Phase 8 Strategy and Implementation

Bundaberg Region Coastal Hazard Adaptation Strategy

Bundaberg Regional Council

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EXECUTIVE SUMMARY

Overview

Bundaberg Region is at the forefront of innovation in natural hazard resilience and adaptation, borne from experience in dealing with a range of challenging events in recent years. The Bundaberg community is also becoming more aware of its natural hazard risk in the wake of these events. Council has a strong focus on natural hazard management and resilience with several programs underway, including the Bundaberg 10 Year Action Plan through the Department of Local Government, Racing and Multicultural Affairs; the Woodgate Shoreline Erosion Management Plan (SEMP); and the Coastal Hazard Adaptation Strategy (CHAS). In response to coastal change, the State Government and Local Government Association of Queensland (LGAQ) provided funding to Queensland coastal councils to develop a strategic approach to managing coastal hazards. The Strategy presents an opportunity to set a new benchmark for how coastal adaptation planning is undertaken in Queensland, through the integration of traditional adaptation planning techniques, stakeholder engagement and adaptation pathways analysis. The Strategy has been driven by and for the affected communities, utilising a co-design approach, with stakeholder engagement being fully embedded within each phase of the project.

Development of the Coastal Hazard Adaptation Strategy

The CHAS is based on the best available data and information available at the time and focusses on individual objectives of the local settlements. In line with the CHAS Minimum Standards, the CHAS Strategy and Implementation document is prepared based on an adaptive management approach to allow for flexibility over time. It is of critical importance to obtain extensive buy-in from the community, Council and stakeholders, particularly when discussing adaptation of coastal hazards that threaten community values. To achieve this, the Community Reference Group (CRG), Stakeholder Advisory Group (SAG) and Council were involved throughout the development of the CHAS.

The development of the CHAS is structured into 8 Phases shown in Figure A. This Phase 8 report summarises the previous Phases, how the community has helped to shape the findings and recommendations, and provides overarching strategic direction for the adaptation to coastal hazards across the Bundaberg region.

FIGURE A. THE OVERALL CHAS PROGRAM STRUCTURE

Key Learnings and Messages

The development of the regional CHAS is a lengthy and technical process, highlighting regional characteristics which lead to bespoke solutions and learnings which shape the important messages for the future of the Bundaberg coastline and adaptation. Primary among these from a local government operational perspective are:

- The responsibility the new knowledge brings to inform residents of known risk.
- Enabling Council to make risk-informed decisions on the future of coastal settlement with regards to infrastructure expenditure, planning and investment.
- Enabling Council to align CHAS actions with various funding opportunities in resilience, adaptation, climate change and recovery. In this changing policy space, governments will not continue to fund recovery without accompanying adaptation strategies.

The broader lessons and messages, which are reiterated in the public document for consultation, attempt to convey the nature and scale of coastal change such as:

- The dynamic nature of the coast and inevitable change.
- Step one is understanding individual risk through community awareness.
- There is a role for everyone - Council is responsible for public assets. The attachment to the coastline felt by the community can be adapted with the help of the community. Private property adaptation will have individual responses and solutions.
- Change indicators are many, and long-term monitoring will provide evidence over time of the coastal change.

The Bundaberg coastline is highly valued by community members, which reinforces the need to be informed and prepare for change.

The Strategy and Implementation Plan

The final deliverables of the project known as the Strategy and Implementation Plan comprise:

- This Phase 8 Strategy and Implementation Report summarises technical evidence that supports the CHAS, strategic direction and a concise prioritised action plan and implementation recommendations.
- The Bundaberg Coastal Hazard Adaptation Strategy public document and video for consultation aimed at the community and stakeholders, which summarises the key findings of the coastal hazard risk assessment and adaptation pathways. This public summary document will also contain a copy of the action plan and implementation elements; and
- The Stakeholder Communication and Engagement Report, which summarises the consultation activities that helped to shape the CHAS.

The preferred adaptation pathways for each settlement are based on findings from Phase 6 and Phase 7 and each action has been identified to treat priority coastal hazard risks over the four sea level scenarios. Several adaptation actions have been considered in the CHAS and are classified as Maintain, Modify or Transform options. The following table summarises the CHAS action plan for each settlement:

Sea level rise scenario	Now		0.2m	0.4m	0.8m
Estimated timing based on triggered approach	**2020**		**~2040**	**~2070**	**~2100**
All settlements	Implementation of an internal Council steering group to champion an adaptation framework, progress planning adaptation options and to ensure continuous monitoring of trigger points. Plan for and perform continuous stakeholder engagement and communication. Development of a land swap and land use and tenure transition policy. Update and improve coastal hazard data. Regular monitoring, reporting and review. CHAS update every 5-10 years, particularly the adaptation pathways versus non-preferred options.				
	Implement 'maintain' strategy of: ■ Disaster Management, ■ Education and awareness, ■ Land use planning to maintain vision for settlement.				
Miara, Winfield and Norval Park	Implement 'maintain' strategy of disaster management, education and awareness and land use planning responses and controls. Monitor erosion and investigate SEMP in Colonial Cove, Winfield		Start planning for land swap at Miara holiday park	Land swap at Miara holiday park	
Moore Park Beach	Implement 'maintain' strategy of providing resilient infrastructure, disaster management, education and awareness and land use planning responses and controls.	Start planning for a causeway Moore Park Road	Start planning for beach nourishment Causeway Moore Park Road	Beach nourishment Start planning for raising Murdochs Linking Road Start planning for causeway Malvern Drive	Road raising Murdochs Linking Road Causeway Malvern Drive
		Start planning for land swap at Surf Club	Land swap at Surf Club.		
Burnett Heads	Implement 'maintain' strategy of providing resilient infrastructure (particularly for water, stormwater and electricity assets), disaster			Start planning for storm surge barrier	Storm surge barrier

Sea level rise scenario	Now		0.2m	0.4m	0.8m
	management, education and awareness and land use planning responses and controls.			Start planning for land swap at Lighthouse Tourist Park	Land swap at Lighthouse Tourist Park
Bargara	Implement 'maintain' strategy of providing resilient infrastructure (particularly for water, and electricity assets), disaster management, education and awareness and land use planning responses and controls. Monitor erosion and investigate SEMP at Bargara Foreshore and Nielson Beach Investigate resilience at Mon Repos.			Start planning for beach nourishment at Kellys Beach	Beach nourishment at Kellys Beach
Innes Park and Coral Cove	Implement 'maintain' strategy of providing resilient infrastructure (particularly for water supply assets), disaster management, education and awareness and land use planning responses and controls.			Start planning for beach nourishment	Beach nourishment
Elliott Heads	Implement 'maintain' strategy of disaster management, education and awareness and land use planning responses and controls.		Start planning for land swap at Elliott Heads holiday park	Land swap at Elliott Heads holiday park	
Coonarr	Implement 'maintain' strategy of disaster management, education and awareness and land use planning responses and controls. Monitor erosion at Coonarr Beach	Start planning for raising key access road and beach nourishment	Raising key access road Beach nourishment		
		Start planning land use and tenure transition	Land use and tenure transition		

Sea level rise scenario	Now	0.2m	0.4m	0.8m
Woodgate Beach	Implement 'maintain' strategy of providing resilient infrastructure (particularly for water, wastewater and electricity assets), disaster management, education and awareness and land use planning responses and controls.	Start planning for raising Acacia Street and Theodolite Creek Road Start planning for beach nourishment	Raising Acacia Street and Theodolite Creek Road Start planning for Raising Paperbark Court and Walkers Point Road. Beach nourishment.	Raising Paperbark Court and Walkers Point Road.
Buxton	Implement 'maintain' strategy of disaster management, education and awareness and land use planning responses and controls. Monitor erosion and investigate SEMP at Wharf St.			

Maintain
Modify
Transform

Trigger based adaptation

The CHAS Action Plan follows a trigger-based approach. This means that change over time is observed and adaptation options are only implemented once they are needed. 'Triggers for action' have been set to identify the point when planning to implement an adaptation option must occur before the threshold for intolerable risk is reached. The trigger-based approach allows adaptation to occur before the risk materialises and provides adequate time for planning, prefeasibility and funding. It also allows a range of actions to be discussed with further consultation with the community.

Implementation of disaster management, education and awareness, land use planning responses, building resilient infrastructure and monitoring rates of erosion have been identified as preferred options to 'maintain' the current risk trends. There is an identified need to implement these measures with immediate effect and it is recognised that Council is already implementing some of these measures as part of its core business.

Beach nourishment / dune reconstruction at Moore Park Beach, Woodgate Beach, Innes Park and Kellys Beach at Bargara are the preferred 'modify' adaptation pathways, along with raising of key access roads to the settlements of Moore Park Beach, Coonarr, Woodgate Beach and Walkers Point. In Burnett Heads, the storm surge barrier represents the only option that effectively mitigates storm tide inundation.

Implementation strategy

Step one of implementation is for Council to create a governance structure to drive the CHAS implementation over time. Recommended implementation and integration activities to deliver the CHAS involve integration of the action plan across a wide range of organisational programs and timeframes. The CHAS is a long-term plan for change and a continual governance cycle of review and change is required to implement adaptation effectively. The core steps for change management and continual governance applied to the CHAS are in Figure B.

FIGURE B. THE CHAS IMPLEMENTATION MANAGEMENT PROCESS

The primary implementation components for consideration include:

- Roles and responsibilities
  - Although Council will have an important role in the strategy and adaptation of public infrastructure, everyone in the community has a role in adaptation.
  - Protection of private infrastructure and property will be guided through an action by the owner.
- Governance of the Strategy
  - Methodology and governance will be driven by Council considering the best-fit approach for existing internal structures, skills and culture.
- Implementation process
  - Regular updates to the CHAS as new science and data appears.
  - Annual monitoring and review tasks in the action plan will not suffice in implementing the pathways approach. The pathways require a broader scale review considering all contributing factors, shown in Figure C below, to ensure the strategy remains effective and efficient.
  - The outcome of monitoring and reviews will also be the development of more detailed action plans for specific assets or the development of additional studies such as Shoreline Erosion Management Plans (SEMP) to mitigate three types of coastal hazard namely coastal erosion, storm tide inundation and permanent inundation from sea level rise.

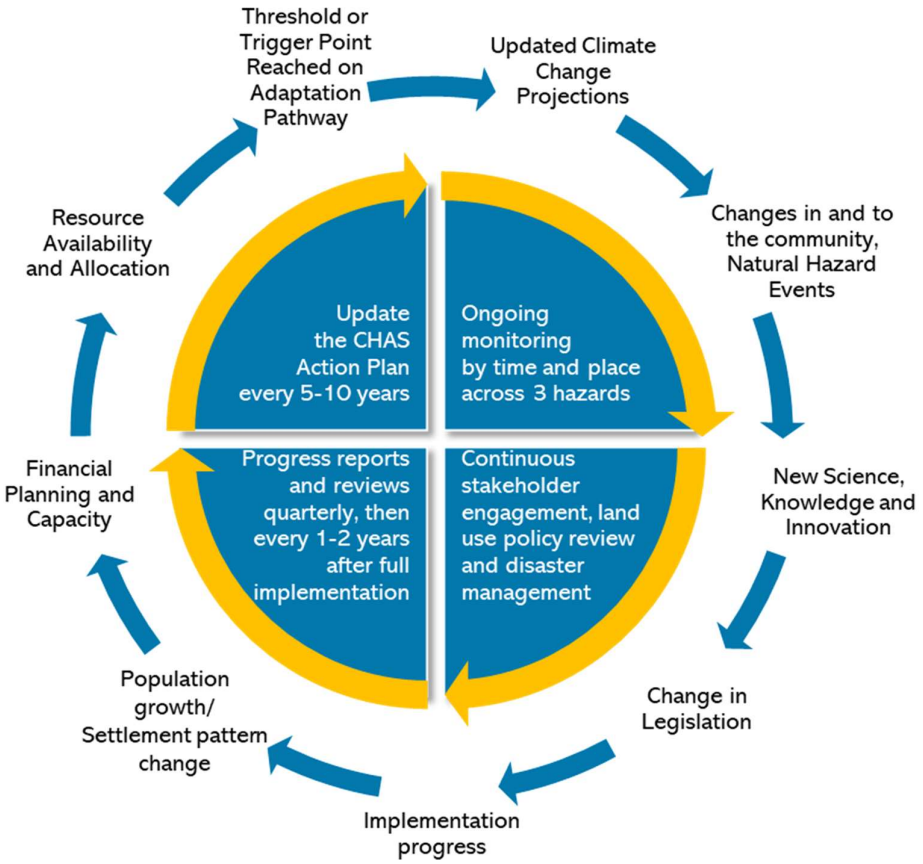

FIGURE C. LONG TERM COASTAL HAZARD ADAPTATION CYCLE

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1 INTRODUCTION

1.1 Background to Coastal Hazard Adaptation Planning

Over the last few years, the Queensland coast (and specifically the Bundaberg Region) has experienced disasters which have resulted in significant economic costs and societal impacts. In response, Bundaberg Regional Council has pro-actively developed a unique perspective on the concepts of, approaches to, and challenges involved in building resilience and undertaking activities to adapt to changing circumstances.

Current projections for Queensland's coastline by 2100 indicate:

- A projected sea level rise of 0.8m
  - The projected sea-level rise of 0.8m by the year 2100 adopted by the Queensland Government is based on climate modelling for probable scenarios of world development as presented in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report released in 2014 (AR5).
  - A decision was made to continue with the previous 0.8m sea-level rise planning value used in the Queensland Coastal Plan 2012 to maintain stability and certainty in the planning environment
- Tropical cyclones are projected to become less frequent, however tropical cyclones that do occur are expected to be more intense and may track further south.

The likely impacts associated with these changes mean that rising sea levels combined with storm tides are likely to cause accelerated erosion and increased risk of inundation. For settlements and infrastructure this is likely to result in damage to and loss of dwellings and infrastructure with community-wide impacts. For ecosystems, sea level rise may lead to loss of habitat, and increased salinity of soils may cause changes to the distribution of plants and animals.

The impact of increasing coastal hazards will affect Queensland councils in the areas of:

- Litigation and legal liability;
- Community expectations;
- Land use planning and development assessments; and
- Asset and infrastructure planning and management.

In response to this, the QCoast2100 program was developed to provide councils in Queensland with assistance to advance coastal hazard adaptation planning. The Program will facilitate the development of high-quality information enabling defensible, timely and effective local adaptation decision-making through access to tools, technical and expert support and grants for eligible councils.

The CHAS program is delivered through eight phases (see Figure 1-1) and each of the phases can be categorised under three themes:

- Commit and get ready
  - Phase 1: Plan for life-of-project stakeholder communication and engagement (Completed 2017)
  - Phase 2: Scope coastal hazard issues for the area of interest (Completed 2017)
- Identify and assess
  - Phase 3: Identify areas exposed to current and future coastal hazards (Completed 2019)
  - Phase 4: Identify key assets potentially impacted (Completed 2019)
  - Phase 5: Risk assessment of key assets in coastal hazard areas (Completed 2019)
- Plan, respond and embed

- Phase 6: Identify potential adaptation options (Completed 2019)
- Phase 7: Socio-economic appraisal of adaptation options (Completed 2020)
- Phase 8: Strategy development, implementation and review (Completion date of 2020)

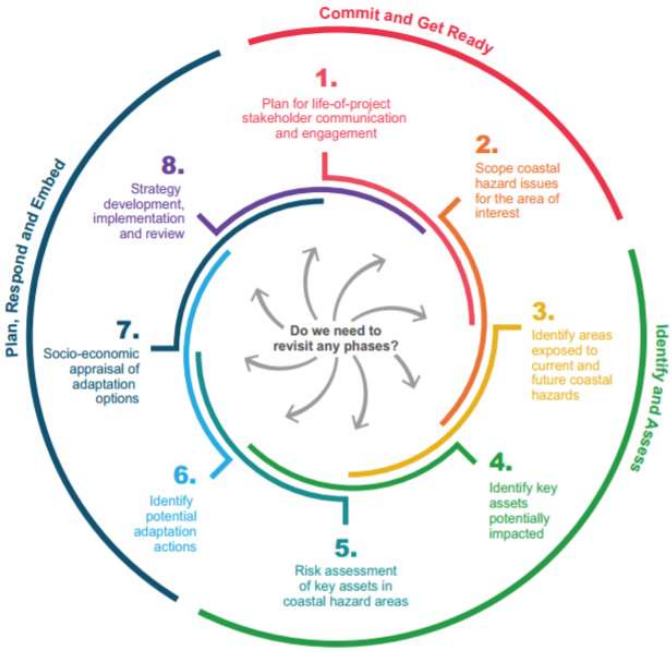

FIGURE 1-1 CHAS PROGRAM PHASES

1.2 CHAS Project

The CHAS Project has been delivered for Council by the principal consultant, Water Technology, with a team of sub-consultants and technical specialists from the following organisations shown in Figure 1-2.

FIGURE 1-2 CHAS PROJECT TEAM

Figure 1-3 provides the CHAS project governance structure for delivery of the CHAS Phases 3 – 8. Overall, Council will ultimately decide to invest in the implementation of recommendations made in the CHAS. Throughout the project, representatives of Council departments formed the Project Control Group (PCG) which helped solve issues that could not be resolved at the Project Manager level.

As the CHAS developed, focus has been provided on how the CHAS strategy is intended to be implemented by the community and stakeholders. This has been facilitated by Council via the formation of both a Community Reference Group (CRG) and Stakeholder Advisory Group (SAG). The CRG is a group of interested, voluntary community members and the SAG comprised key organisations with a vested interest in the coastal region. These groups were established to liaise with Council to help inform the development of the adaptation options and strategies as part of the CHAS.

A minimum 28-day consultation period is also included in the CHAS program which provides opportunity for the community to make submissions on the documentation. A summary of the submissions and how each comment is to be addressed is included in the Stakeholder Communication and Engagement Report. The Stakeholder Communication and Engagement Report also includes a full summary of the community and stakeholder contributions to the CHAS.

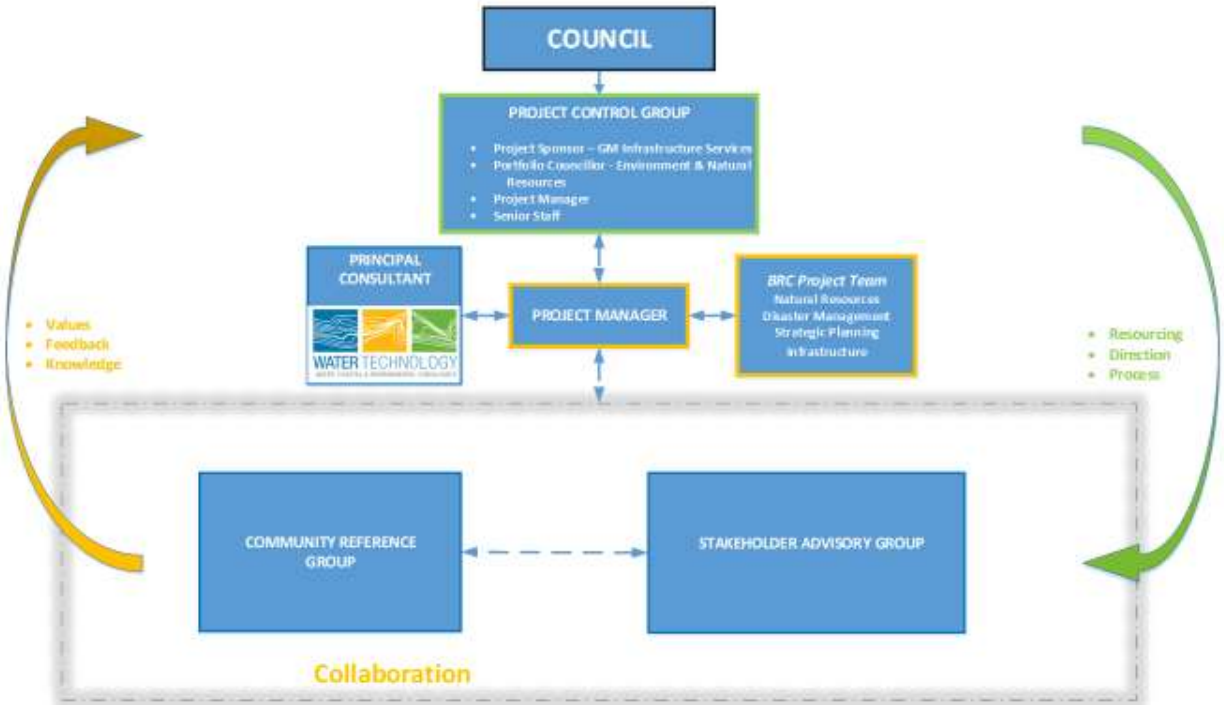

FIGURE 1-3 CHAS PROJECT GOVERNANCE

1.3 Description of Phase 8

The CHAS is based on the best available data at the time and focusses on individual objectives of the local settlements. In line with the CHAS Minimum Standards, the CHAS Strategy and Implementation document is prepared based on an adaptive management approach to allow for flexibility over time. Future reviews and changes might be required to deal with changing risks and uncertainties in climate change projections. Therefore, the action plan is developed on a trigger-based approach, where adaptation is required after a trigger for action has been reached. This can be a specified level of erosion or inundation that is expected at a point in time in the future.

It is of critical importance to obtain extensive buy-in from the community, Council and stakeholders, particularly when discussing adaptation of coastal hazards that threaten community values. To achieve this, the Community Reference Group (CRG), Stakeholder Advisory Group (SAG) and Council were involved throughout the development of the CHAS. The purpose of this Phase 8 report is to summarise the previous Phases, outline how the community has helped to shape the findings and recommendations; and to provide overarching strategic direction for the adaptation to coastal hazards across the Bundaberg region.

The final deliverables of the project known as the Strategy and Implementation Plan comprise:

- This Phase 8 Technical Evidence and Summary Report intended to be an internal document that provides Council:
  - A summary of the technical evidence that supports the CHAS;
  - Strategic direction of the CHAS based on adaptation principles and upholding community values;
  - A concise prioritised action plan and implementation recommendations; and
  - Summary of the stakeholder and community engagement activities.
- The Bundaberg Coastal Hazard Adaptation Strategy public document and video for consultation, aimed at the community and stakeholders, which summarises the key findings of the coastal hazard risk assessment and adaptation pathways;

- The focus of the document is to outline both Council and community's role in implementing adaptation actions to mitigate coastal hazard whilst upholding values and principles identified by the community; and
- The CHAS Summary document will also contain a copy of the action plan and implementation framework.

- The Stakeholder and Communication Engagement Report
  - Full detailed account of consultation and engagement activities undertaken to shape the CHAS;
  - Consultation and engagement activities have been structured under four themes aligned with principles from the International Association for Public Participation (IAP2); and
  - A summary of submissions made upon the CHAS documentation and how each comment has been addressed.

2 DEVELOPMENT OF THE CHAS

The development of the CHAS is structured into eight phases as per Figure 2-1 and a summary of these phases is presented in this chapter. The CHAS process is driven by the communities affected, for the communities affected and utilised a co-design approach with stakeholder engagement being fully embedded within each phase of the project.

A summary of community engagement and consultation outcomes of each phase is also provided in this section. The Stakeholder Communication and Engagement Report will include a detailed account of the community and stakeholder contributions to the CHAS and submission summary on completion of the consultation period.

FIGURE 2-1 OVERALL CHAS STRUCTURE

2.1 Phase 1 Stakeholder Communication and Engagement Plan

2.1.1 Summary of Phase 1

The Stakeholder Communication and Engagement Plan has been prepared as the 'life-of-project' strategy for the management, execution and analysis of engagement activities carried out as part of the preparation of the Bundaberg Region CHAS. The plan, prepared in Phase 1, sets out the framework for 'life-of-project' communication and engagement, whilst also providing more specific detail regarding engagement activities relevant to scoping hazard issues and identifying areas exposed to the hazard.

The consultation approach outlined in the Phase 1 report seeks to provide for the open and transparent communication and engagement with internal and external stakeholders and the community, ultimately seeking to:

- Raise awareness regarding coastal hazards and their impact on communities;
- Establish a shared understanding of the risks communities face from coastal hazards; and
- Gain broad endorsement for proposed adaptation measures.

Overall, the broad communication and engagement opportunities that were applied throughout the various project phases are summarised in Table 2-1. It is acknowledged that the implementation of these activities may have varied and were added to over the life of the project. For further details of the stakeholder and community engagement activities that were implemented throughout the project, please refer to the Stakeholder Communication and Engagement Report.

TABLE 2-1 COMMUNICATION AND ENGAGEMENT METHODS OF PROJECT PHASES

Item/Project Theme	Commit and Get Ready Phases 1-2	Identify and Assess Phases 3-5	Plan, Respond and Embed Phases 6-8
Continuous Engagement Methods			
Project Branding	*End of Phase 2 before commencement of Phase 3*		
Background Information Repository			
Fixed Installation			
Event Based Engagement			
Community interest event/activities	*End of Phase 2 before commencement of Phase 3*		
Education activities			
Event based information 'pop ups'			
Post weather event information 'pop ups'		*Dependent on resourcing and weather events*	*Dependent on resourcing and weather events*
Targeted Event Engagement			
Stakeholder meetings			
Community and Stakeholder workshops			
Community or information gathering			
Media Led Engagement			
Active media management and promotion			
Social media management and promotion			

Phase 1 also identified and analysed all relevant stakeholders, including consideration of:

- Level of impact and interest
- Concerns and areas of interest
- Engagement preferences and techniques
- Consultation risks and mitigation.

The community and stakeholder analysis acknowledges that within the various coastal communities' groups and organisations there are differences and ultimately a targeted approach for each community was required. Furthermore, it was recognised throughout the CHAS project that the list of interested and active stakeholders changed and evolved during the lifetime of the CHAS development and the role of the Community Reference Group in ground truthing outcomes became pivotal

2.2 Phase 2 Scoping Study

2.2.1 Summary of Phase 2 technical findings

The Phase 2 Scoping Study identifies the requirements, data, strategic and local scale issues and opportunities relevant to the region in order to set a solid foundation for subsequent phases of the Bundaberg Coastal Hazard Adaptation Strategy (CHAS).

The Scoping Study includes the following key outputs:

- Overview of the strategic issues and challenges
- Review of the technical data and reporting on any gaps and consequences
- Vulnerable coastal assets
- Socio and demographic review, to understand the potential risk profile of an area
- A review of zoned land to understand the scale of land supply likely to be affected and the relevant information to inform the development of the CHAS
- Preparation of a Scoping Study to provide the framework for future phases of the CHAS.

The Scoping Study has demonstrated that there are and will likely be coastal hazard issues which will impact the community in the Bundaberg Region. The review of asset databases revealed many are mapped within the Coastal Management District and fall within the existing erosion prone area and storm tide inundation mapping. The zoned land review has demonstrated percentage of land subject to potential exposure within each zone across the region. The socio-demographic review has provided an indication of the potential vulnerability of the community.

As a consequence, it was recommended that further understanding of the likelihood and consequence of coastal hazards having an adverse impact on Council operations and community assets and to seek ways through adaptation planning to reduce future exposure to risks of coastal flooding, storm tides and erosion. The Scoping Study has demonstrated the need to develop a full CHAS to enable Council to plan for both the short term and long term needs of the community to maintain where required the built and natural environment and the services within the at risk areas.

2.3 Phase 3 Identify areas exposed to current and future coastal hazards

2.3.1 Summary of Phase 3 technical findings

Phase 3 focused on identifying areas exposed to these current and future coastal hazards. The analysis carried out includes the detailed assessment of various Annual Exceedance Probability (AEP) events, for a range of sea level rise scenarios, for both storm tide inundation and coastal erosion.

The existing storm tide study for the Bundaberg Region (BMT WBM, 2013) only addressed the effect of cyclonic conditions. An earlier study (BPA, 1989a) also evaluated storm surge events on the Bundaberg Region coastline, reporting levels significantly higher than those determined by the 2013 study. The implication is that the storm tide level results from the BMT WBM study only apply for cyclonic events >1% AEP. Furthermore, the existing storm tide study for the Bundaberg Regional Council area did not contain sufficient information for the CHAS, namely it did not include small, more frequent events. To bridge this gap, Water Technology undertook an extreme value analysis from recorded data to fill existing data gaps.

The extreme value analysis undertaken for Phase 3 has resulted in storm tide levels that differ to those currently used within Bundaberg Regional Council's existing Planning Scheme which is based upon the 1% AEP + climate change which was extracted from the existing storm tide inundation study (BMT WBM,

2013). The result of the extreme value analysis shows that the 1% AEP is larger than the one from the existing storm tide study (and larger than HAT), which was to be expected.

A review by the QCoast2100 expert panel was unable to reconcile these inconsistencies so the decision was made to use the Queensland Government NDRP Storm Tide Hazard Interpolation dataset (GHD, 2014) for the 1% AEP storm tide inundation mapping and was adjusted to include sea level rise of 0.8 m.

The Queensland Government had also previously mapped the Erosion Prone Area (EPA) for the whole Council coastal area, and as part of Phase 3, six key locations were analysed in further detail.

The inundation and erosion prone mapping focused on the 1% AEP storm event and 0.8 m sea level rise at the six key study locations deemed to be prone to erosion risks. The remaining localities are dominated by a rocky foreshore, not expected to experience significant erosion. The analysis at each key study location indicated the following:

- Miara, Winfield and Norval Park
  - Significant areas of shoreline, including the caravan park, are within the resulting erosion hazard area.
  - Storm tide inundation is considered an issue, as mapping indicated most of the site being inundated by a 1% AEP storm event.
- Moore Park Beach
  - The township of Moore Park Beach is impacted by the erosion prone area extent from the seaward and landward side due to the low-lying wetlands that envelop the township.
  - Storm tide inundation is likely to be a significant threat to this low-lying township. Extensive inundation of areas to the landward side of the settlement is predicted from the Kolan River estuary, as well some limited direct inundation from the ocean.
- Bargara
  - Beachfront properties are within the extent of the predicted erosion prone area, and the estuary behind Kellys Beach, including parts of the golf course and wetlands, are likely to be susceptible to erosion.
  - The analysis indicates storm tide inundation is limited to the existing beach, estuarine and lagoon areas. The increased inundation in the estuary could result in impacts on The Causeway, Causeway Drive and streets near Ian Cossart Park.
- Innes Park
  - The hard, rocky foreshore results in a narrow erosion hazard area. Despite this, some properties along the beachfront and creek inlet are predicted to be impacted by erosion.
  - Mapping indicates that storm tide inundation may affect a limited number of properties near Palmers Creek mouth.
- Coonarr
  - The erosion hazard analysis suggests there will be impacts to the coastal road and beachfront properties at Coonarr Park.
  - The existing buildings in the Coonarr Beach settlement are not predicted to be inundated, however, Coonarr Park and access routes are likely to be inundated causing potential isolation risks to the settlement.
- Woodgate Beach
  - Existing long-term erosion has caused issues at the northern and southern ends of the township. Additionally, the mapping indicated erosion hazard areas also extend across the foreshore, reaching approximately one block into the existing township.

- Mapping suggests limited storm tide inundation of Woodgate Beach for the 1% AEP event from the seaside, however, there is a significant potential flow path originating from Theodolite Creek.

No technical modelling or erosion analysis was undertaken on the remainder of Council's coastal areas. Instead, the existing Queensland Government data for erosion prone areas was adopted for all other areas.

The exploration of multiple storm tide inundation and erosion event scenarios over a range of planning horizons will significantly improve the risk assessment tasks subsequently undertaken in Phase 4 and 5 of the CHAS. It is therefore recommended Council update the existing Storm Tide Inundation Study for the Bundaberg Region with due consideration of more frequent likelihood events.

2.3.2 Phase 3 stakeholder and community consultation input

Involvement from the local community and stakeholders was sought from the early stages of the CHAS as part of an information gathering exercise to assist with the understanding of the coastal hazards along the Bundaberg region coastline, as well as the establishment of a Community Reference Group (CRG). The CRG is a group of interested, voluntary community members established to liaise between Council and the community to help inform the development of the adaptation options and strategies.

Local stakeholders and organisations were invited to provide an expression of interest in the formation of a Stakeholder Advisory Group (SAG) and complete a Stakeholder survey. Infrastructure data was provided from key asset owners Ergon, Sunwater, Department of Transport and Main Roads and Council.

As part of the information gathering exercise the project team sought supporting information relating to coastal hazards such as photos, videos and stories from community members. Community members were requested to share this information via the 'Share Your Story' link on the CHAS website. The information was utilised to inform the project on beach erosion, storm tides, tidal flooding or impacts from historical cyclone events that have impacted our coastline. The information assisted in obtaining locally specific details to support the development of the CHAS and to help build a publicly accessible record over time.

In addition to the information gathering exercise, the Council also held Community Pop Ups throughout the delivery of the project. 'Our Coast' project team held two Community Pop Ups, one in Bargara on 22 May 2018 and the other at Moore Park Beach on 23 May 2018, which gave the community a chance to find out about the project and discuss their concerns about coastal hazards.

At the first CRG meeting members were introduced to the coastal hazard adaption strategy through a briefing on the project background, purpose of the CHAS, its guiding principles, the Phases involved, status and other supporting information.

A second CRG was held in October where Prof Gavin Smith of the US Department of Homeland Security's Coastal Resilience Centre, a globally recognised expert in climate adaptation, disaster recovery and resilience and Stephen Dredge of Meridian Urban, facilitated a workshop session. The CRG identified characteristics of their communities and the things they value about the coast to shape how the CHAS considers and examines specific aspects of coastal living.

2.4 Phase 4 & 5 identify key assets potentially impacted and assess risks

2.4.1 Summary of Phase 4 and 5 technical findings

Phase 4 focuses on identifying key built, community and natural assets which can be directly or indirectly impacted by coastal hazards, whilst Phase 5 is a risk assessment in conjunction with a vulnerability assessment. Combined Phases 4 and 5 of the Bundaberg Region Coastal Hazard Adaptation Strategy aim to identify triggers where the potential risk to a coastal settlement or priority asset becomes intolerable to the community.

The assessment used the following process:

- Task 1: Identification of assets exposed to current and future coastal hazards
- Task 2: Prioritisation of key assets potentially impacted
- Task 3: Risk assessment of coastal settlements in coastal hazard areas

The process is outlined in Figure 2-2.

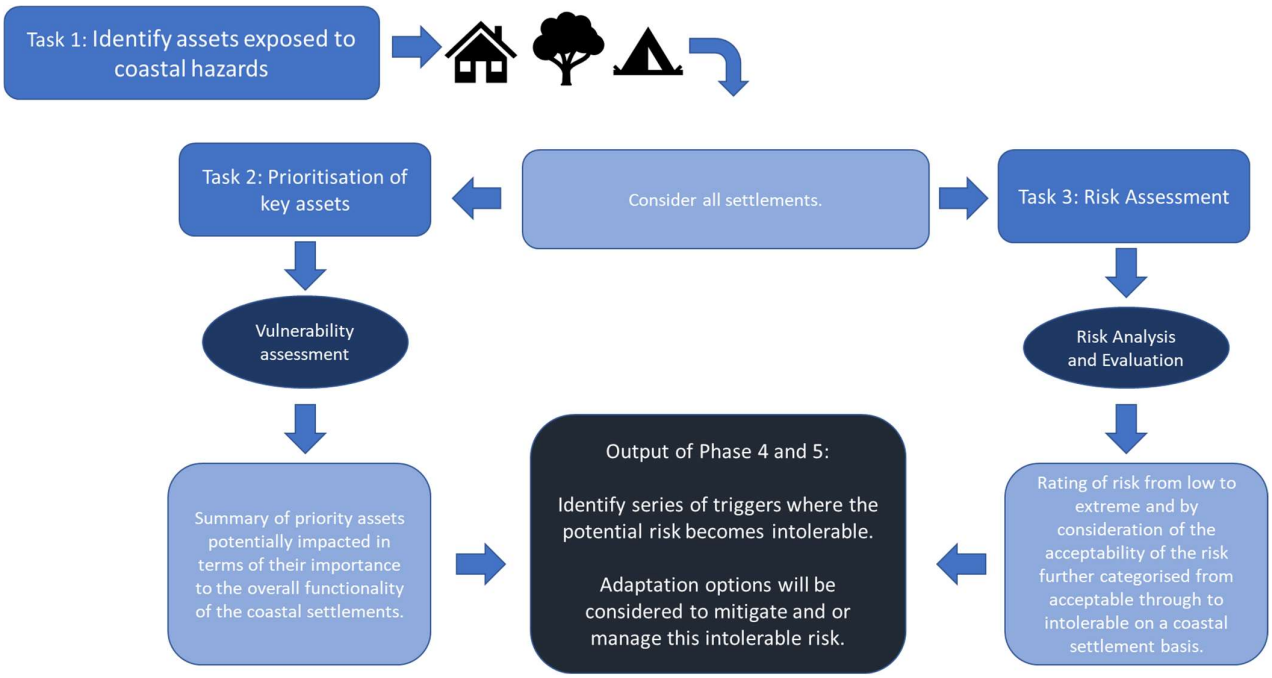

FIGURE 2-2 PHASE 4 AND 5 ASSESSMENT PROCESS

To assist with Task 1 and 2, CRG members were invited to share their experiences with coastal hazards such as storm tide inundation or coastal erosion. The CRG provided local observations and identified a range of infrastructure assets, environmental and cultural features and properties exposed to present day and future coastal hazards. CRG members also provided valuable input into the CHAS project by 'ground truthing' the coastal hazard mapping created in Phase 3.

The community was integral in Task 3 as the key assets predicted to be impacted were presented to the CRG. The group discussed risk tolerability in more detail and helped to prioritise the assets and features based on community values.

A summary of the key outcomes, the risk and vulnerability assessment are displayed in Figure 2-3. The distribution of exposure, vulnerability and risk across the Bundaberg region has shown that the impacts of coastal hazards affect the settlements in each locality in differing ways, relative to their existing exposures, community contexts, social and economic functions and characteristics, and future growth intents.

The results of the risk assessment will be used in Phase 6 to identify options to reduce intolerable risks or maintain tolerable risks.

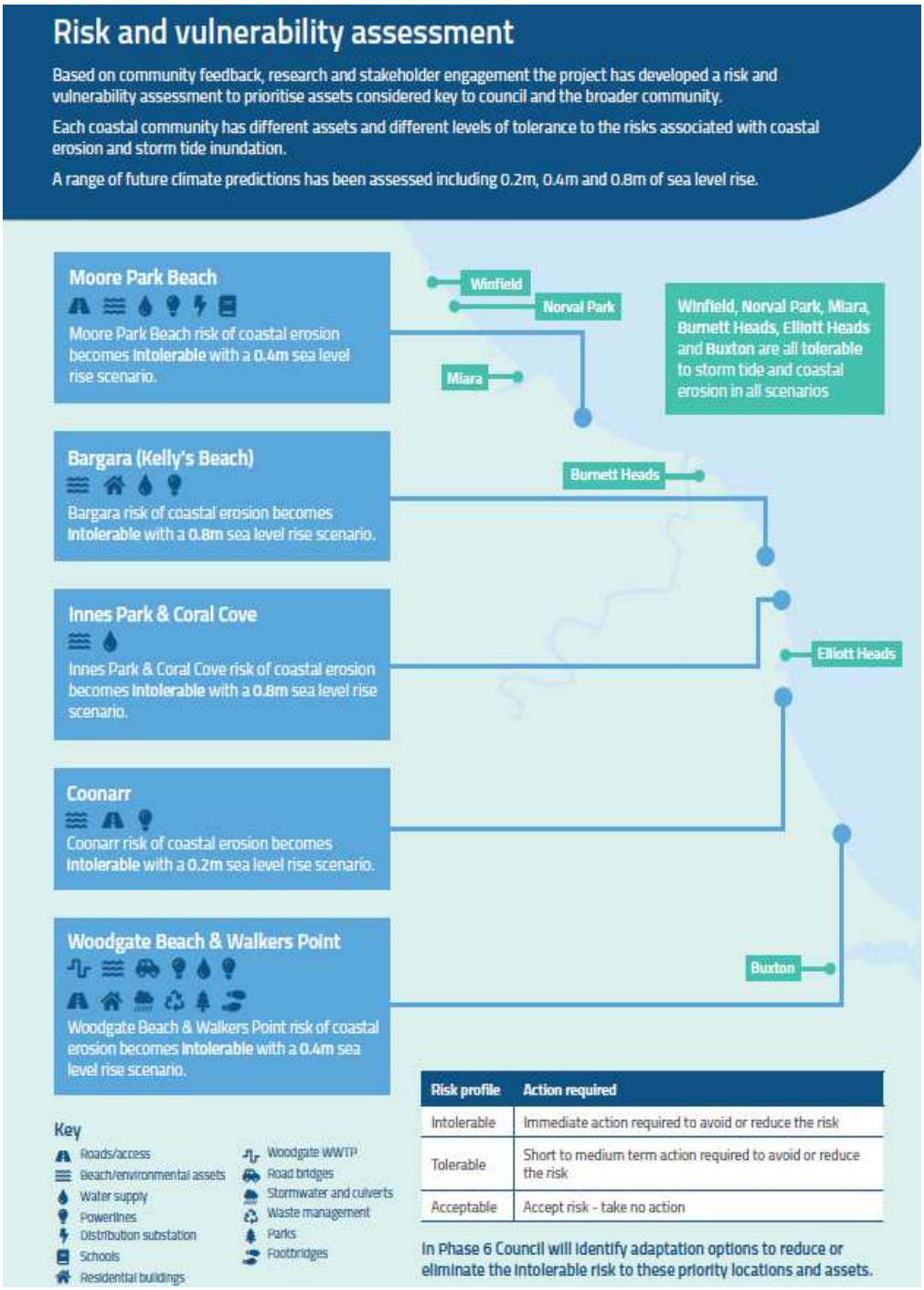

FIGURE 2-3 SUMMARY OF THE RISK AND VULNERABILITY ASSESSMENT

2.4.2 Phase 4 & 5 stakeholder and community consultation input

The Council launched the first “Our Coast” survey to the community in January 2019 and sought input from the wider Bundaberg community about what features of the coast were valued above others and what concerns they had about the potential impacts of coastal hazards on coastal living.

CRG meetings were held during this Phase to guide the development and outcomes of the CHAS. Members aided the identification of key assets exposed to coastal hazards through their local observations at a third CRG meeting on 21 March 2019.

The fourth and fifth CRG meetings were held in May and June 2019 where members contributed to developing and validating the complex vulnerability and risk assessment processes. At the fourth meeting, the results of the full risk assessment process were presented, and the group discussed risk tolerability in more detail and helped to prioritise the assets and features based on community values. At the succeeding meeting, the CRG was presented with the priority areas, i.e. those settlements subject to intolerable risks and the sea level scenario that triggers the intolerable risk.

The CRG also provided input to the vision of resilience for the Bundaberg coastal region to understand future state for the coastal settlements, in terms of coastal hazard risk, and how can each adaptation option helps to achieve this.

A values survey was conducted in May 2019. The survey sought information from the community regarding their views on coastal living, how they would like their coast to look in the future and what aspects of the coast they would like to see protected. Over 600 residents responded, and the results were used to shape the future strategy and manage the risks of coastal hazard by providing guidance and a framework by which adaptation options to coastal hazards were identified.

A SAG meeting was held in May 2019 and the results of the stakeholder advisory group survey collated. This sought to quantify an existing arrangement for mitigating coastal hazards and whether climate change adaptation strategies were implemented. Generally, climate change is not seen as a driver for operations, maintenance and systems management. Adaptation approaches to affected assets and infrastructure are undertaken as a response to a coastal hazard event whereas market forces, innovation and technology and State Government policies tend to be the justification for design guidelines and asset management approaches amongst the stakeholders.

The collaborative arrangement in shared decision making, management and responsibility was successful in developing community driven outcomes through the input of the CRG and SAG. The statements of vision, coupled with insights from the community and stakeholder surveys, provided the framework for Phase 6 where the project team discussed potential adaptation options to reduce or maintain risk from coastal hazard.

2.5 Phase 6 identify potential adaptation options

2.5.1 Summary of Phase 6 technical findings

Phase 6 is the "Option Appraisal Process" and is first of the Phases which attempts to draw the technical information together and start the process of refining and developing options for inclusion in the detailed analysis of Phase 7 and the final Phase 8 strategy. Phase 6 contemplates a long list of suggested mitigation and adaptation options and determines the options which are most suitable to address the risk.

The optioneering process in Phase 6 was guided by the principles of the Bundaberg Coastal Hazard Adaptation Strategy which were developed by stakeholders during the settlement visioning process. The settlement vision statements were developed for key localities through discussion with the community and stakeholders and analysis of the planning scheme.

The long list of potential adaptation options was developed through an optioneering process that applies the maintain, modify or transform methodology. The process integrates the vision of the settlement to arrive at a shortened list of adaptation options. An initial screening of the shortened list options was also undertaken that broadly considers the community values, cost, benefits, constraints and efficacy to decide on the progression of that option into Phase 7.

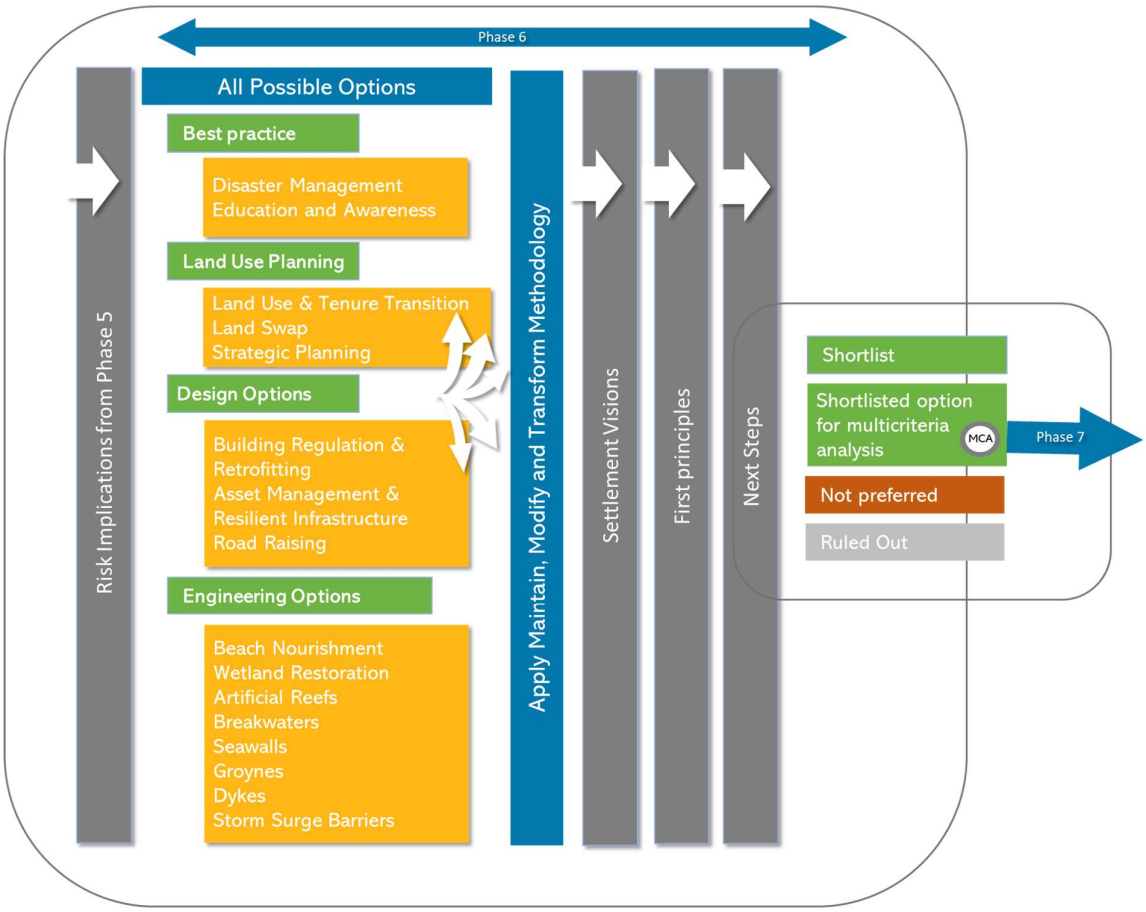

FIGURE 2-4 ADAPTATION OPTIONEERING PROCESS THROUGH PHASE 6 TO PHASE 7

Draft adaptation pathways were also developed and were further refined during and after the multicriteria analysis in Phase 7.

2.5.2 Phase 6 stakeholder and community consultation input

In June 2019, the project team facilitated a workshop with the CRG in Bundaberg to assist in developing the principles of the Bundaberg CHAS. The workshop provided principles upon which the future actions, policies and recommendations can be based, tested and supported for future decision-making. Through discussion, the workshop explored the principles for adaptation across the four themes of:

- resilient economy;
- resilient environment;
- resilient settlements; and
- resilient society.

Stakeholders agree that resilient infrastructure contributes to a resilient settlement, economy, society and environment. Asset managers involved in the development of the long list of adaptation options recognised that implementation of the CHAS principles helps to ensure infrastructure is renewed, managed and replaced with due consideration of coastal hazards.

Further CRG meetings were held in August and October 2019 where members contributed to developing and validating the long list of adaptation options to mitigate coastal hazards now and under future sea level rise scenarios. A range of options were presented to the community group from the “Compendium” of adaptation measures, including regenerative options such as beach nourishment, dune construction and regeneration; coastal engineering options such as seawalls, artificial reefs and groynes; land use planning options such as tenure transition; development controls; and non-structural options such as disaster management, education and awareness campaigns.

The group also reviewed the pros and cons of each option and provided feedback to the project team about the suitability of the options for each coastal settlement in the context of the current and future coastal hazard risks that settlements may experience with a change in risk profile over time.

2.6 Phase 7 socio-economic appraisal of adaptation options

2.6.1 Summary of Phase 7 technical findings

During Phase 7, detailed multi-criteria analysis (MCA) and cost-benefit analysis (CBA) were applied to shortlisted 'modify' adaptation options, which were then compared and ranked. This provides a framework to inform prioritisation of adaptation options into the final CHAS implementation strategy.

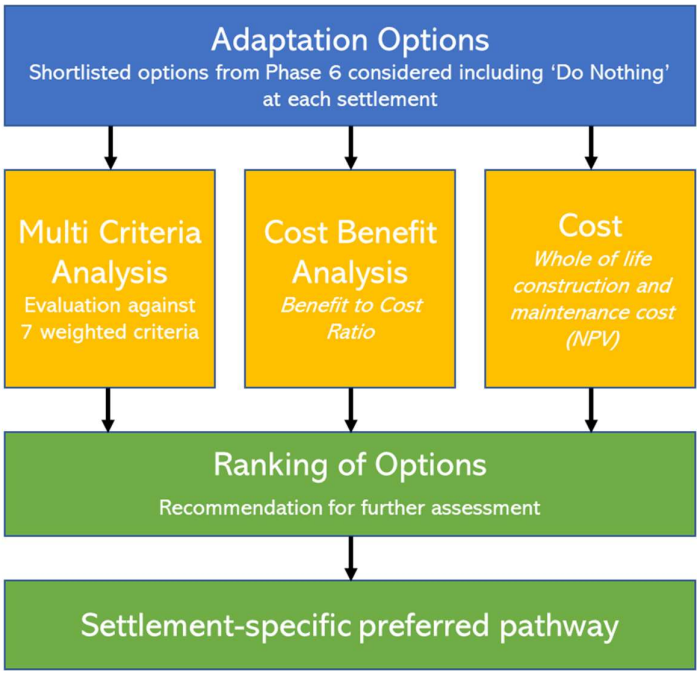

FIGURE 2-5 PHASE 7 SOCIO-ECONOMIC APPRAISAL PROCESS

The priority settlements considered in the socio-economic appraisal are those identified as being exposed to intolerable risks from coastal hazards at some point in the future:

- Moore Park Beach;
- Burnett Heads;
- Bargara;
- Innes Park/Coral Cove;
- Coonarr; and
- Woodgate Beach and Walkers Point.

MCA was performed against key criteria, which were each weighted with input from the community, project stakeholders and Council. The evaluation criteria include effectiveness of the option, adaptability over time, impact on beach access and amenity, technical viability of the option, impact on the natural environment and environmental values, approvals required, and the cost of implementation/maintenance.

CBA enables an assessment of the reduction in coastal hazard damages to property and infrastructure that could be afforded through implementation of the physical adaptation option. The reduction in damages is compared directly with the construction and maintenance cost to provide a benefit-cost ratio (BCR), informing how economically beneficial it is to implement each option.

The results show that soft engineering approaches are preferable, namely beach nourishment, to mitigate coastal erosion risks. This is the recommended adaptation approach for Moore Park Beach, Woodgate Beach,

Coonarr, Innes Park and Kellys Beach, Bargara. This option was ranked higher than other hard infrastructure options, such seawalls, as they are considered to have the same effectiveness but scored much higher with respect to adaptability and impacts on beach access, amenity and environment. Being adaptable to changing sea level scenarios is important as the timing of these events is associated with a high degree of uncertainty.

The evaluation criteria include capital and maintenance cost, environmental and social impact, community acceptability, adaptability, effectiveness over time, legal and approval risks, and technical viability. The MCA provides a ranking based on the evaluation criteria followed by the CBA providing a comparison between the cost of implementation to the benefits received (reduction in coastal hazard damages).

Table 2-2 provides an overall assessment and comparison of the 'modify' options assessed in the MCA and CBA. The MCA score is listed as well as the cost and benefit estimates presented as net present value (NPV) to enable direct comparison of adaptation options implemented over different planning horizons. The result from the CBA is the presented benefit-cost ratio (BCR).

TABLE 2-2 MCA AND BENEFIT-COST RATIO FOR EACH OPTION

Adaptation option	MCA score	Cost estimate	Benefit estimate	Ratio
OPTIONS RECOMMENDED AS PREFERRED ADAPTATION PATHWAYS				
Moore Park Beach Beach Nourishment with Dune (re)construction	77.3	$525,219	$3,830,002	7.3
Woodgate Beach Beach nourishment with Dune (re)construction	73.8	$1,072,437	$6,034,801	5.6
Moore Park Beach Seawall / Rockwall / Buried Seawall	67.4	$802,348	$3,830,002	4.8
Coonarr Beach nourishment with Dune (re)construction	63.8	$177,477	$675,539	3.8
Burnett Heads Storm Surge Barrier and Dyke	60.6	$80,273	$34,173	0.4
Coonarr Land use and tenure transition	59.6	$1,553,137	$693,254	0.4
Innes Park and Coral Cove Beach nourishment with Dune (re)construction	58.8	$11,595	$89,649	7.7
Bargara Beach Nourishment with Dune (re)construction	58.4	$5,846	$225,164	38.5
OPTIONS NOT RECOMMENDED AS PREFERRED ADAPTATION PATHWAYS				
Coonarr Seawalls /Rock wall / Buried Seawall	56.3	$511,532	$675,539	1.3
Woodgate Beach Seawalls /Rock wall / Buried Seawall	46.1	$1,804,230	$6,034,801	3.3
Innes Park and Coral Cove Seawalls /Rock wall / Buried Seawall	43.1	$28,987	$89,649	3.1

Adaptation option	MCA score	Cost estimate	Benefit estimate	Ratio
Bargara, Kellys Beach Seawall / Rockwall / Buried Seawall	40.3	$33,270	$225,164	6.8
Woodgate Beach Land use and tenure transition	37.7	$914,489	$217,441	0.2

The preferred adaptation pathways for each settlement are displayed in Figure 2-6. The options for each settlement are presented based on the high-level screening process in Phase 6 and results of the socio-economic appraisal.

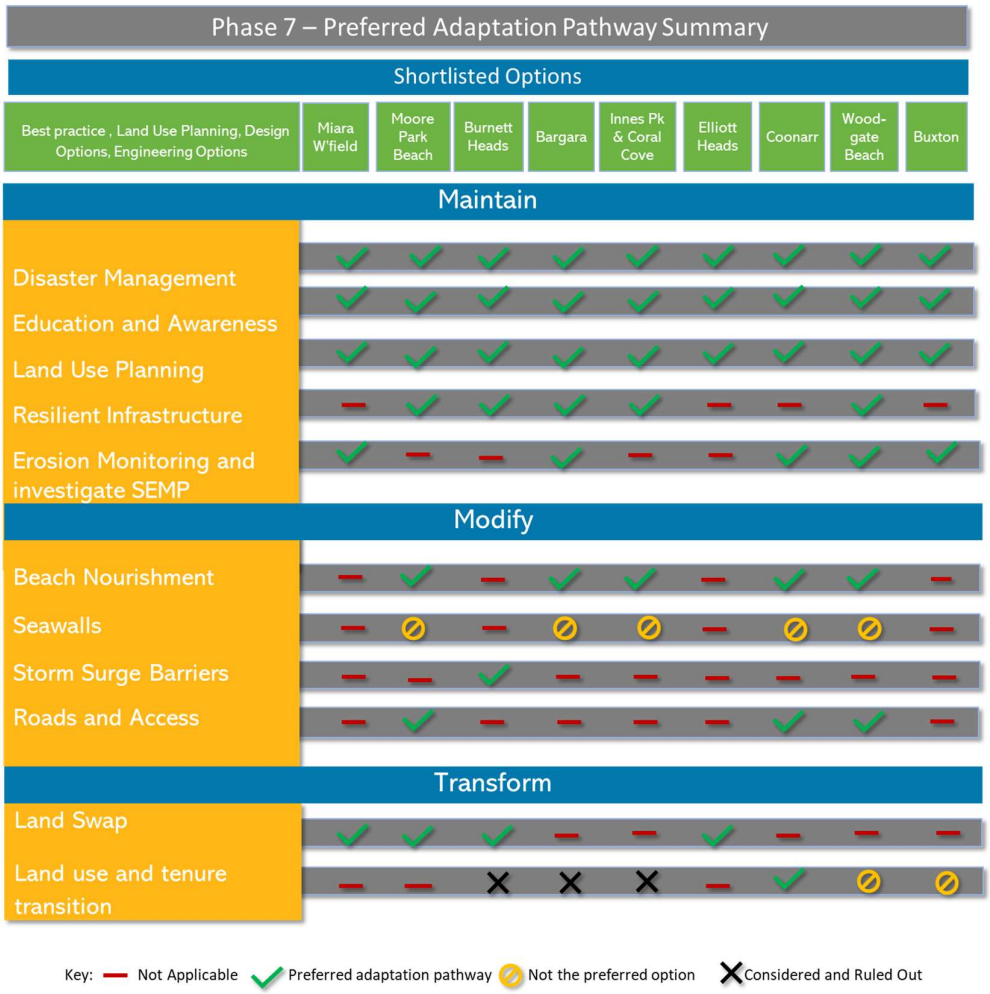

FIGURE 2-6 PREFERRED ADAPTATION PATHWAY SUMMARY

2.6.2 Phase 7 stakeholder and community consultation input

As part of Phase 7, the CRG also provided input into the ranking and screening of adaptation options by considering the costs, benefits, effectiveness, viability and negative impacts of the long list of options. The project team have used the CRG input in conjunction with technical expertise to refine the long list of options and to refine the multi-criteria analysis. This analysis will assist the economic appraisal of the adaptation options for input into the final strategy document in Phase 8.

At the Community Reference Group workshop in March 2020, Council presented the adaptation options from Phase 6 and the elements used to perform the Multi-Criteria Analysis (MCA). MCA criteria weighting was assessed by the CRG members, and this enabled community views to be directly represented in the final outcomes of Phase 7.

2.7 Summary

The CHAS process to date has been driven by the communities affected, for the communities affected. The strategy has utilised a co-design approach wherein stakeholder engagement is fully embedded within each phase of the project. Community pop-ups, the CRG and website updates were implemented to ensure that the community was able to play a crucial role in the development of the CHAS.

The technical findings of the phases presented in this chapter show how hazards and potential risk to the community and assets are expected to increase over the four sea level rise scenarios. Prioritisation is given to reducing 'intolerable risks' into the tolerable range by way of adaptation action that 'modifies' or 'transforms' settlements. The adaptation pathways approach is designed to provide support for Council to be strategic, flexible, and structured when implementing decisions relating to adaptation. The preferred pathways, based on a high-level screening process and socio-economic appraisal, represent both the planning and implementation of the adaptation options.

Stakeholder engagement underpinned the development of Bundaberg Regional Council's Coastal Hazard Adaptation Strategy, throughout all aspects of work. Stakeholder communication and engagement was structured under four themes and aligned with best practice principles from the International Association for Public Participation (IAP2). These key themes and associated activities are:

Continuous engagement, achieved through:

- Project branding;
- Project website; and
- Community values survey.

Event based engagement, achieved through:

- Presence at community events; and
- Community information pop-ups.

Targeted engagement, achieved through meetings with:

- Stakeholder Advisory Group;
- Community Reference Group; and
- Project Control Group.

Media led engagement, achieved through:

- Use of social media;
- Newspaper advertisement; and
- Media releases.

A dedicated project website ensured transparency in communicating CHAS purposes, processes and outcomes with the general public. This was one of the key aspects of communication and enabled a means of providing additional opportunities for interested parties to get involved throughout the CHAS process.

Survey respondents, community representatives and key stakeholders have directly influenced the outcomes of the CHAS, by incorporating local knowledge, preferences, and an understanding of what is valued by the community. Further details are to be provided in the Stakeholder and Community Engagement Report.

With community and stakeholder assistance, the CHAS has successfully identified areas and assets exposed to coastal hazards, undertaken a risk and vulnerability assessment, identified adaptation options and completed a socio-economic appraisal of these options. The following chapters of Phase 8 develop the strategy, action plan and recommendations for implementation and strategic review.

3 THE STRATEGY

This section describes the intent and purpose of the CHAS, overarching strategic direction and process of prioritising adaptation actions using a trigger-based approach. The strategic direction is based on community values and building resilience in the region to reduce the risk from coastal hazards now and into the future. Upholding community values and building resilience capacity provides the foundation for the adaptation principles that will guide preferred adaptation pathways to each coastal settlement. The CHAS Strategy and Implementation is comprised of three main documents:

- Strategy and Implementation document (this Phase 8 Report), intended to be an internal document for Council and contains technical details.
- A CHAS Summary Document for the public that is easy to understand by everyone; and
- Stakeholder Communication and Engagement Report.

3.1 Key messaging

The development of the regional CHAS is a lengthy and technical process, highlighting regional characteristics which lead to bespoke solutions and learnings which shape the important messages for the future of the Bundaberg coastline and adaptation. Primary among these from a local government operational perspective are:

- The responsibility the new knowledge brings to inform residents of known risk;
- Enabling Council to make risk-informed decisions on the future of the coastal settlements with regards to infrastructure expenditure, planning and investment; and
- Enabling Council to align CHAS actions with various funding opportunities in resilience, adaptation, climate change and recovery. In this changing policy space, governments will not continue to fund recovery without accompanying adaptation strategies.

The broader lessons and messages, which are reiterated in the public document for consultation, attempt to convey the nature and scale of coastal change. The following statements reflect the key messages of the CHAS that are included in the CHAS Summary document:

- The CHAS seeks to ensure the characteristics that the community values about the Bundaberg coast are maintained over time in the face of change from natural hazards.
- The Bundaberg coast is dynamic. It changes from one day to the next. Sand moves with the currents and tides, creating different landforms every day. Flora and fauna move with it, thriving in new habitats over time. New businesses open, new residents arrive. People live their own version of a coastal lifestyle.
- Each coastal settlement is different. Bargara is the bustling commercial and tourist centre. Burnett Heads is the region's link to the export market and business advantages. The Coral Cove and Innes Park residential areas are serviced by Bargara, whilst Moore Park Beach and Woodgate are townships full of character. Coonarr, Winfield and Buxton, and the smaller coastal villages are not expected to experience any growth and services are limited.
- People are at the heart of the CHAS. The community has helped to shape every phase of the strategy and its successful implementation is dependent on further involvement by individuals, families, businesses, government, and community organisations.
- Step one is understanding individual risk through community awareness.
- There is a role for everyone - Council is responsible for public assets. The attachment to the coastline felt by the community can be adapted with the help of the community. Private property adaptation will have individual responses and solutions.
- Change indicators are many and long-term monitoring will provide evidence over time of the coastal change.

The Bundaberg coastline is highly valued by community members, which reinforces the need to be informed and prepare for change.

3.2 Adaptation principles

The action plan has been developed using both community values and a settlement-specific approach. The vision of each settlement drives the adaptation option prioritisation. To do this, the settlements were categorised as:

- **Destination Coastal Growth Hub** for Bargara, reflecting its primacy in the coastal urban growth plan;
- **Coastal Townships** for Moore Park Beach and Woodgate, reflecting small amounts of local centre and community use zones with services sufficient to support residences and modest growth visions;
- **Coastal Growth Centres** for Burnett Heads, Innes Park, Coral Cove and Elliott Heads, reflecting their role in providing residential growth, supported by services at Bargara; and
- **Coastal Character Villages** for Buxton, Winfield, Miara and Coonarr, reflecting the vision for these communities of limited growth and services.

The community values were used as a cross-check for appropriateness of adaptation action across the four resilience themes: society, settlement, economy and environment shown in Table 3-1.

The purpose of this strategy is to understand whether change created by coastal hazards may impact the ability of each of these places to reach their potential and how it needs to adapt into the future to reduce exposure to intolerable risks.

TABLE 3-1 COMMUNITY VALUES ACROSS FOUR THEMES OF RESILIENCE

Theme	Principles for Adaptation
Resilient Economy 	■ Stronger relationships with the media generate positive stories on the economy before and after events across multiple channels, ■ Incentivising tourism activities outside the hazard areas, ■ Avoid changing economic dynamics too quickly; and ■ Economic vitality notwithstanding the risks.
Resilient Environment 	■ Let natural processes happen as much as possible, ■ Communicate accurate sea level rise using the Rosslyn Bay wave buoy data, ■ Maximise the ability of the coast to be dynamic, ■ Maximise the use of healthy, mature, resilient wetlands to buffer communities, ■ Strengthen what we have and continue to protect it, ■ Protection of cultural sites, e.g. shell middens; and ■ Recognise partnerships for mutual benefit e.g. State agencies.

Theme	Principles for Adaptation
Resilient Settlements 	■ Commercial centres resilient to coastal hazards, ■ Initial infrastructure is sensitively located and designed – e.g. WWTP, ■ Adjust new development to risk – build smarter, ■ Multiple ways in and out from key locations, ■ Stepping interventions over time, plus no 'one size fits all' approach. ■ Resilient building design is critical; and ■ Clear identification of risk areas.
Resilient Society 	■ Connectivity of people and place, ■ Overcoming fear of loss and taking charge of the future, ■ Be aware of the frequency of events into the future, e.g. more catastrophic events will happen in quicker succession, overcoming perception with knowledge and education on risk, ■ Communicating factual information to provide situational awareness during disaster events, ■ A connected community drives success; and ■ To have confidence in our area.

The challenge with a changing coast is implementing the actions to ensure the envisaged future is realised. Communicating what coastal adaptation means can also be challenging. The public-facing CHAS document attempts to convey important principles to the public about risk and change:

- Change ***is*** required – the coast will not stay the same and some areas are at significant risk;
- Change need not be immediate unless there is a very real risk of loss of life or property;
- Change is everyone's business – there is a role for everyone;
- Ongoing vigilance and monitoring are needed; with responsive and adaptive decision making.

Therefore, the CHAS proposes a 'Pathways Approach' in the action and implementation plans. The CHAS deals with three types of coastal hazard risk and each have different mitigation methods and characteristics, if storm tide inundation risk may be modified through structural intervention in one location, this will not modify sea level rise or coastal erosion in the same location. Underpinning change is the need to continue community awareness, education, disaster management and land use planning amendments on an ongoing basis.

3.3 Reducing the risk

The results of the risk and vulnerability assessment presented a settlement 'risk profile' based on the level of tolerability to the risks associated with coastal hazards. Hazards and potential risk to the community are expected to increase over the four sea level rise scenarios considered in the CHAS. Understanding the tolerability of these risks over time has been important in determining the appropriate adaptation approach for each settlement. Prioritisation is given to reducing 'intolerable risks' into the tolerable range by way of adaptation action that 'modifies' or 'transforms' settlements.

In isolation, some individual adaptation options may reduce the risk profile to a settlement, such as raising a key access road to eliminate the risk of isolation, however adaptation options must be considered as a combined package of solutions. Figure 3-1 shows a theoretical risk profile over time. The adaptation options within each of the three categories drive the risk reductions over time based on key trigger points, i.e. ongoing Maintain options implemented continually ensure that coastal hazard risks are not increased; Modify options

seek to reduce the risk profile or prevent risks from entering the intolerable range; Transform options remove the risk to a specific site via a land swap or land use and tenure transition approach.

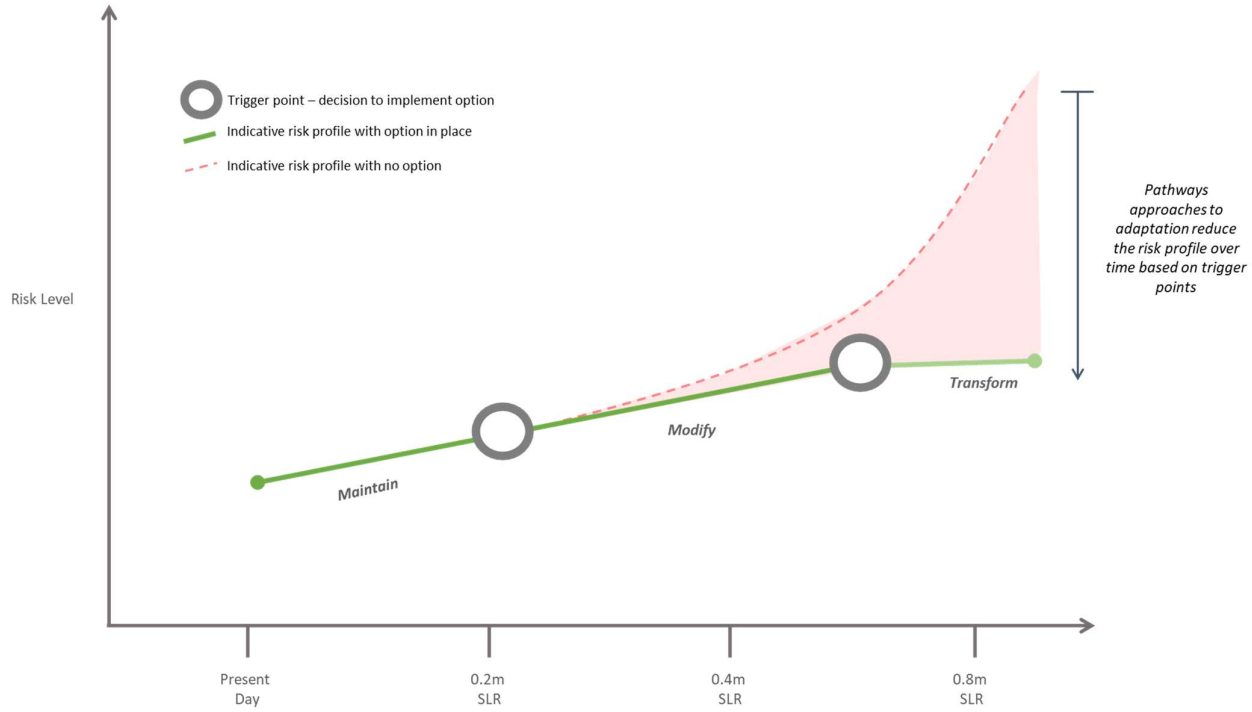

FIGURE 3-1 ADAPTATION PATHWAYS THAT REDUCE THE RISK PROFILE

These visualisations will be provided in section 4.3 to reflect how the preferred adaptation pathways approach will reduce the risk profile in each settlement.

3.4 Adaptation pathways approach

3.4.1 Overview

The pathways approach to adaptation undertaken for the Bundaberg CHAS is an approach designed to schedule adaptation decisions. The approach provides the support for Council to be strategic, flexible and structured when implementing decisions relating to adaptation and allow for planning, prioritisation and budgeting for actions. Trigger points and thresholds help to identify when to revisit decisions or actions.

It is important to note that for all settlements, adaptation will require an immediate focus on disaster management, education and awareness campaigns, and land use planning to ensure the settlement vision and growth pattern are commensurate with the risk.

The preferred pathways represent the planning and implementation of the adaptation options. The Action Plan will illustrate the implementation process of the preferred options only.

3.4.2 Adaptation Options

The adaptation pathway consists of the following adaptation options. This section describes the context of each option.

3.4.2.1 Maintain

There are a range of options in the Maintain category that address coastal processes to protect people and property from the impacts of climate change, sea level rise, coastal erosion, permanent inundation or storm tide inundation.

LAND USE PLANNING

In the first instance, land use planning responses are employed to avoid the risks for new development in a strategic and future sense. The intended strategic outcome for a settlement may be to maintain or modify the development pattern over time through long term change or a no change position. Council will need to ensure the visions for each settlement align with coastal change to ensure projected in-fill development in coastal townships is appropriate and a risk-based approach to planning is in place. The extensive opportunities for changes to the planning scheme and land use planning tools are discussed in detail in the technical appendix of Phase 6.

DISASTER MANAGEMENT

Council, the State Emergency Service, and volunteer and local disaster management groups play an important role in keeping the community safe. The Local Disaster Management Plan outlines activities within the key stages of prevention, preparedness, response and recovery. Disaster management strengthens community disaster preparedness and coordinates systematic responses to potential coastal hazard events.

EDUCATION AND AWARENESS CAMPAIGN

To build awareness and help the community prepare for potential disasters, Council provides extensive resources as part of their disaster management activities. The information used within disaster preparedness campaigns is valid for all hazards and assists the community in the lead up to potential natural hazard events. The resources provided include:

- a household emergency plan guide;
- an emergency kit guide;
- an evacuation plan template;
- preparing pets information; and
- relevant emergency contact numbers.

During an event, the Disaster Dashboard provides real-time, ‘one-stop’ information on warnings, road conditions, news and updates, power outages, and social media along with links to mapping and contact information.

Including specific information to enhance understanding of coastal processes, adaptation options and implications can build resilience in the community through communication and messaging. As the adaptation name suggests both disaster management and community awareness are core actions to be continued regularly to maintain vigilance and preparedness.

RESILIENT INFRASTRUCTURE

The Strategy provides the evidence to influence future infrastructure planning and design decisions based on an understanding of coastal hazards. Building or replacing infrastructure assets with assets that are resilient to coastal hazards increases the service to the community and is necessary for the ongoing function of a settlement.

This approach also minimises interruptions to services such as drainage, roads, water supply and electricity during and after coastal hazard events.

3.4.2.2 Modify

There are a range of options in the Modify category that form physical alterations to the coastline to reduce the risk to people and property from the intolerable range.

BEACH NOURISHMENT

Beach nourishment is the artificial addition of sand to a beach system, increasing the buffer against erosion or halting erosional losses. Beach nourishment reduces the risk of storm tide inundation when combined with dune creation and revegetation of the dune system.

A long-term beach nourishment strategy requires continuous monitoring of shoreline changes to identify timing of renourishment campaigns.

FIGURE 3-2 BEACH NOURISHMENT

SEAWALLS

Seawalls are often incorporated into a Shoreline Erosion Management Plan (SEMP) in combination with beach nourishment and dune regeneration to provide a last line of defence under the coastal dune, reducing the risks of erosion and flooding.

FIGURE 3-3 SEAWALL EXAMPLE

RAISING KEY ACCESS ROADS

Raising key access routes reduces the likelihood of isolation to communities. Two options may be available to Council that reduce the impacts of isolation to affected communities, these include:

- Raise the road above the level where the community becomes isolated;
- Construction of causeway crossing which may experience inundation.

This option prevents isolation of the settlement, provides an evacuation route for the community, allows emergency services access and improves logistics during recovery.

STORM SURGE BARRIERS AND DYKES

Dykes are an artificially constructed wall/fill commonly designed to regulate water levels and to avoid inundation from storm tides. It is usually earthen, covered with vegetation and parallel to the shore of low-lying coastlines. Dykes can be used to control extreme water levels associated with storm tides and in conjunction with sea level rise.

Storm surge barriers are hard engineered structures designed to prevent coastal flooding and maintain navigation at other times. They are normally part of a combined system of barriers (dykes, dunes, etc.) preventing storm tide water levels to flood waters within estuaries, lagoons or waterways.

GROYNES AND ARTIFICIAL HEADLANDS

Groynes are structures built perpendicular to the shoreline that trap sand moving along the coast, causing sand build up on the downdrift side. A variant of a groyne is an artificial headland which acts in the same manner but has a larger footprint. They can be effective in controlling coastal erosion and longshore transport.

Groynes are only effective in areas with sufficient longshore sediment transportation rates. They cause the accumulation of material on one side and erosion on the lee side. Therefore, it is often required to build a whole groyne field to avoid negatively impacting lee-side assets. Groynes are therefore recommended for a whole beach compartment.

3.4.2.3 Transform

LAND SWAP

Land swap may be applied to assets or buildings that are potential severely impacted by intolerable risks. The land swap activity is dependent on availability of an alternative site but is fully effective in removing risk to life and property.

LAND USE AND TENURE TRANSITION

Tenure transition is the process of changing the ownership of land and property in areas subject to high hazards where it may be appropriate to cease occupation of the property in order to free residents from dangerous situations and intolerable risks. Research and experience show, that landowners must feel an immediate threat to consider leaving their property. In addition, the market value of their property must have decreased to an extent that they do not feel they will get a better price on the open market. This adds up to a tough call on land with significant scenic amenity which has major capital improvement.

3.5 Implementation

The implementation chapter introduces the primary components for consideration including essential elements of, roles and responsibilities, governance, implementation over time, and options for integration into Council programs. It is divided into six key sections:

- Governance options;
- Roles and responsibilities;
- Implementation process;
- Strategy lifecycle;
- Implementation timeline; and
- Internal and external integration.

The implementation part of the Strategy makes recommendations for embedding learnings and on-going coastal adaptation into the organisation. This includes the importance of independent governance, outlines the roles various stakeholders can play and the strategy lifecycle and suggested timeline.

3.6 Formal consultation period

As per the CHAS Minimum Standards and Guidelines, prior to the finalisation of a CHAS, a minimum 28-day formal public consultation period is recommended. The intention of this consultation period is to allow the public to make formal submissions on the CHAS.

The following documentation and resources were made publicly available via the Our Coast Bundaberg Coastal Hazard Adaptation Strategy website and links advertised via social media and media outlets:

- A CHAS Summary Document, specifically written for the community
- Coastal hazard mapping portal; and
- Supporting fact sheets, media release, educational video, website surveys and online submission portal.

Upon completion of the consultation period, a report setting out Council's response to the submissions received will be prepared and formally included as part of the Stakeholder Communications and Engagement Report that will accompany this final Phase 8 report (as an addendum).

4 THE ACTION PLAN

This chapter provides the preferred adaptation actions to reduce coastal hazard risks to each settlement over four sea level rise scenarios. The preferred adaptation actions are based on findings from Phase 6 and Phase 7 and therefore the action plan presented in this chapter excludes the approaches that are not preferred. The preferred adaptation actions have been identified to treat priority risks over the following sea level rise scenarios:

- Present day conditions;
- 0.2 m;
- 0.4 m; and
- 0.8 m.

Short-term actions have also been identified, i.e. within a 5 to 10-year period, to help implement the adaptation pathways in the context of governance, planning for action, funding, or review of the adaptation pathways over time.

This section also looks at the potential effect of implementing preferred adaptation actions upon the risk profile of each settlement. This can be achieved through adoption of a 'trigger-based' approach for implementation of adaptation actions based upon the threshold for intolerable risk as determined in Phase 5. Triggers for action identify when adaptation must commence to allow for planning, prefeasibility, funding and further consultation to occur before intolerable risks materialise. For example, if coastal hazard is deemed to be intolerable after 0.8 m sea level rise, the trigger for action must be a point in time between 0.4 m and 0.8 m sea level rise.

4.1 Overview of adaptation options assessed

Several adaptation options have been considered in the CHAS. Adaptation options are classified as per the following three categories:

- **'Maintain'** is an option usually applied where the risk requires action to reduce or maintain the current risk level. These include ongoing work in the areas of disaster management, land use planning, asset planning and maintenance, and community education and awareness programs. These activities do not remove the risk or the hazard.
- '**Modify'** options are generally proposed in settlements where the risk becomes intolerable and include physical options such as raising key access roads, seawalls, beach nourishment or storm surge barriers. The nature of the risk at some settlements means physical intervention against one hazard is not effective in protecting the entire community form all hazards. In some cases, defensive options may only be an interim adaptation method.
- '**Transform'** options are applied where risk is intolerable, these include land use and tenure transition / land swap. This can be complex due to high capitalisation of coastal land and is generally only appropriate in certain circumstances when the land value becomes a true reflection of the risk level.

Table 4-1 provides an overview of the Adaptation Options shortlisted for the CHAS.

TABLE 4-1 ADAPTATION OPTIONS RECOMMENDED AS PREFERRED PATHWAYS

ADAPTATION OPTIONS	Miara, Norval Park, Winfield	Moore Park Beach	Burnett Heads	Bargara	Innes Park, Coral Cove	Elliott Heads	Coonarr	Woodgate Beach, Walkers Point	Buxton
MAINTAIN									
Disaster management	✓	✓	✓	✓	✓	✓	✓	✓	✓
Education and awareness campaign	✓	✓	✓	✓	✓	✓	✓	✓	✓
Land use planning	✓	✓	✓	✓	✓	✓	✓	✓	✓
Resilient infrastructure		✓	✓	✓	✓			✓	
Monitor erosion	✓			✓			✓	✓	✓
Site specific investigation				✓					
MODIFY									
Beach nourishment / dune reconstruction		✓		✓	✓		✓	✓	
Storm surge barrier			✓						
Road raising		✓					✓	✓	
Causeway		✓							
TRANSFORM									
Land swap	✓	✓	✓			✓			
Land use and tenure transition							✓	✓	✓

A site-specific investigation has been identified for Mon Repos Turtle Centre and land swap has been identified for several specific assets: Miara Holiday Park, Moore Park Beach Surf Club and Tourist Park, Lighthouse Tourist Park, and Elliott Heads Tourist Park.

Other options such as building retrofitting, wetland restoration, artificial reefs, breakwaters, groynes and dykes have also been considered during Phase 6 and screened out as not applicable or not preferred for any of the settlements.

Adaptation options need to respond to the three main coastal hazards: permanent inundation from sea level rise, temporary inundation from storm tide events, and coastal erosion. Adaptation options are not always able to be effective against all hazards but collectively will reduce the level of risk to a settlement.

4.2 Action plan

During the CHAS, a long list of potential adaptation options for each coastal settlement area were considered. Some of those options were shortlisted for the Action Plan without undergoing further analysis through the Multi-Criteria Analysis (MCA) and Cost-Benefit Analysis (CBA). Those are options that are considered best-practice non-structural options such as ongoing disaster management, land use planning, community education and awareness, and monitoring erosion. In addition to those, the raising of key-access roads has also been shortlisted to lower the isolation risk of some communities within the Local Government Area (LGA).

All remaining options were further analysed through the MCA and CBA to enable prioritisation and preference of options based on their performance and costs.

The Community Reference Group and Council were involved in the appraisal of the options throughout, to ensure that the CHAS presents adaptation options that align with the resilience and adaptation principles as shown in Table 3-1 and uphold the community values.

The following Table 4-2 shows the CHAS Action Plan. This will be also be provided as part of the Our Coast Strategy document.

TABLE 4-2 ACTION PLAN – PREFERRED ADAPTATION PATHWAYS FOR EACH SETTLEMENT

Sea level rise scenario		Now		0.2m	0.4m	0.8m
Estimated timing of triggered based approach		**2020**		**~2040**	**~2070**	**~2100**
All coastal townships	Council to implement the following priority actions	• Implementation of an internal Council steering group to champion an adaptation framework, progress planning adaptation options and continuous monitoring of trigger points. • Plan for and perform continuous stakeholder engagement and communication. • Development of a land swap and land use and tenure transition policy • Update and improve coastal hazard data. • Regular monitoring, reporting and review. CHAS update every 5-10 years, particularly the adaptation pathways versus non-preferred options				
Miara, Winfield and Norval Park	Risks are tolerable in all scenarios for storm tide and coastal erosion.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Monitor erosion and investigate SEMP		• Start planning for land swap at Miara Holiday Park (alternatively land use and tenure transition)	• Land swap at Miara Holiday Park (alternatively land use and tenure transition)	
Moore Park Beach	Risk of coastal erosion becomes intolerable with 0.4m sea level rise scenario.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Resilient infrastructure	• Start planning for a causeway Moore Park Road (alternatively road raising) • Start planning for land swap at Surf Club	• Start planning for beach nourishment (alternatively seawall) • Causeway Moore Park Road (alternatively road raising) • Land swap at Surf Club	• Beach nourishment (alternatively seawall) • Start planning for raising Murdochs Linking Road (alternatively causeway) • Start planning for causeway Malvern Drive (alternatively road raising)	• Road raising Murdochs Linking Road (alternatively causeway) • Causeway Malvern Drive (alternatively road raising)
Burnett Heads	Risks are tolerable in all scenarios for storm tide and coastal erosion.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Resilient infrastructure (water, electricity, stormwater)			• Start planning for storm surge barrier • Start planning for land swap at Lighthouse Tourist Park	• Storm surge barrier • Land swap at Lighthouse Tourist Park
Bargara	Risk of coastal erosion becomes intolerable with 0.8 m sea level rise scenario.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Monitor erosion and investigate SEMP • Resilient infrastructure (water, electricity) • Investigate Mon Repos in partnership with Queensland State Government Parks and Wildlife			• Start planning for beach nourishment at Kellys Beach (alternatively seawall)	• Beach nourishment at Kellys Beach (alternatively seawall)

Sea level rise scenario		Now		0.2m	0.4m	0.8m
Innes Park and Coral Cove	Risk of coastal erosion becomes intolerable with 0.8m sea level rise scenario.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Resilient infrastructure (water)			• Start planning for beach nourishment (alternatively seawall)	• Beach nourishment (alternatively seawall)
Elliott Heads	Risks are tolerable in all scenarios for storm tide and coastal erosion.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning		• Start planning for land swap (alternatively land use and tenure transition)	• Land swap (alternatively land use and tenure transition)	
Coonarr	Risk of coastal erosion becomes intolerable with 0.2 m sea level rise scenario.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Monitor erosion	• Start planning for raising key access road (alternatively causeway) • Start planning for beach nourishment (alternatively seawall)	• Raising key access road (alternatively causeway) • Beach nourishment (alternatively seawall)		
			• Start planning for land use and tenure transition	• Land use and tenure transition		
Woodgate Beach	Risk of coastal erosion becomes intolerable with 0.4 m sea level rise scenario.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Resilient infrastructure (water, electricity, wastewater) • Woodgate Shoreline Erosion Management Plan (SEMP)		• Start planning for raising Acacia Street and Theodolite Creek Road (alternatively causeway) • Start planning for beach nourishment (alternatively seawall)	• Raising Acacia Street and Theodolite Creek Road (alternatively causeway) • Start planning for raising Paperbark Court, Walkers Point Road (alternatively causeway or land use and tenure transition) • Beach nourishment (alternatively seawall)	• Raising Paperbark Court, Walkers Point Road (alternatively causeway or land use and tenure transition)
Buxton	Risks are tolerable in all scenarios for storm tide and coastal erosion.	Implement 'maintain' strategy of • Disaster Management • Education and awareness campaign • Land use planning • Monitor erosion				

Maintain
Modify
Transform

It is important to note that the preferred pathway represents the results of the CHAS Phases 6 and 7 in the determination of the desired options using the assumptions and data within this study. All viable adaptation options remain 'on the table' for further investigation if required.

The adaptation options identified in the CHAS represent the result of the high-level investigation. To understand the feasibility of the short-listed physical options that are suggested along the open coast, more detailed studies will be required in the form of a Shoreline Erosion Management Plan (SEMP). A SEMP will determine a site-specific approach to mitigate erosion over a 20-year timeframe and may consider the physical and structural options presented in this CHAS.

4.3 Trigger-based approach

The Action Plan follows a trigger-based approach. This means that change over time is observed and adaptation options are only implemented once they are needed. 'Triggers for action' have been set to identify the point when planning to implement an adaptation option must occur before the threshold for intolerable risk is reached.

The trigger-based approach allows adaptation to occur before the risk materialises and provides adequate time for planning, prefeasibility and funding. It also allows a range of actions to be discussed with further consultation with the community.

The current level of risk from coastal hazard to each settlement differs, but across the Bundaberg coastal region there is a clear priority for immediate implementation of disaster management planning, an education and awareness campaign, land use planning and continued monitoring of erosion at key locations.

The reduction in 'risk profile' for each of the priority settlements are presented as a visualisation tool to communicate the benefit of the adaptation option.

4.3.1 Triggers for action - Moore Park Beach

Moore Park Beach has been identified as a priority settlement due to the intolerable risk identified in a 0.4 m sea level rise scenario. The intolerable risk is caused by coastal erosion along the beachfront. There is also risk of isolation to the settlement after a 0.8 m sea level rise scenario.

Sea level rise scenarios are the thresholds for intolerable risk and adaptation must occur before this threshold is reached. Triggers for action are identified in the Action Plan.

Coastal hazards are impacting Moore Park Beach under present day conditions. The tidal gates in the Fairydale Drainage System are currently overtopped above king tide events. The system specifically manages tidal flows to cane lands south east of Moore Park Beach.

To mitigate the potential isolation risks, three adaptation actions have been identified in the Action Plan:

- Causeway at Moore Park Road
- Causeway at Malvern Drive
- Road raising at Murdochs Linking Road

Collectively these actions will prevent the isolation risk to Moore Park Beach. Figure 4-1 shows the potential reduction in risk profile and trigger points for implementation of these adaptation measures. Note that construction of a causeway will reduce the instances of isolation and expedite the recovery process of an inundation event, however it is not considered to prevent isolation and so the trajectory of risk will continue upwards until Murdochs Linking Road is raised.

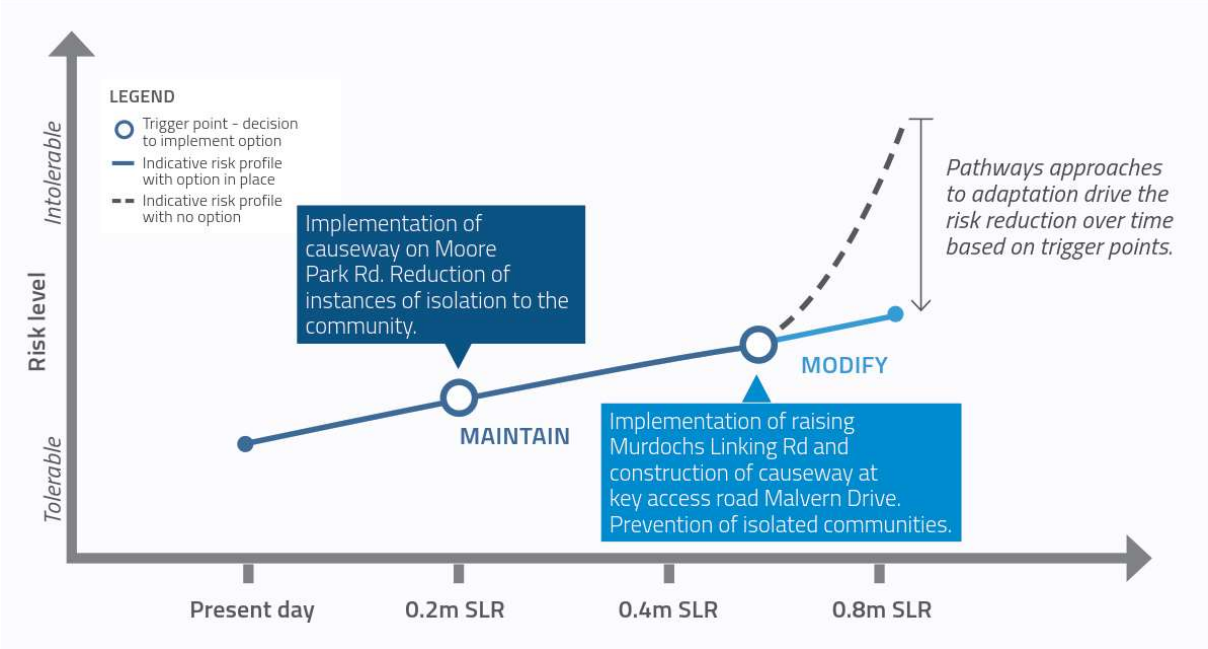

FIGURE 4-1 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN MOORE PARK BEACH (1- MODIFY ISOLATION RISK)

To mitigate the intolerable risks associated with coastal erosion on the beachfront at Moore Park Beach, the preferred adaptation option is to undertake beach nourishment. Figure 4-2 shows the potential reduction in risk profile after implementation of the preferred maintain and modify measures including beach nourishment.

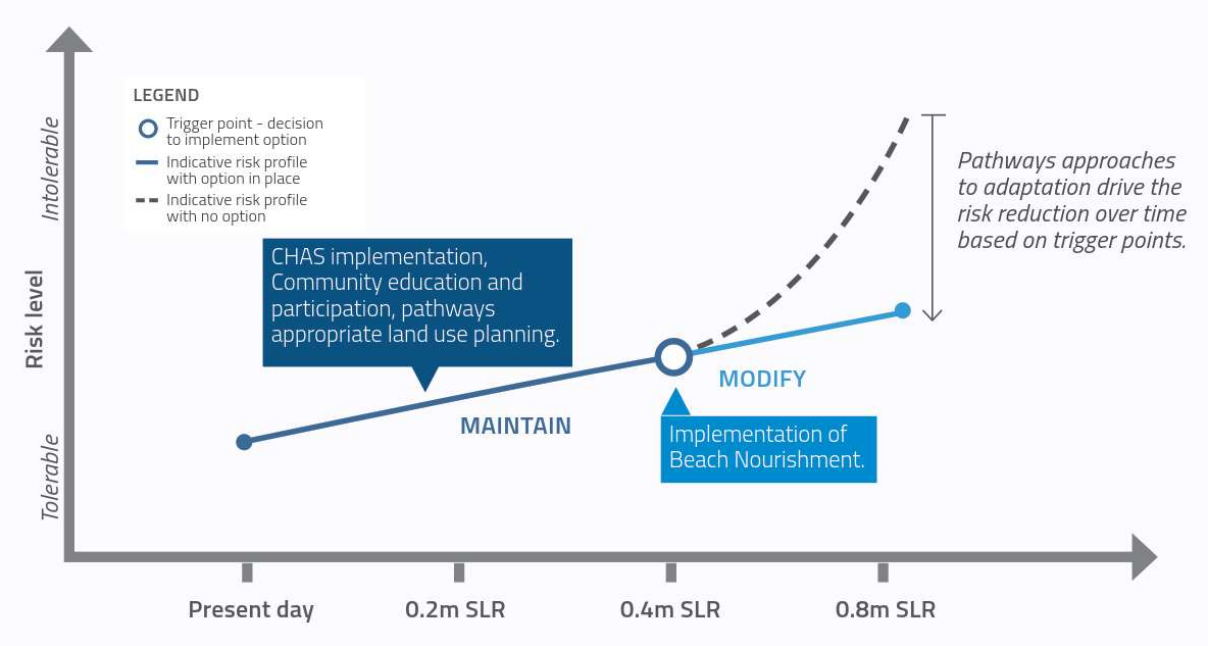

FIGURE 4-2 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN MOORE PARK BEACH (2 – MODIFY EROSION RISK)

The risk profile diagrams for Moore Park Beach indicate that current trajectories for the settlement reflect that the consequences of sea level rise over time have a risk level that is intolerable. As hazards increase over time the risk cannot be maintained in the tolerable range without a decision to invest in the preferred adaptation option to modify the settlement. Approaching the threshold when risk becomes intolerable, i.e. 0.4 m, the trigger point is reached, and beach nourishment may be implemented to keep the risk level within the tolerable range.

This assumes a level of planning has already occurred, as documented in the Action Plan, in the lead up to the trigger point and before the intolerable risk threshold is reached.

4.3.2 Triggers for action – Burnett Heads

Burnett Heads has been identified as a priority settlement due to the intolerable risk identified in a 0.8 m sea level rise scenario. The intolerable risk is caused by storm tide inundation of low-lying communities.

The 0.8 m sea level rise scenario is the threshold for intolerable risk, and adaptation must occur before this threshold is reached. To mitigate the intolerable risk, construction of a storm surge barrier and earth dyke has been identified in the Action Plan. Figure 4-3 shows the potential reduction in risk profile after implementation of the preferred maintain and modify measures including a storm surge barrier and earth dyke.

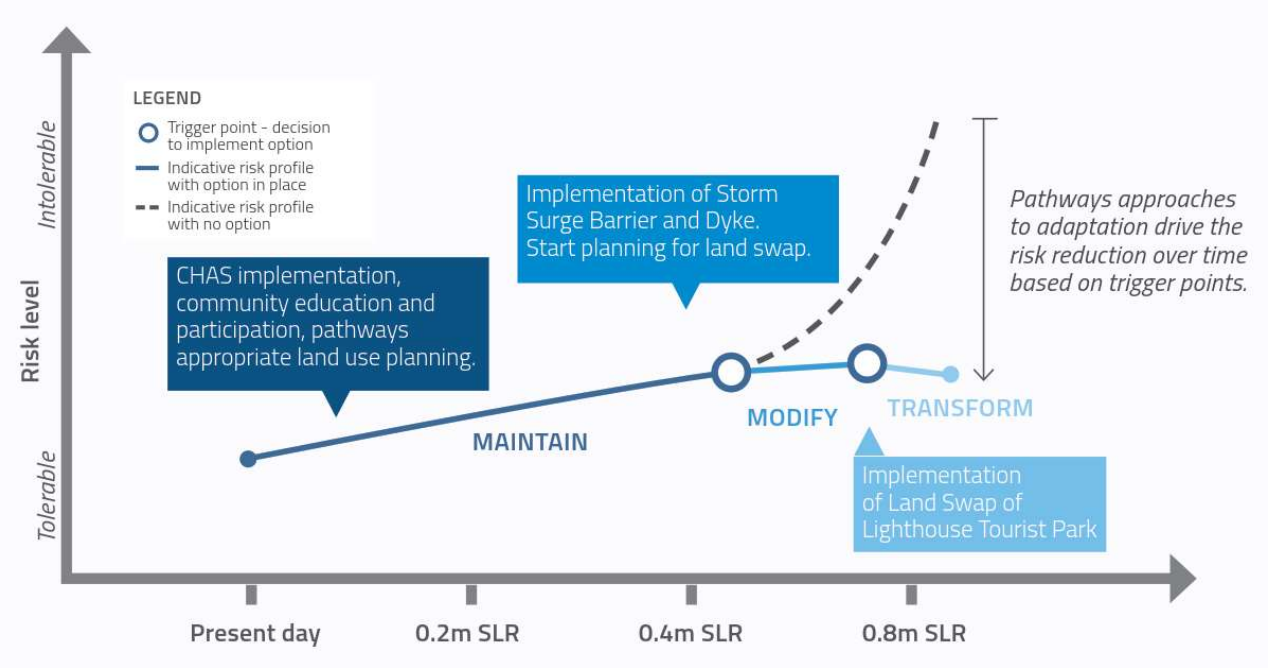

FIGURE 4-3 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN BURNETT HEADS – MODIFY AND TRANSFORM STORM TIDE INUNDATION RISK

The risk profile diagram for Burnett Heads indicates that current trajectories for the settlement reflect that the consequences of sea level rise over time have a risk level that is intolerable. As hazards increase over time, the risk cannot be maintained in the tolerable range without a decision to invest in the preferred adaptation option to modify and, in the case of the Lighthouse Tourist Park, transform areas of land within the settlement. Approaching the threshold at which risk becomes intolerable, i.e. 0.8m, the trigger points are reached; a storm surge barrier and earth dyke may be implemented, and an exercise to relocate the Lighthouse Tourist Park via a land swap is considered. These preferred adaptation options keep the risk level within the tolerable range.

This assumes a level of planning has already occurred, as documented in the Action Plan, in the lead up to the trigger points and before the intolerable risk threshold is reached.

4.3.3 Triggers for action – Bargara

Bargara has been identified as a priority settlement due to the intolerable risk identified in a 0.8 m sea level rise scenario. The intolerable risk is caused by coastal erosion impacts on beachfront residences.

The 0.8 m sea level rise scenario is the threshold for intolerable risk and adaptation must occur before this threshold is reached. To mitigate the intolerable risk, beach nourishment on Kellys Beach has been identified in the Action Plan. Figure 4-4 shows the potential reduction in risk profile after implementation of the preferred maintain and modify measures including beach nourishment.

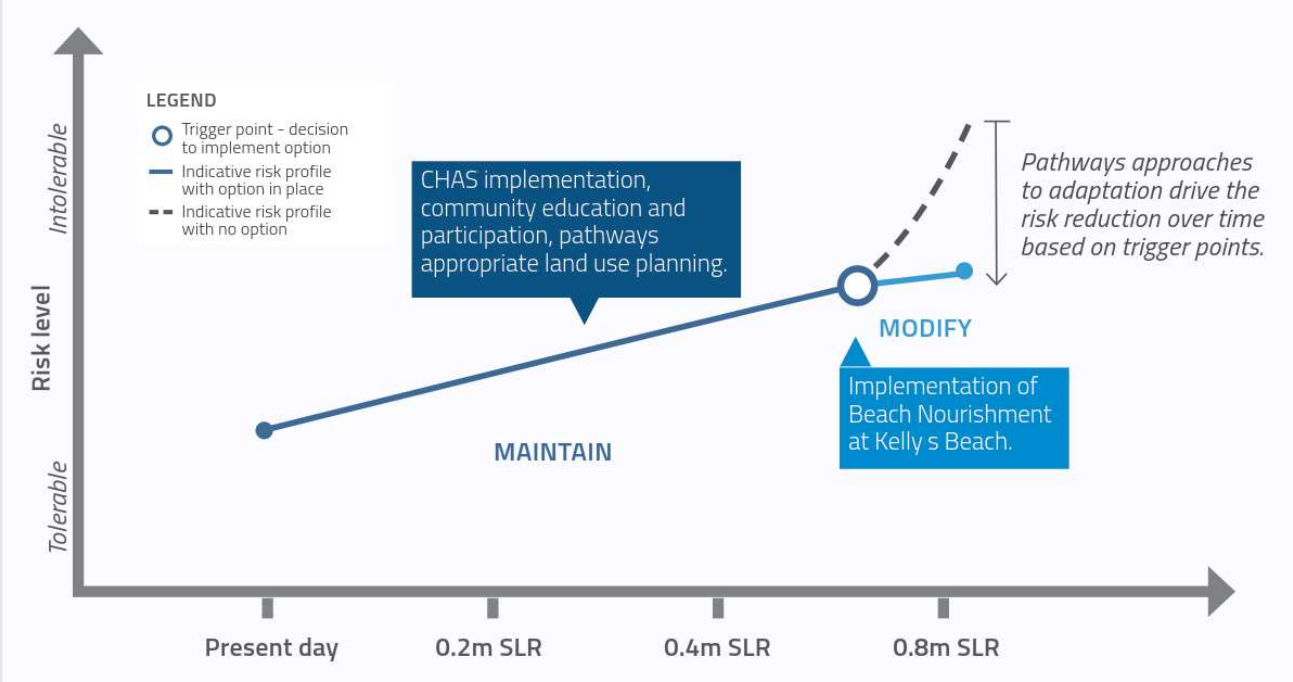

FIGURE 4-4 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN BARGARA – MODIFY EROSION RISK

The risk profile diagram for Bargara indicates that current trajectories for the settlement reflect that the consequences of sea level rise over time have a risk level that is intolerable. As hazards increase over time the risk cannot be maintained in the tolerable range without a decision to invest in the preferred adaptation option to modify the settlement. Approaching the threshold at which risk becomes intolerable, i.e. 0.8 m, the trigger point is reached, and beach nourishment may be implemented. This preferred adaptation option keeps the risk level within the tolerable range.

This assumes a level of planning has already occurred, as documented in the Action Plan, in the lead up to the trigger point and before the intolerable risk threshold is reached.

4.3.4 Triggers for action – Innes Park and Coral Cove

Innes Park and Coral Cove has been identified as a priority settlement due to the intolerable risk identified in a 0.8 m sea level rise scenario. The intolerable risk is caused by coastal erosion of public infrastructure and private residences around the mouth of Palmers Creek.

The 0.8 m sea level rise scenario is the threshold for intolerable risk and adaptation must occur before this threshold is reached. To mitigate the intolerable risk, beach nourishment has been identified in the Action Plan. Figure 4-5 shows the potential reduction in risk profile after implementation of the preferred maintain and modify measures including beach nourishment.

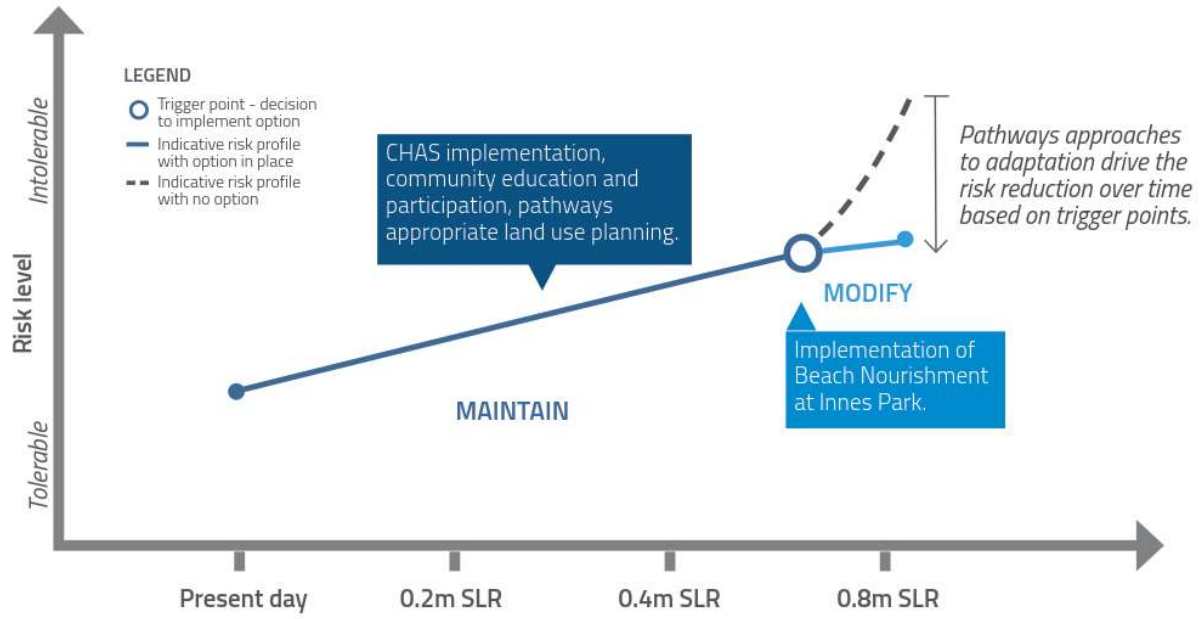

FIGURE 4-5 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN INNES PARK AND CORAL COVE – MODIFY EROSION RISK

The risk profile diagram for Innes Park and Coral Cove indicates that current trajectories for the settlement reflect that the consequences of sea level rise over time create a risk level that is intolerable. As hazards increase over time the risk cannot be maintained in the tolerable range without a decision to invest in the preferred adaptation option to modify the settlement. Approaching the threshold when risk becomes intolerable, i.e. 0.8 m, the trigger points are reached, and beach nourishment may be undertaken to keep the risk level within the tolerable range.

This assumes a level of planning has already occurred, as documented in the Action Plan, in the lead up to the trigger points and before the intolerable risk threshold is reached.

4.3.5 Triggers for action – Coonarr

Coonarr has been identified as a priority settlement due to the intolerable risk identified in a 0.2 m sea level rise scenario. The intolerable risk is caused by coastal erosion along the beachfront. There is also risk of isolation to the settlement. 0.2 m sea level rise is the threshold for intolerable risks and adaptation must occur before this threshold is reached.

To mitigate the potential isolation risks, raising Coonarr Beach Road is identified in the Action Plan.

To mitigate the intolerable risks associated with coastal erosion on the beachfront at Coonarr, the preferred adaptation option identified in the Action Plan is to undertake beach nourishment.

Figure 4-6 shows the potential reduction in risk profile and trigger points for implementation of these adaptation measures.

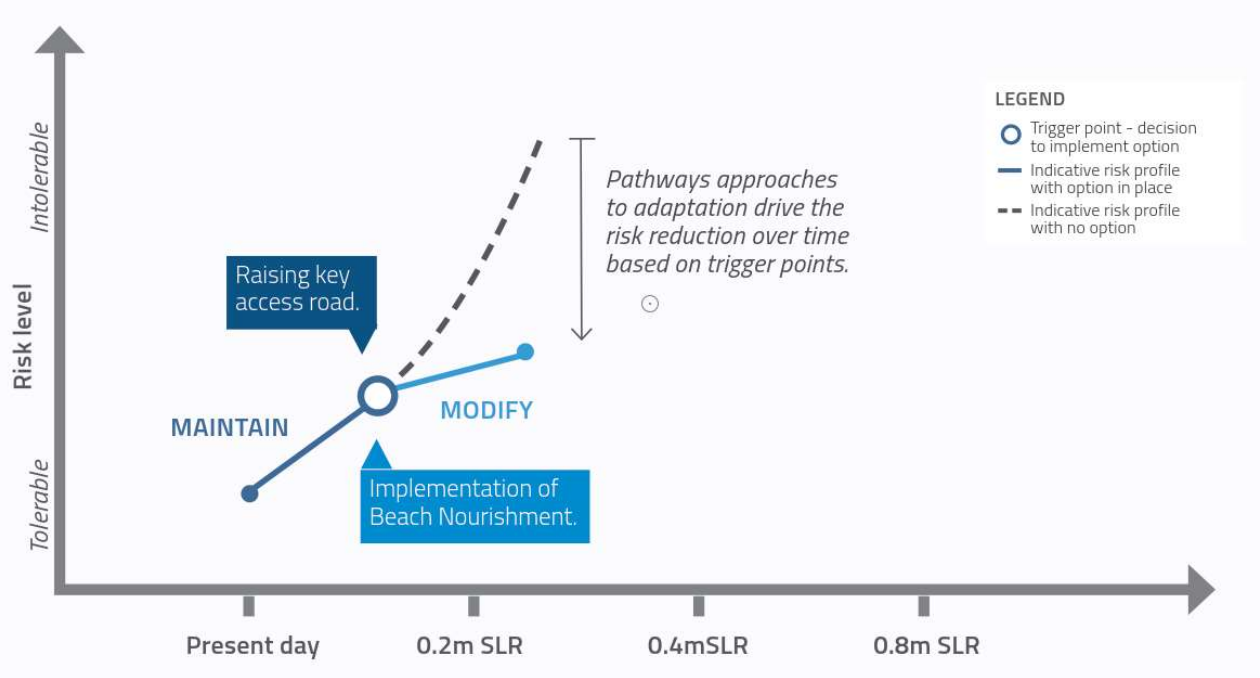

FIGURE 4-6 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN COONARR (1 – MODIFY EROSION RISK)

Land use and tenure transition is also included as a preferred adaptation approach to transform the settlement. Figure 4-7 shows the potential reduction in risk profile after implementation of tenure transition in Coonarr. As discussed, implementation of these options could be as a package of solutions or undertaken individually.

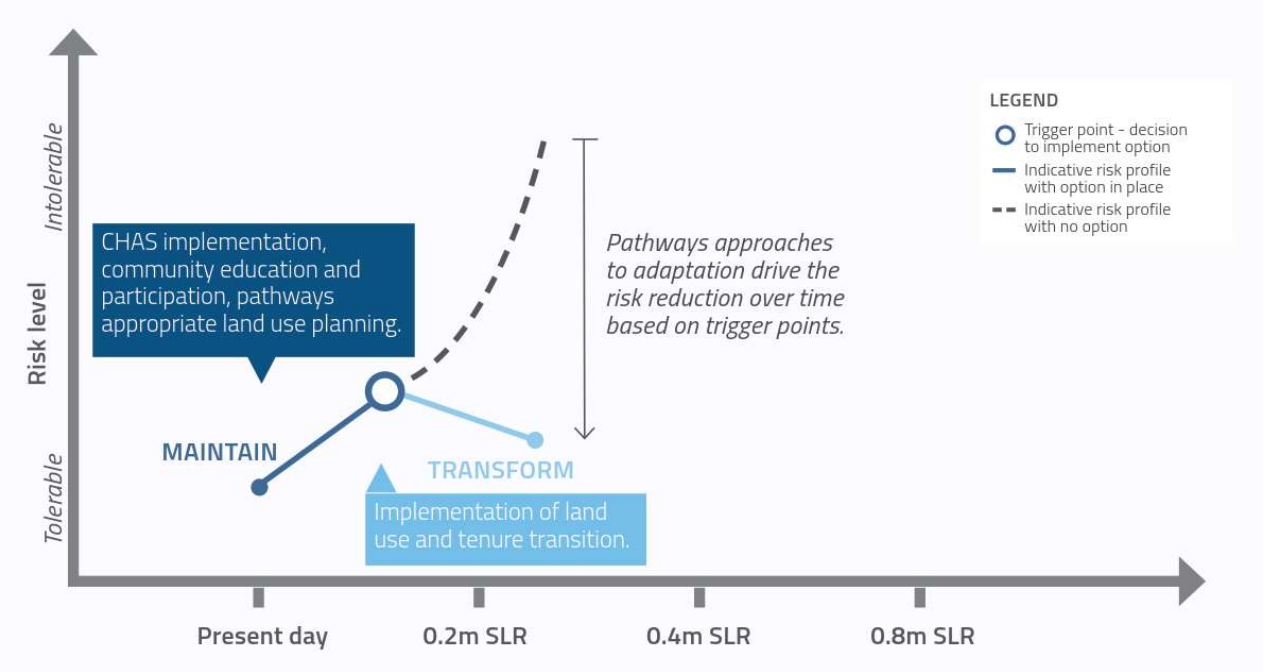

FIGURE 4-7 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN COONARR (2 – TRANSFORM EROSION RISK)

The risk profile diagrams for Coonarr indicate that current trajectories for the settlement reflect that the consequences of sea level rise over time have a risk level that is intolerable. As hazards increase over time the risk cannot be maintained in the tolerable range without a decision to invest in the preferred adaptation option to modify or transform the settlement. Approaching the threshold at which risk becomes intolerable, i.e. 0.2 m, the trigger points are reached and a combination of beach nourishment, raising the access road and land use and tenure transition may be undertaken to keep the risk level within the tolerable range.

This assumes a level of planning has already occurred, as documented in the Action Plan, in the lead up to the trigger points and before the intolerable risk threshold is reached.

4.3.6 Triggers for action – Woodgate Beach and Walkers Point

Woodgate Beach and Walkers Point has been identified as a priority settlement due to the intolerable risk identified in a 0.4 m sea level rise scenario. The intolerable risk is caused by coastal erosion of public infrastructure and private residences along the Woodgate Beach frontage. There is also risk of isolation to the settlement after a 0.8 m sea level rise scenario.

These sea level rise scenarios are the thresholds for intolerable risk and adaptation must occur before this threshold is reached. Triggers for action are identified in the Action Plan.

To mitigate the potential isolation risks, four adaptation actions have been identified in the Action Plan:

- Raising Acacia Street before a 0.4 m sea level rise scenario
- Raising Theodolite Creek Rd before a 0.4 m sea level rise scenario
- Raising Paperbark Court before a 0.8 m sea level rise scenario
- Raising Walkers Point Road before a 0.8 m sea level rise scenario

Collectively these actions will prevent the isolation risk to Woodgate Beach and Walkers Point. Figure 4-8 shows the potential reduction in risk profile and trigger points for implementation of these adaptation measures.

Note that raising the roads of Acacia Street and Theodolite Creek Road will reduce the instances of isolation and expedite the recovery process of an inundation event, however it is not considered to entirely prevent isolation until Paperbark Court and Walkers Point Road are raised.

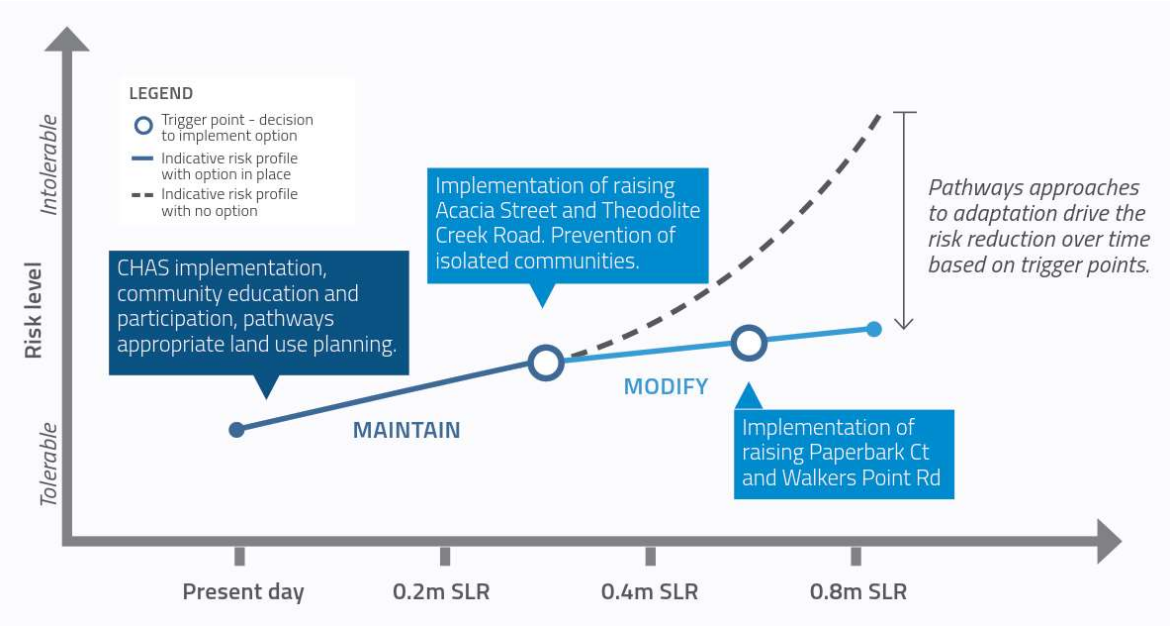

FIGURE 4-8 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN WOODGATE BEACH (1 – MODIFY ISOLATION RISK)

The 0.8 m sea level rise scenario is the threshold for intolerable risk and adaptation must occur before this threshold is reached. To mitigate the intolerable risk, beach nourishment has been identified in the Action Plan. Figure 4-9 shows the potential reduction in risk profile after implementation of the preferred maintain and modify measures including beach nourishment.

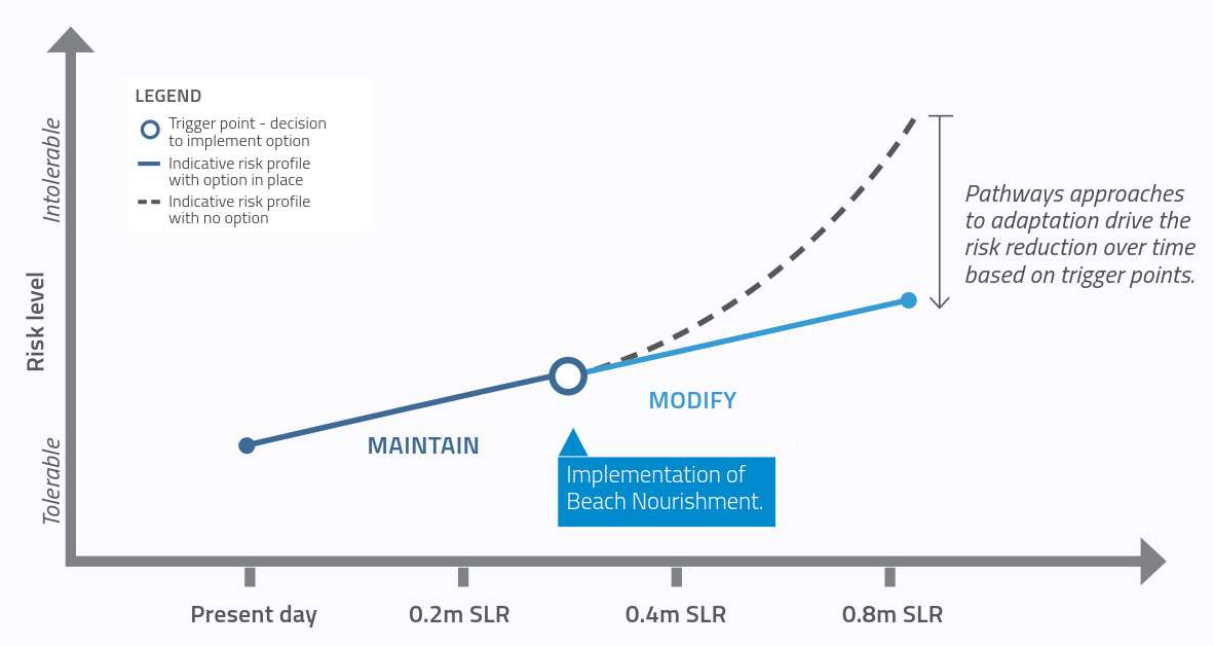

FIGURE 4-9 REDUCTION IN RISK PROFILE – PATHWAYS APPROACHES IN WOODGATE BEACH (2 – MODIFY EROSION RISK)

The risk profile diagrams for Woodgate Beach and Walkers Point indicate that current trajectories for the settlement reflect that the consequences of sea level rise over time have a risk level that is intolerable. As hazards increase over time the risk cannot be maintained in the tolerable range without a decision to invest in the preferred adaptation option to modify the settlement. Approaching the threshold at which risk becomes intolerable, i.e. 0.4 m, the trigger points are reached and a combination of beach nourishment and raising the access road may be undertaken to keep the risk level within the tolerable range.

This assumes a level of planning has already occurred, as documented in the action plan, in the lead up to the trigger points and before the intolerable risk threshold is reached.

4.4 Summary

Implementation of disaster management, education and awareness, land use planning responses, building resilient infrastructure and monitoring rates of erosion have been identified as preferred options to 'maintain' the current risk trends. There is an identified need to implement these measures with immediate effect and it is recognised that Council are already implementing some of these measures as part of core business.

Beach nourishment / dune reconstruction at Moore Park Beach, Woodgate Beach, Innes Park and Kellys Beach at Bargara are the preferred 'modify' adaptation pathways, along with raising of key access roads to the settlements of Moore Park Beach, Coonarr, Woodgate Beach and Walkers Point. In Burnett Heads, the storm surge barrier represents the only option that effectively mitigates storm tide inundation.

Planning for short-term adaptation options will need to commence as a matter of priority to treat priority risks.

Short-term (5-10 years) actions recommended:

- Updating and improving coastal hazard data;
- Continuous monitoring of trigger points and thresholds to update the timing in more detail;

- Implementation of an internal Council steering group;
- Implementation of the 'maintain' strategy for all settlements;
- Plan for and perform continuous stakeholder engagement and communication;
- Commencement of planning for the construction of causeways at Moore Park Beach;
- Development of a land swap and land use and tenure transition policy with specific focus on Miara holiday park, Moore Park Beach Surf Club and Tourist Park, Lighthouse Tourist Park, Biggs Street and Elliott Heads Tourist Park;
- Budget planning for proposed actions and acquire funding grants where available; and
- Review adaptation pathways versus non-preferred options, review and update CHAS.

Specific instruments, plans and processes to implement these actions are discussed in section 4.3.

5 INTERNAL IMPLEMENTATION

This chapter outlines recommended implementation and integration activities and options to deliver the Bundaberg Coastal Hazard Adaptation Strategy (CHAS, the Strategy) and the associated Action Plan within the Council governance structure. It draws on activities and options based on information and findings from the previous phases and best practice from other similar strategies. Council will need to consider implications and integration of the Action Plan across a wide range of organisational programs and timeframes. A coastal hazard adaptation strategy is a long-term plan for change and a continual governance cycle of review and change is required to implement the maintain, modify and transform pathways approach effectively, which is in turn influenced by a raft of external and internal stakeholders.

Ideally, coastal hazard adaptation is integrated and embedded into Council's 'business as usual' activities. Effective delivery of adaptation actions relies on a range of delivery tools including the planning scheme, asset management plans, disaster management and response plans, environment programs, community awareness plans, corporate plan, operational plans, annual budgets and long-term financial planning. The messages on a corporate level are:

- The responsibility the new knowledge brings to inform residents of known risk;
- Enabling Council to make risk-informed decisions on the future of coastal settlement with regards to infrastructure expenditure, planning and investment; and
- Enabling Council to align CHAS actions with various funding opportunities in resilience, adaptation, climate change and recovery. In this changing policy space, governments will not continue to fund recovery without accompanying adaptation strategies

The broader messages, which are reiterated in the public document for consultation, attempt to convey the nature and scale of coastal change such as:

- The dynamic nature of the coast and inevitable change
- The initial step is understanding individual risk through community awareness
- There is a role for everyone - Council is responsible for public assets. The attachment to the coastline felt by the community can be adapted with the help of the community. Private property adaptation will have individual responses and solutions.
- Change indicators are many, and long-term monitoring will provide evidence over time of the coastal change.

The Bundaberg coastline is highly valued by community members, which reinforces the need to be informed and prepare for change. This section, and a visual appreciation of implementation is provided in the separate and complementary document 'Plan on a Page" for the purposes of Council briefings and disseminating the information across Council.

This section looks at the primary components for consideration including essential elements of roles and responsibilities, governance of the Strategy, a potential implementation timeline, and options for integration of the Action Plan into Council's programs.

The information contained in this section is a suite of recommendations for Council to consider in implementing the Strategy over time. It is not exhaustive, nor does it commit Council to these options. The purpose is to provide Council with the raft of implementation options in order that a fit-for-purpose route can be constructed over time.

It is divided into multiple sections: firstly, advice is provided on **implementing a long-term coastal hazard adaptation strategy** with recommendations for embedding learnings and on-going coastal adaptation into the organisation. This includes the importance of independent governance, outlines the roles various stakeholders

can play and the strategy lifecycle and suggested timeline. Further, the section discusses implementing the Action Plan and the recommendation for how this can be integrated into Council's existing structures, and finally investigates the monitoring program and communicating externally. Figure 5-1 illustrates a plan on a page summary for the implementation of the Strategy and Action Plan.

For Council's convenience a **prioritised Implementation Plan** for Council's steering committee to action has been prepared in section 6.4 as a first step towards implementation of the Strategy and Action Plan.

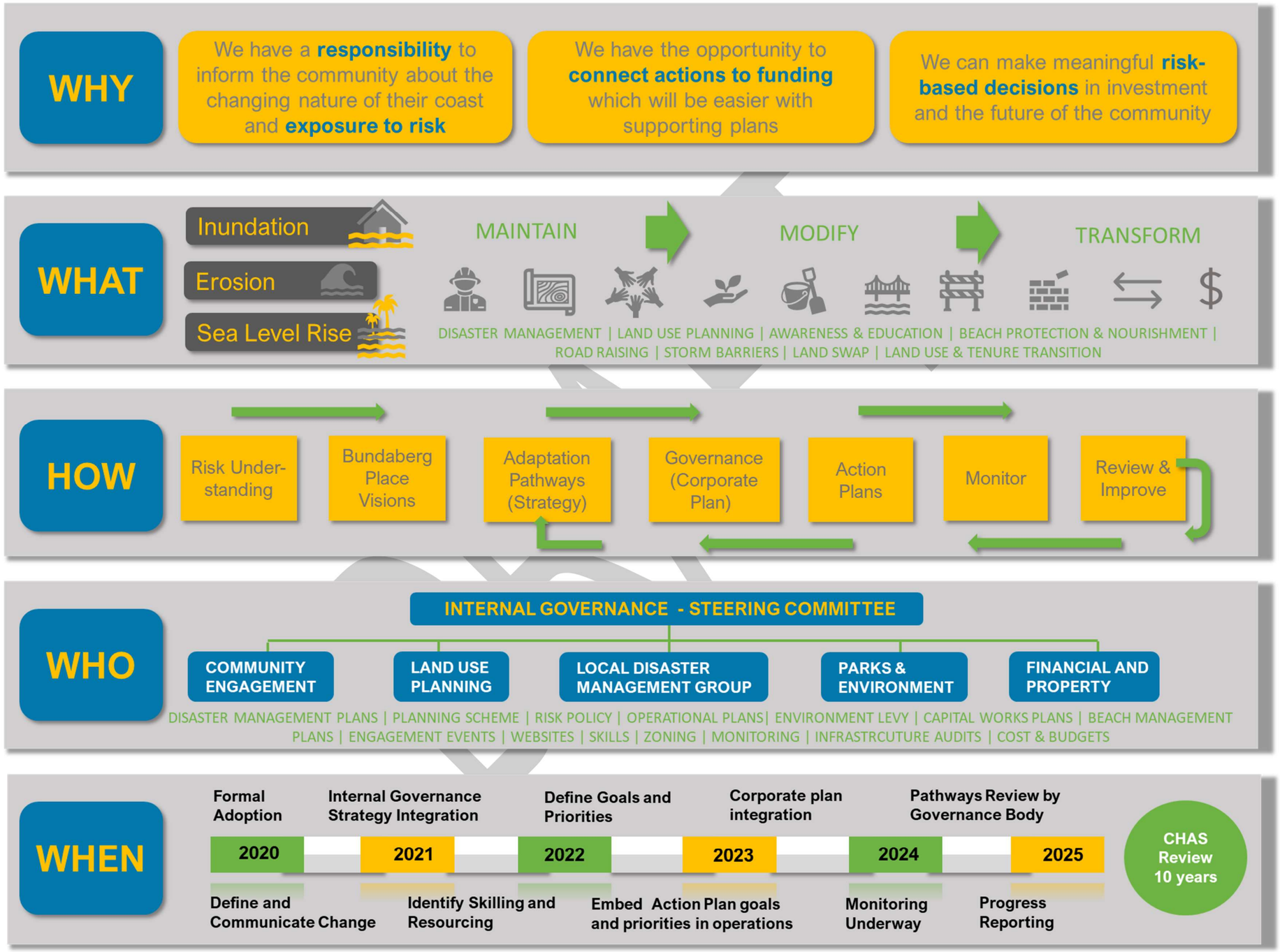

FIGURE 5-1 CHAS INTERNAL IMPLEMENTATION – PLAN ON A PAGE

5.1 Independent Governance: A Steering Committee

Governance of the Strategy over the medium term, and assistance and direction in implementing the Action Plan, will benefit from maintenance of an independent governance structure to fully integrate the Action Plan into the organisation as a part of business as usual. It is recommended that the Project Control Group (PCG) continues its role as a governance body and steering committee to advise Council on implementation matters. This group should be recognised in Council's 2023 Corporate Plan due to the longevity of the CHAS and to provide the appropriate decision-making authority. The PCG can add value to these often-complex tasks through:

- Assisting in identifying the range of amendments needed across corporate documents and policies;
- Advising on appropriate accountability, timeframes, responsibility, and delegated authority as relevant to enable the actions to be executed across the organisation;
- Assisting with resource management plans;
- Assisting with sourcing funding opportunities through either permanent funding arrangements or targeted funding rounds;
- Exploring partnerships with other agencies in some actions which cross jurisdictions or with common objectives such as with utility providers;
- Deciding the extent of the Action Plan information and reporting to be publicly available;
- Assisting with maintaining messaging and public facing communications;
- Development of monitoring processes, tools, reporting frameworks and commencement;
- Internal training and upskilling on the CHAS process, impacts and implementation; and
- Attendance at community engagement events.

There are likely other roles the PCG could fulfill over the medium term as a specialist advisory body and considering their intimate knowledge of this complex process to date, it is recommended that this knowledge is retained in some format to pass on to the organisation in an implementation phase. The agenda for the steering committee will decrease over time once the CHAS is fully implemented.

The membership of the PCG is already extensive, however Council may wish to revisit membership to ensure representative officers from each impacted operational area or directorate, including disaster management, land use planning and community engagement, are intimately involved. Council may also consider identifying some 'Coastal Champions' to assist with messaging and understanding in the organisation.

Alternatively, if the Strategy and Action Plan is integrated across existing workflow at director level, a distinct governance or ownership structure should be in place over the short-medium term until full integration is achieved.

5.2 Roles and Responsibilities

While Council has an important role in the Strategy, everyone in the community is an actor in adaptation. That there is a role for everyone is an important message the public document seeks to convey to the community to establish an understanding of the limits to Council's resources, roles and responsibilities.

For example, long term actions will involve infrastructure outside Council's jurisdiction. Electricity and telecommunications impacts will need to be conveyed to those utility suppliers and asset owners. Council's role will be that of partner, advisor or information provider. Council can be a driving force in promoting the CHAS as the pathways for adaptation but cannot act for other land and asset owners.

A primary aim of the CHAS is to reinforce the message that there is a role for everyone. Businesses, community, state agencies and disaster management all have their role to play in the adaptation process. The aim is for the coastal community members to develop asset specific action plans, based on the findings of the CHAS. The next step is informing the coastal community members to gain and understand individual risk, so they can play their role. This process is a partnership where Council can provide the tools for community to plan for and mitigate that risk.

Being risk aware and prepared to adapt is an intensely individual experience. Everyone's risk exposure is different. Individual understanding of risk and personal strategy development is the first step to a more resilient coastal community. Without understanding and acknowledgement of individual risk to life and property, actors will not understand their role. Table 5-1 below provides a list of potential roles stakeholders can play in implementation of the strategy.

TABLE 5-1 ROLES

Role	Description
Owner	Owner of land or assets responsible for designing, constructing and managing community assets that are resilient to natural hazards including buildings, road and stormwater networks, public space and environmental reserves; or Owner of an adaptation action responsible for funding, execution or implementation to completion.
Partner	Partners working collaboratively with stakeholders on an adaptation action, contributing any integral part towards disaster resilience or preparedness activities and action completion.
Funder	Funders contribute directly with grants and loans for completion of specific actions. Grant funding opportunities are broad and can include: Community Grants Program, environmental, heritage and arts opportunities as well as ongoing local capital works and operational funding provided by the State and Federal Governments.
Leader	A high performing, innovative and customer-focused leader who drives actions and motivates stakeholders. Leaders may provide frameworks or enable actions.
Doer	Doers are the people on the ground and at the coal face who complete the strategy actions and can include anyone in the stakeholders from councils to NGOs, community groups, private land and asset owners, councils, other agencies, and volunteer associations.
Facilitator	A facilitator brings together stakeholders to collectively pursue a shared interest or service or to resolve an issue or implement an action.
Service provider	Service providers may be other stakeholders or agencies who fully fund a service or provide a service, e.g. undertaking controlled fire burns, issue monitoring data.
Supporter, Information provider	Essential stakeholders who bring depth and resources to the adaptation strategy through expert advice and assistance, develop resources to promote a common understanding; provide information; engage with stakeholders at any part of the implementation process.
Advocate	An advocate makes representations or seeks to influence for positive disaster resilience outcomes on behalf of the community or resilience strategy stakeholders.
Regulator	Specific role in response to legislation which may be direct, specific or general in nature.

5.2.1 Council's Roles

Council will play almost all the above roles at some point as part of the CHAS implementation for the long-term strategy and the Action Plan. Roles will be spread across Council's internal programs in its role as a local governance body through all organisational responsibilities. Externally, Council has equally important roles with the community integration and external stakeholders as an information provider, supporter, facilitator and partner.

As a local governance body, Council's responsibilities and roles internal to the organisation are significant. Tangibly as a land and asset owner, but intangibly as a leader and information provider that will convey to the community the risk to life and property and create a safe and prosperous Bundaberg. The roles will vary depending on many of Council's existing program and process structures around:

- Asset management;
- Land tenure;
- Land use planning;
- Disaster management;
- Corporate planning;
- Capital works programs;
- External stakeholder relationships and regional leadership;
- Parks and environmental management; and
- Community engagement.

Within each program, Council staff, technical experts, engagement teams and parks crews will all have differing roles. It is important that each part of the organisation understands their roles in the broader Strategy.

As the public asset owner, Council is entirely responsible for all actions involving public infrastructure. Part of the communication process and role messages, should distinguish between public assets, including managing these economically for the benefit of all ratepayers, and risks associated with private property and the limitations of decision making for private asset owners. This is also valid for other utility providers. It is recommended that this nuance and roles and responsibilities are conveyed to the community in the primary messages.

Externally, the roles will vary from leader and partner to facilitator and information provider in the adaptation planning process: supporting the community and enabling changes internally and externally. Essential baseline support should be provided in the form of:

- Continual reinforcement of key messages about coastal hazard risk through a comprehensive, recurring public education and awareness campaign and activities. This should be conducted in targeted and place-specific ways as well as general campaigns;
- Continual reinforcement of community roles and the need for private sector action plans on a recurring basis. This should be conducted in a targeted approach with community or business partners, e.g. Chambers of Commerce, as well as in general campaigns;
- Enable and encourage partnerships between groups and organisations which can benefit from collaboration and closer association;
- Provide tools, templates, guidance, support, educational information and instruction on the above through mapping, advertising, community groups, awareness programs, newsletters, websites, and any other means or media; and
- Communicate the availability of funding streams.

Council has a raft of other opportunities which they can elect to pursue depending on capacity and resources. This is expanded on throughout these recommendations. There is no limit to the extent of assistance Council can provide and this will change over time.

Case Studies are provided in the following section that highlight different roles in adaptation. Private infrastructure and property protection have been guided through the actions of the property owners. In these examples, the adaptation options, when assessed for costs and monetary benefits, were not feasible for Council to undertake as they did not demonstrate broader community benefit. In cases such as these, Council should take on a supporting role to help residents to come together to organise the adaptation strategies with the tools they provide.

Case study of a private seawall fronting Kellys Beach, Bargara

Located on the beachfront of Miller Street in Kellys Beach, Bargara, a seawall provides protection to the private multi-unit dwelling development. The buried seawall has been constructed within the private residential lot using rock materials deposited in place on the beach side of the development and subsequently covered with vegetation. The rock material has become exposed and is visible at the toe of the wall. Access to the private residential block has been created via steps to the beach via crest of the buried seawall. Figure 5-1 shows the location of the existing private seawall on Kellys Beach.

FIGURE 5-2 KELLYS BEACH, BARGARA, QLD – PRIVATE SEAWALL

Case study of community collaborative funding – Redland City Council

Located on the north-west corner of North Stradbroke Island, the township of Amity Point enjoys a rich diversity of seascapes and landscapes - providing extensive recreational and lifestyle opportunities that are considerably enhanced by local cultural, heritage and environmental values.

The historical development of Amity Point has focused on the shoreline - as residents and visitors seek to enjoy the unique character of this coastal precinct. However, the dynamic nature of the coastal environment means that local foreshores are experiencing erosion, which is threatening these spaces, as well as endangering essential infrastructure.

To protect the mostly private lots fronting the ocean from further erosion all residents agreed to continue an erosion protection scheme on the foreshore. This only worked because all residents came together to fund the works collaboratively.

This approach has been recently confirmed during the development of the Shoreline Erosion Management Plan – Implementation Strategy. During stakeholder consultation of this project it was confirmed that the residents want to continue with the existing scheme which is **individually funded by all affected residents**.

Redland City Council's role is to support residents in the approval process and rock sourcing, as well as maintaining the rock wall at their affected properties e.g. parks.

FIGURE 5-3 AMITY POINT, QLD – COMMUNITY FUNDED COASTAL MANAGEMENT

Case study of a constructed, self-funded seawall at McEwens Beach – Mackay Regional Council

The community of McEwens Beach, approximately 12 km south of Mackay CBD, has experienced significant erosion, receding 95 m over the last 50 years. During cyclone Dylan in January 2014, an existing timber revetment wall that had been constructed without consent was washed away, this highlighted an immediate need for Council and the McEwens Beach residents to find a practical solution to protect the vulnerable coastal properties.

A desire to find an acceptable solution to coastal hazards without relying on statutory powers led to a collaborative approach between Mackay Regional Council, the State government and coastal residents (Sekac and Birkett, 2019).

- A proactive group of affected residents have joined together, along with Council to fund the erosion protection solution on a proportional basis based on frontage to the esplanade.
- The solution involved the construction of an engineered seawall, predominantly at the residents' expense, on erosion prone freehold land owned by Council (as shown in figure 5.2)
- The Council freehold land will ultimately be subdivided and transferred to the coastal residents as the effective 'custodians' of the seawall.

The adaptation journey of McEwens Beach involved resolution of the approval pathways, legal, planning and engineering challenges associated with seawall construction. This approach enhances the capacity of communities, infrastructure facilities and natural areas to recover from stresses, thereby assisting to building a resilient, liveable and vibrant community.

FIGURE 5-4 MCEWENS BEACH, MACKAY (IMAGE SOURCE: MACKAY REGIONAL COUNCIL)

5.3 Implementation Process

For effective implementation of the CHAS, a whole of Council approach is recommended. The first challenge is communicating the Strategy outcomes, implications and importance of acting now across Council. The CHAS is a substantial body of work having taken over three years to complete. It is natural that the organisation cannot be taken on the CHAS journey without some detailed discussion, appreciation and understanding of the way forward.

The methodology to adopt and implement the CHAS as a long-term Strategy including the Action Plan will involve an organisational change process. Local government is adept at this. It is possible that this change can be achieved through either a bottom-up or a top-down approach. This is because the CHAS process is extensive and technical. Actions are the result of complex assessments which may be conveyed well from the bottom-up technical officers involved rather than a top-down directive approach. This will be dependent, of course, on executive leadership team support for holistic adoption of the Action Plan. In its favour, the PCG already has a great cross section of membership to facilitate this support.

The adoption methodology and governance will be decided by Council considering the best-fit approach for existing internal structures, skills and culture. In any case, Figure 5-5 provides the core steps to effective change management applied to the CHAS to outline the extent of whole-of-Council participation. Each step is discussed below:

FIGURE 5-5 CHAS IMPLEMENTATION MANAGEMENT PROCESS

- **Communicate messages: why change?**

Any proposal for change must be accompanied by justification for that change. The CHAS process though Phase 7 presents clear cost benefit analyses. However, to validate the change and decision-making process, Council will need to break that down into a more practical place- and program-based discussion involving –

- broader climate change responsibilities,
- similar activities currently underway, for example the Climate Resilient Councils work through LGAQ,
- previous natural disasters,
- costs to Council,
- the economy,
- public assets, and
- community reactions to natural events.

The CHAS work contains many technical examples of specific place scenarios across the spectrum of 0.2 m to 0.8 m sea level rise for all three hazards to support the case for change.

In the context of Council's corporate roles and responsibilities, Council is the custodian of a range of information that identifies risk to the community, to life and to property from natural hazards. While natural hazards are unpredictable, severe storm and cyclone events are forecast to become less frequent and more intense. Our ability to model change and establish risk and vulnerability metrics improves rapidly, however the pace of change in policy and governance is not keeping up. Council has a responsibility to inform residents of known risk as new knowledge is gained;

The knowledge of risk exposure enables Council to make trigger-based and risk-informed decisions on the future of the coastal settlement with regards to infrastructure expenditure, planning and investment. Local government budgets are always stretched and spending money on assets with a long lifespan and promoting investment in lower risk areas will improve resilience over time.

The policy environment around funding recovery to natural disasters is slowly shifting. Government is starting to question the cost and efficiency of current models. This is evident in the direction of the Bushfires Royal Commission which has been tasked (among other matters) with gauging the State's efforts in becoming more resilient. The CHAS Action Plan enables Council to align actions with various funding opportunities in resilience, adaptation, climate change and recovery and demonstrate that funding will enhance resilience.

An important facet of communicating the Strategy, and the case for change, to the broader community is education and awareness. Irrespective of internal ramifications, the Strategy is a tool for communicating risk to life and property to the broader community and should be targeted at those whose risk exposure is greatest, i.e. private property owners and businesses in coastal areas, so that they can plan for coastal adaptation. Council is wholly responsible for communicating the case for change to the community.

- **Define the change across the organisation**

In this step the Strategy is broken down into relevant programs or leadership teams to identify change and assign responsibility in the Strategy and Action Plan. This may include but not limited to the departments listed in Table 5-2:

TABLE 5-2 CROSS-COUNCIL WORKING

Council department or branch	Responsibility in CHAS implementation
Office of the Chief Executive Officer	Approve governance structure Include in the Corporate Plan of 2023
Infrastructure Directorate	Manage impacts to road, water, stormwater and sewerage assets Capital works planning Determine asset management and lifecycle costs
Organisational Services Directorate	Financial Planning Property services
Community & Environment Directorate	Community engagement Management of community assets Assist in development of action plans for community organisations Protecting and monitoring the foreshore Disaster management
Communications Branch	Develop publications and public messaging through Council's communication channels
Strategic Projects & Economic Development	Understand implications for investment and economic opportunities Understand risk and long-term change for major projects
Development Group	Land use planning integration with planning scheme Land use and tenure transition Implementation of changed visions and conveying place-based risk through scheme instruments.

A simple way to accomplish a strategic level definition of change is through initial briefings and summaries by the PCG.

- **Build common appreciation and goals**

An understanding of what the organisation needs to do is developed at this stage through a common understanding of the Strategy intent and implications connected to the maintain, modify and transform pathways approach. Broad agreement should be reached on prioritisation of matters for Strategy and Action Plan implementation and some timeframes for implementation such as due dates for operational and corporate plans.

Council will need to develop some program-specific implication reports or summaries to make these decisions and consider priorities in view of existing workloads and commitments.

- **Develop internal process and action plans**

This can be done by area of responsibility as described in Council's six executive leadership streams above or through the Strategy governance or Action Plan itself. Each executive leadership stream will progress internally and develop action plans and implementation tasks for individual teams and workflow, following existing frameworks.

Depending on the action intensity and resources needed, some programs may need to create new operational plans or program line items to allocate funding and resources such as intensive community engagement, the allocation of a coastal engagement officer, for example, or the development of more Shoreline Erosion Management Plans. These plans should be specific enough for integration into operational and budget cycles.

- **Ensure staff have support, tools, and skills**

A resource management plan may be devised for endorsement as a method for achieving this step and should cover, time, cost, budget cycles, physical resources and technical resources. It can also identify opportunities for connection with other existing projects, skill and resource gaps, along with start and end times for resource need. The resource management plan can be presented by Strategy, Action Plan component, by program, by timeframe or a combination of all of these.

- **Design a reporting structure**

Council may have reporting and feedback mechanisms already in place into which the CHAS Action Plan can be combined. Reporting will need to occur at a Strategy level to the governance structure and at an operational level for the Action Plan.

- **Measure success**

Due to the dynamic nature of the coastal morphology, this step is particularly important. Success of implementation may be impacted by experience of natural hazard events which provide greater evidence or learnings about the efficacy of the Action Plan or community responses. Measurement against the maintain, modify, transform approach will ensure the Strategy remains on task and the Action Plan is an effective tool. There is guidance further in this document on monitoring programs or actions. The Figure 5-5 above serves as a monitoring guide for the Strategy. Section 5.4 below provides a suggested timeline for integration across the organisation. While section 5.7 provides more detailed information on the types of activities which will measure progress and change in the hazards and the Action Plans.

- **Adjust and Improve**

Amend the Strategy and Action Plan as needed. This is also an important step as the maintain, modify and transform approach is a predictive pathway which may move faster or slower according to coastal morphology with a range of factors at play. Natural hazard events impacting the Bundaberg Coast may bring forward some actions while successful mitigation methods may allow delay of some transformational actions. See Figure 5-2 for the influencing factors across the Strategy lifecycle.

It is recommended that for the initial implementation of the CHAS, it is viewed as a purposeful change management task in order to embed the lessons learned, understanding of risk and the implications for governance and community over the long term.

5.4 The Strategy Life Cycle

The CHAS covers a very long planning horizon up to 2100. Predictions for 80 years from now are going to change. Climate change predictions, and the intensity and frequency of natural events in the Bundaberg region can only be made based on knowledge and situations in the present day. Changes to community attitudes and values, scientific and legislative context, implementation progress, population growth and other innovative options might emerge which will alter adaptation actions. It is therefore important to update the CHAS as new science and data appears. Annual monitoring and review tasks in the Action Plan will not suffice in implementing the pathways approach. The pathways require a broader scale review considering all the contributing factors shown in Figure 5-6 to ensure the Strategy remains effective and efficient.

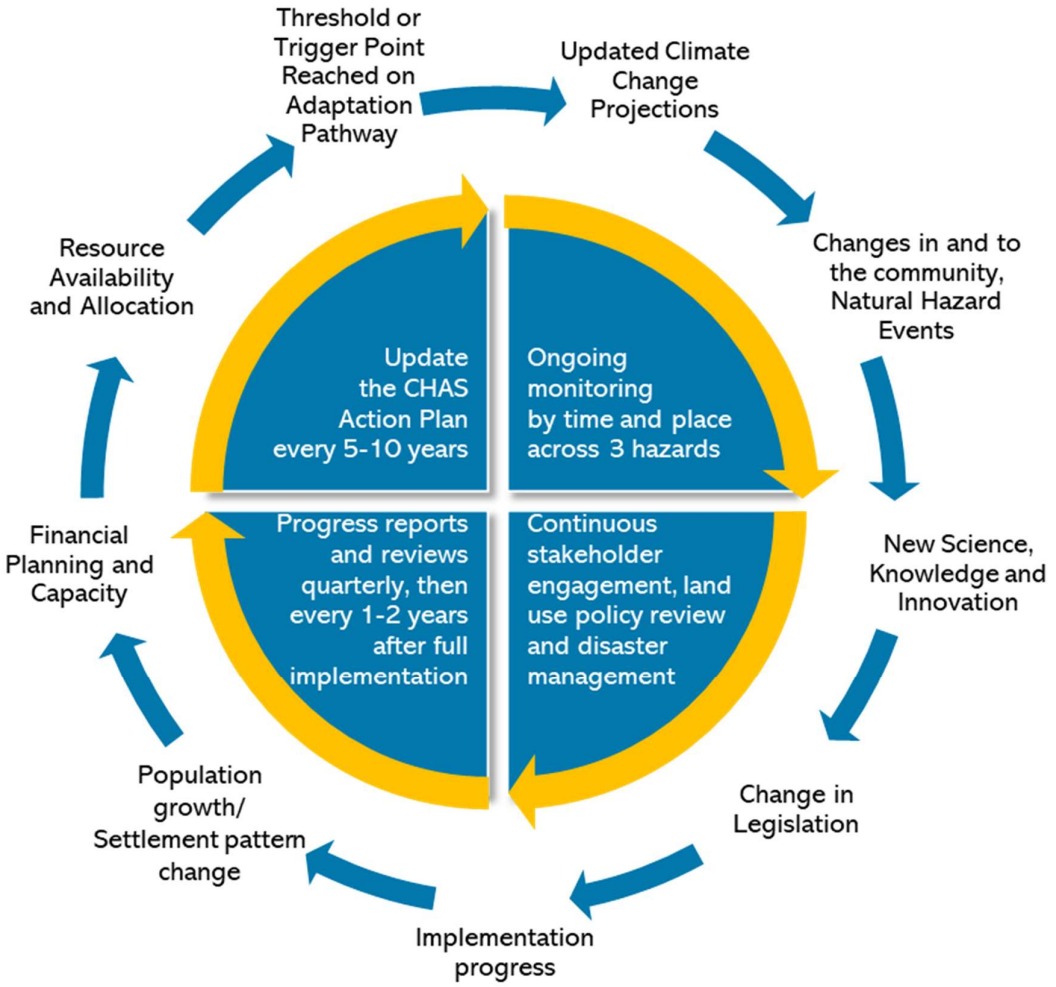

FIGURE 5-6 LONG TERM COASTAL HAZARD ADAPTATION CYCLE

5.5 Implementation Timeline

A timeline for implementation has been prepared to visualise a possible timeline scenario to embed the CHAS across all programs as shown in Figure 5-7. This will assist Council in differentiating between the overarching CHAS as a Strategy from a long-term governance perspective and the implementation of the Action Plan as an operational task..

The timeline covers the next five-year period which is considered a reasonable timeframe for evidence-based implementation of the Strategy into internal systems, setting monitoring programs and review cycles. The timeline infers (per Figure 5-6 above) the Strategy lifecycle of approximately 10 years, recommending a review of the pathways and the CHAS as an action for the 2028-2029 Corporate Plan. Depending on progress and scope of that review, refreshed priorities and goals would be available by 2030.

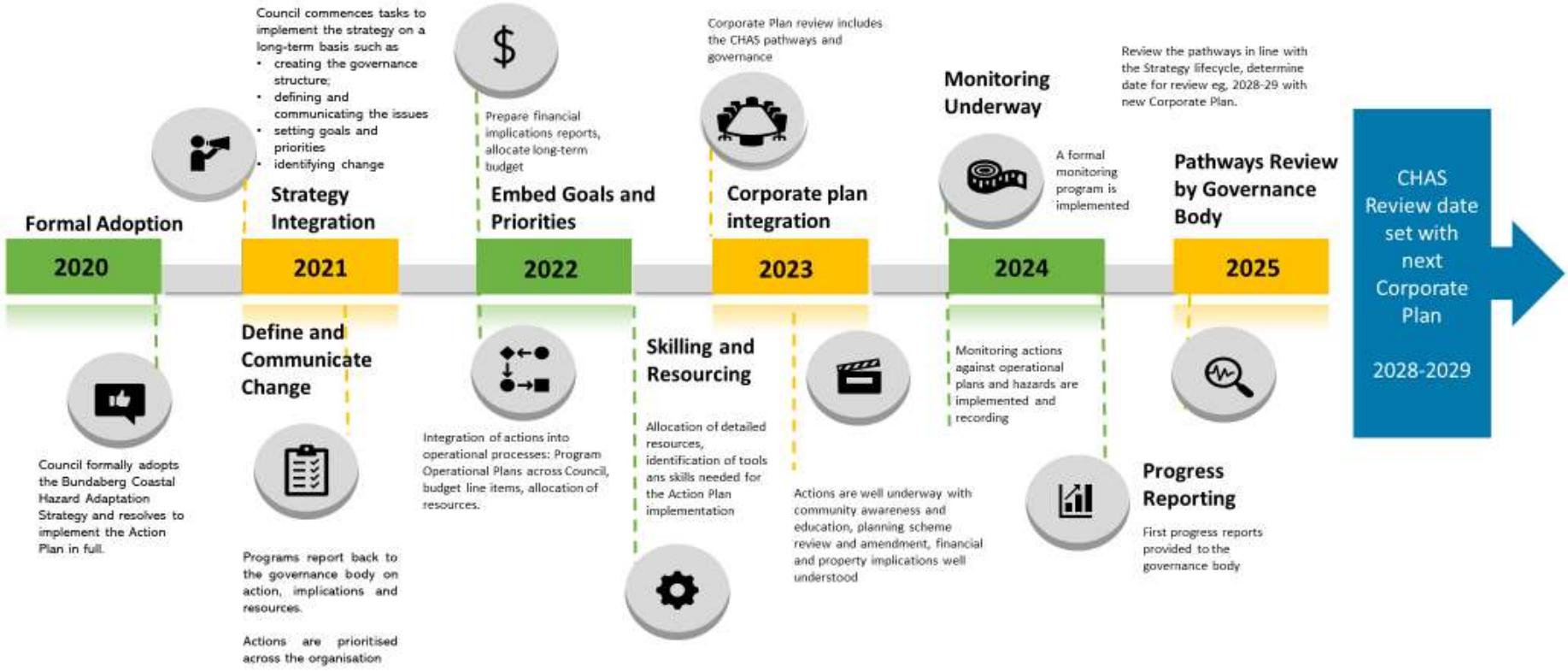

FIGURE 5-7 IMPLEMENTATION TIMELINE

5.6 Internal Governance

There are two tasks for Council internally to address the broader Strategy implementation and executing the Action Plan. The first is identifying and understanding the impact and change needed across the organisation. Secondly, creating the mechanisms, processes and resources to do it.

If the recommendation for an independent governance structure for the implementation of the Strategy outlined in Section 5.1 is adopted, then much of the direction and assistance with identification of issues will come from that steering committee. Where this is not adopted Council will still need to nominate an 'owner' of the CHAS to enable implementation over time. Individual directorates will similarly need a nominated officer to continue to steer the CHAS within their area of responsibility. The Action Plan may be stand-alone or fully integrated into existing Council programs. Either way the following coordination matters need to be considered:

- Create, recommend, or approve a methodology for embedding the Strategy and Action Plan across all relevant Council programs;
- Identify Council corporate and strategic documents, policies and internal processes which may be affected or require updating;
- Identify and develop new policies to enable the execution of the Action Plan such as environmental levies, land swap or land use and tenure transition tools;
- Identify and develop new skills or training to enable the execution of the Action plan such as Coastal Hazard technical understanding, mitigation methods and risk-based decision-making;
- Allocate and commit resources across suggested timeframes;
- Explore partnerships and communicate CHAS outcomes with other agencies and stakeholders external to the organisation (e.g. Port of Bundaberg, utility operators and asset owners);
- Plan for and participate in stakeholder consultation and education and awareness campaigns;
- Initiate monitoring, review and reporting processes and timeframes; and
- Make recommendations on actions in accordance with the measured success and the progress of maintain, modify and transform pathways of Bundaberg's places.

Where the governance for implementation is not through an independent steering committee as recommended above the responsibilities will need to be delegated. While the information and recommendations are presented in this document by area of responsibility, the understanding phase of the strategy should reveal the nature to which many of these actions cross jurisdictions and present opportunities to upskill and to combine efforts, resource and knowledge.

5.6.1 Existing documents and strategies

Council's work is planned, executed, budgeted for, prioritised and decided through a raft of governance documents. Amendments and updates over time will need to consider and incorporate the learnings and outcomes of the CHAS at a strategic level and enable the execution of the Action Plan at an operational level.

- Strategic Documents include:
  - The Corporate Plan due in 2023
  - The Bundaberg Planning Scheme 2015
  - The Economic Development Plan

- Council policy documents include:
  - Asset Management Policy CP-3-008
  - Community Engagement Policy CP-3-014
  - Environmental Policy CP-3-023
  - Risk Management Policy CP-3-027
  - Planning scheme policy documents and supporting studies, structure and neighbourhood planning
- Council operational policy documents include:
  - Annual Operational Plan
  - Annual Budget
  - Long Term Asset Management Plan
  - The Bundaberg Local Disaster Management Plan, including relevant sub-plans
- Council information channels include:
  - Bundaberg Regional Council (website content in areas such as):
    - our coastlines and rivers
    - disaster management guides and evacuation plans
    - creation of a new page dedicated to the community information on coastal hazards
    - planning flood information page includes coastal hazards information and mapping
    - parks, reserves and natural areas page
  - GIS capability and interactive mapping layers
  - E-news, Bundaberg Now

Council has a risk management framework, but does not specifically include climate risk as a category. It is recommended that Council consider moving towards a system that considers climate risk.

This list only recognises current public documents. Council may prefer or find the need for new policies or documents to cover the CHAS governance process and communicating its task to the community, such as land use and tenure transition, and application of the Community and Environment Charge. It is recommended that as part of the initial definition and identification tasks, Council's documentation is reviewed to gauge the extent of desired change.

5.7 Financial and Property Tasks

As the owner of public infrastructure and custodian of most foreshore, environmentally sensitive and riparian corridor land, financial implications are extensive. The options were broadly valued or costed but not in the detail Council requires for comprehensive and informed asset and financial management. Suggested initial tasks are:

- Audit at-risk infrastructure to ensure maintenance and capital expenditure accounts for life expectancy;
- Audit at-risk landholdings by tenure type in freehold or reserve;
- Summarise permanent funding streams through government programs, e.g. QRA, and develop mechanisms to inform the organisation of targeted or one-off funding streams;

- Examine proposed actions and costs;
- Prepare a financial impact report which should consider, in detail, ways of achieving the CHAS outcomes and organisational impacts. It is recommended that Council investigate the timing of implementation as this may provide a greater BCR, this should be considered in any future planning process. For example:
  - Adaptation options have been screened for their cost-benefit during Phase 7 to ensure that the expenditure is justified by having higher benefits than costs. Therefore, most preferred adaptation pathways have a BCR of more than 1 with Burnett Heads and Coonarr an exception (see Table 2-2). In the case of Burnett Heads, the damages to properties expected from sea level rise and permanent inundation could be reduced if the option is implemented before a 0.8 m sea level rise scenario, thus providing a more favourable BCR to this adaptation option.
  - At Coonarr the BCR is based on pre-hazard market value for the purchasing of buildings to test land use and tenure transition. It is unlikely tenure transition will be looked upon favourably or with priority where risk is not evident or material. Therefore, it is important for Council to implement a land swap and land use and tenure transition policy now to ensure that whatever approach is taken is consistent and defendable when the transformational task becomes a priority and the BCR changes over time.
- Potentially, develop a systems code, map, or internal rating system which provides a permanent register or reference to Council assets and land at risk to ensure the known risk is incorporated into all decision making in the future.

The project presents a raft of options which have been broadly tested by the CHAS process, however, executing an adaptation option with a beneficial BCR does not mean that Council can afford all recommended options. Implementation of all preferred adaption options would cost (NPV) roughly about $3.5 million. The implementation timing of the options ranges from about 2040 to 2100. Therefore $3.5 million over a timeframe of about 60 years is not considered onerous, especially when starting the planning and budgeting for it now. It is also important to note that not all adaptation options will need to be funded by Council themselves. Funding opportunities will arise, and Council should be prepared for these applicable funding rounds.

Allocating of monetary resources includes funding required for monitoring and evaluation to determine whether new risks have arisen, the likelihood or consequence that risks have changed, and to identify when trigger points have been reached. The Compendium (Griffith Centre for Coastal Management 2012) includes a preliminary identification of revenue raising mechanisms available to local government for financing the adaptation options and identifying measures to ensure the adaptation strategy can be integrated into local, state and national government planning and program areas. These may include Council rates, loans, grants, special purpose and environmental levies, public private partnerships, etc. Other funding sources may be available to local governments such as infrastructure funds by the state and federal government, land care programs, community group grants or community resilience funds or green bonds.

5.8 Land Use Planning and Statutory Considerations

For new land use, infrastructure and development, the planning scheme is the most effective tool for shaping future settlement patterns and to ensure risk to life and property is not increased. Planning schemes generally have the longest planning horizon of all local government plans and strategies. The CHAS should inform the planning scheme to ensure new development is appropriate to the level of existing or future coastal hazard risk and that development incorporates adaptation options consistent with the direction and outcomes intended by the CHAS.

There are a few ways in which CHAS outcomes can be reflected in planning instruments. Best practice planning for coastal hazard adaptation requires a risk-based approach to land use and development. In the first instance, the planning scheme for Bundaberg was adopted in 2015 and since that time, a new version of the State Planning Policy (SPP) has commenced. It is recommended that the planning scheme reflects the

most up to date mapping and overlay information and the SPP should be viewed as a minimum standard which targets grounding principles. It is up to local governments to convert those principles into place-based narratives and actions.

Council should consider incorporating the outcomes of the CHAS into the planning scheme overlays to convey the risk to the community and development industry. Ultimately this is a fundamental purpose of the CHAS process, i.e. to use the results to make risk-informed decisions which shape the future. The CHAS risk identification process becomes more refined and accurate than the SPP state-wide mapping. The planning scheme is therefore the best tool to convey risk into the future.

The land use planning tasks are outlined in the recommendations made in the Phase 6 Technical Appendix which considered the CHAS findings in relation to the vision outline of the Bundaberg Regional Planning Scheme 2015 to ensure risk is not increased. Land use planning is a primary component of the 'maintain' adaptation pathway and as such the recommendations were not altered by the Phase 7 analysis.

Some of the recommendations propose reviews of planning visions where development is expected to intensify or where risk has been revealed to be intolerable for proposed land uses. An additional tool is now available to address these situations of new information affecting already planned communities: The *Planning Act 2016* provides exoneration from compensation for zone changes where risk assessments have resulted in intolerable risk to life and property, using a Feasible Alternatives Assessment Report.

In addition, land use planning tasks may not all be about change. In the small coastal villages, it is important to maintain visions for low density, limited growth and limited or no extension of urban services into areas which pose future risk to life and property and thereby ensuring transparent application of the risk into planning instruments and mapping to support maintenance of current characteristics.

Other statutory considerations may become apparent in the implementation of the CHAS. For example, adaptation works or development on a foreshore reserve may conflict with the purpose for which land has been reserved under the *Land Act 1994*. Adaptation works may require state approvals under the *Planning Act 2016* or other relevant legislation or require state land tenure to be granted or address *Native Title Act 1993* matters.

Local government should be aware of potential development or tenure approval requirements. Adaptation strategies should consider issues of displaced environmental and cultural values that may be captured under other Queensland legislation, e.g. the *Marine Parks Act 2004,* or Commonwealth legislation such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and may need to refer the proposed works to the Australian Government. The Compendium has a section dedicated to specific implementation mechanisms which may provide further guidance.

5.9 Disaster Management

Disaster Management is the second continual 'maintain' pathway along with land use planning and community engagement. The Bundaberg Local Disaster Management Plan (LDMP) supports these roles in its outline of associated roles in keeping the community safe.

The current LDMP Sub-plan D – Cyclone, Flood and Storm Surge does not contain any information on tidal inundation and storm surge. There are many other sub-plans which are not publicly available which may similarly benefit from enhanced information and a place-based approach to coastal hazards.

It is recommended that the Disaster Management Officer review documentation and community awareness activities to ensure the most up-to-date information and messages are at hand. This can include updating training materials and emergency responses in the event of tidal inundation and expected storm surges particularly in the areas of isolation and evacuation opportunities. This review may result in identification of

response and recovery gaps. The Disaster Management Unit should consider developing specific awareness and emergency action plans for at-risk coastal communities.

In between times it is recommended that the Disaster Management Unit assists with opportunities for community engagement in education and awareness. These opportunities will arise for collaboration of resources for community education. Disaster experts can play a formidable role in helping the community understand risk to life and property.

During events, the Disaster Management Unit can also play an assistance role in documenting events and impacts across time.

5.10 Community Engagement

Conveying risk of natural hazard during 'peace' time is difficult. Communicating with residents, industry, and non-for-profit organisations has challenges ordinarily, but when the messages may be met with dismissal, communications teams are challenged further. There are several primary messages that can be focussed on simply to raise awareness. These are:

- That the dynamic nature of the coast means change is inevitable and there is tangible risk to life and property in some places;
- That there is a role for everyone in understanding, adapting, and planning for that risk; and
- That individuals should know their own risk and prepare for it.

These messages are like those already conveyed for any other natural hazard event. The issue for coastal hazards is that they are slow moving, slow to materialise (unless associated with a cyclonic event) and therefore difficult for people to visualise or put into context of their own property. The Phase 8 public document has been designed to reinforce these core messages.

Irrespective of internal ramifications, the Strategy is a tool for communicating risk to life and property to the broader community and is targeted at those places where risk exposure is greatest: to private property owners, business and community members in order to plan for coastal adaptation. Council is wholly responsible for communicating the case for change to the community.

It is recommended that there is a regular and recurring, targeted and place-based communications strategy in place to convey the three key messages to the community and to assist with development of place-based local community adaptation plans discussed below.

5.10.1 Building Local Adaptation Plans

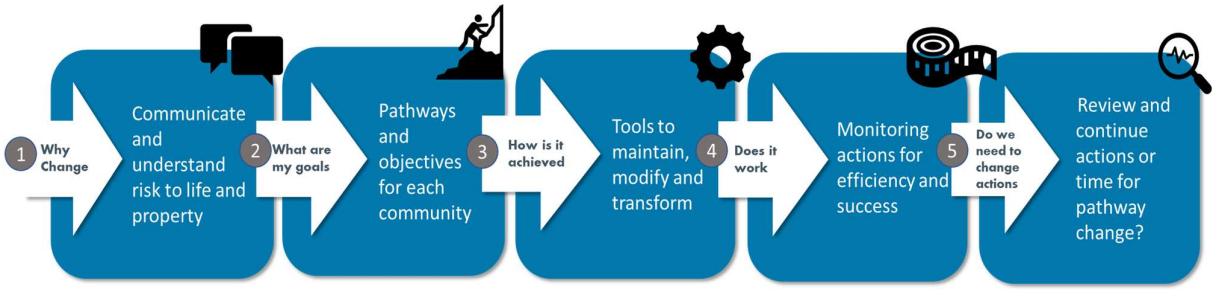

FIGURE 5-8 LOCAL ADAPTATION PLANS PROCESS

The recommendation of the CHAS outlines that Council should prepare a range of tools to assist coastal communities, social and not-for-profit clubs and community organisations, and private landowners by providing the tools and information they need to map out their own adaptation plan. Broadly, this can be interpreted as a mini CHAS along a uniform process like that presented in Figure 5-8. This is a simplified version of the change management plan in Section 5-1.

Step one commences with the communication and understanding task so that community members understand there is risk to life and property and understand this in relation to their own assets and immediate family, employees, or members as relevant.

Step two involves planning out their pathways. They will need to know their trigger points for change and which hazards are likely to impact them. For example, *is the risk of storm tide inundation real at 0.2 m sea level rise? Is the risk tolerable and so a "maintain" pathway can be established or is the risk intolerable and there is a need for future transformation?*

Step three requires a chosen pathway. What are the tools available for that community member to maintain, modify or transform? Is this early warning? Evacuation plans or protection of physical assets? Rearrangement of business insurances and contingencies? How might this risk affect asset values?

Step four and step five are part of any business, life or financial plan: regular monitoring, review and adjustment. This mini adaptation strategy can be achieved with the community through:

- Community forums in association with disaster management awareness events;
- Creation of templates and guides for individual site, business, street, or organisation risk assessments and adaptation strategies;
- Dedicated web pages and on-line resources; and
- Regular attendances and information sessions with local and targeted stakeholder groups in the coastal communities.

A broad action plan can be developed for each locality using the universal model above and is aimed at individual property or asset owners.

5.10.2 Community as Leaders

Continuous stakeholder engagement will be required to ensure community buy-in and to observe any changes to the communities. This should be undertaken in parallel with the education and awareness campaigns to enable the community to understand their personal risk and create strategies for private property.

Community engagement can also harness the collective energy of the community for the greater good. Some community champions and leaders will be well suited to a more active role in the Strategy implementation and localised adaptation plans. Community is especially well placed to assist with the monitoring task as they live and work in the coastal settlements. Council should consider allocating resources to promote and encourage:

- Community land care group or a 'coast watch' group which monitors events as they occur;
- Using an app or an on-line forum to monitor and upload local images of events, which is a very valuable asset over time. For example, the NSW government's CoastSnap[1] beach monitoring project encourages community members to take photos from particular locations that can be combined to show changes to the coast over time; or

[1] https://www.environment.nsw.gov.au/research-and-publications/your-research/citizen-science/digital-projects/coastsnap

- Developing local representatives to assist with communicating messages by inviting them to participate in the PCG meetings and implementation.

Building and maintaining community awareness is the final of the three continual actions in the 'maintain' pathway of the CHAS. The opportunities and methods for engagement are unlimited and are only constrained by imagination and resources.

It is recommended that coastal hazards are integrated into permanent and regular natural hazard communication with the community and that some targeted communication occurs in areas of intolerable or imminent risk. Communication should be broad, use multiple mediums and connect to other activities within council, e.g. land use planning changes, mapping, tools, guides, and further information.

5.11 Environment

Finally, Council is custodian of the coastline, foreshores, dunes, coastal recreation areas, and riparian corridors which so many residents enjoy and value. Proximity to these features form an integral part of the reason coastal residents live where they do. Like the communications actions, the opportunities to care for coasts are only limited by imagination and resources.

However, the environment officers will play essential roles in monitoring and data collection along with minimum activities in beach and shoreline protection. These minimum activities can be enhanced through promotion of community input and harnessing of community resources to create shared care opportunities. The community can also play a valuable role in monitoring events as noted above and this can be encouraged either through environmental programs or community engagement, or a collaboration of both programs. Some of the activities the environmental staff could employ are:

- Waterways, dunes, inlets and vulnerable areas revegetation program;
- Community land care groups or 'Beachwatch';
- Community image and event recording bank;
- Fencing and signage;
- Local public adaptation layer in Council's mapping system;
- Land use and tenure transition schemes;
- Shoreline erosion management plans, including aerial photography surveys;
- Beach nourishment; and
- Dune reconstruction.

The environment program has multi-faceted responsibilities of caring for the environment for intrinsic reasons, caring for the environment as a valued quality of life aspect through parks and gardens; and caring for the environment in the face of risk. Figure 5-9 shows, in plan-on-a-page style, the areas of responsibility and potential activities across the organisation discussed in this section.

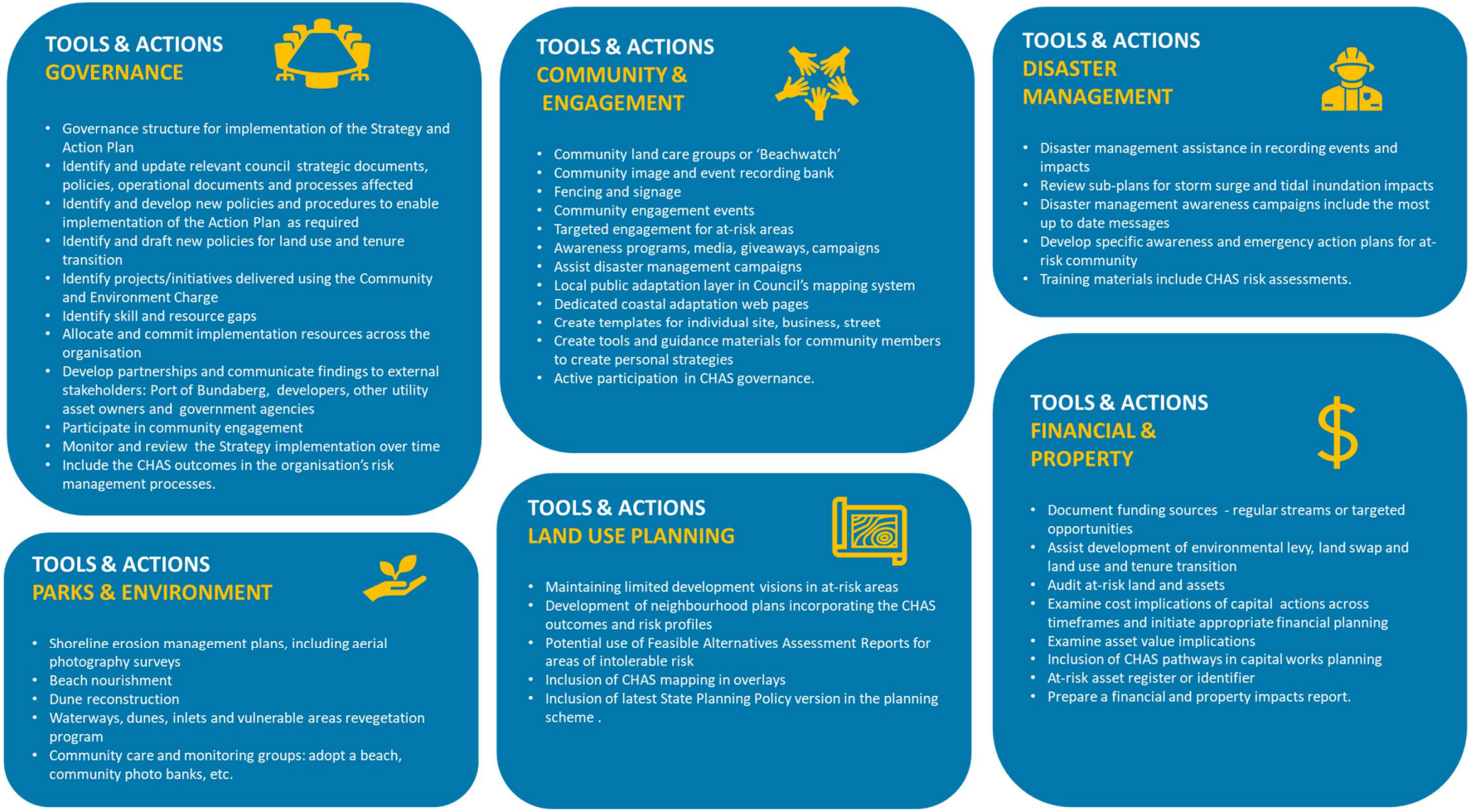

FIGURE 5-9 IMPLEMENTATION ACTIVITIES BY PROGRAM - PLAN-ON-A-PAGE

5.12 Monitoring and Review

The monitoring and review process has been further detailed in this section as the options for monitoring and measurements of actions can be complex and many. Monitoring is often not straightforward and involves some effort over long periods of time. New data comes from continuous monitoring to assess the likely timing of trigger points and thresholds. Impacts on the budget and cost-benefit will also need to be monitored as resources might become scarce, e.g. sand availability in the region for beach nourishment works, and/or property prices variability, specifically after a coastal hazard event. The generic monitoring process is shown in Figure 5-10.

Monitoring will also need to be on two levels: the Strategy implementation and the individual activities in the Action Plan. The monitoring program is essential as the reporting will not have value unless it is against agreed goals and targets using measurable indicators across applicable reporting timeframes.

FIGURE 5-10 MONITORING PROCESS

This model can be used to encapsulate the entire Strategy including internal and external activities. Thus, monitoring and review will occur by:

- program actions and activities such as community awareness and education events;
- operational plan objectives;
- individual hazard;
- individual place and area of intolerable risk; and
- corporate plan objectives.

The initial governance structure should map out how the monitoring and reporting structure will function. Regular updating of the CHAS itself should be undertaken every 5-10 years with regular progress reports and Strategy reviews from the steering committee to Council every 1-2 years. The progress reports will need to:

- Report on progress to date;
- Identify additional data needs;
- Identify which data will need to be updated in which timeframe;
- Review implementation actions; and
- Report on stakeholder engagement activities and outcomes.

FIGURE 5-11 STRATEGY IMPLEMENTATION INDICATORS

The review will need to include measurable outcomes over time to gauge performance on four accounts. The first is the implementation actions themselves that Council has set to complete through the governance structure. These are set simply by measuring the goals set in the various mechanisms across the organisation. Potential indicators for the Action Plan are shown below.

The other three are the three hazards. These will measure the efficacy of the pathways adaptation process and the CHAS itself. Some examples for measurable outcomes for the three coastal hazards are shown below in Figure 5-8. Many of these indicators will take some time to produce a trend or meaningful measurements, while others require community cooperation, collaboration and event recording in often difficult circumstances. The more indicators that can be achieved, the more robust the adaptation planning will be.

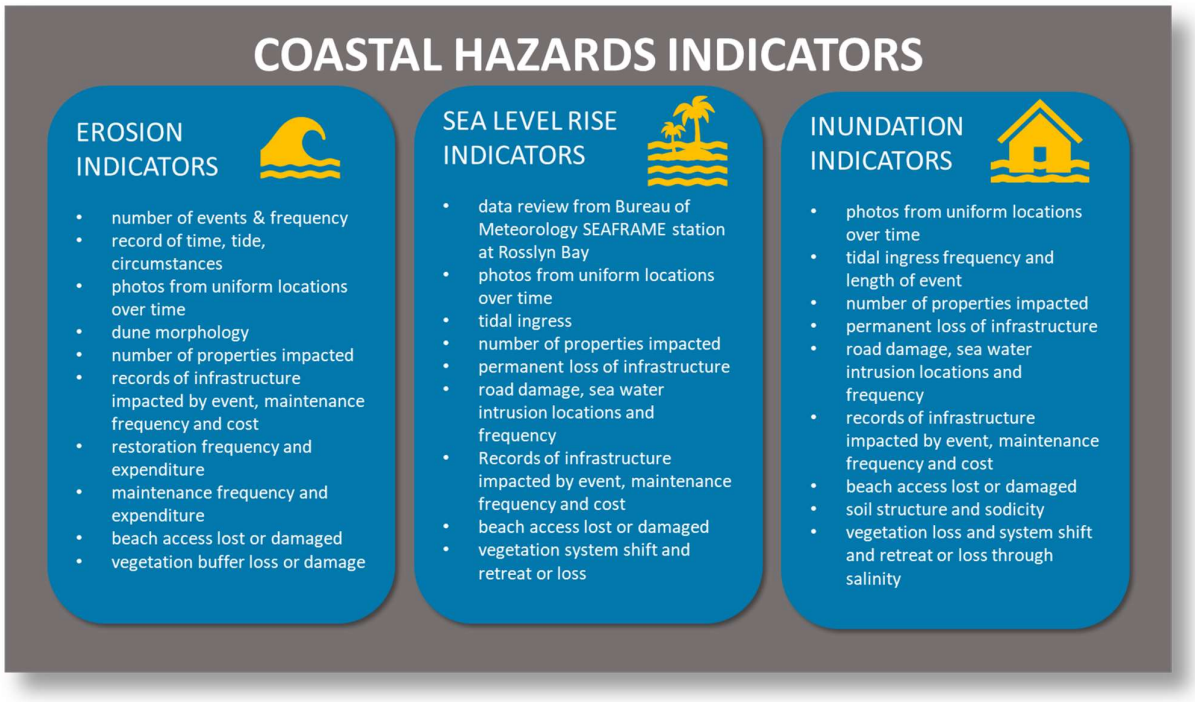

FIGURE 5-12 MONITORING MEASURES

5.13 External Stakeholders

In addition to Council implementing the CHAS, the delivery of adaptation options will also involve other partners and stakeholders such as state agencies, infrastructure and utility providers, other asset owners and private landholders.

Leading best practice in a strategic local government document such as this would expand the Action Plan component of the CHAS to include other key stakeholders. The CHAS provides a framework to align adaptation actions and works by other stakeholders with the long-term intent, priorities and outcomes sought for the local government area. In the short term the governance structure will:

- Set out the terms of communicating the findings of the CHAS to relevant stakeholders;
- Identify the relevant stakeholders and their interests;
- Keep the stakeholders informed; and
- Set a common agenda for the future.

In 2019, various external stakeholders were engaged within the CHAS process including targeted landowners, primary producers, land care, community members and the Port of Bundaberg. A survey was distributed seeking interest from potential external stakeholders, forums conducted to explain the CHAS and to identify risk to assets and features. The external stakeholders who took part in the CHAS including the community reference group would be a good starting point for future engagement.

External stakeholders and the terms of the communication are limited only by will and resources. It is likely that interest will peak directly after a natural hazard event or in association with other forums rather than a stand-alone consultation.

6 SUMMARY

This chapter summarises the recommendations drawn from the Phase 8 Implementation Strategy and Action Plan and captures the challenges and limitations of developing the CHAS. There are a few recommendations for Council to consider for successful implementation of the CHAS Strategy and Action Plan. It is also important to recognise the limitations of this high-level strategic assessment. Review of the preferred adaptation pathways may prompt further detailed investigation and a different preferred pathway. To initiate the roll-out of the CHAS Strategy and Action Plan, the immediate next steps are listed in this chapter.

6.1 Challenges and limitations

It is important to note that the high-level strategic nature of the study was to identify priority areas of high risk and adaptation actions to reduce the impact of those risks. The CHAS successfully identifies the priority settlements, priority risks and preferred adaptation approaches, which provides locations for potential further investigation and/or collation of data. The following dot points summarise the key challenges and limitations:

- Refinement of the erosion prone area focused on key study locations, namely Miara, Moore Park Beach, Bargara, Innes Park, Coonarr and Woodgate Beach. No further analysis of the erosion prone area has been undertaken on the remainder of Council's coastal areas, instead the existing Queensland Government data for erosion prone areas was adopted for all other areas, which is limited to the 1%AEP erosion prone area extent under a 0.8 m sea level rise scenario.
- The initial assessment of exposure to coastal hazard in Miara, Winfield and Norval Park was comparatively higher than other localities in Bundaberg, on an asset percentage basis. It was considered that the caravan park has a high adaptive capacity and therefore a sensitivity analysis of the economic assumptions has been undertaken to include the semi-permanent structures associated with the Miara caravan park. More than 50% of the site is exposed to coastal hazard which is why a "transform" adaptation approach of land swap is identified in this settlement.
- A fit-for-purpose consequence scale has been developed and adapted from industry best practice and guidelines. The economic scale, i.e. catastrophic consequence of greater than $100 million, has been adapted from the Federal Department of Industry, Innovation and Science – Risk Management Handbook. It was also noted that the issues of isolation were not adequately addressed within existing literature, therefore a settlement which is isolated under a coastal hazard scenario is considered to have catastrophic social consequence.
- The physical 'modify' options shortlisted for socio-economic appraisal are located in the areas chosen for refinement of the erosion prone area in Moore Park Beach, Bargara, Innes Park, Coonarr and Woodgate Beach. The socio-economic analysis of shortlisted options investigates the benefit cost ratio at the selected sea level rise scenario where the risk passes the threshold of intolerable risk. The BCR may prove to be more favourable if the timeframe of implementation is brought forward, this is because properties that suffer inundation from permanent sea level rise inundation would benefit from the physical measure.
- For the purpose of the high-level assessment, the GIS approach to calculating damages assumes the same reduction in damages from both beach nourishment and a seawall, whereas in reality the 'protected area' may differ.

6.2 Recommendations

A list of recommendations has been prepared to summarise the discussion in this paper. It is not intended to be exhaustive but a guide for Council to start the implementation process.

TABLE 6-1 SUMMARY OF RECOMMENDATIONS

Implementation area	Description
Strategy Implementation	For effective implementation of the CHAS, a whole-of-Council approach is recommended in accordance with Figure 5-2
Strategy Implementation	It is recommended that the Project Control Group (PCG) continues its role as a governance body and steering committee to advise Council on implementation matters.
Strategy Implementation	It is recommended that the knowledge gained by the PCG is retained in some format to pass on to the organisation in an implementation phase, if not retained as the steering committee or internal governance body
Strategy Implementation	It is recommended that the lifecycle of the CHAS is approximately 10 years with the next review of the pathways and the CHAS to be included as an action for the 2028-2029 Corporate Plan.
Existing documents and strategies	It is recommended that as part of the initial definition and identification tasks, Council documentation is reviewed to gauge the extent of desired change.
Roles and Responsibilities	It is Council's responsibility to communicate the Strategy outcomes, implications, and importance of acting now across Council.
Roles and Responsibilities	Council is wholly responsible for communicating the case for change to the community. It is recommended that there is a regular and recurring, targeted and place-based communications strategy in place to convey the three key messages to the community, irrespective of internal implementation.
Financial and property tasks	It is recommended that Council investigate the timing of implementation as this may provide a greater BCR, this should be considered in any future planning process.
Financial and property tasks	It is recommended that budget planning for proposed actions and acquisition of funding grants, where available, commences now.
Financial and property tasks	It is recommended that a financial impact report is prepared which delves deeper into ways of achieving the CHAS outcomes and organisational impacts.
Land Use Planning and Statutory considerations	It is recommended that the planning scheme reflects the most up-to-date mapping and overlay information.
Land Use Planning and Statutory considerations	It is recommended that reviews are undertaken of planning visions where development is expected to intensify or where risk has been revealed to be intolerable for the land uses proposed.
Land Use Planning and Statutory considerations	It is recommended that the land use planning tasks, outlined in the recommendations made in the Phase 6 Technical Appendix which considered the CHAS findings in relation to the vision outline of the Bundaberg Regional Planning Scheme 2015, are reviewed and actioned.
Disaster Management	It is recommended that the Disaster Management Unit reviews documentation and community awareness activities to ensure the most up-to-date information and messages are to hand.
Disaster Management	In between times, it is recommended that the Disaster Management Unit assists with opportunities for community engagement in education and awareness.

Implementation area	Description
Community Engagement	It is recommended that the difference between responsibilities for public and private assets and therefore roles and responsibilities are conveyed to the community in the primary messages.
Community Engagement	It is recommended that key messages and coastal hazard information and updates are integrated into permanent and regular natural hazard communication with the community.
Community Engagement	It is recommended that some targeted communication occurs in areas of intolerable or imminent risk.
Community Engagement	Communication should be broad, use multiple mediums and connect to other activities within Council, e.g. land use planning changes, mapping, tools, guides and further information.
Community Engagement	Council should prepare a range of tools to assist coastal communities, social and not-for-profit clubs, community organisations, and private landowners to map out their own adaptation plans.
Community Engagement	Council should draw on community leaders who have already participated in engagement as a starting point for continued external collaboration or as candidates for inclusion on a governance committee.
Monitoring and Review	It is recommended that Council adopt a monitoring and review cycle for the Strategy and the Action plan across fit-for-purpose timeframes and processes.
Monitoring and Review	Continuous monitoring of trigger points and thresholds to update the timing in more detail is necessary to allow cyclical updates of the strategy
Action Plan	Implementation of the 'maintain' strategy for all settlements.
Action Plan	Commencement of planning for the construction of causeways (or alternative treatments) at Moore Park Beach.
Action Plan	Development of a land swap, land use and tenure transition policy with specific focus on Miara Holiday Park, Moore Park Beach Surf Club and Tourist Park, Lighthouse Tourist Park, Biggs Street and Elliott Heads Tourist Park.

6.3 Next Steps

Finally, if the preferred adaptation options are adopted for further assessment, the following next steps are required for progression:

- Implement the high priority items listed in the Implementation Plan in section 6.4,
- Recognise the limitations of the CHAS as a high-level assessment, further quantification of the costs and benefits (including intangible benefits).
- Explore combinations of preferred modify and transform options to priority settlements, such as beach nourishment, seawalls, raising key access roads, land swap, land use and tenure transition for discussion with the community.
- Ensure the strategy actions are embedded across all Council programs for risk-aware decisions as business as usual. The CHAS works in tandem with many other aspects of Council business and community values and will be embedded into:
  - Land use planning and community visioning;
  - Building regulations;

- Community facilities and support programs;
- Asset management processes;
- Infrastructure planning and cost-benefit analysis tasks;
- Parks and environmental protection;
- Emergency management and disaster recovery; and
- Monitoring and reporting system.

- Decisions one organisation or landowner will make will not be appropriate for other organisations, properties or locations. Being risk aware and adaptable is an intensely individual experience. Everyone's risk exposure is different. Individual understanding of risk and personal strategy development is the first step to a more resilient coastal community.
- Council will be the facilitator and leader of recommendations but not necessarily the doer. There are practical roles for residents, business, community organisations, state agencies, and disaster management. An ambitious aim of the CHAS is that every part of the community in the coastal area: private land or business owner, surf club, school, retirement village, local motel or sports club should know and understand their own risks and create a suitable action plan for assets, premises, and members.
- As the facilitator and leader, Council will provide tools, templates, guidance, in kind assistance and alert the community to any appropriate funding streams among Council-specific actions and a plethora of possible small-scale actions across all Council programs.

6.4 Implementation plan

The Implementation Plan prioritises each action and recommendation found within the Strategy and Action Plan, organised as high, medium, and low priority. The following table can assist Council in implementing CHAS actions over time, as well as the allocation of budgets to support resilience across Bundaberg's coastal settlements. Prioritisation is as follows:

- H – High priority
- M – Medium priority, and
- L – Low priority.

TABLE 6-2 IMPLEMENTATION PLAN AND ACTION PRIORTISATION OVERVIEW

Ref	Title	Description	Priority	Cost [2]
1	Establish Council steering group	Implementation of an internal Council steering group to champion an adaptation framework, progress planning adaptation options and continuous monitoring of trigger points (applicable for all coastal townships).	H	Nominal
2	Develop land swap, land use and tenure transition policy	Development of a land use and tenure transition policy by Council (applicable for coastal townships with land tenure transition actions).	H	To be determined
3	Review Council's Asset Management Policy to reflect climate risk	Refinement of asset management policy by Council to include due consideration of climate induce coastal hazards (applicable for select coastal townships with infrastructure resilience actions).	H	To be determined
4	Ongoing engagement and communication in all settlements	It is recommended that coastal hazards are integrated into permanent and regular natural hazard communication with the community and that some targeted communication occurs in areas of intolerable or imminent risk. Communication should be broad, use multiple mediums and connect to other activities within council, e.g. land use planning changes, mapping, tools, guides and further information.	H	To be determined
5	Ongoing disaster management in all settlements	It is recommended that the Disaster Management Officer review documentation and community awareness activities to ensure the most up to date information and messages are at hand. This can include updating training materials and emergency responses in the event of tidal inundation and expected storm surges particularly in the areas of isolation and evacuation opportunities. This review may result in identification of response and recovery gaps.	H	To be determined
6	Ongoing land use planning in all settlements	The CHAS should inform the planning scheme to ensure new development is appropriate to the level of existing or future coastal hazard risk and that development incorporates adaptation options consistent with the direction and outcomes intended by the CHAS.	H	To be determined
7	Review and update Storm Tide Inundation Study	Review and update existing Storm Tide Inundation Study for Bundaberg Region to include examination of more frequent likelihood storm events less than the 1% AEP and address non-cyclonic events.	H	To be determined
8	Continue to implement SEMP at Woodgate Beach	Woodgate Beach: Implement continuous monitoring of coastal erosion and outcomes of the Woodgate Shoreline Erosion Management Plan.	H	To be determined
9	Monitor coastal erosion in Bargara (SEMP)	Bargara Foreshore and Nielson's Beach: Implement continuous monitoring of coastal erosion and investigate implementation of a Shoreline Erosion Management Plan.	H	To be determined
9	Monitor coastal erosion at Kellys Beach	Implement continuous monitoring of coastal erosion at Kellys Beach.	H	To be determined
10	Monitor coastal erosion in Colonial Cove (SEMP)	Colonial Cove: Implement continuous monitoring of coastal erosion and investigate implementation of a Shoreline Erosion Management Plan.	H	To be determined
11	Monitor coastal erosion in Coonarr (SEMP)	Coonarr: Implement continuous monitoring of coastal erosion and investigate implementation of a Shoreline Erosion Management Plan.	H	To be determined
12	Monitor coastal erosion in Buxton (SEMP)	Wharf Street, Buxton: Implement continuous monitoring of coastal erosion investigate implementation of a Shoreline Erosion Management Plan.	H	To be determined

[2] Please refer to Phase 6 – Technical Appendix C Engineering Design and Construction Costs

13	Partner with Parks & Wildlife Service for turtle nesting investigations	Bargara: Investigate a site-specific resilience strategy for Mon Repos Turtle Centre in Partnership with Queensland State Government Parks and Wildlife Service. This strategy may need to consider coastal hazard impacts to turtle nesting beaches across the Bundaberg region.	H	To be determined
14	Planning land swap for Moore Park Beach Surf Club	Moore Park Beach: Start planning possible land swap required for Moore Park Beach Surf Club.	H	To be determined
15	Start planning for construction to address regular inundation on Moore Park Road	Moore Park Beach: Start planning for a causeway Moore Park Road (alternatively road raising).	H	$2,062,500[2]
16	Planning for possible land use and tenure transition, beach nourishment and raising key access roads in Coonarr	Given the potential intolerable risk at 0.2 m sea level rise, there is a clear priority for immediate implementation of disaster management planning, an education and awareness campaign, land use planning and continued monitoring of erosion at Coonarr. However, the timing of projected impacts means that planning for a range of additional options needs to commence immediately, focusing on beach nourishment, land use and tenure transition and road raising. The way in which these options are implemented, either individually or as a combined package of solutions, requires further investigation during the planning stage with input from the local community.	H	$6,010,000[2] $449,000[2] $1,629,000[2]
17	Implement asset management policy in Bargara	Bargara: Apply policy to enhance resilience of critical infrastructure (focusing on water and electricity infrastructure).	H	To be determined
18	Implement asset management policy in Burnett Heads	Burnett Heads: Apply policy to enhance resilience of critical infrastructure (including water, electricity and stormwater infrastructure).	H	To be determined
19	Implement asset management policy in Innes Park and Coral Cove	Innes Park and Coral Cove: Apply policy to enhance resilience of critical infrastructure (focusing on water infrastructure).	H	To be determined
20	Implement asset management policy in Moore Park Beach	Moore Park Beach: Apply policy to enhance resilience of critical infrastructure (including water, electricity and stormwater infrastructure).	H	To be determined
21	Implement asset management policy in Woodgate Beach	Woodgate Beach: Apply policy to enhance resilience of critical infrastructure (including water, electricity and stormwater infrastructure).	H	To be determined
22	Manage coastal hazard data	Update and improve coastal hazard data (applicable for all settlements).	M	To be determined
23	Ongoing monitoring and review of strategy and action plan	Regular monitoring, reporting and review of all CHAS actions. CHAS update every 5-10 years, particularly the adaptation pathways versus non-preferred options.	M	To be determined
24	Planning land swap for Elliott Heads Holiday Park	Elliott Heads: Start planning the land swap required for Elliott Heads Holiday Park. Alternatively, start planning for land use and tenure transition.	M	To be determined
25	Planning land swap for Miara Holiday Park	Miara: Start planning the land swap required for Miara Holiday Park. Alternatively, start planning for land use and tenure transition.	M	To be determined
26	Implement causeway construction on Moore Park Road	Moore Park Beach: Construct causeway on Moore Park Road. Alternatively, raise this road for greater resilience to regular inundation.	M	$2,062,500[2]
27	Planning for beach nourishment in Moore Park Beach	Moore Park: Start planning for beach nourishment required for Moore Park Beach. Alternatively, start planning to construct a seawall at this location.	M	$4,564,000[2]
28	Planning for beach nourishment in Woodgate Beach	Woodgate Beach: Start planning for beach nourishment required for Woodgate Beach. Alternatively, start planning to construct a seawall at this location.	M	$9,240,000[2]
29	Planning for raising key access roads in Woodgate Beach	Woodgate Beach: Start planning to raise Acacia Street. Alternatively, start planning for a causeway to be constructed.	M	$2,400,000[2]
30	Planning for raising key access roads in Woodgate Beach	Woodgate Beach: Start planning to raise Theodolite Creek Road. Alternatively, start planning for a causeway to be constructed.	M	$1,462,5000[2]
31	Implement land swap for Moore Park Beach Surf Club	Moore Park Beach: Implement the land swap required for Moore Park Beach Surf Club according to suburb-specific planning and the policy.	M	To be determined
32	Implement land use and tenure transition in Coonarr	Coonarr: Implement the land use and tenure transition required for residential properties in Coonarr, according to suburb-specific planning.	M	$6,010,000[2]
33	Implement beach nourishment in Coonarr	Coonarr: Implement beach nourishment required for Coonarr Beach OR construct seawall, according to suburb-specific planning.	M	$449,000[2]
34	Implement raising key access roads for Coonarr Beach	Coonarr: Raise Coonarr Beach Road OR construct causeway, according to suburb-specific planning.	M	$1,629,000[2]

35	Plan and implement land swap for Lighthouse Tourist Park, Burnett Heads	Burnett Heads: Start planning the land swap required for Burnett Heads Lighthouse Tourist Park.	L	To be determined
36	Plan and implement raising Murdochs Linking Road, Moore Park Beach	Moore Park Beach: Start planning to raise Murdochs Linking Road. Alternatively, start planning for a causeway to be constructed in this location.	L	$1,905,000[2]
37	Plan and implement raising key access roads in Woodgate Beach	Woodgate beach: Start planning to raise Paperbark Court. Alternatively, start planning for a causeway to be constructed in these locations, or for tenure transition planning.	L	$3,937,500[2]
38	Plan and implement raising key access roads in Woodgate Beach	Woodgate beach: Start planning to raise Walkers Point Road. Alternatively, start planning for a causeway to be constructed in these locations, or for tenure transition planning.	L	$1,005,000[2]
39	Plan and implement causeway construction on Malvern Drive, Moore Park Beach	Moore Park Beach: Start planning for construction of a causeway on Malvern Drive. Alternatively, start planning to raise this road.	L	$294,000[2]
40	Plan and implement beach nourishment for Kellys Beach, Bargara	Bargara: Start planning for beach nourishment required for Kellys Beach. Alternatively, start planning to construct a seawall at this location.	L	$1,310,960[2]
41	Plan and implement beach nourishment for Innes Park and Coral Cove	Innes Park and Coral Cove: Start planning for beach nourishment required for Innes Park Beach and Coral Cove. Alternatively, start planning to construct a seawall at these locations.	L	$2,600,000[2]
42	Plan and implement a storm-surge barrier along Buss Road, Burnett Heads	Burnett Heads: Start planning to construct a storm-surge barrier along the alignment of possible Buss Road port access upgrade in partnership with DTMR and Port Authority.	L	$18,000,000[2]
43	Implement land swap in Elliott Heads Holiday Park	Elliott Heads: Implement the land swap required for Elliott Heads Holiday Park according to settlement-specific planning and the policy.	L	To be determined
44	Implement land swap in Miara Holiday Park	Miara: Implement the land swap required for Miara Holiday Park according to settlement-specific planning and the policy.	L	To be determined
45	Implement beach nourishment in Moore Park Beach	Moore Park Beach: Implement beach nourishment required for Moore Park Beach OR construct seawalls, according to suburb-specific planning.	L	$4,564,000[2]
	Implement beach nourishment in Woodgate Beach	Woodgate Beach: Implement beach nourishment required for Woodgate Beach OR construct seawalls, according to settlement-specific planning.	L	$9,240,000[2]

[2] Please refer to Phase 6 – Technical Appendix C Engineering Design and Construction Costs

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