 1
	Education and knowledge sharing	Facilitating knowledge sharing and education on coastal values, hazards and adaptation	Sheet 2
	Monitoring	Monitoring changes in coastal hazard risk and effectiveness of adaptation.	Sheet 3
Planning	Place-based planning and planning scheme	Informing statutory planning and strategies Local Resilience Planning	Sheet 4
	Disaster management	Updating emergency response planning	
Maintaining and improving infrastructure	Increase infrastructure resilience	Modifying critical infrastructure (e.g. raising floor levels) Modifying drainage networks Resilient homes	Sheet 5
	Relocate infrastructure	Relocating critical infrastructure	
Environmental protection, maintenance and enhancement	Dune protection and maintenance	Minimising dune disturbance, maintaining vegetation	Sheet 6
Coastal engineering and nature-based solutions	Beach nourishment	Beach scraping and / or importing additional sand to the beach	Sheet 7
	Living shorelines	Create a zone for wave energy to break and dissipate	Sheet 8
Coastal engineering	Structures to assist with sand retention	Using structures (groynes, sand fencing) to help retain sand	Sheet 9
	Structures to dissipate wave energy	Constructing offshore breakwaters or artificial reefs to dissipate wave energy (submerged or exposed)	Sheet 10
	Last line of defence structures	Constructing seawalls / revetments	Sheet 11
	Structures to minimise inundation	Constructing levees / dykes	Sheet 12

5. Adaptation response by sub-region

An adaptation response and pathway has been assigned for each sub-region across the Moreton Bay region. Further detailed adaptation response and pathways have been developed for localities within the sub-regions and are presented in Section 6.

The adaptation response takes into consideration what is at risk (land and assets), and how the risk is changing over time – the emerging risk profile (present day, 2050 and 2100) (Table 8).

Active management is already ongoing at a number of locations, typically in response to shoreline erosion. By 2100, there are some limited properties across the region where coastal hazard risk is intolerable and transition to an alternative land use may be appropriate (due to increasing coastal hazard risk), subject to the outcome of initial priority adaptation actions for these locations.

Woorim Beach

5. Adaptation response by sub-region

Table 8. Adaptation response by reporting sub-regions (all coastal hazards)

Reporting sub-region	Present day	2050	2100	Comment
Bribie Island	Actively manage	Actively manage	Transition and change*	Active mitigation of erosion at known hotspot locations for Woorim. Active mitigation of tidal and storm tide inundation for residential areas, roads and at-risk infrastructure, including access to Bribie Island. If a resilient built form cannot be achieved by 2050, planning would need to commence for a potential transition plan for limited properties at Bongaree.
Pumicestone Passage	Actively manage	Actively manage	Transition and change*	Active mitigation of tidal and storm tide inundation for residential areas, roads and at-risk infrastructure, including access to Toorbul. If a resilient built form cannot be achieved by 2050, planning would need to commence for a potential transition plan for limited properties at Toorbul.
Northern Moreton Bay	Actively manage	Actively manage	Transition and change*	Active mitigation of tidal and storm tide inundation for residential areas, roads and at-risk infrastructure, including access to Beachmere. If a resilient built form cannot be achieved by 2050, planning would need to commence for a potential transition plan for limited properties at Beachmere.
South Deception Bay	Monitor (Look and learn)	Actively manage	Actively manage	Active mitigation of tidal and storm tide inundation for residential areas, roads and at-risk infrastructure.
Peninsula and Pine River	Avoid (and maintain)[1]	Monitor (Look and learn)[1]	Actively manage[1]	Inundation hazard risk (tidal and storm tide) for the Peninsula area is expected to remain low by 2100. Minimal infrastructure and buildings are likely to be impacted by 2100. Dohles Rocks (Griffin) presently has inundation risk (tidal and storm tide) for the residential area, roads and infrastructure that needs to be actively managed. If a resilient built form cannot be achieved, planning would need to commence for potential transition plan for limited properties and will need to follow a more advanced adaptation response pathway.
Estuarine areas	Avoid (and maintain)	Avoid (and maintain)	Monitor (Look and learn)	Inundation hazard risk (tidal and storm tide) is expected to remain low by 2100. Minimal infrastructure and buildings are likely to be impacted by 2100.

** Transition response may be appropriate for limited properties within the sub-region only.*

[1] Dohles Rocks to follow a more advanced adaptation pathway of actively manage now progressing to transition and change (beyond 2050).

5.1 Determining adaptation actions

A range of adaptation actions have been defined to enable a strategic approach to coastal hazard adaptation across the Moreton Bay region. A suite of priority actions across the six themes (Table 7) have been defined at:

- The regional scale (outlined in Section 5)
- the locality scale as part of the adaptation response pathway (outlined in Section 66).

The program of priority actions has been informed by the initial screening of options based on community priorities, as well as a detailed cost-benefit analysis for tailored coastal engineering options.

Baseline actions of dune protection and maintenance, and mangrove protection and enhancement, will be critical for increasing resilience, and there is benefit in commencing trials early to monitor effectiveness and update economic assessments accordingly in the future.

Actions across capacity building, land use planning, and commencing nature-based trials and adaptation options are the core focus for most localities, combined with some site-specific targeted investigations to inform future updates of the adaptation pathways.

Adaptation requirements may also change over time and should be the subject of future Plan updates.

5.2 Region-wide actions summary

The Coastal Hazard Adaptation Strategy priority actions across the region include a range of actions relevant to the six themes identified for the Plan:

1. Enhancing community custodianship
2. Planning
3. Maintaining and improving infrastructure
4. Environmental protection, maintenance and enhancement
5. Coastal engineering and nature-based solutions
6. Coastal engineering

Priority region-wide 10 year actions for each of these themes are summarised in Table 9, with some additional information / guidance in Supplement C to the Plan.

Adaptation response and actions specific to different localities across the region are provided in the location summaries (Section 6).

5. Adaptation response by sub-region

Table 9. Region-wide actions

Adaptation actions	2023 Priority strategic actions (completed within 10 years)
1. Region-wide initiatives to enhance custodianship	
1.1 Community stewardship	1.1.1 Establish coastal resilience program. Designated Program Lead (Coastal Planning and Policy) for the stewardship program and broader Coastal Hazard Adaptation Strategy implementation.
	1.1.2 Support experiences and activities that enable restoration and protection of natural areas and wildlife habitats to ensure our special natural areas and wildlife habitats are connected, protected and enhanced.
	1.1.3 Review social vulnerability mapping and identify actions to enhance resilience in particular related to inundation hazards and access/services disruption.
	1.1.4 Review infrastructure and technology needs to reduce impacts on communities from access disruption linked to inundation events.
	1.1.5 Continue to support and prepare local businesses to respond to emergencies and build longer term resilience.
	1.1.6 Seek co-funding / resources for further initiatives.
1.2 Knowledge sharing	1.2.1 Continue to partner with First Nation representatives to understand their needs, aspirations and involvement in coastal hazard adaptation, including the identification of cultural values, management of significant sites, supporting their ongoing role in caring for country and informing future adaptation approaches.
	1.2.2 Develop a coastal management communication and engagement plan and associated materials to deliver coastal hazard preparedness to empower local businesses, industry and the community to make informed decisions.
	1.2.3 Prepare a strategic approach to guide stakeholder education for engagement on coastal environmental values, including restoration and enhancement outcomes.
	1.2.4 Formalise and coordinate information sharing and accessibility to relevant hazard exposure data within Council and between Council and state agencies.
1.3 Monitoring	1.3.1 Support the continuation of photo point monitoring system (CoastSnap) at key locations, maintain the data platform / website and utilise this data to inform implementation of the shoreline management actions and identify emerging maintenance issues.
	1.3.2 Develop and integrate CHAS implementation evaluation governance and metrics into existing monitoring programs including the region-wide, coastal areas drone survey and CoastSnap to measure performance.
	1.3.3 Establish drone survey (elevation and aerial imagery) monitoring (every 2 – 3 years), or other tailored monitoring and reporting needed to inform adaptive management.
	1.3.4 Develop a framework to monitor the long-term impact of climate change on key environmental areas (endangered and essential habitat for vulnerable wildlife) to inform coastal management at these locations and surrounding areas.
	1.3.5 Through the implementation of the Living Coast Plan and Biodiversity Plan, establish arrangements for monitoring that identifies coastal environmental threats (including due to sea level rise) and changes to biodiversity conditions.

Adaptation actions	2023 Priority strategic actions (completed within 10 years)
1. Region-wide initiatives to enhance custodianship	
1.4 Research	1.4.1 Establish collaboration with key universities and research centres to progress relevant actions in the Plan.
	1.4.2 Apply for funding grants for relevant actions.
	1.4.3 Develop a research and delivery partnership / collaboration to implement pilot studies which demonstrates nature-based solutions identified from shoreline erosion management plan updates.
2. Planning	
2.1 Place-based planning and planning scheme	2.1.1 Use the Plan (including coastal hazard mapping and emerging risk information) to inform all relevant corporate and operational policy and planning matters across Council.
	2.1.2 Review CHAS outputs as part of considering content for inclusion in a new planning scheme, including erosion prone areas and storm tide hazard mapping for planning scheme purposes.
	2.1.3 Review future development and infrastructure servicing options for urban areas subject to 2100 Highest Astronomical Tide (HAT).
	2.1.4 Undertake prioritised place-based Local Resilience Plans and determine triggers for relocation of specific foreshore assets and / or coordinated adaptation and transition planning (as specified in locality pathways).
2.2 Disaster management	2.2.1 Review disaster management plans using updated erosion prone area and storm tide inundation mapping, the CHAS risk assessment, and information on economic implications.
	2.2.2 Review the long-term adequacy of evacuation facilities and evacuation routes for different coastal hazard adaptation planning horizons.
3. Maintaining and improving infrastructure	
3.1 Increasing infrastructure resilience	3.1.1 Embed coastal hazard risk information (across all planning horizons) into asset planning and management to identify Council assets at risk and to inform appropriate maintenance requirements, renewal timeframes, potential relocation and future design considerations.
	3.1.2 Develop / update design standards and guidelines for infrastructure including stormwater drainage assets, wastewater assets, water assets, community and cultural assets, property assets, ICT assets, roads, fleet assets, marine assets, parks and open space assets, so service standards can continue to be met at 2050 and 2100.
	3.1.3 Review opportunities to improve drainage networks in locations where the risk of inundation for infrastructure is high (embedded within asset management plan).
	3.1.4 Investigate bridge conditions and marine trafficability relating to coastal hazard risk as part of the asset renewal.
	3.1.5 Promote resilient and sustainable design principles within the community and building sector (link in with action 1.2).
3.2 Relocate infrastructure	3.2.1 Relocate specific assets, where defined in adaptation pathways as part of asset renewal process.
4. Environmental protection, maintenance and enhancement	
4.1 Dune and vegetation protection and maintenance	4.1.1 Undertake dune, wetland and riparian enhancement and management in areas identified in location specific adaptation pathways.
4.2 Environmental protection	4.2.1 Coastal management plans for the ongoing survival of key terrestrial and marine species that use Moreton Bay and its coastal areas, particularly those already under threat, by considering how management decisions impact their distribution, habitat and life-cycle requirements.

5. Adaptation response by sub-region

Adaptation actions	2023 Priority strategic actions (completed within 10 years)
4. Environmental protection, maintenance and enhancement	
4.2 Environmental protection	4.2.2 Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.
	4.2.3 Protect, maintain and manage creeks, waterways and wetlands as natural systems so they are healthy, thriving and resilient to the impacts of climate change.
	4.2.4 Investigate the implications of sea level rise on coastal environmental values, wetlands and coastal vegetation.
5. Coastal engineering and nature-based	
5.1 Beach nourishment	5.1.1 Scope for potential future works, in accordance with adaptation pathway planning.
	5.1.2 Investigate cost-effectiveness and environmental soundness of sand sources for beach nourishment / back-passing.
	5.1.3 Identify key areas for long term ongoing beach nourishment / back-passing.
5.2 Living shorelines	5.2.1 Pilot coastal environmental enhancement projects that improve environmental values and provide protection from coastal hazards (as per location-based actions). These areas should focus where existing seawalls are adjacent to significant environmental areas.
6. Coastal engineering	
6.1 Coastal hazard reduction	6.1.1 Undertake stormwater and drainage investigations, planning and design upgrades at identified areas in location specific pathways and incorporate into shoreline erosion management planning.
6.2 Coastal hazard protection works	6.2.1 Review, develop and implement shoreline erosion management planning (SEMP) to align with the directions of the Living Coast Plan and that incorporates location specific actions (use the Plan to support Cost Benefit Analysis for priority sites).
	6.2.2 Investigate flooding solutions / concept options including backflow prevention devices at priority areas to inform adaptation pathway planning at relevant locations.
	6.2.3 Undertake investigation on canal estate requirements for sea level rise adaptation including stability and design standards for revetment walls.
	6.2.4 Develop a region-wide approach and guidance for integrating stormwater drainage and outfall upgrades into concept design upgrades of future coastal protection works in main urban coastal areas.
	6.2.5 Continue to implement seawall prioritisation works into present day capital work planning and embedded in adaptation pathways for relevant locations.

Woorim Beach

6. Locality summaries

The Plan focuses on key localities that are at risk of coastal hazards in the present day and at greater risk into 2100. Adaptation pathways for these key localities are summarised in the following sections.

6.1 Bribie Island sub-region

The sub-region of Bribie Island includes the suburbs of Woorim, Bongaree, Bellara, Banksia Beach, White Patch and Welsby (Figure 10). Pumicestone Passage is located between Bribie Island and the mainland, and the island is connected via Bribie Island Bridge. There are canal estates at Bongaree, Bellara and Banksia Beach.

Table 10. Adaptation response for Bribie Island (all coastal hazards)

Reporting sub-region	Present day	2050	2100
Bribie Island	Actively manage	Actively manage	Transition and change

Figure 10. Reporting sub-region – Bribie Island

6. Locality summaries

LOCALITY 1: Woorim

Woorim is located at the western side of Bribie Island and spreads for 3 km along the beach (Figure 11). The Woorim community highly value living on the coast and accessing the natural environments. Its coastal areas support an abundance of marine wildlife, including turtles, shorebirds and dugong. Woorim Beach is also known as important nesting habitat for endangered loggerhead turtles. Other highly valued places include the Woorim foreshore, beaches and beachside facilities such as parks and walking tracks. Woorim is one of two beaches in the region with a wheelchair accessibility ramp and beach matting.

The Woorim community already observes and experiences some impacts of coastal hazards. The Woorim foreshore is likely to be increasingly exposed to open coast erosion into the future. Tidal inundation areas and those prone to

temporary storm tide inundation may also expand up Freshwater Creek Lagoon. Assets at risk include public infrastructure in the foreshore area and environmental areas.

The present day adaptation response for Woorim is to continue to actively manage coastal hazard risk, and begin preparations for additional hazard mitigation and planning for impacts including potential transition of the foreshore use in the future.

The adaptation pathway includes a focus on protecting and enhancing the existing natural coastal hazard defences (the dune system) and undertake beach nourishment campaigns when necessary.

Review of the adaptation pathway will be ongoing and guided by the outcome of present day actions (Table 11). Region-wide actions also apply where relevant to this locality

Figure 11. Woorim

Table 11. Woorim adaptation pathway

Sea level rise projections

	Present day	2050 (0.3m)	2100 (0.8m)
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Community stewardship	Continue stewardship program / initiatives.		
Monitoring	Establish photo-point (CoastsSnap) monitoring system.		
Planning	As per region-wide actions as applicable identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions as applicable identified in Table 35.		
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Dune and vegetation protection and maintenance	Support community dune protection initiatives.		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Beach nourishment	Review and implement Shoreline Erosion Management Plan. Review the effectiveness of current Woorim Beach sand back-passing trial. Continue beach nourishment program at key locations.	Review and consider a long-term program for beach nourishment and maintenance.	
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works		If sand back-passing is not providing adequate protection, investigate last line of defence structures (e.g. seawall, revetment). Establish triggers for implementation. If triggered, prepare design and approvals for last line of defence structure (if applicable).	If triggered, implement last line of defence structures (if applicable).

6. Locality summaries

LOCALITY 2: Bongaree

Bongaree is located towards the southern end of Bribie Island (Figure 12). Bongaree Beach is a narrow low energy beach that is approximately 3 km long. It is subject to wave and tidally driven sediment transport that moves slowly north along the beach. This section of the shoreline currently has a seawall and groynes to protect it.

The coastal zone between the Bongaree town centre and the bridge includes a continuous road, foreshore reserve, fishing jetty, boat ramp, visitor facilities and canal estate.

Other highly valued places include Buckley's Hole Conservation Park to the south of the town centre. Important infrastructure includes the Bribie Island Bridge, Bribie Island Retirement Village, RSL Care Bongaree, Bribie Island High School, and future Bribie Island Satellite Hospital.

The Bongaree community already observes and experiences some impacts from coastal hazards. Tidal inundation is the greatest threat and could affect evacuation routes. Low-lying areas are also vulnerable to storm tide and facing increasing risk from these hazards into the future.

The present day adaptation response for Bongaree is to actively manage coastal hazard and begin preparations for additional hazard mitigation in the future. If a resilient built form cannot be achieved by 2050, planning would need to commence for potential transition for limited areas of Bongaree.

The adaptation pathway includes a focus on maintaining existing shoreline protection works, trialling a living shoreline design, and reviewing the adaptation pathway over time and considering future alternatives (Figure 12). Region-wide actions also apply where relevant to this locality.

Buckley's Hole Conservation Park, Bongaree

Figure 12. Bongaree

Table 12. Bongaree adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Monitoring	Establish photo-point (CoastSnap) monitoring system.		
Knowledge sharing	Promote the benefits of nature based coastal management and resilient homes.		
Planning	As per region-wide actions as applicable identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
Relocate infrastructure		Prepare Asset Management Plan to consider extent / use of the foreshore land and assets in the coastal hazard area, and alternatives for the future.	Implement relocation of assets in accordance with the Asset Management Plan (if feasible).
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat south of Bongaree.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Living shoreline pilot site - develop concept design and monitoring plan for living shoreline in front of South Esplanade (link to action 1.3.3). Implement living shoreline design. Review the effectiveness of living shoreline design.	If successful, continue to implement living shoreline design and expand as necessary. Review of effectiveness of living shoreline design. If living shoreline does not achieve expected level of service, consider hybrid or other solutions. Review pathway options and establish triggers for change of pathway.	Review of effectiveness of living shoreline design. Review pathway options.
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Shoreline Erosion Management Plan. Maintain existing shoreline protection works. Implement seawall prioritisation works at Welsby Parade.	If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable)

6. Locality summaries

LOCALITY 3-6: Bellara, Banksia Beach, White Patch, Welsby

Bellara, Banksia Beach, White Patch and Welsby are located on the western side of Bribie Island (Figure 13). They are separated from the mainland by the Pumicestone Passage and backed by the Bribie Island National Park on the eastern part of the localities. White Patch is connected to Banksia Beach via Wrights Creek bridge.

Sylvan Beach runs along the Bellara foreshore with a number of parks spread along the beach. The land uses for both Bellara and Banksia Beach are mostly residential and canal estates. Banksia Beach also features Kakadu Beach Bird Sanctuary which is an important high-tide refuge site for endangered migratory and local birds. The majority of White Patch is undeveloped land being within the Bribie Island National Park. The shoreline along Bellara and Banksia Beach has existing vegetated foreshore and sections of additional protection works including seawalls and revetments. Revetment walls are present along the canal estate waterfront areas.

Assets that may be at risk if mitigation actions are not maintained or upgraded include the public foreshore infrastructure, the access road, some private assets, and the sandy beach. Low-lying areas and canal systems may also be increasingly exposed to tidal, storm tide and co-incidental flooding in the future. Low-lying areas may be at risk from long term inundation hazards.

The present day adaptation response for Bellara, Banksia Beach, White Patch and Welsby is to continue to actively manage coastal hazard risk and begin preparations for additional hazard mitigation and potential transition of the foreshore land use in the future.

The adaptation pathway includes a focus on maintenance of existing shoreline protection works, reviewing the pathway over time and considering future alternatives including new protection works for critical assets (Table 13). Region-wide actions also apply where relevant to these localities.

Figure 13. Bellara, Banksia Beach, White Patch and Welsby

Table 13. Bellara, Banksia Beach, White Patch and Welsby adaptation pathway

Sea level rise projections

	Present day	2050 (0.3m)	2100 (0.8m)
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions identified in Table 35.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience		Investigate White Patch level of sevice in terms of access (bridge) and services. Work with the Queensland Government and utility providers to investigate the impact of coastal hazards on the serviceability of Bribie Island Bridge. For bridges over canals investigate the ability to maintain marine trafficability.	Implement bridge upgrades or renewal (if necessary).
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Undertake environmental enhancement and vegetation maintenance along the Bellara Foreshore and White Patch.	If environmental enhancement and vegetation maintenance does not achieve the expected level of service, consider hybrid or other solutions. Review pathway options and establish trigger for change of pathway.	Review pathway options.
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Implement seawall prioritisation works at Solander Esplanade and Sylvian Beach Esplanade (Bellara Foreshore Project). Develop concept designs for upgrading seawalls (Bellara only).	If triggered, upgrade seawalls and maintain seawall infrastructure (if applicable).	If water levels at canal estate are too high too often by 2100, undertake feasibility study for potential tidal barrier for canal estates.

6. Locality summaries

6.2 Pumicestone Passage sub-region

The sub-region of Pumicestone Passage includes the suburbs of Donnybrook, Meldale, Toorbul and Ningi (Figure 13). Located on the mainland, its coastline borders the Pumicestone Passage waterway. Elimbah Creek flows through Meldale, joining the Passage north of Toorbul. Ningi Creek lies adjacent to Ningi and joins the Pumicestone Passage at the southern end of Toorbul. The communities in this sub-region have smaller populations than other coastal areas in Moreton Bay. Therefore, there are less built assets than other areas at risk from coastal hazards. This sub-region also hosts an abundance of marine wildlife, including dugongs, and shorebirds that nest on the shoreline.

Table 14. Adaptation response for Pumicestone Passage (all coastal hazards)

Reporting sub-region	Present day	2050	2100
Pumicestone Passage	Actively manage	Actively manage	Transition and change

Figure 13. Reporting sub-region – Pumicestone Passage

6. Locality summaries

LOCALITY 7: Donnybrook

Donnybrook is situated in the middle of Pumicestone Passage, on the western side (Figure 14).

Existing areas of mangroves span the majority of the coastal and estuarine frontage and provide protection for adjacent land and assets from erosion and inundation hazards.

A limited extent of low-lying land on the northern end of the residential area around the estuarine frontage is likely to become further exposed to storm tide inundation and expanding tidal areas in the future.

The present day adaptation response for Donnybrook is to continue actively managing coastal hazard risks, and begin preparations for additional hazard mitigation including potential transition of the foreshore use in the future.

The adaptation pathway includes a focus on protecting the existing natural coastal hazard defences (mangroves and vegetation), reviewing the adaptation pathway over time and considering future alternatives (Table 15). Region-wide actions also apply where relevant to this locality.

Figure 14. Donnybrook

Table 15. Donnybrook adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Knowledge sharing	Focus on action 1.2.3 – enhance signage on hazards and coastal environmental values.		
Planning	As per region-wide actions, including:		
Place-based planning	Develop place-based Local Resilience Plan for foreshore areas of Donnybrook to assist with coordinated adaptation and transition planning in the long-term.		Review adaptation pathway and reduce 2100 approach to "actively manage" if a resilient built form for very high intolerable risk properties is achieved.
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
Environmental protection, maintenance and enhancement	As per region-wide actions identified in Table 35.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement Shoreline Erosion Management Plan.		

6. Locality summaries

LOCALITY 8: Meldale

Meldale is bounded by Bullock Creek to the north and Elimbah Creek to the south and east (Figure 15). Residents value access to the coastline for water-based recreation, such as fishing and boating.

Existing areas of mangroves along the frontage are providing protection for adjacent land and assets from erosion and inundation hazards.

Low-lying areas are likely to be exposed to more frequent storm tide inundation and expanding tidal areas in the future. However, very limited public or private assets are expected to be impacted.

The present day adaptation response for Meldale is to continue actively managing coastal hazard risks and begin preparations for additional hazard mitigation and potential transition of the foreshore land use in the future.

The adaptation pathway includes a focus on maintaining and enhancing existing natural coastal hazard defences (mangroves and vegetation) and reviewing the adaptation pathway over time (Table 16). Region-wide actions also apply where relevant to this locality.

Elimbah Creek, Meldale

Figure 15. Meldale

Table 16. Meldale adaptation pathway

Sea level rise projections

	Present day	2050 (0.3m)	2100 (0.8m)
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Knowledge sharing	Focus on action 1.2.3 – enhance signage on hazards and coastal environmental values.		
Planning	As per region-wide actions, including:		
Place-based planning	Develop place-based Local Resilience Plan for the foreshore areas of Meldale to assist with coordinated adaptation and transition planning in the long-term.		Review adaptation pathway and reduce 2100 approach to “actively manage” if a resilient built form for very high intolerable risk properties is achieved.
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
Environmental protection, maintenance and enhancement	As per region-wide actions identified in Table 35.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions identified in Table 35.		

6. Locality summaries

LOCALITY 9: Toorbul

Toorbul is located on the western side of Pumicestone Passage with Bribie Island to the east. It is bounded on the east by Pumicestone Channel, to the north by Elimbah Creek and the south by Ningi Creek. Parrot Island and Shag Island are low flat islands immediately off the coast within the locality (Figure 16). Toorbul is also an important shorebird habitat with several roosting sites along The Esplanade.

The shoreline includes mangroves, pockets of beaches, and sections of protection works, backed by the main access road. Some sections of existing revetment are undergoing upgrades and extensions are currently planned. Existing areas of mangroves along the frontage are providing protection for adjacent land and assets from erosion and inundation hazards.

There is no immediate coastal erosion threat to the Toorbul foreshore, but some areas may become threatened by projected sea level rise in the future.

Low-lying areas may also be increasingly exposed to tidal and storm tide inundation. Assets that may be at risk include public foreshore infrastructure, some private assets, and access roads.

Important infrastructure includes Toorbul Community Hall, Toorbul Fire Station Metro and Toorbul Community and Sports Centre.

Pumicestone Road is the only local connector road connecting Toorbul and when cut means that Toorbul becomes an isolated community.

The present day adaptation response for Toorbul is to continue to actively manage coastal hazard risk, and begin preparations for additional hazard mitigation and potential transition of the foreshore use in the future. If a resilient built form cannot be achieved by 2050, work would need to commence for a potential transition plan for very high intolerable risk areas of Toorbul.

The adaptation pathway includes a focus on mangrove protection and enhancement, trialling a living shoreline design, maintenance and upgrades for foreshore protection works, reviewing planning controls, resilient homes, and drainage upgrades (Table 17).

Review of the adaptation pathway will be ongoing and guided by the outcome of present day actions. Region-wide actions also apply where relevant to this locality.

Figure 16. Toorbul

Table 17. Toorbul adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions identified in Table 35.		
Planning updates	As per region-wide actions, including:		
Place-based planning	Develop place-based Local Resilience Plan for the foreshore areas of Toorbul to assist with coordinated adaptation and transition planning in the long-term.		Review adaptation pathway and reduce 2100 approach to "actively manage" if a resilient built form for very high intolerable risk properties is achieved.
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes and public infrastructure within the community and building sector (link in with action 1.2).		
	Review opportunities to improve drainage networks and backflow prevention devices where the risk of inundation is high (embedded within asset management plan). The drainage network including stormwater run-off and tidal inundation to be investigated as part of the Local Resilience Plan.		
Relocate infrastructure	Undertake feasibility study for drainage upgrades and road/services raising for Pumicestone Road or alternative adaptation options. Assess septic system vulnerability to coastal hazards.	Implement drainage upgrades and road/services raising. Prepare Asset Management Plan to consider extent/use of the foreshore land and assets in the coastal hazard area, and alternatives for the future.	Implement relocation of assets in accordance with Asset Management Plan (if feasible).
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant shorebird habitat.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Living shoreline pilot site - develop concept design and monitoring plan for living shoreline in front of The Esplanade (link to action 1.3.3). Implement living shoreline design. Review effectiveness of living shoreline design. Progress hybrid solution detailed design at The Esplanade and seek grant funding for oyster reef (hybrid solution).	Review of effectiveness of living shoreline design. Implementation hybrid solution at The Esplanade. If living shoreline does not achieve expected level of service, consider hybrid or other solutions. Review pathway options and establish triggers for change of pathway.	Review of effectiveness of living shoreline design. Review pathway options.
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement Shoreline Erosion Management Plan. Maintain existing shoreline protection works. Implement seawall prioritisation works at Pumicestone Road and The Esplanade.	Implement seawall prioritisation works at The Esplanade. Concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement wall raise. Implement additional structural protection or upgrades (if applicable)

6. Locality summaries

LOCALITY 10: Ningi

Ningi is located on the southwestern side of Pumicestone Passage with Bribie Island to the east. Ningi is bounded to the north by Ningi Creek, to the east by Sandstone Point and to the south by Godwin Beach (Figure 17).

Existing areas of mangroves along the frontage of the main Ningi community are providing protection for adjacent land and assets from erosion and inundation hazards.

Low-lying areas are likely to be exposed to storm tide inundation and expanding tidal areas in the future. However, very limited public or private assets are expected to be impacted.

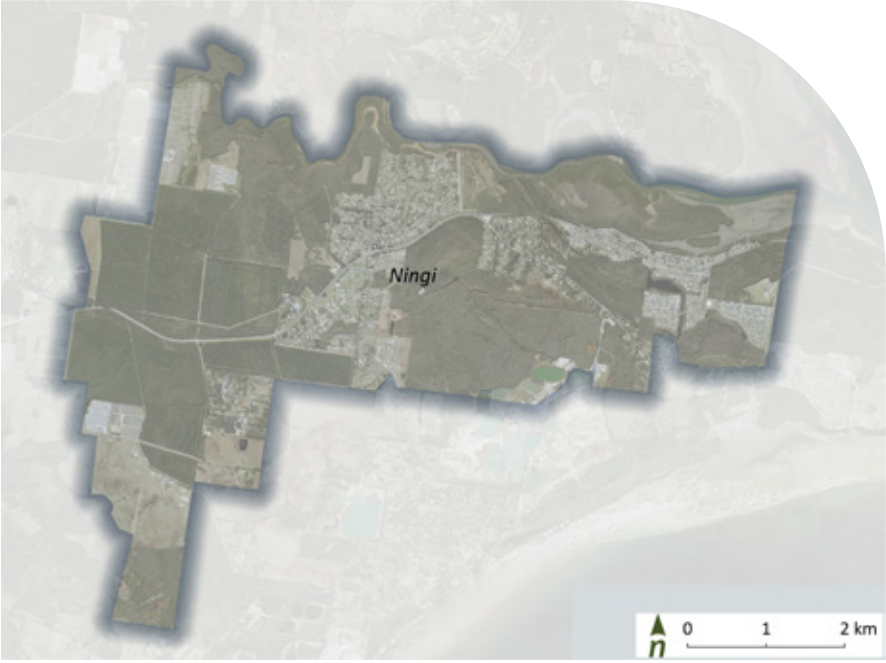


Figure 17. Ningi

The adaptation response for Ningi is to continue to actively manage coastal hazard risk. The adaptation pathway includes a focus on protecting existing natural coastal hazard defences (mangroves and vegetation) and reviewing the adaptation pathway over time (Table 18). Region-wide actions also apply where relevant to this locality.

Table 18. Ningi adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Knowledge sharing	Focus on action 1.2.3 – enhance signage on hazards and coastal environmental values.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
Environmental protection, maintenance and enhancement	As per region-wide actions identified in Table 35.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions identified in Table 35.		

6.3 Northern Moreton Bay sub-region

The reporting sub-region of Northern Moreton Bay includes the suburbs of Godwin Beach, Sandstone Point and Beachmere (Figure 18). The mouth of Pumicestone Passage is situated east of Sandstone Point, and the Caboolture River mouth opens up south of Beachmere, both of which open up into Moreton Bay. This coastline hosts a mix of developed areas, sandy beaches and mangroves, wetlands and lakes along the coastal zone.

Due to its proximity to the coastline, residents highly value access to the coast and its natural, family-friendly places, opportunities for recreation, and the associated coastal lifestyle.

The overall adaptation response for Northern Moreton Bay is presented in Table 19.

Table 19. Adaptation response for Northern Moreton Bay (all coastal hazards)

Reporting sub-region	Present day	2050	2100
Pumicestone Passage	Actively manage	Actively manage	Transition and change

Mangroves at Beachmere

Figure 18. Reporting sub-region – Northern Moreton

6. Locality summaries

LOCALITY 11: Godwin Beach

Godwin Beach is located to the west of Sandstone Point with a 500 m long beachfront settlement. The Godwin Beach foreshore is a 30 m wide grassy reserve lined with casuarina trees and a low sloping seawall and stormwater outlets. Godwin Beach is fringed by mangroves and fronted by an intertidal ridged sand flat approximately 1 km wide (Figure 19).

The shoreline is likely to be increasingly exposed to beach erosion. Low-lying areas may be exposed to storm tide inundation and expanding tidal areas in the future. However, very limited public or private assets are expected to be impacted.

The adaptation pathway includes a focus on mangrove protection and enhancement, trialling a living shoreline design, maintenance and upgrades for foreshore protection works, resilient homes and drainage upgrades to inform the long-term adaptation pathway for the area (Table 20).

Review of the adaptation pathway will be ongoing and guided by the outcome of present day actions. Region-wide actions also apply where relevant to this locality.

Godwin Beach foreshore

Figure 19. Godwin Beach

Table 20. Godwin Beach adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions as applicable.		
Education and knowledge sharing	Facilitate knowledge sharing and education on coastal values, hazards and adaptations (link with action 1.2).		
Planning	As per region-wide actions, including:		
Place-based planning	Continue to partner with First Nation representatives to manage Godwin Beach Reserve (link with action 1.2.1)		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Dune and vegetation protection and maintenance	Continue to partner with First Nation representative to undertake dune and riparian protection, enhancement and management using traditional approaches.		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat adjacent to the Godwin Beach urban area.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Living shoreline pilot site - develop concept design and monitoring plan for living shoreline in front of The Esplanade (link to action 1.3.3) Implement living shoreline design and review the effectiveness of living shoreline design.	If successful, continue to implement living shoreline design and expand as necessary. Review of effectiveness of living shoreline design. If living shoreline does not achieve expected level of service, consider hybrid or other solutions. Review pathway options and establish triggers for change of pathway.	Review of effectiveness of living shoreline design. Review pathway options.
Coastal engineering and nature-based	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Maintain existing shoreline protection works.	If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable).

6. Locality summaries

LOCALITY 12: Sandstone Point

Sandstone Point is situated along the eastern mainland coastline (Figure 20). Spinnaker Sound Marina, Turners Camp Island and a caravan park are located on the norther-eastern side of Sandstone Point, and mostly residential areas and Pebble Beach are situated to the south.

The south of Sandstone Point is at a higher elevation than the northern side. Hence, the low-lying areas may be increasingly exposed to erosion, storm tide inundation and expanding tidal areas in the future.

Across the foreshore area, a limited number of public assets including beach access and recreation infrastructure, and private assets including the caravan park, may be at risk from erosion and inundation by 2100.

The present day adaptation response at Sandstone Point is to actively manage coastal hazard risk.

The adaptation pathway includes a focus on mangrove protection and enhancement, trialling a living shoreline design, scoping of additional shoreline protection works and reviewing the adaptation pathway over time (Table 21). Region-wide actions also apply where relevant to this locality.

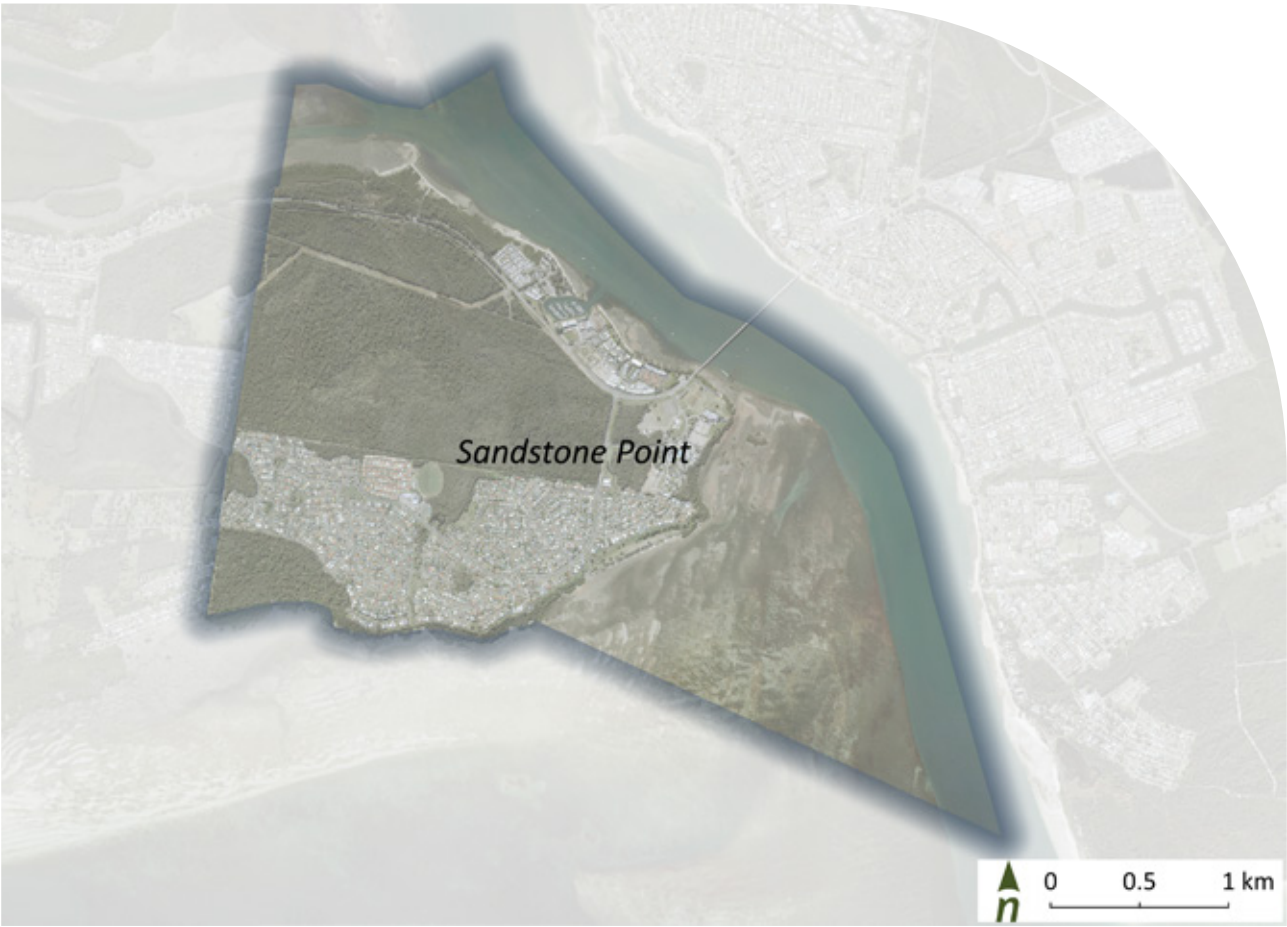


Figure 20. Sandstone Point

Table 21. Sandstone Point adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions identified in Table 35.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions identified in Table 35.		
Environmental protection, maintenance and enhancement	As per region-wide actions identified in Table 35.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Living shoreline pilot site - develop concept design and monitoring plan for living shoreline in front of Kalmakuta Drive Park (link to action 1.3.3) Implement living shoreline design. Review effectiveness of living shoreline design.	If successful, continue to implement living shoreline design and expand as necessary. Review of effectiveness of living shoreline design. If living shoreline does not achieve expected level of service, establish triggers for change of pathway.	Review of effectiveness of living shoreline design. Review pathway options.
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Maintain existing shoreline protection works.	If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable).

6. Locality summaries

LOCALITY 13: Beachmere

Beachmere is located in the northern section of Moreton Bay between Deception Bay and Godwin Beach (Figure 21). The beachfront settlement covers approximately 7 km of the shoreline. The beach consists of a narrow high tide strip of sand, fronted by 500 m wide low ridge sand flats.

Existing structures are in place to manage shoreline position and mitigate erosion, such as seawalls. Sections of existing public seawall have upgrades currently planned. The southern end of the shoreline is in a dynamic zone at the mouth of the Caboolture River.

Beachmere foreshore

This area is likely to be increasingly exposed to erosion and tidal and storm tide inundation into the future. Across the foreshore area, residential areas, roads and infrastructure may be at risk from erosion and inundation by 2100.

The present day adaptation response for Beachmere is to continue to mitigate coastal hazard risk and begin preparations for additional hazard mitigation and potential land use transition for very high intolerable risk areas. If a resilient built form cannot be achieved by 2050, planning would need to commence for a potential transition plan for very high risk areas of Beachmere.

The adaptation pathway includes a focus on protecting and enhancing vegetation, trialling a living shoreline design, maintaining existing protection works, reviewing the adaptation pathway over time and considering future alternatives (Table 22). Road and stormwater drainage upgrades are required to address the risk from rising sea levels and to reduce isolation of the community. Region-wide actions also apply where relevant to this locality.

Figure 21. Beachmere

Table 22. Beachmere adaptation pathway

	Sea level rise projections		
		0.3m	0.8m
	Present day	**2050**	**2100**
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Education and knowledge sharing	Facilitate knowledge sharing and education on coastal values, hazards and adaptation (link to 1.2).		
Planning	As per region-wide actions, including:		
Place-based planning	Develop place-based Local Resilience Plan for the foreshore areas of Beachmere to assist with coordinated adaptation and transition planning in the long-term.	Review adaptation pathway and reduce 2100 approach to "actively manage" if a resilient built form for very high intolerable risk properties is achieved.	
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
Relocate infrastructure	Undertake a feasibility study for drainage upgrades and road/ services raising for Beachmere Road or alternative adaptation options.	Implement drainage upgrades and road/services raising.	
		Prepare Asset Management Plan to consider extent / use of the foreshore land and assets in the coastal hazard area, and alternatives for the future.	Implement relocation of assets in accordance with Asset Management Plan (if feasible).
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Dune and vegetation protection and maintenance	Implement vegetation management plan in line with Beachmere Shoreline Management.		
Environment	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35		
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Maintain existing shoreline protection works. Implement and guide property owners in implementing the approved A-Line alignment, technical requirements and development approval pathways in line with *Beachmere Shoreline Management*. Implement seawall prioritisation works at Moreton Terrace, Timothy Esplanade, Bakers Flat Road and Biggs Avenue.	Establish triggers for implementation. If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable).

6. Locality summaries

6.4 South Deception Bay sub-region

The reporting sub-region of South Deception Bay includes the suburbs of Deception Bay, Rothwell, Newport and Scarborough (Figure 22). All these suburbs are situated close to the coastline, bordering Moreton Bay.

This coastline contains a mix of highly developed areas and sandy beaches as well as areas of mangroves and wetlands in the coastal zone.

Due to its proximity to the coastline, residents highly value access to the coast and its natural, family-friendly places, opportunities for recreation, and associated coastal lifestyle.

Table 23. Adaptation response for South Deception Bay (all coastal hazards)

Reporting sub-region	Present day	2050	2100
Pumicestone Passage	Monitor (Look and learn)	Actively manage	Actively manage

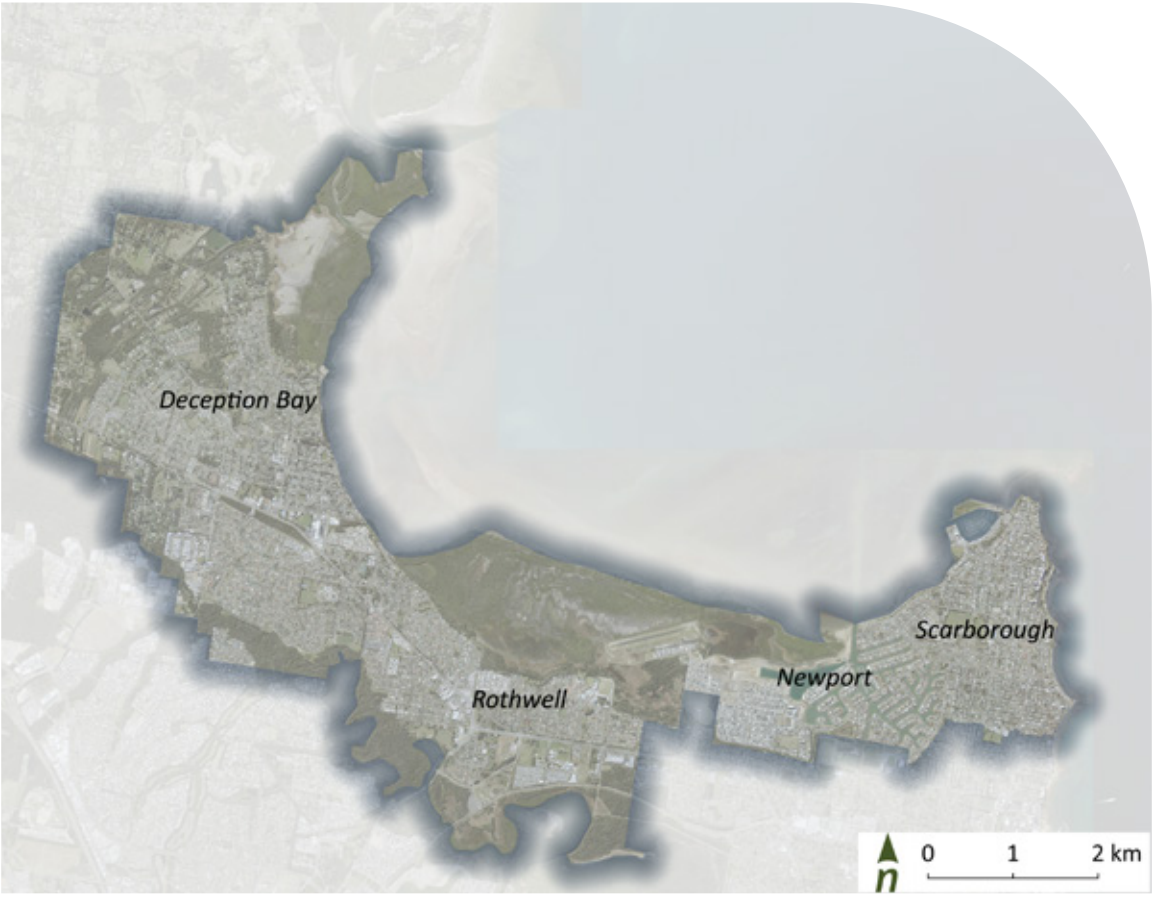


Figure 22. Reporting sub-region – South Deception Bay

Endeavour Park, Newport

6. Locality summaries

LOCALITY 14: Deception Bay

Deception Bay is situated in the south-western corner of the bay (Figure 23). Deception Bay also hosts a portion of the internationally significant Moreton Bay Ramsar site, which is of high ecological value and a key habitat for migratory shorebirds.

This section of the coast is likely to be increasingly prone to tidal and storm tide inundation in the future. Assets that may be at risk include public foreshore infrastructure, roads, some private assets, and the Moreton Bay Ramsar site.

The present day adaptation response for Deception Bay is to continue to monitor coastal hazard risks and begin preparations for additional hazard mitigation in the future.

The adaptation pathway includes a focus on protecting and enhancing vegetation, maintaining existing protection works, reviewing the adaptation pathway over time, and considering future alternatives (Table 24). Region-wide actions also apply where relevant to this locality.

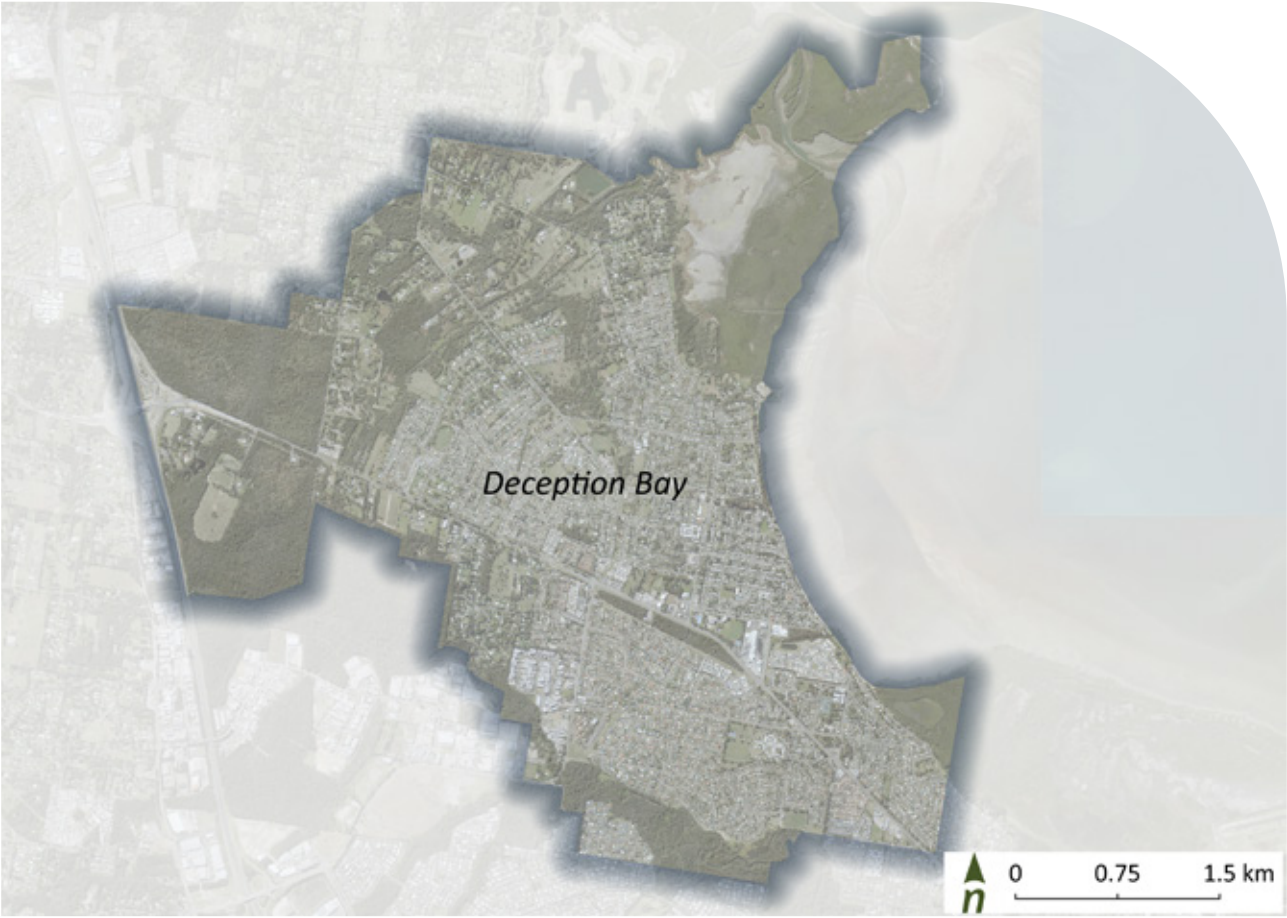


Figure 23. South Deception Bay

Table 24. Deception Bay adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Monitor (Look and learn)**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Community stewardship	Establish photo-point (CoastSnap) monitoring system.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions identified in Table 35.		
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Maintain existing shoreline protection works. Implement seawall prioritisation works at Esplanade.	Establish triggers for implementation. If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable).

6. Locality summaries

LOCALITY 15: Rothwell

Rothwell is situated in the west of the Redcliffe Peninsula. It is bounded by Deception Bay to the west and Saltwater Creek to the south and southwest (Figure 24). This area includes the Redcliffe Aerodrome and the largest portion of the internationally significant Moreton Bay Ramsar site, which spans the shoreline.

The mangroves provide a natural defence to erosion events. Across the foreshore area, a limited number of public assets, roads and infrastructure are at risk.

The present day adaptation response for Rothwell is to continue to monitor coastal hazard risk and begin preparations for additional hazard mitigation in the future.

The adaptation pathway includes a focus on mangrove protection and enhancement, environmental stewardship, reviewing the adaptation pathway over time and considering future alternatives (Table 25). Region-wide actions also apply where relevant to this locality.

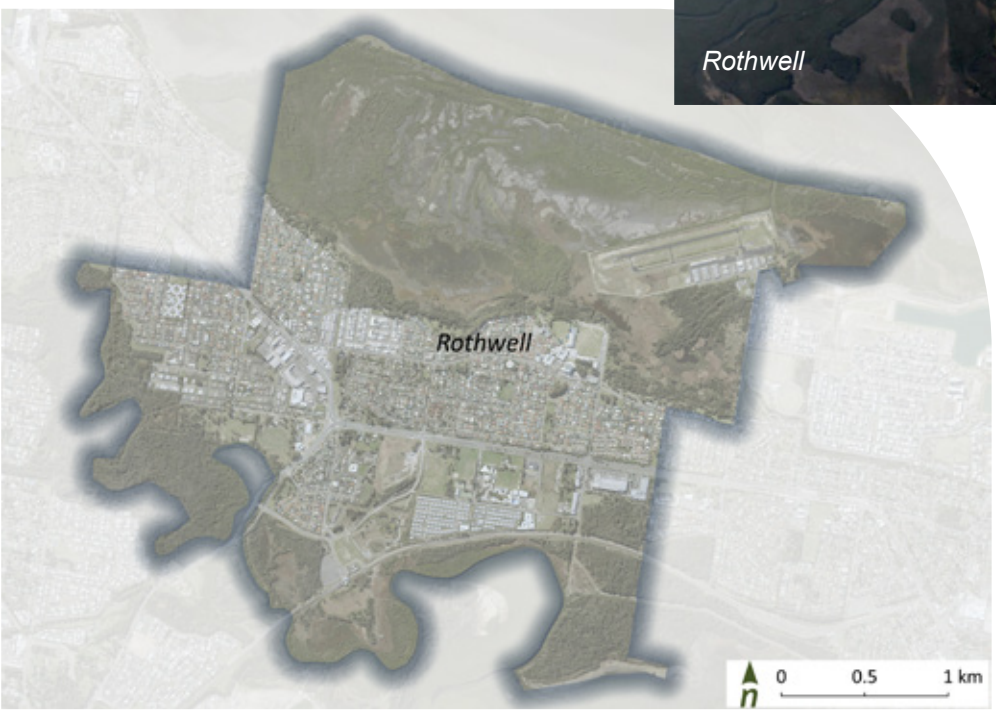


Figure 24. Rothwell

Table 25. Rothwell adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Monitor (Look and learn)**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Knowledge sharing	Focus on action 1.2.3 – enhance signage on hazards and coastal environmental values.		
Planning updates	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Relocate infrastructure	Prepare Asset Management Plan to consider works to the Redcliffe Aerodrome and Anzac Avenue for future use.		Implement works and / or relocation of assets in accordance with Asset Management Plan (if feasible).
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works		Establish triggers for implementation. If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable).

6. Locality summaries

LOCALITY 16: Newport

Newport is situated in the north of the Redcliffe Peninsula, including the canal estates of Newport Waterways, Stockland Newport and bayside frontage extending east (Figure 25).

Existing areas of mangroves along the bay frontage west of Newport Waterways are providing protection for adjacent land and assets from erosion and inundation hazards. The Newport Waterways canal estate areas have extensive shoreline infrastructure protection including seawalls and revetments.

Low-lying areas, including Endeavour Park, Oyster Point and bayside frontage to the east, are likely to be exposed to tidal and storm tide inundation in the future.

The present day adaptation response for Newport is to continue to actively monitor coastal hazard risk, and begin preparations for additional hazard mitigation in the future.

The adaptation pathway includes a focus on maintaining existing shoreline protection works, supporting property owners in increasing resilience, reviewing the adaptation pathway over time, and considering future alternatives including new protection works for critical assets (Table 26).

Figure 25. Newport

Table 26. Newport adaptation pathway

Sea level rise projections

	Present day	0.3m 2050	0.8m 2100
Adaptation response	**Monitor (Look and learn)**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions identified in Table 35		
Planning	As per region-wide actions identified in Table 35		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience		Investigate bridge conditions and marine trafficability.	
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	AAs per region-wide actions, including:		
Coastal hazard protection works	Maintain existing shoreline protection works.	Review pathway options. Establish triggers for implementation. If triggered, support property owners in undertaking concept planning for additional structural protection or upgrades to wall and private revetments at canal estate for increased resilience (if applicable).	If triggered, support property owners in implementing additional structural protection or upgrades (if applicable). If existing wall and private revetments at the canal estate do not offer the required level of protection by 2100, undertake a feasibility study for a potential tidal barrier for the canal estate.

6. Locality summaries

LOCALITY 17: Scarborough

Scarborough is the northern most locality on the Redcliffe Peninsula (Figure 26). Scarborough is spread over either side of the northern Reef Point. To the west is Jamieson Park and Scarborough Boat Harbour. Jamieson Park is a low energy, red gravely sandy high tide beach, fronted by a 300 m wide rock and sand flats and backed by a seawall and stormwater outlets.

Scarborough beaches are located on the east side of the point and face east of Moreton Bay. Scarborough Beach is bordered at both ends by groynes. It is backed by a large grassy foreshore with toilets, a picnic area and a playground.

Existing structures are in place to manage shoreline position and mitigate erosion, including groynes and seawalls. Low lying areas are prone to stormwater drainage issues during large tides and heavy rainfall.

Scarborough is likely to be increasingly exposed to erosion and tidal and storm tide inundation into the future. Across the foreshore area, public assets including beach access and recreation infrastructure, and private assets, may be at risk from erosion and inundation by 2100.

The present day adaptation response for Scarborough is to continue to actively monitor coastal hazard risk, trialling a living shoreline design, establish a pilot Local Resilience Plan, and begin preparations for additional hazard mitigation and potential land use transition for very high intolerable risk areas (Table 27). Region-wide actions also apply where relevant to this locality.

Scarborough Beach, Scarborough

Figure 26. Scarborough

Table 27. Scarborough adaptation pathway

Sea level rise projections

		0.3m	0.8m
	Present day	**2050**	**2100**
Adaptation response	**Monitor (Look and learn)**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Community stewardship	Establish photo-point (CoastSnap) monitoring system.		
Planning	As per region-wide actions, including:		
Place-based planning	Local Resilience Plan pilot site - develop place-based Local Resilience Plan for the Jamieson Park foreshore area to assist with coordinated adaptation and transition planning in the long-term.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
	Review opportunities to improve drainage networks and backflow prevention devices where the risk of inundation is high (embedded within asset management plan). Investigate the drainage network including stormwater run-off and tidal inundation as part of the Local Resilience Plan. This includes reviewing opportunities to improve overland flow paths to enhance the existing drainage network, especially at locations connecting to the bay.		
Environmental protection, maintenance and enhancement	As per region-wide actions identified in Table 35.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Living shoreline pilot site - develop concept design and monitoring plan for living shoreline in front of Oyster Point (link to action 1.3.3). Implement living shoreline Design. Review effectiveness of living shoreline design.	If successful, continue to implement living shoreline design and expand as necessary. Review of effectiveness of living shoreline design. If living shoreline does not achieve expected level of service, consider hybrid or other solutions. Review pathway options and establish triggers for change of pathway.	Review of effectiveness of living shoreline design. Review pathway options.
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Maintain existing shoreline protection works. Implement seawall prioritisation works at Oyster Point Esplanade, Reef Point Esplanade (Jamieson Park), Prince Edward Parade, Landsborough Avenue, Flinders Parade, Beach Park (groyne), Kennedy Esplanade and Fortune Street.	If triggered, undertake concept planning for additional structural protection or upgrades (if applicable).	If triggered, implement additional structural protection or upgrades (if applicable).

6. Locality summaries

6.5 Peninsula and Pine River

The reporting sub-region of Peninsula and Pine River includes the suburbs of Redcliffe, Margate, Woody Point, Clontarf and Griffin (Figure 27). These suburbs are situated close to the coastline, bordering Moreton Bay. The Pine River enters the Bay south of Griffin, and Hay's Inlet sits to the north of this entrance, between Griffin and Clontarf on the western side of Redcliffe Peninsula. This coastline contains many highly developed areas and sandy beaches along with areas of mangroves and wetlands in Hays Inlet and the Pine River.

The beaches along the coastline offer high recreational and natural value to the community, including structures such as the Redcliffe Jetty and Woody Point Jetty. The community also value the local character and lifestyle associated with living close to the coast and being able to safely access these coastal areas. Suttons Beach at Margate is one of two beaches in the region that provide a wheelchair ramp and beach matting. Many residential areas, community facilities, roads and walking paths are located within the coastal zone.

Table 28. Adaptation response for Peninsula and Pine River (all coastal hazards)

Reporting sub-region	Present day	2050	2100
Pumicestone Passage	Avoid (and maintain)	Monitor (Look and learn)	Actively manage

Figure 27. Reporting sub-region – Peninsula and Pine River

Suttons Beach, Margate

6. Locality summaries

LOCALITY 18: Redcliffe

Redcliffe is situated in the east northeast of the Redcliffe Peninsula, and takes in Drury Point, Queens Beach North, Queens Beach, Queens Beach South, Redcliffe Jetty, Redcliffe Point and Suttons Beach (Figure 28).

The Redcliffe foreshore is a sandy coastline with a relatively narrow dune system. Existing structures are in place to manage shoreline position and mitigate erosion, including a continuous seawall.

This section of the coastline is likely to be increasingly prone to erosion and tidal inundation in the future. Assets that may be at risk include public foreshore infrastructure, local roads, some private assets, and the natural sandy beach and dune system.

The present day adaptation response for Redcliffe is to avoid placing new development or assets in coastal areas and continue to monitor coastal hazard risk in the future.

The adaptation pathway includes a focus on avoiding placing new development or assets in high risk coastal areas and reviewing the adaptation pathway over time (Table 29). Region-wide actions also apply where relevant to this locality.

Figure 28. Redcliffe

Table 29. Redcliffe adaptation pathway

Sea level rise projections

	Present day	2050 (0.3m)	2100 (0.8m)
Adaptation response	**Avoid (and maintain)**	**Monitor (Look and learn)**	**Actively manage**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Community stewardship	Establish photo-point (CoastSnap) monitoring system.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Avoid placement of non-relocatable public assets along the dune, foreshore and beach areas at high risk of coastal hazards.		
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Dune and vegetation protection and maintenance	Undertake dune protection and enhancement.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Beach nourishment	Undertake a feasibility study for beach nourishment.		Undertake beach nourishment (if applicable).
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Maintain existing shoreline protection works. Implement seawall prioritisation works at Redcliffe Parade (Charlish Park), Prince Edward Parade, Redcliffe Point and Shields Street.		Review the effectiveness of existing shoreline protection works.

6. Locality summaries

LOCALITY 19-20: Margate and Woody Point

Margate and Woody Point are located directly south of Suttons Beach in the southeast of the Redcliffe Peninsula (Figure 29).

The Margate foreshore is backed by a continuous seawall and walkway. Towards the southern end is the Scotts Point Bathing Pavilion. Woody Point has

a rocky reef section and a narrow 200 m long beach to the east, and a south facing shoreline into Hays Inlet to the west.

Existing seawalls are in place to manage shoreline position and mitigate erosion for this section of the coastline.

The western side of Woody Point Jetty is likely to be increasingly prone to storm tide inundation in the future. Limited assets that may be at risk include public foreshore infrastructure, roads and private assets.

The present day adaptation response for Margate and Woody Point is to avoid placing new development or assets in coastal areas and continue to monitor coastal hazard risk in the future.

The adaptation pathway includes a focus on avoiding placing new development or assets in coastal areas and reviewing the adaptation pathway over time (Table 30). Region-wide actions also apply where relevant to this locality.

Figure 29. Margate and Woody Point

Table 30. Margate and Woody Point adaptation pathway

	Present day	2050 (Sea level rise projections 0.3m)	2100 (Sea level rise projections 0.8m)
Adaptation response	**Monitor (Look and learn)**	**Monitor (Look and learn)**	**Actively manage**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Community stewardship	Establish photo-point (CoastSnap) monitoring system north of Suttons Beach.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Avoid placement of non-relocatable public assets (e.g., coastal pathway) along the dune, foreshore and beach areas at high risk from coastal hazards.		
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Dune and vegetation protection and maintenance	Undertake dune protection and enhancement.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Beach nourishment	Undertake a feasibility study for beach nourishment.		Undertake beach nourishment (if applicable).
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Review and implement the Shoreline Erosion Management Plan. Implement seawall prioritisation works at Margate Parade, Woodcliffe Crescent, Whytecliffe Parade, Hornibrook Esplanade, Gayundah Esplanade, Lilla Street and Oxley Avenue.		Review the effectiveness of existing shoreline protection works.

6. Locality summaries

LOCALITY 21-22: Clontarf and Kippa-Ring

Clontarf and Kippa-Ring are located at the southwestern side and centre of the Redcliffe Peninsula, respectively (Figure 30).

The southwest facing section of the shoreline consists of Bells Beach, Pelican Park and Clontarf Beach. Bells Beach is a narrow high tide beach backed by a reserve with a caravan park across the road that terminates at Pelican Park, which contains a range of recreational and picnic facilities, including a boat ramp at the western end.

Existing areas of mangroves span across the western side of Clontarf and Kippa-Ring, providing protection for adjacent land from tidal and storm tide inundation. Assets are at risk primarily from storm tide inundation and this is expected to increase in the future, including the Clontarf waste station.

The present day adaptation response for Clontarf and Kippa-Ring is to avoid placing new development or assets in high risk coastal areas and continue to monitor coastal hazards in the future.

The adaptation pathway includes a focus on avoiding placing new development or assets in coastal areas and reviewing the adaptation pathway over time (Table 31). Region-wide actions also apply where relevant to this locality.

Bells Creek Drain, Clontarf

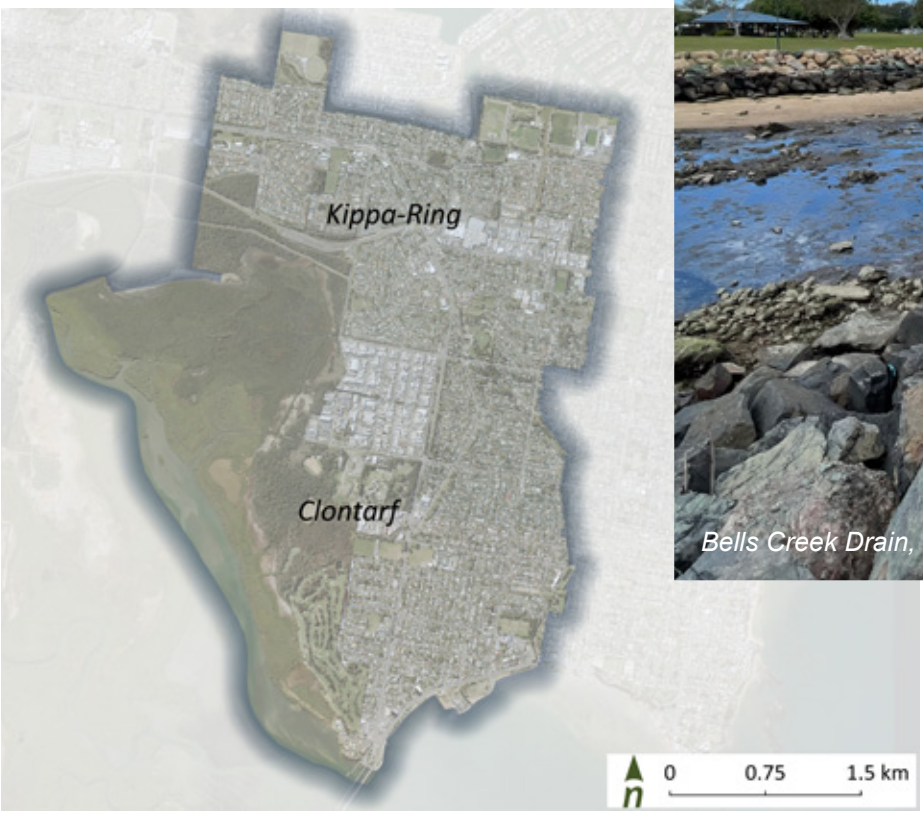


Figure 30. Clontarf and Kippa-Ring

Table 31. Clontarf and Kippa-Ring adaptation pathway

Sea level rise projections

	Present day	2050 (0.3m)	2100 (0.8m)
Adaptation response	**Avoid (and maintain)**	**Monitor (Look and learn)**	**Actively manage**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions identified in Table 35.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Avoid placement of non-relocatable public assets (e.g., coastal pathway) along the dune, foreshore and beach areas at high risk from coastal hazards.	Undertake a feasibility study for a tide gate at Bells Creek.	
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Dune and vegetation protection and maintenance	Undertake dune and riparian protection and enhancement.		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Implement seawall prioritisation works at Hornibrook Esplanade and Haysmouth Parade.		

6. Locality summaries

LOCALITY 23: Dohles Rocks (Griffin)

The Dohles Rocks foreshore is located on the Pine River and includes both residential and agricultural land as well as recreational boating and fishing facilities along the northern foreshore (Figure 31). The Dohles Rocks foreshore area also has significant environmental values and includes the Osprey House Environmental Centre, shorebird areas and significant wetlands. The foreshore also provides public recreational facilities and access to the Pine River.

Existing structures are in place to manage shoreline position and mitigate erosion, including a seawall at Dohles Rocks. The seawall and adjacent stormwater drainage require improvements to minimise tidal inundation that can be experienced in low-lying areas.

Low-lying areas are currently prone to erosion, tidal and storm tide inundation and this is likely to increase in the future. Dam releases can significantly increase tidal inundation during severe weather.

Dohles Rocks is particularly at risk and is a high priority for adaptation response. Assets at risk include the only access road to Dohles Rocks village area, public foreshore infrastructure and private assets.

The present day adaptation response for the Dohles Rocks foreshore area is to actively manage coastal hazard risk. If the risk exposure to very high intolerable risk properties can be reduced by 2050, the future adaptation response will be to continue to actively manage coastal hazards.

The adaptation pathway includes a focus on maintenance and upgrades of existing structures, and developing a pilot Local Resilience Plan for Dohles Rocks (Table 32). Region-wide actions also apply where relevant to this locality.

Dohles Rocks, Griffin

Figure 31. Dohles Rocks (Griffin)

Table 32. Dohles Rocks (Griffin) adaptation pathway

Sea level rise projections

	Present day	2050 (0.3m)	2100 (0.8m)
Adaptation response	**Actively manage**	**Actively manage**	**Transition and change**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions, including:		
Community stewardship	Raise community awareness and enhance social adaptive capacity for inundation hazards.		
Knowledge sharing	Action 1.2.3 - facilitate training / education workshops / events, focusing on nature-based solutions (mangroves, dunes, living shorelines) and resilient homes.		
Planning	As per region-wide actions, including:		
Place-based planning	Local Resilience Plan pilot site - develop place-based Local Resilience Plan for Dohles Rocks to assist with coordinated adaptation and transition planning in the long-term.	Review adaptation pathway and reduce 2100 approach to "actively manage" if a resilient built form for very high intolerable risk properties is achieved.	
Disaster management	Review alternatives to using tank water in recovery post inundation to properties through the Local Resilience Plan.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Promote resilient homes within the community and building sector (link in with action 1.2).		
	Review opportunities to improve drainage networks and backflow prevention devices where the risk of inundation is high (embedded within asset management plan). Investigate the drainage network including stormwater run-off and tidal inundation landward of the foreshore area as part of the Local Resilience Plan.		
Relocate infrastructure	Implement the Local Resilience Plan based on findings.	Review the Local Resilience Plan for further actions.	Review the Local Resilience Plan for further actions.
Environmental protection, maintenance and enhancement	As per region-wide actions, including:		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions, including:		
Living shorelines	Implement the Local Resilience Plan based on findings.	Review the Local Resilience Plan for further actions.	Review the Local Resilience Plan for further actions.
Coastal engineering	As per region-wide actions, including:		
Coastal hazard protection works	Upgrade and maintain existing shoreline protection works. Implement seawall prioritisation works at Dohles Rocks foreshore. Implement Local Resilience Plan based on findings.	Review the Local Resilience Plan for further actions.	Review the Local Resilience Plan for further actions.

6. Locality summaries

6.6 Estuarine areas

The estuarine areas sub-region includes the suburbs and communities east of the Bruce Highway, including Burpengary East and North Lakes. Caboolture River and Burpengary Creek flow around Burpengary East to enter Moreton Bay, and Saltwater Creek is situated close to North Lakes, connecting to Kedron Brook. Elimbah Creek also flows through this sub-region in the north. This sub-region includes low-lying land with a mix of developed and large green places.

Residents highly value access to waterways (such as via Ulmann Road Boat Ramp) and natural areas (such as North Lakes Environmental Reserve and Freshwater National Park) for recreation.

The overall adaptation response for South Deception Bay is presented in Table 33.

Table 33. Adaptation response for estuarine areas (all coastal hazards)

Reporting sub-region	Present day	2050	2100
Estuarine areas	Avoid (and maintain)	Avoid (and maintain)	Monitor (Look and learn)

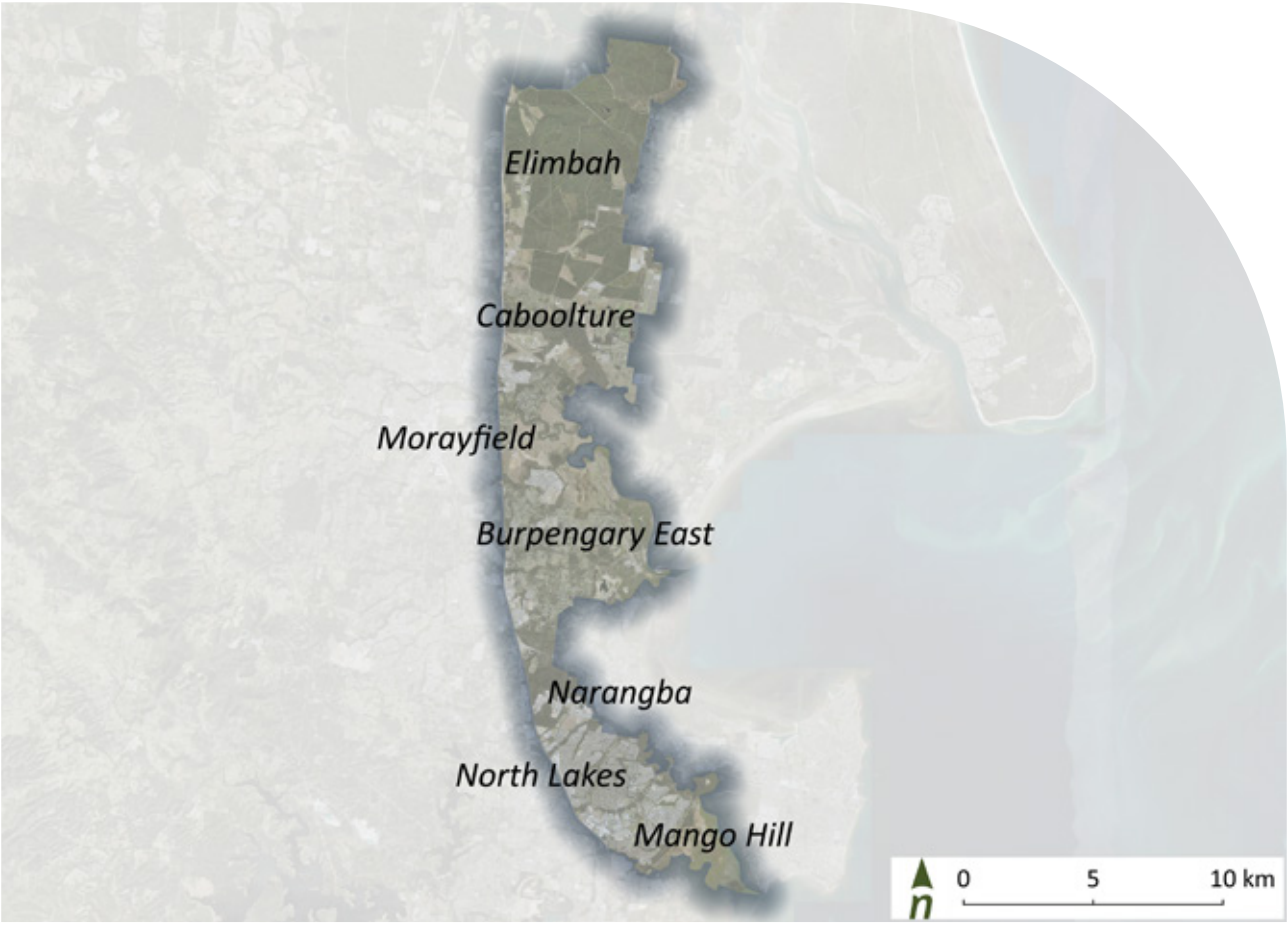


Figure 32. Estuarine areas

LOCALITY 24-30: Mango Hill, North Lakes, Narangba, Burpengary East, Morayfield, Caboolture, Elimbah

The estuarine areas are located inland of the coast (Figure 32).

Limited assets and infrastructure may still be affected by coastal hazards during extreme events. The risk is greatest from tidal inundation, which is expected to affect small sections of the highway and local streets and may impact evacuation routes. Storm tide inundation may also affect private assets and community facilities in the present day, with the number of assets at risk from all coastal hazards increasing over time.

The present day adaptation response for Mango Hill, North Lakes, Narangba, Burpengary East, Morayfield, Caboolture and Elimbah is to avoid placing new development or assets in coastal areas and continue to monitor coastal hazard risk in the future.

The adaptation pathway is to continue the present day response and review the adaptation pathway over time (Table 34). Region-wide actions also apply here where relevant.

Table 34. Mango Hill, North Lakes, Narangba, Burpengary East, Morayfield, Caboolture, Elimbah adaptation pathway

		Sea level rise projections	
		0.3m	0.8m
	Present day	**2050**	**2100**
Adaptation response	**Avoid (and maintain)**	**Avoid (and maintain)**	**Monitor (Look and learn)**
Adaptation Actions			
Region-wide initiatives to enhance custodianship	As per region-wide actions identified in Table 35.		
Planning	As per region-wide actions identified in Table 35.		
Maintaining and improving infrastructure	As per region-wide actions, including:		
Increasing infrastructure resilience	Avoid placement of non-relocatable public assets (e.g., coastal pathway) along the coastal areas.		
Environmental protection, maintenance and enhancement	As per region-wide actions identified in Table 35.		
Environmental enhancement	Coastal management plans for the protection of highly valued environmental areas and significant habitat.		
	Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.		
Coastal engineering and nature-based	As per region-wide actions identified in Table 35.		
Coastal engineering	As per region-wide actions identified in Table 35.		

7. Implementation

Moreton Bay Regional Council will implement the Living Coast Plan through a range of mechanisms including:

- An adaptive management framework
- Embedding outcomes and actions from the Plan into existing Council process and activities
- Implementing new initiatives from the Plan.

It is also expected that Council will work with the State Government and review the outputs of the Plan to inform future coastal hazard areas and coastal management districts as part of State Planning interests. Relevant information from the Plan's risk assessment process will also inform development of the planning scheme.

A summary of the priority actions for the Moreton Bay region is presented in Table 35

This is the start of the adaptation process

Adapting to coastal hazards is a shared responsibility for all stakeholders and the Moreton Bay community. We look forward to working together as we continue the adaptation journey. This Plan represents the start of an ongoing process of planned adaptation over time. Adaptation pathways will be continually informed by community input and ideas, new knowledge, and monitoring the effectiveness of actions. We encourage everyone to consider how you can build your own resilience and adapt to future climate change.

7.1 Next steps

It is intended that the Living Coast Plan will be reviewed approximately every 5 years. The next review of the Plan is due in 2027.

The review will include consideration of:

- Success of implementation:
  - Integration into council and stakeholder plans and processes
  - Delivery of on-ground activities
  - Community perspectives on adaptation effectiveness
  - Reduction in coastal hazard risk.
- Triggers to update the Plan include consideration of:
  - Any changes in the science / policy environment (e.g. sea level rise predictions, approach to defining coastal hazard areas)
  - Updated technical information that may be available
  - Any additional urban development or substantial landscape changes in the region
  - Any rapid environmental change imposing limitations on current preferred adaptation pathways.
  - Any changes in community attitudes and risk tolerance
  - A strategic decision by Council linked to other strategic objectives.

Redcliffe

7. Implementation

7.2 Summary of priority actions across the Moreton Bay region

To guide implementation, a detailed action plan is presented in Table 35.

Table 35. Summary of adaptation actions by locality to be implemented or reviewed within 10 years

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
1. Region-wide initiatives to enhance custodianship								
1.1 Community stewardship	1.1.1 Establish coastal resilience program. Designated Program Lead (Coastal Planning and Policy) for the stewardship program and broader Coastal Hazard Adaptation Strategy implementation.	●	●	●	●	●	●	●
	1.1.2 Support experiences and activities that enable restoration and protection of natural areas and wildlife habitats to ensure our special natural areas and wildlife habitats are connected, protected and enhanced.	●	●	●	●	●	●	●
	1.1.3 Review social vulnerability mapping and identify actions to enhance resilience in particular related to inundation hazards and access / services disruption.	●	●	●	●	●	●	●
	1.1.4 Review infrastructure and technology needs to reduce impacts on communities from access disruption linked to inundation events.	●	●	●	●	●	●	●
	1.1.5 Continue to support and prepare local businesses to respond to emergencies and build longer term resilience.	●	●	●	●	●	●	●
	1.1.6 Seek co-funding / resources for further initiatives.	●	●	●	●	●	●	●
1.2 Knowledge sharing	1.2.1 Continue to partner with First Nation representatives to understand their needs, aspirations, and involvement in coastal hazard adaptation, including the identification of cultural values, management of significant sites, supporting their ongoing role in caring for country and informing future adaptation approaches.	●	●	●	●	●	●	●

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
Medium priority	High priority	High priority	High priority	High priority	High priority	High priority	Medium priority	Medium priority	Medium priority	High priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority

7. Implementation

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
1. Region-wide initiatives to enhance custodianship								
1.2 Knowledge sharing	1.2.2 Develop a coastal management communication and engagement plan and associated materials to deliver coastal hazard preparedness to empower local businesses, industry and the community to make informed decisions.	●	●	●	●	●	●	●
	1.2.3 Prepare a strategic approach to guide stakeholder education for engagement on coastal environmental values, including restoration and enhancement outcomes	●	●	●	●	●	●	●
	1.2.4 Formalise and coordinate information sharing and accessibility to relevant hazard exposure data within Council and between Council and state agencies.	●	●	●	●	●	●	●
1.3 Monitoring	1.3.1 Support the continuation of photo-point monitoring system (CoastSnap) at key locations, maintain the data platform / website and utilise this data to inform implementation of the shoreline management actions and identify emerging maintenance issues.	●	●					
	1.3.2 Develop and integrate CHAS implementation evaluation governance and metrics into existing monitoring programs including the region-wide coastal areas, drone survey and CoastSnap to measure performance.	●	●	●	●	●	●	●
	1.3.3 Establish drone survey (elevation and aerial imagery) monitoring (every 2 – 3 years), or other tailored monitoring and reporting needed to inform adaptive management.	●	●	●	●	●	●	●

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority
				High priority			High priority	High priority	High priority		
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority
Medium priority	Medium priority	Medium priority	High priority	High priority	High priority	High priority	High priority	High priority	Medium priority	Medium priority	Low priority

7. Implementation

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
1. Region-wide initiatives to enhance custodianship								
1.3 Monitoring	1.3.4 Develop a framework to monitor the long-term impact of climate change on key environmental areas (endangered and essential habitat for vulnerable wildlife) to inform coastal management at these locations and surrounding areas.	●	●	●	●	●	●	●
	1.3.5 Through the implementation of the Living Coast Plan and Biodiversity Plan, establish arrangements for monitoring that identifies coastal environmental threats (including due to sea level rise) and changes to biodiversity conditions.	●	●	●	●	●	●	●
1.4 Research	1.4.1 Establish collaboration with key universities and research centres to progress relevant actions in the Plan.	●	●	●	●	●	●	●
	1.4.2 Apply for funding grants for relevant actions.	●	●	●	●	●	●	●
	1.4.3 Develop a research and delivery partnership / collaboration to implement pilot studies which demonstrates nature-based solutions identified from shoreline erosion management plan updates.		●			●		
2. Planning								
2.1 Place-based planning and planning scheme	2.1.1 Use the Plan (including coastal hazard mapping and emerging risk information) to inform all relevant corporate and operational policy and planning matters across Council.	●	●	●	●	●	●	●
	2.1.2 Review CHAS outputs as part of considering content for inclusion in a new planning scheme, including erosion prone areas and storm tide hazard mapping for planning scheme purposes.	●	●	●	●	●	●	●

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority
Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority
High priority	Medium priority					High priority					
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority

7. Implementation

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
2. Planning								
2.1 Place-based planning and planning scheme	2.1.3 Review future development and infrastructure servicing options for urban areas subject to 2100 Highest Astronomical Tide (HAT).	●	●	●	●	●	●	●
	2.1.4 Undertake prioritised place-based Local Resilience Plans and determine triggers for relocation of specific foreshore assets and / or coordinated adaptation and transition planning (as specified in locality pathways).				●	●	●	
2.2 Disaster management	2.2.1 Review disaster management plans using updated erosion prone area and storm tide inundation mapping, the CHAS risk assessment, and information on economic implications.	●	●	●	●	●	●	●
	2.2.2 Review the long-term adequacy of evacuation facilities and evacuation routes for different coastal hazard adaptation planning horizons.	●	●	●	●	●	●	●
3. Maintaining and improving infrastructure								
3.1 Increasing infrastructure resilience	3.1.1 Embed coastal hazard risk information (across all planning horizons) into asset planning and management to identify Council assets at risk and to inform appropriate maintenance requirements, renewal timeframes, potential relocation and future design considerations.	●	●	●	●	●	●	●
	3.1.2 Develop / update design standards and guidelines for infrastructure including stormwater drainage assets, wastewater assets, water assets, waste assets, community and cultural assets, property assets, ICT assets, roads, fleet assets, marine assets, parks and open space assets, so service standards can continue to be met at 2050 and 2100.	●	●	●	●	●	●	●

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
						High priority				High priority	
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	Medium priority	Medium priority	Medium priority	High priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	Medium priority	Medium priority	Medium priority	High priority	Low priority

7. Implementation

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
3. Maintaining and improving infrastructure								
3.1 Increasing infrastructure resilience	3.1.3 Review opportunities to improve drainage networks in locations where the risk of inundation for infrastructure is high (embedded within asset management plan).	●	●	●	●	●	●	●
	3.1.4 Investigate bridge conditions and marine trafficability relating to coastal hazard risk as part of the asset renewal.	●	●	●	●	●	●	●
	3.1.5 Promote resilient and sustainable design principles within the community and building sector (link in with action 1.2).	●	●	●	●	●	●	●
3.2 Relocate infrastructure	3.2.1 Relocate specific assets, where defined in adaptation pathways as part of asset renewal process.	●	●	●	●	●	●	●
4. Environmental protection, maintenance and enhancement								
4.1 Dune and vegetation protection and maintenance	4.1.1 Undertake dune, wetland and riparian enhancement and management in areas identified in location specific adaptation pathways.	●	●	●	●	●	●	●
4.2 Environmental enhancement	4.2.1 Develop coastal management plans for the ongoing survival of key terrestrial and marine species that use Moreton Bay and its coastal areas, particularly those already under threat, by considering how management decisions impact their distribution, habitat and life-cycle requirements.	●	●	●	●	●	●	●
	4.2.2 Investigate risks to key coastal environmental values, including options to respond to those risks, changing ecological needs and climate change considerations, so that our natural areas and habitats are connected, protected and enhanced.	●	●	●	●	●	●	●

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
High priority	High priority	High priority	High priority	High priority	High priority	High priority	Medium priority	Medium priority	Medium priority	High priority	Low priority
Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Medium priority	Low priority	Low priority	Low priority	Medium priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority
Low priority	Low priority	Medium priority	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority	Low priority	Medium priority	Low priority
High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	High priority	Medium priority
Low priority	High priority	High priority	High priority	High priority	High priority	High priority	Low priority	Low priority	High priority	High priority	Low priority
Low priority	High priority	High priority	High priority	High priority	High priority	Low priority	Low priority	Low priority	High priority	Medium priority	Medium priority

7. Implementation

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
4. Environmental protection, maintenance and enhancement								
4.2 Environmental enhancement	4.2.3 Protect, maintain and manage creeks, waterways and wetlands as natural systems so they are healthy, thriving and resilient to the impacts of climate change.	●	●	●	●	●	●	●
	4.2.4 Investigate the implications of sea level rise on coastal environmental values, wetlands and coastal vegetation.	●	●	●	●	●	●	●
5. Coastal engineering and nature-based								
5.1 Beach nourishment	5.1.1 Scope for potential future works, in accordance with adaptation pathway planning.	●						
	5.1.2 Investigate cost-effectiveness and environmental soundness of sand sources for beach nourishment / back-passing.	●						
	5.1.3 Identify key areas for long term ongoing beach nourishment / back-passing.	●						
5.2 Living shorelines	5.2.1 Pilot coastal environmental enhancement projects that improve environmental values and provide protection from coastal hazards (as per location-based actions). These areas should focus where existing seawalls are adjacent to significant environmental areas.		●			●		
6. Coastal engineering								
6.1 Coastal hazard reduction	6.1.1 Undertake stormwater and drainage investigations, planning and design upgrades at identified areas in location specific pathways and incorporate into shoreline erosion management planning.		●		●	●	●	

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Medium	Low	Medium
Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Medium	Low	Medium
		Medium				Medium	Medium	Medium			
		High				Medium	Medium	Medium			
		High				Medium	Medium	Low			
High	High					High					
High	High	High				High				High	

7. Implementation

Adaptation Actions	2022 Priority strategic actions (completed within 5 – 10 years)	Woorim	Bongaree	Bellara, Banksia Beach, White Patch and Welsby	Donnybrook	Toorbul	Meldale	Ningi
6. Coastal engineering								
6.2 Coastal hazard protection works	6.2.1 Review, develop and implement shoreline erosion management planning (SEMP) to align with the directions of the Living Coast Plan and that incorporates location specific actions (use the Plan to support Cost Benefit Analysis for priority sites).	●	●	●	●	●		
	6.2.2 Investigate flooding solutions / concept options including backflow prevention devices at priority areas to inform adaptation pathway planning at relevant locations – linked to location specific pathways.		●		●	●	●	
	6.2.3 Undertake investigation on canal estate requirements for sea level rise adaptation including stability and design standards for revetment walls.		●	●				
	6.2.4 Develop a region-wide approach and guidance for integrating stormwater drainage and outfall upgrades into concept design upgrades of future coastal protection works in main urban coastal areas.	●	●	●	●	●	●	●
	6.2.5 Continue to implement seawall prioritisation works into present day capital work planning and embedded in adaptation pathways for relevant locations.	●	●	●		●		

High priority Medium priority Low priority

Sandstone Point	Godwin Beach	Beachmere	Deception Bay	Rothwell	Newport	Scarborough	Redcliffe	Margate and Woody Point	Clontarf and Kippa-Ring	Dohles Rocks (Griffin)	Estuarine areas
●	●	●	●			●	●	●	●		
●	●	●				●				●	
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8. References

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9. Glossary

Adaptation – The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm, or exploit beneficial opportunities. In some natural systems, human intervention may help a system adjust to the expected climate and its effects.

Adaptation pathway - A series or sequence of management actions (over time) directed to achieving long-term adaptation objectives.

Adaptive capacity - The ability of systems, institutions, humans, plants, and animals to adjust to potential damage, to take advantage of opportunities or to respond to consequences.

Adaptive management - Similar to an adaptation pathway, adaptive management is a structured approach to decision making commonly used in natural resource management, that allows a response to a 'trigger' or 'event' to be altered where required.

Annual Exceedance Probability (AEP) - The Annual Exceedance Probability is the probability of a storm event occurring in a given year. The defined storm event for Queensland State coastal hazard mapping is a 1% AEP. This is equivalent to an event that occurs on average every 100 years. This is sometimes referred to as a 1-in-100-year event or as having an Average Recurrence Interval (ARI) of 100 years.

Beach - The portion of the coastal zone periodically subjected to wave action. The seaward limit of a beach is typically defined as the spring low tide line, while the landward limit, as the vegetation line.

Calculated (open coast) erosion – This component of the erosion prone area is calculated through a width assessment formula, which includes the rate of long-term erosion, short-term erosion from storms or cyclones, erosion due to sea-level rise, allowance for dune slumping, and a factor of safety. This component is often termed 'open coast' erosion.

Coast - The coast is the tidal foreshore and adjacent areas that include the built and natural environments. Defining natural features incorporate the coastal plains, dunes, open beaches, rocky shores, estuaries, and near-shore marine waters, reefs, and coastal lagoons.

Coastal adaptation - Future modification of actions and behaviour through construction of infrastructure or change in land use practices that prevents or reduces adverse impacts associated with coastal hazards.

Coastal erosion - Erosion occurs when winds, waves and coastal currents act to shift sediments away from an area of the shore.

Coastal geomorphology - The physical shape, processes and patterns associated with the coast, including landforms, soils, and geology.

Coastal hazards - Natural coastal processes that may negatively impact on the natural environment and human use of the coastal zone. Hazards include coastal erosion, storm tide inundation, and inundation due to sea-level rise.

Coastal processes - Natural processes including ecological, waves, tides and tidal currents and sand movement.

Coastal vulnerability - The threat to coastal landforms, social, economic, and environmental systems, associated infrastructure, or land use that may be caused by a sustained shift in environmental conditions.

Consequence - A term commonly used in a risk assessment to estimate the impacts of an event.

Cost benefit analysis - An economic analysis used to determine the ratio between the benefits and costs of a project, option, or decision. A ratio greater than one means the benefits outweigh the costs and the option is likely to be viable. A ratio of less than one means the costs outweigh the benefits and the option is not likely to be viable.

Disaster management - The organisation and management of resources and responsibilities for dealing with social, economic, and environmental aspects of emergencies, in particular preparedness, response, and recovery in order to lessen the impact of disasters.

Erosion Prone Area (EPA) - An area subject to coastal erosion or tidal inundation and declared to be erosion prone under section 70(1) of the Coastal Protection and Management Act 1995. The erosion prone area includes the calculated (open coast) erosion prone area, the area subject to tidal inundation with sea level rise, and a default tidal area.

EPA default tidal area – A width added to defined coastal hazard extents that could potentially be affected by erosion or inundation over a nominated planning period. A horizontal buffer of 40 m is applied to the 2100 highest astronomical tide (HAT) for certain scenarios, under Queensland State Government Guidelines.

Highest Astronomical Tide (HAT) - The highest water level that can be predicted to occur under average meteorological conditions and any combination of astronomical conditions.

Landform - The natural shape of the Earth's surface. Landforms range in size from small features such as dunes and estuaries found at a local scale, to large features such as mountain ranges and coastal plains that may exist at regional scales.

Likelihood - A term commonly used in a risk assessment to estimate the chance of an event occurring.

Long-term erosion (recession or retreat) - Erosion resulting in a continuing landward movement (loss) of the shoreline or a net landward movement of the shoreline within a specified time.

Relative sea level - Sea level as measured by an official tide gauge with respect to the land upon which it is situated.

Resilience - The capacity of social, economic and environmental systems to cope with or 'bounce back' following a hazardous event or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure, while also maintaining the capacity to adapt and transform.

Risk assessment - A systematic process of evaluating the potential risks that may be associated with an event or activity.

Sea level rise - An increase in the mean level of the ocean. For Queensland, a projected sea-level rise of 0.8 metres by the year 2100 has been adopted by the Queensland Government.

Shoreline - A designated line representing the landward limit of the sea. Methods used to define shorelines include fixed vertical levels or identifying the physical interface of water and land (e.g. with aerial photography).

Short-term erosion (storm bite) - Erosion that occurs periodically on a short-term basis, often during a storm. The shoreline and beach then gradually regain sediment (rebuild).

Storm surge - Elevated sea level at the coast caused by the combined influence of low pressure and high winds associated with a severe storm such as a tropical cyclone or East Coast Low.

Storm tide - The total elevated sea height at the coast combining storm surge and the predicted tide height.

Storm tide inundation - When ocean water levels and waves are high enough to cause localised flooding of normally dry land.

Tides - The regular rise and fall of the water surface resulting from gravitational attraction of the moon and sun and other astronomical bodies acting upon the rotating earth.

Supplement A
Factsheets

Please refer to the Living Coast Plan website at
https://yoursay.moretonbay.qld.gov.au/coastal-hazard-adaptation-strategy

Supplement B
Coastal hazard mapping

Please refer to Council's flooding website at
https://www.moretonbay.qld.gov.au/Services/Property-Ownership/Flooding

Supplement C

Adaptation options – summary sheets

Please refer to the Living Coast Plan website at
https://yoursay.moretonbay.qld.gov.au/coastal-hazard-adaptation-strategy

MORETONBAY.QLD.GOV.AU
(07) 3205 0555
MBRC@MORETONBAY.QLD.GOV.AU

Moreton Bay
Regional Council