

Princess Royal Harbour CHRMAP

Summary Document

City of Albany

15 May 2026



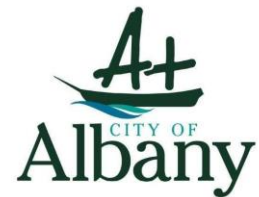


Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
V01	Draft for Steering Committee Review	Nick Dugan	Nick Dugan	19/04/2024
V02	Draft for Public Review	Astrid Stuer	Nick Dugan	2/8/2024
V03	Draft for Public Review	Karl Ilich	Joanna Garcia-Webb	15/5/2026

Project Details

Project Name	Princess Royal Harbour CHRMAP
Client	City of Albany
Client Project Manager	Adrian Nicoll
Water Technology Project Manager	Astrid Stuer
Water Technology Project Director	Gildas Colleter
Authors	Karl Ilich
Document Number	22040008_R07_V03



COPYRIGHT

Water Technology Pty Ltd has produced this document in accordance with instructions from City of Albany for their use only. The concepts and information contained in this document are the copyright of Water Technology Pty Ltd. Use or copying of this document in whole or in part without written permission of Water Technology Pty Ltd constitutes an infringement of copyright.

Water Technology Pty Ltd does not warrant this document is definitive nor free from error and does not accept liability for any loss caused, or arising from, reliance upon the information provided herein.

Level 1, 21 Adelaide Street
Fremantle WA 6160
Telephone (08) 6555 0105
ACN 093 377 283
ABN 60 093 377 283





ACKNOWLEDGEMENT OF COUNTRY

The Board and employees of Water Technology acknowledge and respect the Aboriginal and Torres Strait Islander Peoples as the Traditional Custodians of Country throughout Australia. We specifically acknowledge the Traditional Custodians of the land on which our offices reside and where we undertake our work.

We respect the knowledge, skills and lived experiences of Aboriginal and Torres Strait Islander Peoples, who we continue to learn from and collaborate with. We also extend our respect to all First Nations Peoples, their cultures and to their Elders, past and present.



Shallow waters of Princess Royal Harbour. Source: Google Maps



EXECUTIVE SUMMARY

The Western Australian Government Western Australian Planning Commission's "State Planning Policy No. 2.6: State Coastal Planning Policy" (WAPC, 2013, herein referred to as "SPP2.6") addresses climate change, sea level rise, increased coastal inundation and coastal erosion. SPP2.6 recommends that management authorities develop a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for land use or development vulnerable to coastal hazards. Specific CHRMAP Guidelines have been developed to assist this process (WAPC, 2019).

The Princess Royal Harbour (PRH) region has been identified as potentially exposed to inundation hazard. Additionally, Little Grove (located within Princess Royal Harbour) is on a "watchlist" for coastal erosion vulnerability (Seashore Engineering, 2019). This coastal hazard risk is a key trigger for the requirement of this CHRMAP. Therefore, the study aimed to investigate and plan for coastal hazards likely to affect Princess Royal Harbour. Figure 1-1 shows the study area. The study area is a semi-enclosed natural harbour in Albany on the south coast of Western Australia. The Harbour is approximately 4 km wide and 8 km long, with an approximate area of 28 km² within the City of Albany. The Harbour contains subtidal seagrass meadows and the working Port of Albany. The Port of Albany is a significant exporter for the state.

This CHRMAP increases knowledge and understanding of coastal hazard risks and identifies risk management and adaptation measures for implementation. The outcomes will be used to inform local government policies, strategies and plans, including (but not limited to), planning strategies, community strategic plans, drainage strategies, asset management plans, emergency management plans, and foreshore management plans. The project adhered to the WAPC (2019) guidelines with scope and deliverables consistent with their objectives and SPP2.6. In addition, the project has identified the strategic direction for coastal adaptation scenarios from the present to 2122 (100-year management time frame) and determined an implementation plan describing risk management measures to be undertaken to achieve this direction. Overall, this CHRMAP has developed flexible adaptation pathways for the region and will serve as a key reference for management, planning and policymaking for the short-term (0-25 years), medium-term (25-50 years), and long-term (100 years).

The PRH shoreline was divided into five management units:

- MU1 - Point King to Melville Point
- MU2 - Melville Point to Rushy Point
- MU3 - Rushy Point to Limekilns Point
- MU4 - Limekilns Point to Geake Point
- MU5 – Geake Point to Uredale Point

A Coastal Hazard Assessment identified the coastal hazards in the study area that need to be considered in the CHRMAP. Hazard maps were produced defining the erosion and inundation extents for present day, 2047, 2072 and 2122. It is acknowledged that the hazard identification component of the present study was undertaken to provide a broad understanding of exposure that can support government planning at a regional level. The hazard identification may be superseded by future site-specific studies. Results derived from this study should not be over-interpreted at a micro-scale due to the assumptions applied and the limitations in resolution.

Following the Hazard Assessment, a Coastal Assets and Community Values Identification investigation was undertaken to identify the assets within the coastal hazard zone. All the assets in the coastal hazard zone were identified and classified into seven categories as listed below. The quantity of each asset category by Management Unit, category and planning horizon are presented for each hazard.

- Residential
- Commercial



- Developed Foreshore reserve
- Public & Community
- Roads
- Environmental
- Heritage

Community and stakeholder involvement is a critical component of the CHRMAP process, as it defines what and how much value is placed on assets within the study area. As such, the project contained a high level of community and stakeholder engagement. Engagement outcomes have informed the adaptation planning process and ensured all needs are considered. This provides ownership of the CHRMAP with those that it affects, and acceptance of its outcomes. A Community Values assessment using various engagement methods was used to identify key values and concerns for the study area.

Key values identified by participants across the whole study area as follows:

- Beaches and foreshore areas for activities like walking, cycling, visiting nearby venues, fishing, swimming, exercise, views, residing nearby
- Health of environmental areas for their flora and fauna diversity which participants could appreciate – by birdwatching for example
- Coastal recreation
- Tourism
- Culturally significant (Aboriginal and European Heritage)

The values collated from the engagement to date have been used to generate the success criteria below for the vulnerability and risk assessment component of the CHRMAP:

- Ensure future land use and development does not accelerate coastal erosion or inundation risks or have a detrimental impact on the functions of public reserves,
- Manage land at risk of coastal erosion and inundation to avoid inappropriate land use and development,
- Maintain the harbour for environmental health, including flora and fauna habitat,
- Conserve, enhance and maintain the natural environment and character of the study area,
- Sustain the ability for the current and future generation to recreate along the harbour,
- Protect and or manage appropriately the provision of recreational assets in the coastal zone.

A Vulnerability Analysis, which constitutes the second stage of the risk identification process, was undertaken to develop likelihood, consequence, level of risk, adaptive capacity and vulnerability ratings for the seven asset categories. All identified at-risk assets within the five management units are presented for each of the planning horizons, for each hazard.

Extreme vulnerability to erosion has been identified from the present day onwards, and for a higher number of assets than inundation. This is due to the larger area affected by the erosion hazard and the lower adaptive capacity to the erosion hazard. Extreme vulnerability to erosion has been identified from the present day onwards for more than one asset category in all MU's except MU1.

The inundation vulnerability ratings are generally low and medium ratings from present day. At the 100-year timeframe the ratings are generally medium, with residential, public and community, and commercial categories presenting high levels of vulnerability.



Recommended adaptation options to manage the coastal erosion and inundation vulnerability are presented to give direction for future investigations and funding opportunities. The recommendations are preliminary as they are based on currently available information. Future investigations are required to confirm they are suitable, including further consultation with stakeholders and the community. Subsequently a likely outcome is that a combination of options may be the preferred approach in some locations. The recommendations are based on the analysis presented in this report. Additional considerations may be incorporated into future analyses.

The proposed options should be the subject of further investigations, surveys, policy review, impact investigations (environmental, visual and social), development approval and authorities' endorsement, local stakeholder and community engagement, preliminary design, detailed design, costing and any other applicable preparation work required prior to be implemented. The options should be optimised and modified following such additional investigations.

To address erosion for the PRH coastline in the short-term a combination of Planned / Managed Retreat (MU4) and Protection with existing Seawalls (parts of MU1; and parts of MU5) and Beach Renourishment (parts of MU1; MU2; M3; and MU5) has been shown to be the preferred approach as a result of this analysis. To address inundation in the short-term a combination of Accommodate (MU1) and Protection with Levees (parts of MU2, MU3, MU4, and MU5) has been shown to be the preferred approach. It is recommended investigations are undertaken to confirm suitable levee design. Individual maps depicting each hazard and the extent of proposed treatment options for each MU are provided in Appendix A.

A number of additional general investigations are recommended:

- Foreshore asset audit to inform asset management.
- Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat.
- Sand source feasibility study.
- Emergency evacuation plan.
- Update Foreshore Management Plans.
- Prioritisation of Management Units and re-analysis of sub-units.
- Feasibility study of combining treatment of both erosion and inundation hazard with one management option.

The CHRMAP is a strategic planning document that considers long timeframes. While the CHRMAP provides a rationale for coastal hazard management a substantial amount of preparatory work, detailed in the CHRMAP recommendations, is required before "on-the-ground implementation" can proceed. The next phase of research and studies would consider priority items in more detail, including:

- Community and stakeholder engagement - Community education about coastal hazard projections and targeted engagement with stakeholders whose values and interests could be affected,
- Data collection and analysis
- Preliminary and detailed design investigations; environmental investigations to mitigate potential impacts; economic and budgeting analysis to determine accurate costs once detailed designs are available.



CONTENTS

1	INTRODUCTION	10
1.1	Background	10
1.2	Structure of this Report	13
2	ESTABLISH THE CONTEXT	14
2.1	Purpose	14
2.2	Objectives	14
2.3	Scope	14
2.4	Local Context	15
2.5	Existing Planning Controls	15
2.6	State Planning Policies and Strategies	16
2.7	Community and Stakeholder Engagement	17
3	RISK IDENTIFICATION	20
3.1	Erosion Hazard Assessment Method	20
3.1.1	Summary	20
3.1.2	Method	20
3.2	Inundation Hazard Method	21
3.3	Hazard Results	21
4	COASTAL ASSETS AND COMMUNITY VALUES IDENTIFICATION	23
4.1	Asset Identification	23
4.2	Asset Classifications	23
4.3	Community Values Engagement Process	23
4.4	Coastal Assets and Community Values	24
4.5	Success Criteria	24
5	VULNERABILITY ANALYSIS	25
5.1	Method	25
5.2	Identification of Assets	25
5.3	Exposure / Likelihood	25
5.4	Sensitivity / Consequence	26
5.5	Potential Impact (Level of Risk)	27
5.6	Adaptive Capacity	28
5.7	Vulnerability Ratings	28
6	RISK EVALUATION AND TREATMENT	32
6.1	Risk Evaluation - Priorities for Treatment	32
6.2	Risk Management and Adaptation Hierarchy	32
6.3	Risk Treatment Options	34
6.4	Multi-Criteria Analysis	36
7	RISK TREATMENT ANALYSIS	38
7.1	Cost Benefit Analysis	38
7.1.1	Approach	38



7.1.2	Options Suitable for Cost-Benefit Analysis	38
7.1.3	Other Options	39
7.1.4	Cost Benefit Analysis Methodology	39
7.1.5	Recommended option(s) for further consideration for each MU	39
8	IMPLEMENTATION	42
8.1	Implementation Strategy	42
8.2	Land Use Planning	43
8.2.1	Statutory Planning Mechanisms	43
8.2.2	Recommended Planning Controls	44
8.2.3	Management Requirements	47
8.3	Funding Options	48
8.3.1	Operating Budget, General Rates and Coastal Management Fund	49
8.3.2	Specified Area Rate	49
8.3.3	Levies	49
8.3.4	Lease Land Management	49
8.3.5	State Grants – CoastWA	49
8.3.6	Federal Grants	50
8.3.7	Beneficiary (user) Pays	51
8.4	Monitoring and Review	51
8.4.1	Review of Existing Coastal Monitoring	51
8.4.2	Recommended Coastal Monitoring Activities	51
8.4.3	Trigger Points	53
8.4.4	CHRMAP Review	54
8.5	Implementation Overview	54
8.6	Short-term Implementation	57
8.6.1	Key Assumptions	58
8.6.2	Further Investigations	58
8.7	Medium and Long-term Implementation	61
8.8	Detailed Implementation Plans	61

APPENDICES

Appendix A	Maps of Erosion and Inundation And Recommended Adaptation Options	
Appendix B	Establish The Context Chapter Report	
Appendix C	Risk Identification Chapter Report	
Appendix D	Vulnerability Analysis Chapter Report	
Appendix E	Risk Evaluation And Treatment chapter report	
Appendix F	Assessment of Risk Treatment Options Chapter Report	
Appendix G	Implementation and Monitoring Chapter Report	
Appendix H	Coastal Hazard Local Planning Policy	

LIST OF FIGURES

Figure 1-1	Princess Royal Harbour Study Area	11
------------	-----------------------------------	----



Figure 1-2	Methodology	12
Figure 2-1	State Planning Framework for Western Australia	16
Figure 2-2	Policy Relationships	17
Figure 5-1	Vulnerability assessment components (reproduced from Allen Consulting, 2005)	25
Figure 5-2	Vulnerability relationship	28
Figure 6-1	Coastal hazard risk management and adaptation planning hierarchy (adapted from WAPC, 2019)	33
Figure 8-1	Beach nourishment underway at Sunshine Coast, QLD	56
Figure 8-2	Typical earth levee design, (SES 2022)	57
Figure 8-3	Earth levee example from the Netherlands (California Water Blog, 2015)	57
Figure 8-4	Princess Royal Harbour Study Area	62

LIST OF TABLES

Table 2-1	Summary of engagement activities	18
Table 4-1	Success criteria	24
Table 5-1	Exposure/Likelihood Rating	26
Table 5-2	Sensitivity / Consequence ranking	26
Table 5-3	Risk Level (Potential Impact) Matrix as Product of Sensitivity (Consequence) and Exposure (Likelihood)	27
Table 5-4	Risk level definition	28
Table 5-5	Adaptive Capacity	28
Table 5-6	Vulnerability Matrix as a Product of Risk Level and Adaptive Capacity	29
Table 5-7	Vulnerability results for Erosion. Asset categories not at risk are not included	29
Table 5-8	Vulnerability results for inundation. Asset categories not at risk are not included	31
Table 6-1	Erosion vulnerability ratings by management unit & planning horizon	32
Table 6-2	Inundation vulnerability ratings by management unit & planning horizon	32
Table 6-3	Adaptation consideration summary	33
Table 6-4	Risk treatment options from WAPC (2019)	35
Table 6-5	Multi-Criteria Analysis summary by MU. Green indicates options recommended for further investigation (CBA); orange cells are unclear, so will be analysed further; red cells are not recommended for inclusion or further analysis	37
Table 7-1	Risk treatment options from WAPC (2019) suitable for CBA. Note PR4 and PR5 are greyed out as they did not progress through MCA for any MU's.	39
Table 7-2	Recommended CBA options for erosion for each MU	40
Table 7-3	Recommended CBA options for inundation for each MU	41
Table 8-1	CHRMAP implementation strategy. Note: S1 Erosion Allowance is the allowance for the current risk of erosion, further detail is available in Section 4 of the Appendix C Risk Identification Chapter report.	42
Table 8-2	Recommended updates to SCA15 in LPS 2.	46
Table 8-3	Recommended coastal monitoring activities	52
Table 8-4	Recommended Coastal Investigations	59
Table 8-5	MU1 – Point King to Melville point recommendations in priority order	63
Table 8-6	MU2 – Melville Point to Rushy Point recommendations in priority order	65
Table 8-7	MU3 - Rushy Point to Limekilns Point recommendations in priority order	69
Table 8-8	MU4 – Limekilns Point to Geake Point recommendations in priority order	72



Table 8-9 MU5 - Geake Point to Uredale Point recommendations in priority order

74



1 INTRODUCTION

1.1 Background

It is internationally recognised that the mean sea level has been rising globally since the nineteenth century and is predicted to rise at an increasing rate in the future (IPCC 2021). Rising sea levels and intensifying storm activity will increase the risk of coastal inundation (temporary coastal flooding), storm erosion and long-term shoreline recession. State governments across Australia have introduced obligations that require local governments to consider and plan for these hazards. In Western Australia (WA), the governing policy is the Western Australian Planning Commission's (WAPC) State Planning Policy No. 2.6: State Coastal Planning Policy (WAPC, 2013, herein referred to as "SPP2.6"). SPP2.6 recommends that management authorities develop a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for land use or development potentially vulnerable to coastal hazards. Specific guidelines have been developed to assist in this process (WAPC, 2019).

SPP2.6 requires adequate risk management planning is undertaken where the existing or proposed development is in an area at risk of being affected by coastal hazards over the 100-years planning timeframe. SPP2.6 and the CHRMAP Guidelines provide the risk assessment framework to be applied to identify risks that are intolerable to the community, and other stakeholders such as local governments, indigenous and cultural interests, and private enterprise. Risk management measures are then developed according to the adaptation hierarchy outlined in SPP2.6.

The City of Albany (City) recognised the land surrounding Princess Royal Harbour (PRH) as being potentially exposed to coastal hazards and climate change, which triggered the need for this CHRMAP. The CHRMAP study aims to investigate the nature and severity of coastal hazard vulnerabilities that are likely to affect this area over future planning horizons. Refer Figure 1-1 for locality, study area extent and management units.

This CHRMAP project aims to increase knowledge and understanding of coastal hazard risks and identify risk management and adaptation measures for implementation. The outcomes will be used to inform local and state government policies, strategies and plans, including (but not limited to), planning strategies, community strategic plans, drainage strategies, asset management plans, emergency management plans, and foreshore management plans. The project adheres to the WAPC (2019) guidelines with scope and deliverables consistent with the objectives identified by these guidelines and SPP2.6. In addition, the project will determine the strategic direction for coastal adaptation scenarios from the present-day to 2122 (100-year management time frame) and identify an implementation plan to achieve this direction. Overall, this CHRMAP will develop a flexible adaptation pathway for the region and serve as a key reference for management, planning and policymaking for the short-term (0-25 years), medium-term (25-50 years), and long-term (50-100 years).

Delivery of this project has occurred over 8 stages (as summarised in Figure 1-2), each representing a key hold point with staged review by the project steering committee. The staged approach is developed according to the City's scope and is in line with the CHRMAP Guidelines (WAPC, 2019). This report presents the CHRMAP project summary and makes recommendations to address erosion and inundation vulnerabilities. The red bubble in Figure 1-2, indicates where this component sits in the CHRMAP methodology.



Figure 1-1 Princess Royal Harbour Study Area

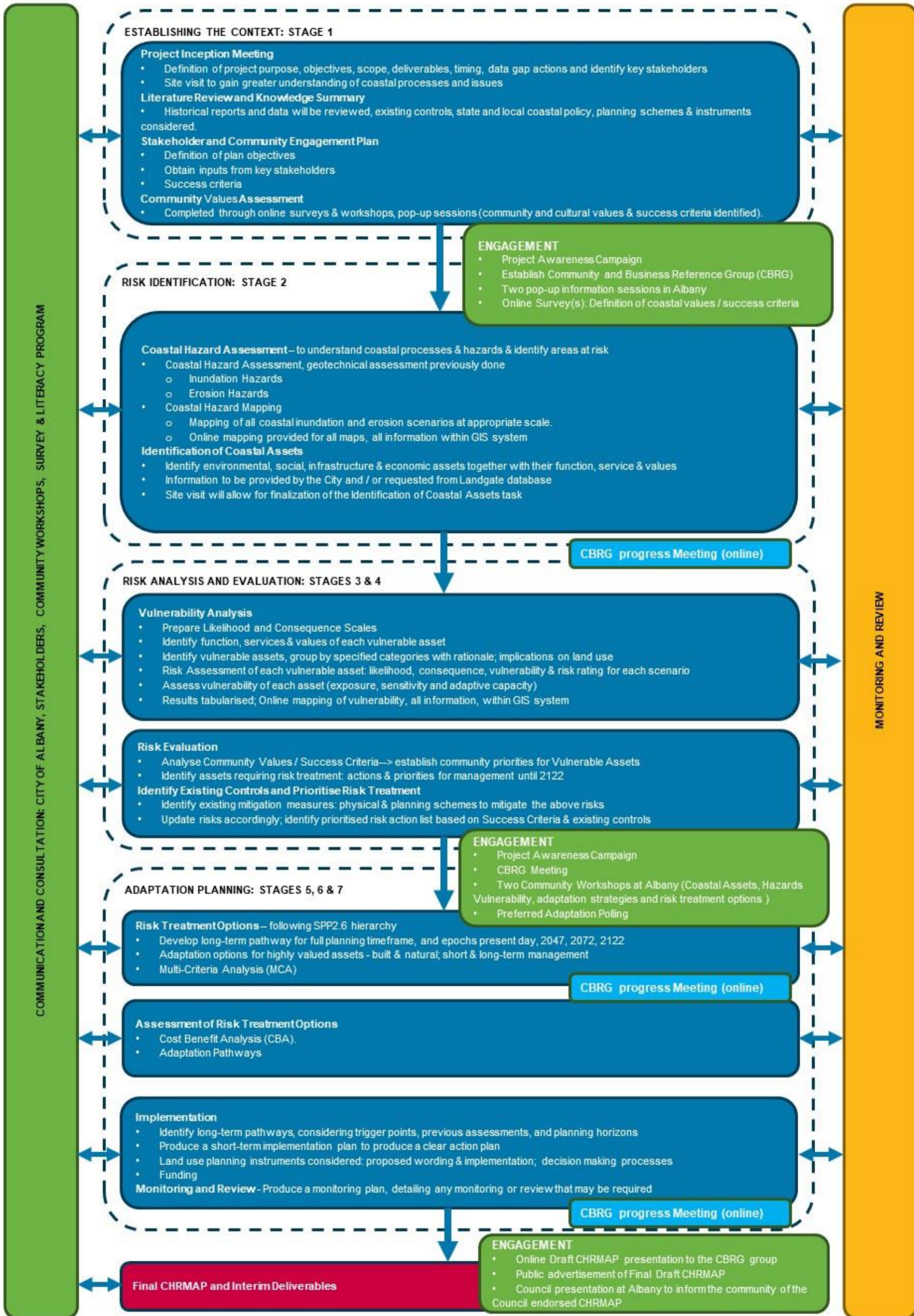


Figure 1-2 Methodology



1.2 Structure of this Report

This report is a summary document outlining the CHRMAP project and presenting content from the previous project stages and technical chapter reports. It has been written to provide an overview that is more accessible to a wider audience. This report addresses coastal hazard vulnerabilities for the City and should be considered in combination with the more detailed technical reports which are provided as appendices. References are provided throughout this document and refer to the documents listed in the reference section of the relevant technical reports.

To facilitate the coastal hazard assessment and development of adaptation options, the study area was delineated into several management units which are determined according to a set of factors:

- Jurisdiction boundaries
- Presence of coastal assets and relevant stakeholders
- Shoreline orientation
- Natural and manmade shoreline features, such as extended shoreline hardening (e.g. seawalls)
- Points established by geological features and/or localised sediment transport regimes, and
- Coastal processes and potential hazard types.

The PRH shoreline was divided into five management units:

- MU1 - Point King to Melville Point
- MU2 - Melville Point to Rushy Point
- MU3 - Rushy Point to Limekilns Point
- MU4 - Limekilns Point to Geake Point
- MU5 – Geake Point to Uredale Point



2 ESTABLISH THE CONTEXT

An Establish the Context Chapter Report was prepared (Appendix B). This report outlines in detail the key management and adaptation issues that need to be considered in the CHRMAP, summarised below.

2.1 Purpose

The purpose of this project was for the City to work with the Steering Group and consultant(s) to develop a CHRMAP for Princess Royal Harbour – City of Albany. The Steering Group included the City of Albany, Southern Ports Authority (SPA), and community representatives with support and technical advice from Department of Planning Lands and Heritage (DPLH), and Department of Transport (DoT).

The purpose of the CHRMAP was to provide strategic guidance for coordinated, integrated and sustainable land use planning and management decision-making by the City of Albany including management of, and adaptation to, coastal hazard risks (coastal erosion and inundation). Management of risks to the study area's land adjacent to the ocean coast is very important for the social, environmental, infrastructure and economic assets and values of the local communities. A coordinated approach which identifies areas likely to be affected to erosion and/or inundation and requiring management and adaptation to mitigate the risks will provide increased resilience to these communities. The CHRMAP will also guide necessary changes to the City of Albany Local Planning Strategy, Local Planning Scheme and other relevant strategies and local planning policies.

2.2 Objectives

The overall objectives of this CHRMAP were to:

- Improve understanding of coastal features, processes and hazards in the study area
- Consider rainfall and catchment flooding in addition to storm surge inundation
- Identify significant vulnerability trigger points and respective timeframes for the relevant sediment cells to mark the need for immediate or medium-term risk management measures
- Identify assets (natural and man-made) and the services and functions they provide situated in the coastal zone
- Gain an understanding of asset(s)' vulnerability
- Identify the value of the assets that are vulnerable to adverse impacts from coastal hazards
- Determine the consequence and likelihood of coastal hazards on the assets, and assign a level of risk
- Identify possible (effective) risk management measures (or 'actions') and how these can be incorporated into short and longer-term decision-making
- Engage stakeholders and the community in the planning and decision-making process.

2.3 Scope

This CHRMAP identifies values and assets with intolerable risk levels to the coastal erosion and inundation hazards within the study area. Risk management measures were considered to reduce risks to tolerable levels. Tasks to implement the measures are summarised to provide strategic guidance on medium and longer-term risk management but provide more focus on short-term (<25 years) management measures. The CHRMAP has focussed on preserving assets and values which provide public benefit, although private at-risk assets are also identified.



2.4 Local Context

Princess Royal Harbour is a semi-enclosed, natural harbour in Albany on the south coast of Western Australia (Figure 1-1). The Harbour is approximately 4 km wide and 8 km long, with an approximate area of 28 km². It is oriented in a north-west to south-east direction and is connected via the Ataturk entrance to the more exposed coastal waters of King George Sound and the southern Indian Ocean. The harbour is not connected to any rivers but receives freshwater inflow from rainfall runoff, groundwater seepage and drainage discharge associated with the adjacent land catchment and drainage infrastructure. The harbour contains substantial subtidal seagrass meadows and the working Port of Albany, which is a bulk products port, exporting mainly grain and woodchips, in the order of 3 to 4 million tonnes per annum. Other smaller trades are the export of silica sand and the import of fertiliser and fuel.

Princess Royal Harbour is classified as a 'tidal reach of inland waters' by SPP2.6 (WAPC, 2013). This means that it is an inland waterbody that is predominantly controlled by coastal related processes, such as tides and sea level variations. Within the harbour there are areas of 'sandy', 'rocky' (generally 'hard rock') and 'mixed sandy and rocky' coast per the definitions in SPP2.6, as well 'hardened' shorelines being controlled by coastal structures.

2.5 Existing Planning Controls

Planning in Western Australia is guided and regulated by the State Planning Framework, which ranges from overarching strategic planning strategies, to specific planning policies and supportive guidelines. Figure 2-1 explains the framework, which includes planning at the state, regional, and local levels and demonstrates how strategic planning is implemented through statutory planning controls (e.g., local planning schemes) and local planning policies. This Framework sits within the Planning and Development Act 2005. The relationships of the various policies are presented in Figure 2-2.

The planning documents within this Framework were reviewed to determine which are relevant to coastal hazard planning in the project area. This review helped to: assess the adequacy of the existing planning documents for addressing coastal hazards; identify gaps that needed to be addressed through the CHRMAP process (such as planning controls that are required or need amending to enable implementation of CHRMAP recommendations); identify any potential planning issues that may constrain the CHRMAP process; and ensured that the adaptation plan aligns with state, regional and local planning frameworks.

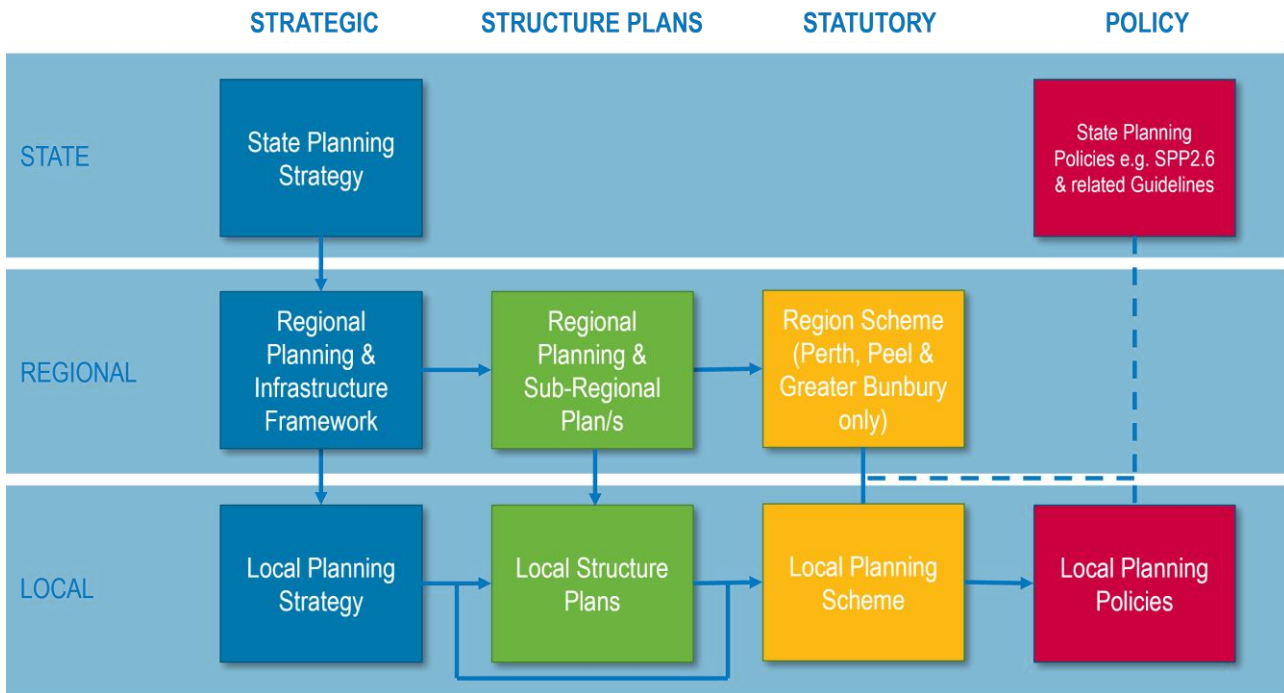


Figure 2-1 State Planning Framework for Western Australia

2.6 State Planning Policies and Strategies

The following state documents have been reviewed. Information relevant to the CHRMAP has been included below:

- State Planning Strategy 2050
- The WA Coastal Zone Strategy 2017
- State Planning Policy 2.6 – State Coastal Planning Policy, and associated Guidelines
- Coastal Hazard Risk Management and Adaptation Planning Guidelines 2019
- State Planning Policy 3.4: Natural Hazards and Disasters

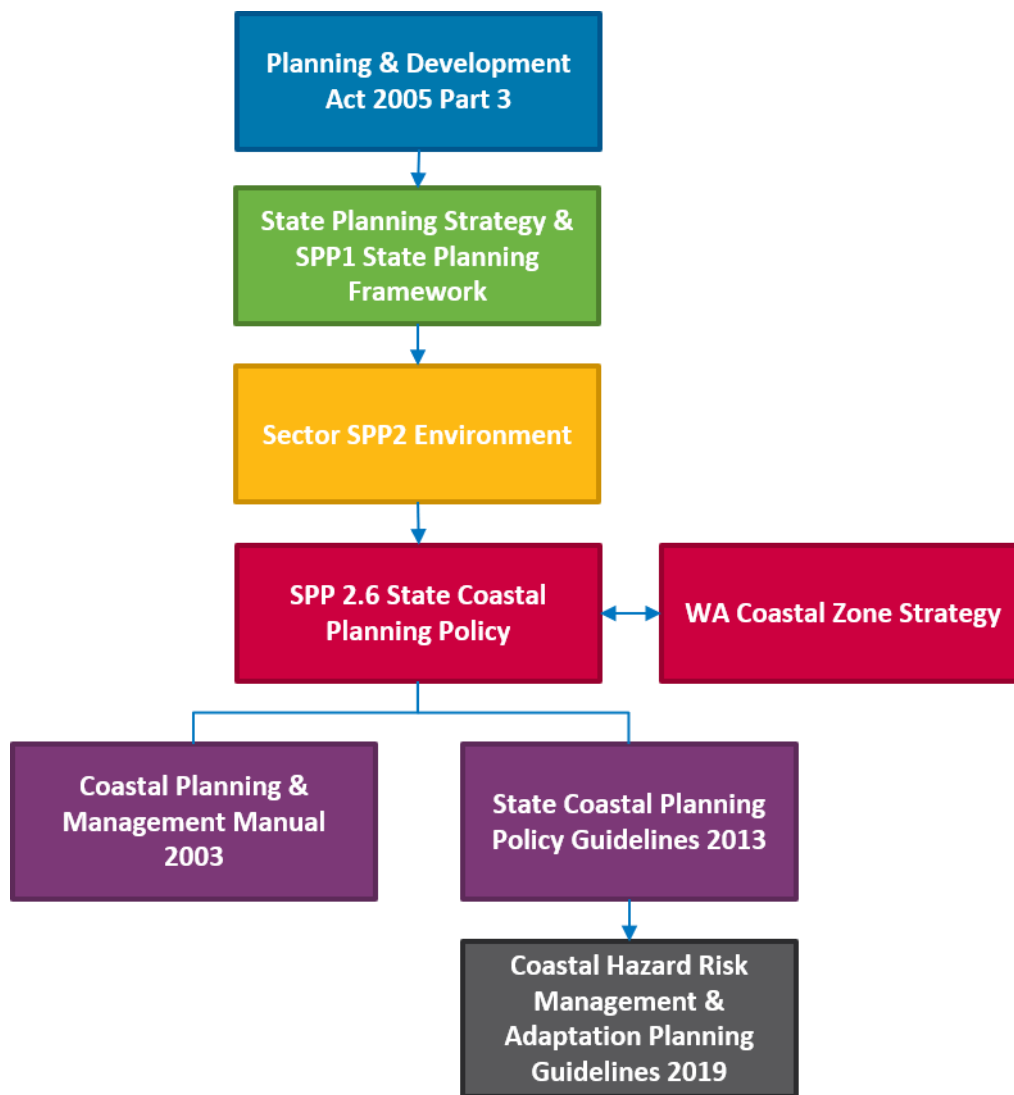


Figure 2-2 Policy Relationships

Regional and local planning documents were also reviewed for study area and discussed further in the Establish the Context Report (Appendix B).

2.7 Community and Stakeholder Engagement

Key to the success of the CHRMAP project will be to ensure that the adaptation plan is underpinned by community and stakeholder values and knowledge. To this end, a Community and Stakeholder Engagement Plan was developed in order to identify relevant stakeholders and determine the structure and pathways for their engagement throughout the CHRMAP process. The plan was intended to be fit-for-purpose, and commensurate with the size and scope of the CHRMAP – so as to avoid consultation fatigue within the community. This plan was prepared in accordance with the requirements of, and for consistency with, the International Association of Public Participation (IAP2) documentation.

Table 2-1 summarises the engagement activities undertaken to achieve the overarching objectives of the community and stakeholder engagement plan for the CHRMAP which were to:

- Promote knowledge and information sharing to and from community and key stakeholders to support the collection of:



- coastal values,
- assets and
- preferred adaptation options,
- planning framework requirements for beneficiaries pays requirements.
- Break down complicated and technical information to be easy to understand.
- Aim to reach a diverse range of community members and key stakeholders through various methods.
- Offer accessible and convenient engagement activities for the community and stakeholders to attend.
- Keep the community interested and engaged throughout the project timeline with carefully timed communications and engagement events.

Table 2-1 Summary of engagement activities

Activity	Timeline	Participants	Key Finding
Coastal Values Survey	February and April 2022	55	If respondents were not able to reside, visit or work at the harbour, due to the impact of coastal hazards, they noted it would have an extreme impact on their life. For most other activities, if respondents were unable to do these at the harbour it would result in a significant impact to their life, indicating their strong value in the ability to interact with Princess Royal Harbour.
Information Session and Intercept Surveying	April 2022	45	Most participants considered it very important that in 20 years, land in the coastal zone associated with the harbour will be managed to ensure land use and development does not accelerate coastal erosion or inundation risks or have a detrimental impact on the functions of public reserves.
Community and Business Reference Group	2022 - 2024	12	Allowed for additional discussion between business representatives and community members.
Project Awareness Campaign	April 2022	N/A	Over 20 flyers and 700 letters to residents were distributed to promote the survey and continue to raise awareness of the project. The project was promoted online with webpage, e-mail campaign, social media post, e-newsletter.
Community Scenarios Workshops	May 2023	36 attendees	Two workshops to inform the community of the project and projected impact from coastal processes, as well as gather feedback about asset prioritisation, the perceived consequences of coastal hazards and the preferred adaptation strategies and management options along the coastline.
Steering Committee meeting	February 2026	~15	Meeting to provide project progress update and an overview of the final stages of the CHRMAP process, including the upcoming engagement activities; and an overview of the Benefit Distribution Analysis (BDA) findings.



Activity	Timeline	Participants	Key Finding
Community and Business Reference Group	March 2026	~15	Meeting to provide project progress update and an overview of the final stages of the CHRMAP process.
Elected Members Briefing	March 2026	Staff and councillors	Meeting to provide project progress update and an overview of the final stages of the CHRMAP process. Presentation of engagement plan and BDA.
Stakeholder and landholder meetings	March 2026	~5	Meetings to provide affected landholders with further information about the project and an opportunity to discuss future implementation.
Draft CHRMAP	June 2026	N/A	Draft CHRMAP will be placed on the CHRMAP website for public comment. The document will be emailed / mailed to stakeholders identified as not having access to the CHRMAP website. Two community drop-in sessions will be undertaken.



3 RISK IDENTIFICATION

A Risk Identification Chapter Report (Appendix C) was prepared to identify the coastal hazards in the study area that need to be considered in the CHRMAP. Hazard maps were produced defining the erosion and inundation extents for present day, 2047, 2072 and 2122.

A key policy objective of SPP2.6 is the provision of a coastal foreshore reserve. The coastal foreshore reserve is essentially a 'space' between the ocean and private land. It should accommodate a range of functions and values such as geomorphological integrity, biodiversity, heritage, public ownership, and access. The component of the coastal foreshore reserve to allow for coastal processes should be sufficient to mitigate the risks of coastal hazards by allowing for landform stability, natural variability, and climate change. The coastal foreshore reserve is a critical input into the coastal hazard risk management and adaptation planning framework outlined in SPP 2.6. The assessment considers allowances for coastal erosion and storm surge inundation in parallel.

The PRH coastline features a mixture of sandy, rocky, and artificially hardened shorelines, with substantial intertidal areas and shallow seagrass assemblages. It is a reasonably complex shoreline with various types of coastal hazards present in this region. **It is acknowledged that the hazard identification component of the present study was undertaken to provide a broad understanding of exposure that can support government planning at a regional level - and will be superseded once site-specific studies become available.** Results derived from this study should not be over-interpreted at a micro-scale due to the assumptions applied and the limitations in model resolution. More detailed risk assessments and analysis may be required for the development of detailed engineering measures for specific sites. No geophysical or geotechnical assessments have been undertaken across the study to date. Erosion response across the study area may differ to the predictions of this study. Further investigations (including geotechnical assessment) are a recommendation of this CHRMAP.

3.1 Erosion Hazard Assessment Method

3.1.1 Summary

A desktop review of available information was undertaken, including:

- Metocean conditions
- Coastal processes
- Existing coastal monitoring and management
- Existing coastal hazard information
- The coastal hazard identification approach has been developed based on the following policies and guidelines:
- State Planning Policy 2.6 State Coastal Planning Policy (SPP2.6) – which provides a clear method for the evaluation of hazards in tidal areas.
- Coastal Hazard Risk Management and Adaptation Planning Guidelines (CHRMAP Guidelines)

3.1.2 Method

SPP2.6 stipulates the following components be considered when evaluating the coastal erosion risk:

- Storm erosion in response to storm waves and loss of beach material.
- Historic shoreline movement that highlights the chronic/long-term evolution of the coast. This could be contributed by littoral drift processes, larger scale morphological movements, long-term water level/wave



dynamic variations (~18.6 yrs. tidal cycle, interannual climate oscillations e.g., La Niña effects, Pacific Ocean decadal Oscillation etc.) and climate change impacts (SLR, more intense storms and rainfalls etc.).

- Direct response to future sea level rise.

SPP2.6 indicates the methods for determining the allowance for erosion for a sandy coast are derived principally for open coastlines. The standard method from SPP2.6 was used which considers erosion allowances relative to the present Horizontal Shoreline Datum (HSD). The HSD is defined as the active limit of the shoreline under storm activity. It is the line from which the erosion hazard allowance is applied from. In this assessment HSD has been determined by the elevation of the 100-year ARI Peak Steady Water Level at individual locations around the Harbor. The HSD line is included in the erosion hazard maps (Maps of Erosion and Inundation).

The erosion hazard study was carried out by the following steps:

- 1) Classification of the coast as Rocky or Mixed Sand and Rock or Sandy coast. Portions of the PRH shoreline are comprised of naturally occurring granite and have been classified as 'hard rock'. Negligible shoreline change is expected over the 100-year planning timeframe for hard rock coasts.
- 2) HSD is defined by topographic contours, ground-truthed by vegetation lines.
- 3) Simulate storm erosion for the 100-year ARI storm (S1).
- 4) Allowance for the current risk of storm erosion (S1) estimated by numerical modelling software (SBEACH).
- 5) Evaluate historic shoreline movement trends based on historic vegetation lines (S2).
- 6) Evaluate sea level rise impacts for present day, 2047, 2072 and 2122 (S3).
- 7) Apply corrections for controlled shoreline segments. Where shoreline controls such as seawalls and breakwaters exist, these structures have been incorporated in the erosion hazard extents for the anticipated design life of the structures.
- 8) Calculation of the uncertainty allowance as per SPP2.6
- 9) Evaluate total erosion values for each coastal management zones and for four different planning periods i.e., present day, 2047 (short term), 2072 (medium term) and 2122 (long term).
- 10) Mapping of erosion hazard lines defined by HSD+S1+S2+S3+uncertainty

3.2 Inundation Hazard Method

SPP2.6 requires the allowance for inundation to be the maximum extent of inundation calculated as the sum of S4 Inundation plus the predicted extent of sea level rise. A detailed numerical modelling approach was used to assess coastal inundation with calibration to existing studies and information.

The allowance for the extent of coastal inundation has been calculated as the maximum extent of storm inundation during the 500-years average recurrence interval (ARI) storm event. This was defined as the peak steady water level calculated based on analysis of available measured water level data, plus an allowance for wave set-up. An allowance for catchment inundation has also been provided, to account for freshwater runoff from adjacent land catchments. This was calculated using hydrological and hydraulic modelling to estimate the localised increase in water level at the major surface water discharge locations within PRH.

3.3 Hazard Results

A key outcome of the coastal hazard assessment was the confirmation that both coastal erosion and coastal inundation hazards are present along the PRH shoreline. The interpreted risk levels that will guide adaptation



planning for future stages of the project will be governed by either the coastal erosion and coastal inundation extents, depending on the section of the harbour.

The total erosion hazard allowance and inundation levels for all MU's is available in the Risk Identification Chapter Report (Appendix C). Detailed mapping for all MU's is provided in Appendix A.



4 COASTAL ASSETS AND COMMUNITY VALUES IDENTIFICATION

A process to identify Coastal Values and Community Assets was undertaken for the coastal hazard zone - reported in the Risk Identification and Vulnerability Analysis Chapter Reports (Appendix C and Appendix D). Community and stakeholder involvement is a critical component of the CHRMAP process, as it defines what and how much value is placed on assets within the study area. This informs the adaptation planning process and ensures all needs are considered. As such, the project contains a high level of community and stakeholder engagement. This provides ownership of the CHRMAP with those that it affects, and acceptance of its outcomes.

4.1 Asset Identification

Coastal assets (both natural and built) were identified in the following ways:

- 1) Asset information was provided by Steering Group members.
- 2) Landgate assets database, including for roads.
- 3) The coastal values survey(s) and other engagement activities to identify additional assets of importance and value to the community.
- 4) Site visit to investigate locations where information was not clear from the desktop assessment.
- 5) Manual identification of further assets from aerial photography (e.g., developed areas of foreshore reserve)

4.2 Asset Classifications

At the time of identification, each asset was categorised into a classification. This streamlines the adaptation planning process in subsequent phases of the project. The study team grouped assets into the following classifications:

- Residential
- Commercial
- Developed Foreshore reserve
- Public & Community
- Roads
- Environmental
- Heritage

4.3 Community Values Engagement Process

The engagement activities for the project have been presented in Section 2.7. Specifically for this stage of the project they included:

- Coastal values survey
- Information session
- Intercept surveying
- Community and Business Reference Group
- Letterbox drop and social media posts



In the preliminary stage of engagement, stakeholders completed a survey to comment on activities they value and their locational preferences for these. Participants also provided feedback on how they use the different areas of the coastline.

4.4 Coastal Assets and Community Values

Key values identified by participants across the whole study area are as follows:

- Beaches and foreshore areas for activities like walking, cycling, visiting nearby venues, fishing, swimming, exercise, views, residing nearby
- Health of environmental areas for their flora and fauna diversity which participants could appreciate – by birdwatching for example
- Coastal recreation
- Tourism
- Cultural significant (Aboriginal and European Heritage)

Key issues and concerns / risks to the coastal values:

- Public access to the beach and foreshore
- Beach erosion and its environmental, social and financial impacts
- Vegetation retention, revegetation and the need to do more to protect coastal areas from erosion
- Human impact on the coastal natural assets and values to the community

4.5 Success Criteria

The values collated from the engagement were used to generate the success criteria for the vulnerability and risk assessment component of the CHRMAP. These are key to the whole CHRMAP as these criteria were used to drive the selection of adaptation options. The success criteria are presented in Table 4-1 below.

Table 4-1 Success criteria

- Ensure future land use and development does not accelerate coastal erosion or inundation risks or have a detrimental impact on the functions of public reserves.
- Manage land at risk of coastal erosion and inundation to avoid inappropriate land use and development.
- Maintain the harbour for environmental health, including flora and fauna habitat.
- Conserve, enhance and maintain the natural environment and character of the study area
- Sustain the ability for the current and future generation to recreate along the harbour.
- Protect and or manage appropriately the provision of recreational assets in the coastal zone



5 VULNERABILITY ANALYSIS

A Vulnerability Analysis Chapter Report (Appendix D) was prepared which constitutes the second stage of the risk identification process. Likelihood, consequence, level of risk, adaptive capacity and vulnerability scales were developed for the asset categories. All identified at-risk assets within the management units were then assigned vulnerability ratings, according to the various scales. The vulnerability results are presented in full in the Vulnerability Analysis Chapter Report. A summary of the results is presented below by management unit and asset category for each of the planning horizons.

5.1 Method

A vulnerability assessment defines the degree of impact coastal hazards are likely to have on coastal assets over the planning timeframe. The vulnerability of coastal assets to coastal hazards is related to its exposure to the hazard, its sensitivity to that exposure, and the ability of the asset to be modified or adapted to manage this exposure. This is displayed diagrammatically in Figure 5-1; the input components are displayed in blue.

Inundation and erosion hazards are considered separately. Assets are grouped according to classification for ease of interpretation. Ratings were discussed with the Steering Group to ensure they reflect the community views and confirmed during the Community Workshops in May 2023.

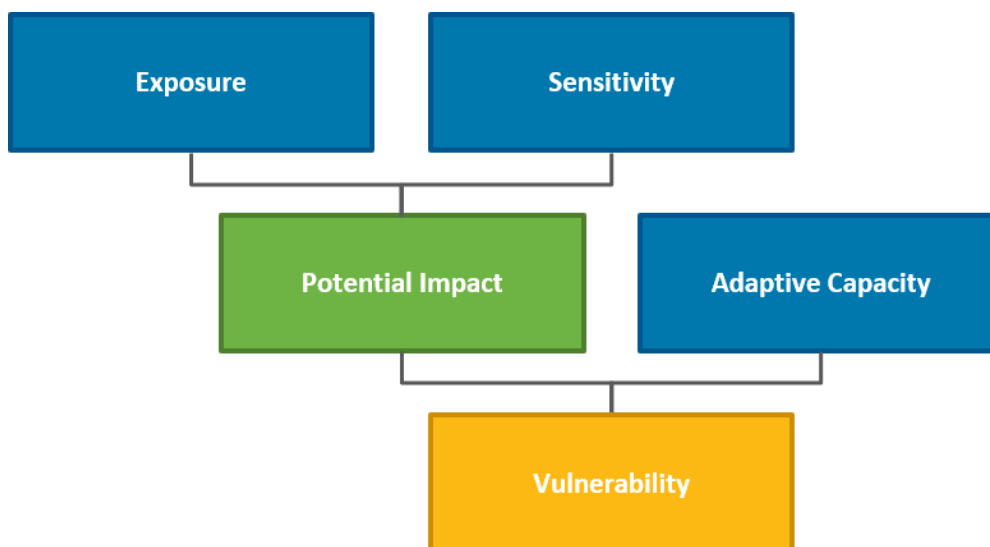


Figure 5-1 Vulnerability assessment components (reproduced from Allen Consulting, 2005)

5.2 Identification of Assets

One of the main challenges of this CHRMAP is the numerous assets and management zones. The asset classification presented in Section 4.2 was developed to address the main coastal adaptation issues and key locations and enable a simple yet effective method for adaptation planning across the broader study area.

5.3 Exposure / Likelihood

The **exposure / likelihood** of identified assets represents the likelihood of coastal hazards impacting on an asset. That is, the chance of erosion and / or storm surge inundation impacting on existing and future assets and their values (WAPC, 2019). The likelihood scale adopted for this study is presented in Table 5-1. Ratings have been allocated to asset categories for each hazard at each timeframe based on the interpretation of the hazard assessment results. The methods used are explained in detail in Vulnerability Analysis Chapter Report.



Table 5-1 Exposure/Likelihood Rating

Likelihood Rating	Description	Annual Exceedance Probability for 100-year timeframe
Almost Certain	Expected to occur in most circumstances	>90%
Likely	Impact to asset shoreline for a given planning timeframe is likely	50-90%
Possible	Impact to asset shoreline for a given planning timeframe is possible	10-50%
Unlikely	Impact to asset shoreline for a given planning timeframe is unlikely	1-10%
Rare	May occur in exceptional circumstances	<1%

5.4 Sensitivity / Consequence

The **sensitivity / consequence** is an asset’s responsiveness to a coastal hazard. This could be a gradual or stepped change response to discrete events (WAPC, 2019). The sensitivity can be applied to the asset itself, or to the asset’s function and the criticality of the service it provides (CoastAdapt, 2017).

The consequence ranking presented in (Table 5-2) constitutes the physical impact of the event to the asset, as well as that of the values attributed to it by the success criteria defined earlier in the study.

For each hazard, the consequence was assessed against the criteria qualitatively, based on experience of the impacts of coastal erosion and inundation, and the examples presented in the consequence scale. Each asset category is assigned a sensitivity / consequence rating, for erosion and inundation respectively. The purpose of assigning vulnerability is to identify and prioritise what requires adaptation.

Table 5-2 Sensitivity / Consequence ranking

Consequence Level	Physical, Financial	Environment	Community / Social & Cultural
Insignificant	No or minimal damage, perhaps requiring increased maintenance Financial loss less than \$5,000	Little impact on environment	Minimal short-term inconvenience to asset, services and function, <5% of community affected. Many alternatives exist
Minor	Minor damage to assets resulting in restrictions in capability, financial loss of \$5,000 to \$20,000	Short term damage to environment. Recovery will be strong. Local or regional alternate habitat exists	Isolated but noticeable (short term) decline or disruption to asset, services and function, <10% of community affected. Alternative sites exist



Consequence Level	Physical, Financial	Environment	Community / Social & Cultural
Moderate	Damage to assets resulting in isolated loss of capability, financial loss of \$20,000 to \$50,000	Medium term loss of environmental assets. Recovery is likely. Local or regional alternate habitats exist. Environmental damage requiring restitution or internal clean-up.	Moderate (short to medium term) decline or disruption to assets, services and function, <25% of community affected. No convenient alternative exists
Major	Significant damage to many assets resulting in very limited capability, financial loss of \$50,000 to \$150,000	Long-term damage to environmental assets. Limited chance of recovery. No local alternate habitat(s) exist. Regional habitats exist. Environmental damage requiring restitution or internal clean-up.	Severe (medium-term) decline or disruption to asset, services and function, <50% of community affected. No convenient alternative exists
Severe	Significant damage to most assets resulting in loss of capability, financial loss of over \$150,000	Permanent damage to environmental assets. No chance of recovery. No alternate habitat(s) exist. Major breach of legislation or extensive environmental damage requiring third party investigation	Long term or permanent loss of asset, services and function >75% of community affected. No alternative exists

5.5 Potential Impact (Level of Risk)

Risk level, or **potential impact**, is calculated as the **product** of exposure and sensitivity (see Table 5-3). It provides a classification of the potential impact of coastal hazards on identified assets, which was determined for each project timeframe. Definitions are provided in Table 5-4.

Table 5-3 Risk Level (Potential Impact) Matrix as Product of Sensitivity (Consequence) and Exposure (Likelihood)

Sensitivity / Consequence	Exposure / Likelihood				
	Rare	Unlikely	Possible	Likely	Almost Certain
Severe	Medium	High	Extreme	Extreme	Extreme
Major	Medium	Medium	High	Extreme	Extreme
Moderate	Low	Medium	Medium	High	High
Minor	Low	Low	Low	Medium	Medium
Insignificant	Low	Low	Low	Low	Low



Table 5-4 Risk level definition

Risk Profile	Definition
Low	Tolerable risk. A level of risk that is low and manageable without intervention outside routine asset maintenance.
Medium	A level of risk that may require intervention to mitigate, such as changes to design standards or asset maintenance. Short to medium term action required.
High	A level of risk requiring significant intervention to mitigate in the immediate to short term.
Extreme	Immediate action required to reduce risk to acceptable levels

5.6 Adaptive Capacity

The **adaptive capacity** is the asset's ability to adjust/adapt to the identified hazard. It was determined based on the potential for the system to be modified to cope with the impacts from coastal hazards. Assets with high adaptive capacity can easily be adapted. For instance, beach and dune systems often have higher adaptive capacity than coastal infrastructure and residential land. The scale of adaptive capacity is provided in Table 5-5. Rating of adaptive capacity was determined by assets/asset groups as well as opinions from stakeholders and community.

Table 5-5 Adaptive Capacity

Adaptive Capacity	Description
No adaptation required	Potential impact has insignificant effect on asset. Controls are re-established naturally or with ease before more damage would likely occur.
Very High	Good adaptive capacity. Functionality restored easily. Adaptive systems restored at a relatively low cost or naturally over time.
High	Decent adaptive capacity. Functionality can be restored, although additional adaptive measures should still be considered. Natural adaptive capacity restored slowly over time under average conditions
Moderate	Small amount of adaptive capacity. Difficult but possible to restore functionality through repair and redesign.
Low	Little or no adaptive capacity. Potential impact would destroy all functionality. Redesign required.

5.7 Vulnerability Ratings

Vulnerability is calculated as the **product** of potential impact (risk level) and the adaptive capacity (Figure 5-2 and Table 5-6). As per WAPC (2019), four levels of vulnerability are considered in this study which should be assessed for each of the planning timeframes considered by this CHRMAP. **Vulnerability** ratings are Extreme, High, Medium and Low.

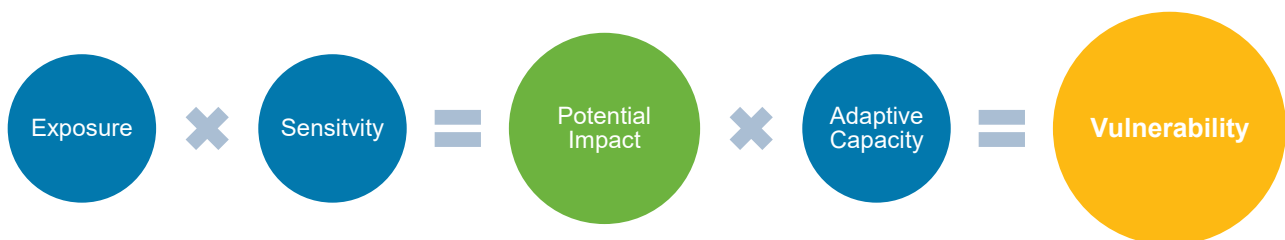


Figure 5-2 Vulnerability relationship



Table 5-6 Vulnerability Matrix as a Product of Risk Level and Adaptive Capacity

Risk Level	Adaptive Capacity			
	Low	Moderate	High	Very High
Extreme	Extreme	Extreme	High	Medium
High	Extreme	High	Medium	Medium
Medium	High	Medium	Medium	Low
Low	Medium	Medium	Low	Low

Using the methodology described above the overall vulnerability ratings for each category within each management unit for each planning horizon were assigned and are presented in Table 5-7 and Table 5-8 below for erosion and inundation respectively. The results are summarised as:

Erosion presents the largest vulnerability ratings and a higher number of assets at risk than inundation. This is due to the bigger extension of the erosion hazard and the lower adaptive capacity to the erosion hazard.

Extreme vulnerability to erosion has been identified from the present day onwards for more than one asset category in all MU's except MU1. Overall the most common vulnerability is related to erosion.

The inundation vulnerability ratings are generally low and medium ratings from present day. At the 100-year timeframe the ratings are generally medium, with residential, public and commercial categories presenting high levels of vulnerability.

Table 5-7 Vulnerability results for Erosion. Asset categories not at risk are not included

Management Unit	Vulnerability				Summary
	Present	2047	2072	2122	
MU1-Point King to Melville point					
Residential	High	High	Extreme	Extreme	This is a hardened coast; erosion is a key risk for the 2122 timeframe when the design life of the structures is past due.
Commercial	High	High	Extreme	Extreme	
Developed Foreshore Reserve	Low	Low	Medium	Medium	
Public & Community	High	High	High	Extreme	
Roads	High	High	Extreme	Extreme	
Environmental	Medium	Medium	Medium	Extreme	
Heritage	High	High	High	Extreme	
MU2 - Melville Point to Rushy Point					
Residential	Extreme	Extreme	Extreme	Extreme	This MU has the most categories affected from the present day.
Commercial	Extreme	Extreme	Extreme	Extreme	
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Public & Community	High	Extreme	Extreme	Extreme	
Roads	Extreme	Extreme	Extreme	Extreme	
Environmental	Medium	Medium	Extreme	Extreme	
Heritage	High	High	Extreme	Extreme	



MU3 - Rushy Point to Limekilns Point					
Residential	High	Extreme	Extreme	Extreme	Erosion is a key risk for 6 of the 7 categories within this MU.
Commercial	High	Extreme	Extreme	Extreme	
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Public & Community	High	Extreme	Extreme	Extreme	
Roads	Extreme	Extreme	Extreme	Extreme	
Environmental	High	Extreme	Extreme	Extreme	
Heritage	Extreme	Extreme	Extreme	Extreme	
MU4 - Limekilns Point to Geake Point					
Residential	Extreme	Extreme	Extreme	Extreme	Erosion is a key risk for 5 of the 7 categories within this MU.
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Public & Community	High	High	High	Extreme	
Roads	Extreme	Extreme	Extreme	Extreme	
Environmental	High	Extreme	Extreme	Extreme	
Heritage	Extreme	Extreme	Extreme	Extreme	
MU5 - Geake Point to Uredale Point					
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Roads	High	High	Extreme	Extreme	
Environmental	Extreme	Extreme	Extreme	Extreme	
Heritage	Extreme	Extreme	Extreme	Extreme	



Table 5-8 Vulnerability results for inundation. Asset categories not at risk are not included

Management Unit	Vulnerability				Summary
	Present	2047	2072	2122	
MU1-Point King to Melville point					
Residential	Medium	Medium	Medium	Medium	The Port of Albany, Albany Waterfront Marina and carpark, Anzac Park are affected in this MU.
Commercial	Medium	Medium	Medium	High	
Developed Foreshore Reserve	Low	Medium	Medium	Medium	
Public & Community	Medium	Medium	Medium	Medium	
Roads	Medium	Medium	Medium	Medium	
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	
MU2 - Melville Point to Rushy Point					
Residential	Medium	Medium	Medium	High	All the natural foreshore area and a significant amount of commercial and residential properties are affected.
Commercial	Medium	Medium	Medium	High	
Developed Foreshore Reserve	Low	Medium	Medium	Medium	
Public & Community	Medium	Medium	Medium	Medium	
Roads	Medium	Medium	Medium	Medium	
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	
MU3 - Rushy Point to Limekilns Point					
Residential	Medium	Medium	Medium	High	Princess Royal Sailing Club, a significant amount of Developed Foreshore reserve, residential and commercial are affected in this MU.
Commercial	Medium	Medium	Medium	High	
Developed Foreshore Reserve	Low	Medium	Medium	Medium	
Public & Community	Medium	Medium	Medium	Medium	
Roads	Medium	Medium	Medium	Medium	
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	
MU4 - Limekilns Point to Geake Point					
Residential	Medium	Medium	Medium	High	All the natural and developed foreshore area and some residential properties are affected.
Developed Foreshore Reserve	Low	Medium	Medium	Medium	
Public & Community	Medium	Medium	Medium	Medium	
Roads	Medium	Medium	Medium	Medium	
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	
MU5 - Geake Point to Uredale Point					
Roads	Medium	Medium	Medium	Medium	Large areas of heritage environmental land are affected in this MU.
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	



6 RISK EVALUATION AND TREATMENT

A Risk Evaluation and Treatment Chapter Report (Appendix E) was prepared, identifying risks and presenting and assessing treatment options using multi-criteria analysis. A summary is provided below.

6.1 Risk Evaluation - Priorities for Treatment

The erosion and inundation vulnerability ratings presented in (Section 5) were considered for each MU as a whole by averaging the vulnerability ratings of individual asset categories; Table 6-1 and Table 6-2. All MUs at all planning horizons have unacceptable levels of vulnerability for both erosion and inundation (medium or above) for one or more asset categories, and therefore need to be considered for risk treatment options. There are greater vulnerabilities to erosion in the study area compared to inundation. A vulnerability rating above “medium” require risk management.

Table 6-1 Erosion vulnerability ratings by management unit & planning horizon

Management Unit	2022	2037	2052	2122
MU1 - Point King to Melville point	High	High	High	Extreme
MU2 - Melville Point to Rushy Point	High	High	Extreme	Extreme
MU3 - Rushy Point to Limekilns Point	High	Extreme	Extreme	Extreme
MU4 - Limekilns Point to Geake Point	High	High	High	Extreme
MU5 - Geake Point to Uredale Point	High	High	Extreme	Extreme

Table 6-2 Inundation vulnerability ratings by management unit & planning horizon

Management Unit	2022	2037	2052	2122
MU1 - Point King to Melville point	Medium	Medium	Medium	High
MU2 - Melville Point to Rushy Point	Medium	Medium	Medium	High
MU3 - Rushy Point to Limekilns Point	Medium	Medium	Medium	High
MU4 - Limekilns Point to Geake Point	Medium	Medium	Medium	High
MU5 - Geake Point to Uredale Point	Medium	Medium	Medium	Medium

6.2 Risk Management and Adaptation Hierarchy

SPP2.6 provides a hierarchy of adaptation pathways to guide decision-making in coastal areas to be used by planning authorities and development proponents when considering adaptation options to minimise coastal hazard risks at the local level. The hierarchy, presented in Figure 6-1, indicates a clear preference against the adoption of ‘protect’ as a long-term adaptation pathway. This preference is re-emphasised in SPP2.6, the policy guidelines, the CHRMAP Guidelines and the WA Coastal Zone Strategy. This hierarchy is discussed further below.

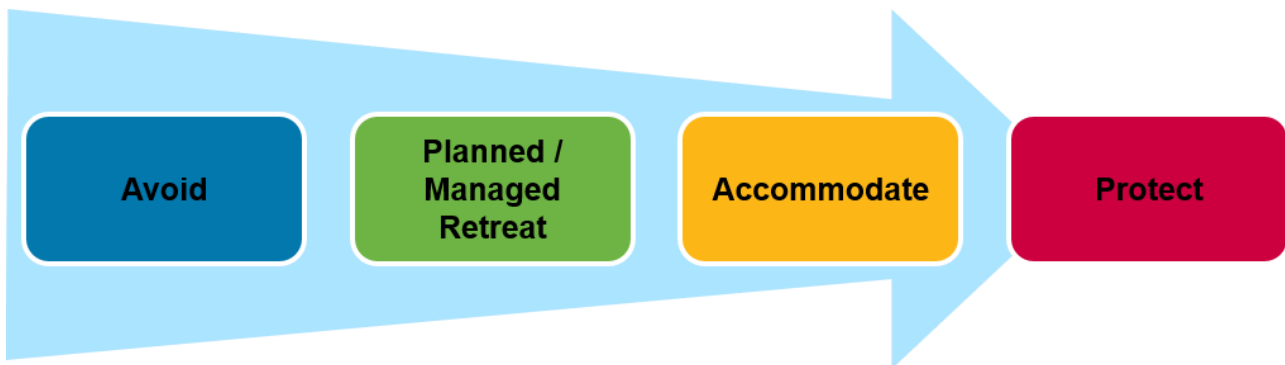


Figure 6-1 Coastal hazard risk management and adaptation planning hierarchy (adapted from WAPC, 2019)

Maintaining public access to the coast in developed areas is one of the main objectives of SPP2.6. The current State legislative framework means that where the shoreline recedes beyond private property boundaries, public access and trespass issues are likely to arise. This situation implies that public authorities have two main adaptation options available to them for preserving public coastal access:

- **Planned or Managed Retreat** i.e., maintaining a foreshore reserve through public acquisition of private property; or,
- **Protect** i.e., preventing the shoreline from receding beyond private property boundaries by stabilising the current shoreline position using various protection measures

Where public authorities cannot commit to either of these options over the long term, it is likely that public authorities will need to **Accommodate**, by modifying local planning frameworks to help ensure that new development is appropriately designed and located. Public authorities in this situation may also choose to consider the appropriateness of interim Protection measures to preserve public interests by delaying shoreline recession and minimising the effect of regular nuisance inundation events on existing development and infrastructure.

Table 6-3 presents a summary of the relevant information for adaptation. The CHRMAP process aims to minimise coastal hazards and maximise the beneficial use of the coast.

Table 6-3 Adaptation consideration summary

- Adaptation options should minimise coastal process interference and legacy issues
 - The adaptation hierarchy is presented in Figure 6-1
- Coastal development must be sustainable in the long term and must balance the community, economic, environmental and cultural needs
- Local Governments are responsible for managing risks to **public assets** and any assets they manage. They should also:
 - Develop local policies and regulations consistent with state legislation and policy
 - Facilitate building resilience and adaptive capacity within the local community
 - Work in partnership with the community to identify and manage risks/impacts
- Management strategies that preserve the natural coastline and move development away from the active coastal zone in an orderly manner are considered ideal. Of particular relevance to the CHRMAP process is the user-pays principle, whereby those who benefit most from protection must provide the greatest financial contribution
- Adaptation options should maintain future flexibility to build resilient coastal communities
- A key adaptation option will be the use of planning mechanisms, including managed Retreat.



6.3 Risk Treatment Options

Table 6-4 below presents a list of generally available adaptation options suitable for most coastal sites. These relate to both short-term and long-term adaptation to coastal hazards in general, not just in relation to planning for climate change impacts. The column on the right-hand side provides some discussion as to the possibility of its application for the study area.



Table 6-4 Risk treatment options from WAPC (2019)

Option Category	Option Name	Option Code	Description of how it will help
Avoid	Locating assets in areas that will not be vulnerable to coastal hazards	AV	Assets will not be vulnerable to risk arising from coastal hazards.
Planned / Managed Retreat	Leaving assets unprotected	PMR1	Accept loss following hazard event. Only implement repairs to maintain public safety. Allow for retreat that allows natural recession of the shoreline over the long-term.
	Demolition / removal / relocation of asset from inside hazard area.	PMR2	Relevant for assets of low value where it is impractical both technically and financially to design the asset to withstand the impact of the coastal hazards instead of relocating it.
	Prevention of further development / prohibit expansion of existing use rights	PMR3	This risk treatment option would enable existing development and use rights to continue without increasing them, until such time that risk arising from coastal hazards is intolerable. Specified in a local planning scheme.
	Voluntary acquisition	PMR4	This risk treatment option would require the acquisition of affected properties, on a voluntary basis.
Accommodate	Design assets to withstand impacts	AC1	Where avoiding or relocating an asset is not an option, design of assets to withstand the impact of inundation.
Protect	Beach nourishment or replenishment	PR1	Placement of sand within the beach profile and/or dunes to activate beach coastal processes and provide a sediment supply.
	Groyne	PR2	Construction of groynes to stop or restrict the movement of sand around the end of the structure, to provide protection to assets behind the beach/foreshore reserve. They are primarily effective where there is longshore sand supply or when partnered with sand nourishment.
	Seawall	PR3	Construction of a seawall usually along an entire section of shoreline. Where a beach is to be retained, this risk treatment option should generally be accompanied with beach nourishment or replenishment.
	Artificial reef	PR4	Construction of a submerged artificial reef offshore, to dissipate wave energy impacting the shore by causing waves to break on their seaward side and reducing wave energy on the leeward side. Artificial reefs do not block waves and during storm events water depths over the reef may be sufficient to allow waves to pass over the reef without breaking, reducing their effectiveness in protecting the beach from erosion.
	Offshore breakwater	PR5	Construction of an emergent offshore barrier (often referred to as an offshore breakwater). Offshore breakwaters effectively block wave energy by absorbing wave impact on their seaward side. They create a lower wave energy section of beach immediately in its lee, which is characterised by a salient where sand accretes in the low energy environment.
	Levee	PR6	Inundation protection using a levee to minimise inundation on low-lying land.
No Regrets	Monitoring	NR1	Involves long-term baseline monitoring and event-based monitoring following storm erosion events.
	Protection Structure Audit	NR2	Involves undertaking an audit of existing protection structures, to determine their current condition, effectiveness and future protection potential.
	Notification on title	NR3	Indicates to current and future landholders that an asset is likely to be affected by coastal erosion and/or inundation over the planning timeframe. Helps current and future owners make informed decisions about level of risk they are/may be willing to accept, and that risk management is likely to be required at some stage within the planning timeframe.
	Emergency evacuation plans	NR4	Where existing assets may be affected by inundation and are not already identified in an existing emergency evacuation management plan. Such plans are important in managing the safety of community and stakeholders.
Do Nothing	Do Nothing	DN1	Assumes all levels of risk are accepted and assumes that there is no change in existing planning controls, and no actions are implemented (i.e., no controls are implemented to treat known coastal risks).



6.4 Multi-Criteria Analysis

Successful risk management and adaptation planning requires identification and diligent assessment of suitable options to ensure selection of the best strategy. The chosen option should mitigate risk to an acceptable level whilst maximising the values important to the stakeholders and community. For this CHRMAP the key assessment criteria were:

- Effectiveness
 - Ability for the option to mitigate the coastal hazard
- Environmental Impact
 - Impact on existing native vegetation / dunes / coastal processes
 - Includes consideration of:
 - Any construction / clearing impacts
 - Impact of maintenance on the environment
- Social Impact
 - This considers stakeholder and community impacts from previous CHRMAP chapters
 - Potential impacts on Aboriginal and European heritage sites and values are considered in this criterion.
- Aesthetic Impact
 - The visual appeal of the option
 - Consideration of whether option aesthetically meets wider vision of the area
- Cost
 - Upfront capital costs
 - Ongoing maintenance costs
 - Economic affects – such as loss of businesses, income, value
- Future Adaptability
 - Whether the option is easily adaptable in future, such as for updated sea level rise actuals or projections
 - If the option limits the feasibility of selecting other options in future

Water Technology undertook an initial assessment of options against the criteria. **All ratings are somewhat subjective; however, community and stakeholder engagement allowed for additional feedback from the community and further review of the scores attributed – discussed further below.**

Following the preparation of the draft MCA, the results were reviewed by the Steering Committee and the Community And Business Reference Group. In addition, community members attended two workshops to provide their thoughts on adaptation options to enable further review and calibration of the MCA scoring. The engagement focussed on the Environmental, Social and Aesthetic Impact categories. Several component category scores changed during this review process, but only the following options changed recommendations:

- MU1 – PMR2 Demolition / removal / relocation of asset from inside hazard area – changed from ‘Not Recommended’ to ‘Recommended’.
- MU1 – PR3 Seawall – changed from ‘Suitability Unclear’ to ‘Recommended’.



- MU1 – PR4 Artificial Reef– changed from ‘Suitability Unclear’ to ‘Not Recommended’.
- MU2 - PR3 Seawall – changed from ‘Not Recommended’ to ‘Suitability Unclear’.
- MU5 – PR2 Groynes, PR3 Seawall, PR4 Artificial Reef and PR5 Offshore Breakwaters – all changed from ‘Suitability Unclear’ to ‘Not Recommended’.

In most cases it is necessary to implement more than one option, and the options selected through the MCA may vary between management units and with implementation timeframes. Table 6-5 summarises the evaluated status of each option for each management unit. Options receiving a positive score are recommended for further consideration.

Table 6-5 Multi-Criteria Analysis summary by MU. Green indicates options recommended for further investigation (CBA); orange cells are unclear, so will be analysed further; red cells are not recommended for inclusion or further analysis

Option	MU1	MU2	MU3	MU4	MU5
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	11	11	11	11	11
Leaving assets unprotected (PMR1)	N/A	2	2	2	N/A
Demolition / removal / relocation of asset from inside hazard area (PMR2)	1	7	7	7	7
Prevention of further development / prohibit expansion of existing use rights (PMR3)	6	6	6	10	6
Voluntary acquisition (PMR4)	4	5	5	5	N/A
Design assets to withstand impacts (AC1)	8	11	10	10	8
Beach nourishment or replenishment (PR1)	3	5	4	-1	0
Groynes (PR2)	0	-1	-2	-8	-2
Seawalls (PR3)	1	0	-2	-12	-2
Artificial reef (PR4)	-1	-2	-2	-2	-1
Offshore breakwater (PR5)	-5	-5	-5	-5	-1
Levee / Weir / Storm Surge Barrier (PR6)	N/A	3	2	1	1
Monitoring (NR1)	8	8	8	8	8
Protection Structure Audit (NR2)	8	8	8	N/A	8
Notification on title (NR3)	8	8	8	8	8
Emergency evacuation plans (NR4)	6	6	6	6	6
Do nothing (DN1)	-10	-10	-10	-7	-7



7 RISK TREATMENT ANALYSIS

An Assessment of Risk Treatment Options Chapter Report (Appendix F) was prepared to analyse options using Cost-Benefit Analysis (CBA). A summary is provided below.

7.1 Cost Benefit Analysis

7.1.1 Approach

The CBA aims to examine the selection of coastal adaptation options through economic analysis. This CBA includes coastal adaptation options requiring significant financial investment and recommended by the MCA. While the CBA process assists in contrasting options available “*at the time of the analysis*” and “*for a set of specific assumptions*”, it is not the Panacea for decision-making. For instance, changing scientific, environmental and macro-economic considerations can upset cost estimates in the future. Some of the CBA assumptions may not hold true for the long duration often considered in CBA analysis for major infrastructure (for example due to global events and technological advances).

The CBA analysis allows selection of coastal adaptation options which are economically more defensible than other options which could require more effort to achieve a reduced outcome. However, to prepare a CBA some assumptions must be made, and changing these assumptions can significantly affect the valuation of economic benefits.

For instance, the CHRMAP CBA has only addressed valuing the loss of assets, managed retreat and physical protection options. This CBA does not consider indirect costs that another user might consider to be a loss. For example, the analysis did not include costs associated with Special Control Area (SCA) title notifications, emergency planning, and development restrictions. Also, options selected have been designed to provide a similar level of beach and foreshore amenity to the present-day situation. This may not be practical. There may be further decisions about coastal amenities management (such as policies, planning decisions, legal proceedings, etc.), guided by community values, which may alter this assumption. Furthermore, in this CBA all coastal adaptation options are designed to provide beach and foreshore amenities into the future.

The cost-benefit of each coastal adaptation option is presented in net present value (NPV) terms. NPV is a standard economic analysis to compare options with time-variable costs and benefits. It allows for the adjustment of all future economic considerations to present-day dollars for a more direct comparison. This relates to the time-value of money, as planned expenses in the future are, in a sense, cheaper than equivalent costs today. The real discount rate chosen for this project was 4%, with sensitivity analyses at 7% and 2%. This decision was based on similar assessments the very long timeframe of analysis, and concerns about valuing future spending so low, which is at odds with resilient coastal planning principles.

The CBA has been performed over a 100-year period, to match the project planning timeframe and meet the requirements of the CHRMAP. It should be noted that the uncertainty around the CBA estimates and assumptions made grows with time. Cost estimates beyond 2040 should be viewed as indicative trends only. Long-term coastal adaptation pathways should be monitored and updated regularly.

7.1.2 Options Suitable for Cost-Benefit Analysis

The CBA has only addressed options, including practical and economic actions across the planning timeframe. The economic base case used for comparison is calculated by valuing the loss of assets and values in an assumed scenario of inaction rather than “Business As Usual” (BAU). Total inaction is unrealistic in practical terms as emergency management works and obligations of other legislation would require LGAs and State Departments to act when projected coastal erosion and inundation occur. The economic inaction scenario is also different to the “Do-Nothing” adaptation option, which would assume that anyone over the planning timeframe undertakes no actions or management, and that hazards and resultant asset loss/damage occur



exactly as the hazard analysis suggests. The adaptation options considered suitable for CBA are summarised in Table 7-1 – managed retreat and physical protection options (e.g., beach nourishment, groynes, seawalls, levees).

Table 7-1 Risk treatment options from WAPC (2019) suitable for CBA. Note PR4 and PR5 are greyed out as they did not progress through MCA for any MU's.

Option Category	Option Name	Option Code
Planned / Managed Retreat	Voluntary acquisition	PMR4
Protect	Beach nourishment or replenishment	PR1
	Groyne	PR2
	Seawall	PR3
	Artificial reef	PR4
	Offshore breakwater	PR5
	Levee	PR6

7.1.3 Other Options

The remaining adaptation options from WAPC (2019) are not considered suitable for CBA and have been costed using traditional budgeting techniques for MUs where they received a positive MCA score. Section 8 provides cost estimates and notes on any scoping details or assumptions.

7.1.4 Cost Benefit Analysis Methodology

The steps taken to complete the CBA are summarised below:

- Finalise quantities of assets at risk for all asset categories for both erosion and inundation hazards for each Management Unit (MU) at each timeframe
- Determine an appropriate unit value for each category for both loss to erosion and damage by inundation
- Valuing the loss of existing assets and values – this assumes the scenario of complete inaction over the next 100 years
- Scoping and designing the adaptation options
- Pricing the adaptation options
- Reducing all costs to NPV
- Conducting sensitivity analysis on NPV discount rate used in analysis
- Presenting a summary of the inaction scenario and adaptation options in NPV for both erosion and inundation
- Recommendation of options to proceed to for further consideration.

7.1.5 Recommended option(s) for further consideration for each MU

The CBA has been used as an additional tool to assist decision-making when assessing adaptation options with which to proceed. However, the reality that only some of the WAPC adaptation options are suitable for CBA, and the uncertainty in the effectiveness of those that are not suitable, means that the CBA results need to be used cautiously whilst considering the rest of the information identified during the CHRMAP project.



The review of the CBA results shows that the ranking of options for each MU by current NPV price depends on which discount rate is used. If options stayed in the same ranking for all three discount rates, there would be a stronger argument for selecting a single option with which to proceed. Options recommended to proceed are presented in Table 7-2 for erosion and Table 7-3 for inundation. The recommendations have considered the CBA results holistically as well as being cognisant of the findings of previous stages of the CHRMAP. Other non-CBA options form part of the implementation recommendations in Section 8.

Table 7-2 Recommended CBA options for erosion for each MU

Management Unit	Recommended Option	Notes
MU1	PR1 Beach Nourishment	<ul style="list-style-type: none"> PR1 is best value for all discount rates and has a positive benefit/cost ratio for all rates. PR3 Seawall is not recommended as it would mean the loss of the beach. Should the objectives of this MU change in the future PR3 Seawall may be suitable in the long-term. PR1 Beach nourishment could also later be transitioned to both PR2 Groynes or PR3 Seawall if required. PMR4 Retreat by voluntary acquisition is the worst value option for all discount rates.
MU2	PR1 Beach Nourishment	<ul style="list-style-type: none"> PR1 is best value for all discount rates and has a positive benefit/cost ratio for all rates. PR3 Seawall is not recommended as it would mean the loss of the beach. Should the objectives of this MU change in the future PR3 Seawall may be suitable in the long-term. PMR4 Retreat by Voluntary Acquisition is the worst value option for all discount rates.
MU3	PR1 Beach Nourishment	<ul style="list-style-type: none"> PR1 is best value for all discount rates and has a positive benefit/cost ratio for all rates. PR3 Seawall is not recommended as it would mean the loss of the beach. Should the objectives of this MU change in the future PR3 Seawall may be suitable in the long-term. PMR4 Retreat by Voluntary Acquisition is the worst value option for all discount rates.
MU4	PMR4 Retreat by Voluntary Acquisition	<ul style="list-style-type: none"> PMR4 Retreat by Voluntary Acquisition is the best value option for one discount rate (7%) and has a positive benefit/cost ratio for this rate. PMR4 Retreat by Voluntary Acquisition does not have a positive benefit-cost ratio for the other two rates (4% and 2%) but no other options were deemed appropriate for CBA. Other non-CBA options will form part of the management approach and will be presented at the Stage 7 Implementation Report.
MU5	PR1 Beach Nourishment	<ul style="list-style-type: none"> PR1 Beach Nourishment has a positive benefit-cost ratio for all rates.



Table 7-3 Recommended CBA options for inundation for each MU

Management Unit	Recommended Option	Notes
MU1	N/A	<ul style="list-style-type: none"> Following the MCA, no suitable options were identified for CBA. Recommended management will focus on Monitoring (NR1), Accommodate (AC1) and Emergency Evacuation Plans (NR4) and is outlined in Section 8.
MU2	PR6 Levee	<ul style="list-style-type: none"> PR6 Levee has a positive benefit/cost ratio for all rates.
MU3	PR6 Levee	<ul style="list-style-type: none"> PR6 Levee has a positive benefit/cost ratio for two discount rates (7% and 4%).
MU4	PR6 Levee	<ul style="list-style-type: none"> PR6 Levee has a positive benefit/cost ratio for all rates.
MU5	PR6 Levee	<ul style="list-style-type: none"> PR6 Levee has a positive benefit/cost ratio for all rates.



8 IMPLEMENTATION

An Implementation and Monitoring Chapter Report (Appendix G) was prepared to present recommended actions to progress coastal hazard adaptation planning for PRH. A summary is provided below.

8.1 Implementation Strategy

It is recommended the City employ a staged implementation strategy to incorporate the CHRMAP’s strategic recommendations into its operations as outlined in Table 8-1.

Table 8-1 CHRMAP implementation strategy. Note: S1 Erosion Allowance is the allowance for the current risk of erosion, further detail is available in Section 4 of the Appendix C Risk Identification Chapter report.

Milestone	Adaptation Actions	Adaptation Hierarchy
Present (i.e. prior to CHRMAP endorsement)	Continue to accommodate development under the current planning framework with conditions requiring removal or relocation of the development once the Horizontal Shoreline Datum (HSD) is within 40m of the most seaward point of the development, in accordance with the CHRMAP Guidelines.	Planned/ Managed Retreat; Accommodate
CHRMAP Endorsement	Continue to accommodate development under the current planning framework with conditions requiring removal or relocation of the development once the HSD is within the S1 distance of the most seaward point of the development. The City shall update the online mapping tool to include the relevant data from the CHRMAP, including the HSD and S1 values for locations subject to erosion.	Planned/ Managed Retreat; Accommodate
Scheme Amendment / LPP Endorsement	<p>Assess development against the amended planning framework which supports the adaptation hierarchy under the CHRMAP Guidelines, specifically:</p> <ul style="list-style-type: none"> Prohibit subdivision or rezoning of land which has been identified as being subject to erosion over the 100-year planning timeframe; or Prohibit development within the S1 distance of the HSD; or Accommodate development not identified as being impacted by erosion in the short-term (S1) with conditions for the managed retreat of the development once the most seaward point of the development is within the short-term erosion zone (future HSD position plus S1 erosion). <p>Accommodate development prone to inundation provided certain design requirements can be achieved, in accordance with the with a Coastal Hazard Local Planning Policy, to be prepared by the City</p>	Avoid; Planned/ Managed Retreat; Accommodate
Protection Measures Constructed	Accommodate development where protection measures have been undertaken in accordance with the CHRMAP and/or any other relevant assessment endorsed by a suitably qualified coastal engineer. Development approvals may be time limited, at the discretion of the City.	Accommodate; Protect



8.2 Land Use Planning

There is a direct relationship between coastal hazard exposure and development. The way that buildings and assets are designed and located determines their exposure, ultimately impacting risk to people and property.

Land use planning has an important role to play in increasing the resilience of coastal areas to sea level rise, storm-tide inundation, and erosion, as they govern how coastal areas are developed and managed.

Therefore, development planning controls are an important tool to use in reducing risk exposure.

8.2.1 Statutory Planning Mechanisms

A review of the existing planning controls concluded that a local planning scheme amendment to modify the existing Special Control Area (SCA) was the most appropriate approach to address coastal hazards within the PRH. The following section provides a summary of recommendations for the City to update its current planning framework to effectively manage the coastal erosion and inundation risks identified in the CHRMAP.

The planning mechanisms have been recommended in accordance with the CHRMAP Guidelines, specifically Appendix 4 – Planned or managed retreat – existing planning framework and instruments. These provide guidance on planning risk treatment options across the risk management and adaptation hierarchy.

8.2.1.1 Avoid

The best form of risk management is to eliminate hazards, activities and exposures that can adversely affect an asset. Accordingly, the primary planning response shall be to avoid further intensification of development through rezoning or subdivision.

It is acknowledged that it may not be practically possible to completely avoid development on private land that has already been zoned under LPS 2. In these instances, alternative adaptation options will need to be considered.

8.2.1.2 Planned/Managed Retreat

The CHRMAP Guidelines provide guidance on how to effectively implement a policy of planned or managed retreat for locations that have been identified as being vulnerable to coastal processes through the CHRMAP. Appendix 4 of the CHRMAP Guidelines recommend the introduction of mechanisms to reduce or prevent the ongoing use of private land at risk of coastal hazards. The first step involves changing the local planning framework to enable the mechanisms for planned or managed retreat to be applied. The second step, once it has been determined that private use of the land should cease, contemplates the transfer of affected land from private to public ownership.

The recommended SCA provisions in Table 8-2 will enable the City to implement a policy of planned or managed retreat once it has been determined that the private use of the land should cease through certain trigger events. The City should aim to complete the necessary amendments to the local planning framework by 2037 which provides a 10-year period before at-risk assets are predicted to be impacted by 2047. This is deemed an appropriate period for the City and landholders to reach an agreement on an appropriate solution to either accommodate the private asset through design criteria, relocate or remove the private asset or where no alternatives exist, transfer the land from private to public ownership.

The CHRMAP Guidelines provides a framework for triggering the voluntary or compulsory acquisition of private land affected by coastal processes where the public foreshore can no longer provide a natural barrier or where



physical protection measures are not possible due to environmental, economic or social constraints. The options to acquire private land include:

- Land reserved under LPS 2:
 - Purchase of the land if the owner is willing to sell it by ordinary sale pursuant to Section 190 of the Planning and Development Act 2005.
 - Compulsory taking of the land without agreement pursuant to Section 191 of the Planning and Development Act 2005 coupled with the Land Administration Act 1997.
- Land zoned under LPS 2 within an SCA:
 - Taking of land by agreement under the Land Administration Act 1997.
 - Compulsory taking with the assistance of the Minister for Lands for a 'public work' under the Land Administration Act 1997.

The acquisition processes recommended in the CHRMAP Guidelines supports compensation paid to property owners. However, there is no obligation to adopt a policy that effectively forces the City to compensate property owners. In addition, there is no legal responsibility for the City to provide protection of a private property from natural hazards, nor compensate property owners where the land is lost to erosion. Accordingly, the City will need to determine the most appropriate mechanism available for the taking of land and identify potential funding streams, actions, responsibilities and implementation for the acquisition of vulnerable properties.

Once at-risk properties have been acquired, all structures and assets shall be removed, and the land reserved for 'Foreshore' under LPS 2. This will enable expansion of the foreshore reserve, maintaining a natural barrier to coastal processes.

8.2.1.3 Accommodate

The accommodate risk treatment option aims to utilise design and management strategies to reduce the risk to an acceptable level, allowing land to continue to be used until it has been determined that private use of the land should cease. The accommodate risk treatment option will be enacted through provisions within LPS 2 under an SCA and the adoption of a Local Planning Policy which provides specific design requirements for development in vulnerable areas.

8.2.1.4 Protect

The protect risk treatment option refers to physical protection measures such as seawalls, groynes, offshore breakwaters, artificial headlands, beach nourishment and the likes. It would not be practical for the planning framework to require landholders to undertake protection measures as part of the decision-making process.

8.2.2 Recommended Planning Controls

8.2.2.1 Local Planning Strategy

This CHRMAP will inform the next iteration of the City's Local Planning Strategy to guide land use planning and development in areas prone to coastal hazards. Areas of risk should not be identified for further intensification of development through rezoning or subdivision.

The Local Planning Strategy shall include a provision for all SPP 2.6 requirements to be met at the earliest stage possible, including the requirements for the ongoing provision of a coastal foreshore reserve.

The Local Planning Strategy must consider the coastal hazard risks identified in this CHRMAP alongside other relevant planning matters including environmental, economic and social considerations to holistically inform and shape future expansion, as a precursor to future amendments to the City's Local Planning Scheme.



8.2.2.2 Local Planning Scheme Amendment

The City's Local Planning Scheme No. 2 (LPS 2) has recently been approved by the Minister for Planning and replaces the previous Local Planning Scheme No. 1 (LPS 1). Future amendments to LPS 2, as initiated by the City, shall include the following provisions, in accordance with the CHRMAP Guidelines:

- Update Special Control Area 15 – Princess Royal Harbour Inundation Area under Schedule 8 of LPS 2 to Special Control Area 15 – Princess Royal Harbour Coastal Hazard Area. The recommended provisions for SCA 15 have been outlined in Table 8-2.
- Update SCA 15 on the Scheme Map to reflect the 2122 coastal hazard risks identified in Cardno (2022).

The City shall amend LPS 2 to include the recommendations of this CHRMAP as part of next scheduled scheme review. The City may defer implementation of certain recommendations following updates to the hazard modelling through future iterations of this CHRMAP.

8.2.2.3 Special Control Area

Schedule 8 of LPS 2 already contains SCA 15 which prescribes certain requirements in response to inundation along the PRH coastline. To ensure the planning response is concise and easy to interpret, it is recommended that SCA 15 is modified rather than include a new SCA to holistically respond to the coastal hazards identified in this CHRMAP. The recommended updates to SCA 15 have been summarised in Table 8-2.

It is noted that some forms of development cannot be controlled by a SCA, such as works carried out by public authorities under the *Public Works Act 1902*. The City should liaise with the public authorities regarding such development to ensure it is not incongruous with the long-term pathway set out for the area.



Table 8-2 Recommended updates to SCA15 in LPS 2.

Name of Area	Purpose	Additional Provisions
Special Control Area 15 – Princess Royal Harbour Coastal Hazard Area (SCA 15)	<p>(1) To provide guidance for land use and development within areas subject to erosion and inundation.</p> <p>(a) To identify land within Princess Royal Harbour at risk of coastal erosion and inundation by 2122.</p> <p>(b) To ensure land in the coastal zone is continuously available for coastal foreshore management, public access, recreation and conservation purposes.</p> <p>(c) To ensure public health and safety and reduce risk associated with coastal erosion and inundation.</p> <p>(d) To avoid inappropriate land use and development of land at risk of coastal erosion and inundation.</p> <p>(e) To ensure land use and development does not accelerate coastal processes; or have a detrimental impact on the functions of public reserves.</p> <p>To ensure coastal process considerations are taken into account in preparing strategic planning proposals and in assessing subdivision and development applications.</p>	<p>(1) Notwithstanding any other provision of the Scheme, all proposed development within SCA 15 requires the approval of the local government.</p> <p>(2) In considering any application for subdivision or development approval, or its advice in relation to a proposed structure plan within SCA15, the local government is to have particular regard to subsidiary legislation and planning instruments that relate to the land: Where the local government decides to approve an application for development approval, it may impose a condition to require the registration of a notification under section 70A of the Transfer of Land Act 1893 on the Certificate of Title of the subject land advising:</p> <p>(a) That the lot is located in an area likely to be subject to coastal erosion or inundation over the next 100 years.</p> <p>(b) Any limited term of a development approval.</p> <p>(c) Any requirement to remove approved development and restore the land as near as practicable to its pre-development condition to the satisfaction of the local government upon a trigger event occurring, as defined in an adopted local planning policy.</p> <p>(3) Where subdivision applications are received within SCA 15, the local government may recommend that the Commission requires a notification under section 165 of the P&D Act to be placed on the Certificate(s) of Title of the subject land advising that the lot(s) is located in an area likely to be subject to coastal erosion and inundation over the next 100 years.</p>



8.2.2.4 PRH Coastal Hazard Local Planning Policy

Following the introduction of SCA 15 into LPS 2, the City shall prepare and adopt a Coastal Hazard Local Planning Policy in accordance with Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015*. It is recommended that the Local Planning Policy includes provisions identified in Appendix H which may be subject to further refinement by the City following the completion of this CHRMAP.

8.2.3 Management Requirements

8.2.3.1 Recommended Conditions

The City shall include the following conditions and advice notes to a Local Planning Policy recommended conditions which can then be applied to development applications within SCA 15, at the discretion of the City.

Conditions:

1. The development approval shall cease to have effect and the development removed when:
 - a. The most landward part of the Horizontal Shoreline Datum is within *[insert here the distance equivalent of the S1 Erosion Allowance (allowance for the current risk of erosion¹) for the subject lot as per the Princess Royal Harbour Coastal Hazard Risk Management Adaptation Plan as amended from time to time]* metres of the most seaward part of the development; or
 - b. A public road is no longer available or able to provide legal access to the property; or
 - c. Water, sewerage or electricity to the lot is no longer available due to coastal hazards.
2. Any development approval granted in respect to Condition 1 shall require the land to be rehabilitated to its pre-development condition, once the development has been removed. The land shall be rehabilitated to the specifications and satisfaction of the Local Government, at the landholders cost.
3. A notification, pursuant to Section 70A of the Transfer of Land Act 1893 is to be placed on the Certificate of Title of the proposed development lot advising of the existence of a coastal hazard. The notification is to state as follows:

'Vulnerable coastal area - This lot is located in an area likely to be subject to coastal erosion and inundation over the next 100 years and is subject to conditions of development approval which requires removal and/or rehabilitation of development to pre-development conditions if the time limit specified on the development approval is reached or any one of the following events occurs:

- a) *the most landward part of the Horizontal Shoreline Datum being within [insert here the distance equivalent of the S1 Erosion Allowance (allowance for the current risk of erosion¹) for the subject lot as per the Princess Royal Harbour Coastal Hazard Risk Management Adaptation Plan as amended from time to time] metres of the most seaward part of the habitable building;*
- b) *a public road no longer being available or able to provide legal access to the property;*
- c) *when water, sewerage or electricity to the lot is no longer available as they have been removed/decommissioned by the relevant authority due to coastal hazards or in the case where on-site effluent disposal systems exist, the minimum separation to ground water cannot be maintained.'*

¹ S1 Erosion Allowance is the allowance for the current risk of erosion, further detail is available in Section 4 of the Appendix C Risk Identification Chapter report and an overview image is provided in Appendix H.



Advice Notes:

1. The applicant is advised that the Horizontal Shoreline Datum means the active limit of the shoreline under storm activity, as defined in State Planning Policy 2.6 – State Coastal Planning Policy.

8.2.3.2 Online Mapping Tool

The erosion and inundation hazard data provided in the CHRMAP should be included on the City's online mapping tool. This will ensure staff and the community have access to information on any affected land and how the adaptation measures may impact on future development.

Information on relevant coastal hazards and the implications for property, now and into the future, should also be made available to potential buyers upon making a land purchase enquiry.

8.2.3.3 Foreshore Management Plans

Foreshore management plans can provide a strategy to deliver the recommendations of this CHRMAP for particular foreshore reserves throughout the City. Foreshore management plans can be a key tool for communication and engagement with the community as they include detailed planning for community places and facilities.

The City should prepare a foreshore management plan for PRH to provide guidance for the ongoing management of foreshore reserves, monitoring of assets and the triggers for the managed retreat of public assets and infrastructure at risk of erosion.

8.2.3.4 Emergency Response and Evacuation

In accordance with the *Emergency Management Act 2005*, the City is responsible for assisting the community in preparing, preventing, responding and recovering from various emergencies. The City's Local Emergency Management Committee (LEMC) has prepared a Local Emergency Management Arrangement (LEMA) which includes useful information in relation to emergency preparation and response to coastal hazards.

The LEMA should be reviewed in conjunction with this CHRMAP to ensure areas identified as being at risk have arrangements in place to assist with emergency response and recovery.

8.3 Funding Options

This section identifies all known revenue-raising mechanisms available for obtaining funds to assist implementation. Funding mechanisms considered include:

- Local Government:
 - Operating budget, general rates and coastal management fund,
 - Special area rates / differential rating,
 - Levies,
 - Lease land management,
- State Government grants, and
- Federal Government grants, and
- Beneficiary Pays.



8.3.1 Operating Budget, General Rates and Coastal Management Fund

The individual land managers within the study area should consider establishing a coastal management fund that includes specific allowance for managing and adapting to the risk posed by coastal erosion and inundation. The purpose of this fund includes:

- To allocate a percentage of the organisation's operating budget for coastal management. The percentage and amounts will vary for each organisation but between 0.5% and 3.0% is proposed.
- To save funds routinely so that when triggers are met the established management actions can be implemented efficiently.
- Acknowledge coastal management costs are forecast to increase in line with sea level rise and the realisation of coastal hazard projections.

8.3.2 Specified Area Rate

Where adaptation options are designed to protect specific sections of coastal land and assets, such as private property, it is recommended that the City progress the establishment of a specified area rate in line with the outcomes of benefit distribution analysis. The rate can be applied to those beneficiaries within the 100-year hazard zone, and the amount raised should consider the estimated 100-year cost for each option.

8.3.3 Levies

It is recommended the City investigate the feasibility of establishing a particular levy for coastal management that would be a transparent source of the coastal management fund discussed above.

8.3.4 Lease Land Management

Coastal land vested with coastal managers in the study area and leased to third parties represents a unique scenario whereby implementation of some Options may require specific lease clauses, but there is also potential to raise funds for coastal management. During considerations of lease renewal, coastal managers should consider the land use, vulnerability of the land, projected timeframe of unacceptable vulnerability, length of lease, recommended implementation options and need for any specific clause around triggers or required management actions by the lessee. Increases in lease amounts may be able to raise funds to help offset the cost of management.

8.3.5 State Grants – CoastWA

CoastWA aims to implement a strategic response to the growing impacts of coastal hazards to ensure sustainable land use and development on the coast for the long-term. CoastWA committed \$33.5 million of funding over five years from 2021-26. The program was extended in February 2026 with \$24 million for another three years to 2029, with \$4 million in grant funding available for coastal management and protection projects in 2026. For further information visit <https://www.wa.gov.au/government/document-collections/coastwa-grants>. It comprises the following grant programs:

- Coastal Adaptation and Protection grants,
- Hotspot Coastal Adaptation and Protection Major Project Fund,
- Coastwest grants,
- Coastal Management Plan Assistance Program.

There are also two other grant programs relevant to coastal hazard risk management in WA:

- Regional Economic Development Grants,



■ Local Government Financial Assistance Grants.

The Department of Transport administers the Coastal Adaptation and Protection (CAP) grants and the Hotspot Coastal Adaptation and Protection (H-CAP) Major Project Fund. CAP grants provide financial assistance for local projects that identify and manage coastal hazards. The program aims to build partnerships with local coastal managers, such as local governments and help them understand and adapt to coastal hazards. CAP Grants fund up to 50% of project costs. H-CAP supports projects which design and implement adaptation Options at coastal erosion hotspots identified by the DoT in recent years. Invitations to apply for H-CAP are sent directly to eligible coastal managers - those with a completed CHRMAP and an identified erosion hotspot. The Princess Royal Harbour does not contain any formally recorded DoT coastal erosion hotspots.

Coastwest grants support eligible coastal land managers and community organisations to undertake projects that manage and enhance WA's coastal environments through rehabilitation, restoration and preventative actions. Coastwest grants are administered by the Department of Planning, Lands and Heritage on behalf of the WAPC.

Coastal Management Plan Assistance Program (CMPAP) grants support eligible coastal land managers to develop and implement adaptation and management plans and strategies for coastal areas that are, or are predicted to become, under pressure from a variety of challenges. CMPAP grants are administered by the Department of Planning, Lands and Heritage on behalf of the WAPC.

Other WA grant programs which may provide funding for coastal projects include Royalties for Regions and Local Government Financial Assistance Grants.

Regional Economic Development Grants are facilitated by Department of Primary Industries and Regional Development and promotes and facilitates economic, business and social development in regional Western Australia for the benefit of all Western Australians. For further information visit: <https://www.dpir.wa.gov.au/businesses/grants-and-support/regional-economic-development-grants/>

Local Government Financial Assistance Grants are administered by the Department of Local Government, Sport and Cultural Industries. They are grants funded by the Commonwealth Government and are distributed among 137 local governments in WA each year. The grants allow councils to spend the funds according to local priorities. For further information visit: <https://www.dlgsc.wa.gov.au/local-government/local-governments/financial-assistance-grants>

It should be noted that State funding mechanisms require matching cash contributions from the land manager, and as such, funding will still need to be sourced through one or more of the other available measures. State funding grants may also restrict access to funding where public monies would partially or predominantly benefit private landholders or users.

Because coastal hazards and coastal land management will continue to evolve and are unlikely to be resolved by 2029 (beyond the term of the CoastWA Grants), long-term sustainable funding is likely to be required from the State.

8.3.6 Federal Grants

Federal grants are variable and often unpredictable, but it is important for coastal managers to stay aware of any funding and grant programs available. Early planning and preparation will mean more-competitive applications can be prepared quickly when grants are announced.

It should be noted that Federal funding mechanisms may require matching cash contributions from the land manager, and as such, funding may still need to be sourced through one or more of the other available measures. Federal funding grants may also restrict access to funding where public monies would partially or predominantly benefit private landholders or users.



The Australian Government has established the Disaster Ready Fund which will deliver up to \$200 million in funding per financial year for disaster risk reduction and resilience initiatives. Coastal hazards (erosion, inundation, and sea level rise) are an eligible hazard type. The total Australian Government funding is up to \$1 billion over five years from 2023-24 to 2027-28, with funding to be matched by the applicants. DRF Round Four is due in 2026. For more information visit [Disaster Ready Fund | NEMA](#).

8.3.7 Beneficiary (user) Pays

'User Pays' principles essentially dictate that the beneficiaries of adaptation options should pay for them. Mechanisms for fund raising may include:

- Specified Area Rates – as described above and considering the findings of benefit distribution analysis.
- Mechanisms for visitors to the town, as users of the coastline, to contribute. This could be in the form of a levy applied to their accommodation, or paid parking at key tourist sites.
- Developer contributions where specific developments benefit from their coastal location.

During 2025 the City investigated options for benefit distribution analysis. The analysis provides information on methods and proportions by which the City could fund coastal works from direct beneficiaries.

8.4 Monitoring and Review

Monitoring is essential to managing coastal hazards, tracking when coastal hazards reach trigger points, understanding the coastline evolution, capturing changes to vulnerabilities and measuring the success of coastal management actions.

Coastal monitoring will inform the short-term implementation phase and increase the knowledge base for subsequent CHRMAP revisions and targeted investigations. Monitoring and review tasks include:

- Review of existing coastal monitoring programs,
- Review of coastal hazard projects outlined in erosion hazard assessment,
- Recommend coastal monitoring activities to identify trigger points, to record dilapidation, to record when trigger points occur and to include indicative costs of monitoring works,
- Recommend Trigger points, and
- Recommend CHRMAP review.

8.4.1 Review of Existing Coastal Monitoring

The following coastal monitoring activities are currently undertaken in the study area and should be continued:

- Shoreline vegetation movement analysis from aerial photos undertaken by DoT
- Water level monitoring at the Albany Port undertaken by DoT
- Wave monitoring undertaken by DoT
- Bathymetric surveys commissioned Southern Ports and DoT.

8.4.2 Recommended Coastal Monitoring Activities

The monitoring activities described below are designed to identify the impacts of the recommended Options and to record the evolution of the coastal trigger points.

Should any Option be modified, or other coastal projects be undertaken (such as maritime, or recreation/tourism projects) where coastal hazard risk management is not the primary focus, they should be



subject to the same CHRMAP principles and require their own monitoring program appropriate to their location, size and objectives. Recommended coastal monitoring activities are presented in Table 8-3 **Error! Reference source not found.**

Table 8-3 Recommended coastal monitoring activities

Monitoring Activity	Overview	Location	Timing
Beach and foreshore topographic survey.	<p>It is recommended to prepare an RFQ to engage a certified professional surveyor for a long-term beach and foreshore topographic survey data collection program (assumed as three years).</p> <p>Routine beach and dune surveys, in the form of beach profiles as a minimum, are recommended every 6 months, following the summer and winter seasons, every 400m along the coast in undeveloped areas and every 100m in developed areas. Beach profiles may be spaced more closely where Options include trigger points monitoring and/or to support specific project requirements. The beach survey may also be continuous along the coast using LiDAR or other appropriate technique with a view to capture coastal processes more accurately, while allowing the processing of beach profile data. Additionally, surveys can be undertaken immediately following severe storms producing significant beach erosion. These are useful for recording historical events, confirming the presence of bedrock, and calibrating models. The survey datasets should be centralised into a database, which includes previous historical beach profiles and quality control information such as survey date, datum, survey mark, beach material encountered (rock vs sand) and method used.</p>	MU's 2, 3, 4 & 5.	2026-2029.
Field photos.	Collect beach and foredune monitoring photos at the same time as the beach and foreshore topographic survey, particularly for inundation events as it is often impractical to organise detailed survey at short notice.	All MU's.	2027-2029.
Bathymetric survey.	<p>Collect additional nearshore bathymetry data (water depths) for future coastal processes investigations and option development in all MU's. Survey should target reaching depths of approximately -4.0mAHD.</p> <p>Specifically bathymetric survey of shallow waters of MU1 to identify any changes in sand and seagrass banks, approximately every 5 years.</p>	All MU's. Focus on MU1 sand and seagrass banks.	2027



Monitoring Activity	Overview	Location	Timing
Coastal protection structure audit.	<p>The City should prepare an RFQ and engage a consultant to undertake an audit of the coastal protection structures the City is responsible for the care, control and maintenance of.</p> <p>Regular monitoring of the coastal management structures (Protection Structure Audit – NR2) – e.g., revetment seawalls and breakwaters should be undertaken with consistent methodology to allow comparison between inspections. These can be commenced immediately, and the initial assessment would identify an appropriate review schedule for each structure, or if there is an issue with an asset. Such assessment would occur yearly to blend into the City’s existing asset management reporting systems.</p>	MU’s 1, 2, 3 & 5.	2028
Geotechnical investigations.	<p>Geotechnical investigations are proposed to identify the potential presence and depths of local bedrock strata below the beach and foreshore. When bedrock is located relatively near the surface, it can provide some natural resistance to erosion and help inform the refinement and design of coastal management options.</p> <p>However, in low-lying areas, the presence of bedrock may not significantly mitigate the coastal hazards. Such investigation may be carried out by ground penetration radar, test pits or survey observations following beach erosion events.</p>	All MU’s.	2029 / 2030 / 2031.

8.4.3 Trigger Points

The CHRMAP consider four types of trigger points, as follows:

- **Proximity trigger:** Where the most landward part of the Horizontal Shoreline Datum (HSD) is within the Current Risk of Storm Erosion Allowance (S1 value) of the most seaward point of a public asset of interest or private property lot boundary. Due to the high value of the foreshore reserve, the foreshore reserve may be considered to be “the most seaward point”. If individual assets have a specific distance-based trigger relating to the HSD then the beach and dune survey activities described above should be used to collect topographic data that can be used to map the updated HSD position.
- **Access trigger:** Where a public road is considered no longer available or able to provide legal access to the property.
- **Utilities trigger:** When water, sewage, communications or electricity to the lot is no longer available as they have been removed/decommissioned by the relevant authority due to coastal hazards.
- **Damage trigger:** Any property within the hazard zone and within a dedicated Special Control Area, that is damaged by a coastal hazard from an extreme weather event shall require LGA approval before being repaired. The review process should involve re-fit of minor or moderately damaged assets to accommodate coastal hazards in the future; or removal and redevelopment outside the hazard zone for damaged assets.

This list follows a sequential / prioritisation order. That is, a “proximity trigger” is recommended over a “damage trigger”.



8.4.4 CHRMAP Review

This CHRMAP should be updated at least every 10 years to maintain currency and should be considered a “living document”. An earlier review should be considered if any of the following events occur:

- Substantial storm events generating severe coastal hazards approaching or exceeding the CHRMAP projections.
- Significant changes to land-use planning – such as complex amendments to, or full review of, the Local Planning Scheme.
- New information becomes available which substantially affects the summary of local community values and assets (natural or built). This may typically occur when consulting the community regarding other documents such as the Local Planning Scheme or Foreshore Management Plan, or the occurrence of a significant storm event.
- Hazard modelling for the study area should be updated given any of the following:
 - recent data collection
 - planning changes
 - updates in climate change science, specifically local sea level rise projections
 - changes coastal engineering methodology
 - changes to the CHRMAP success criteria by coastal land managers
 - triggers are reached.

Ongoing coastal management operations within the study area should consider the status of both short and long-term adaptation strategy progress, including assessment of the performance and review of any identified strategies.

Monitoring of CHRMAP outcomes, actions and future updates should always include consultation with stakeholders and the community to make sure any changes are communicated, and that the stakeholders’ positions are reflected in the coastal management outcomes.

8.5 Implementation Overview

The coastal adaptation pathway includes short-term, medium-term and long-term actions. Short-term actions are anticipated to be implemented within the next 25 years; medium-term actions implementation would occur between 25-50 years; while long-term actions would be implemented beyond 50 years towards 100 years’ time.

Detailed implementation plans for each MU are presented in Section 8.8. One or more Options have been recommended to proceed for further investigation and/or implementation for each MU for each of the coastal hazards - erosion and inundation. The recommendations have considered the CBA results holistically as well as being reliant on the findings of previous stages of the CHRMAP.

The CHRMAP is a strategic planning document that considers long timeframes. While the CHRMAP provides a rationale for coastal hazard management, a substantial amount of preparatory work, detailed in the CHRMAP recommendations, is required before “on-the-ground implementation” can proceed. The next phase of research and studies should consider priority items in more detail. Long-term adaptation strategies/pathways have been recommended for erosion and inundation that will allow for the continuous function of local communities whilst accommodating the increasing burden of coastal hazards. The long-term strategy informs future planning instruments, supports monitoring, recommends planning reviews and underpins collaboration between coastal land managers, stakeholders and the community.



The following recommendations are based on currently available information. Recommendations that are included in this document are made based on the assumptions provided throughout this document (recognising the gaps in information that will need to be resolved) and a multi-criteria analysis based on technical, economic, social and environmental criteria. The recommendations encapsulate the preferred approach based on the available information, while being aware that assumptions need to be confirmed and more information and data collected.

Future investigations are required to confirm they are suitable, including further consultation with stakeholders and the community. The next step, following finalisation of this CHRMAP, is to confirm a program of investigative works over the short to medium term, to help inform the timing and scope of future investigations. Subsequently a likely outcome is that a combination of options may be the preferred approach in some MU's. The recommendations are based on the analysis presented in this report. Additional considerations may be incorporated into future analyses.

All recommendations still need further research. The CHRMAP provides the basis for which the City may access grant funding to undertake this work; after which, recommendations may be updated, improved, or confirmed. This process requires ongoing engagement with affected communities.

Preferred pathways have been identified via the most cost-effective option to implement them based on available information. High-level concept design work has been undertaken to allow budget estimates. Further consideration of the local coastal processes, design and costs is required before these recommendations can be progressed to seek funding, environmental impact assessment and approvals / endorsement. Composite protection options may be effective for sections of the study area. Further localised engagement is recommended through this process as well as local monitoring of coastal processes, to allow for more detailed consideration of options.

The two primary coastal management pathways for mitigating **erosion hazards** at PRH are Planned / Managed Retreat and Protection. The specific details of these preferred pathways need to be confirmed following further data collection and analysis in the years ahead to make sure the best methods are used – further explanation is provided for each below:

- Planned / Managed retreat (PMR4 – Voluntary Acquisition): Use the planning instruments and long-term plan to systematically move assets with low adaptive capacity out of the hazard zone.
- Protect (PR1 – Beach Renourishment): Undertake works as necessary to prevent erosion to assets. This is anticipated as relatively small scale works to maintain approximately the same level of beach and foreshore amenity currently experienced (Refer Figure 8-1). If significant storm damage occurs or pre-emptive works are preferred larger scale works with additional foreshore vegetation rehabilitation could occur. If more frequent management works are undertaken the sandy beach could be rebuilt as required with small beach width amounts and volumes. Further investigations are required to complete relevant designs and identify the best sources of nourishment sand – these are presented in Section 8.6.2.



Figure 8-1 Beach nourishment underway at Sunshine Coast, QLD

The two coastal management actions mitigating **inundation hazards** at PRH are Accommodate and Protection. The specific details of these preferred pathways need to be confirmed following further data collection and analysis in the years ahead to make sure the best methods are used – further explanation is provided for each below:

- Accommodate (Design assets to withstand impacts – AC1): limit damage from inundation events through finished floor level requirements. This option increases resilience but is often not suitable as an isolated pathway.
- Protect (Levee / Barrier – PR6): Undertake works as necessary to prevent or limit inundation of assets exposed along the coast. Future design work would need to confirm dimensions, toe design, surface treatments, necessity for a crest trafficable via vehicles, varying cross-section designs for different locations. Figure 8-2 and Figure 8-3 provide an indication of similar structure. For this concept design phase, the permanent earthen levees were allowed for with the following details:
 - Base width of 13m
 - Crest width of 1m
 - Height of 2m
 - Slope at 1V:3H
 - Surfacing of grass / revegetation



Figure 8-2 Typical earth levee design, (SES 2022)



Figure 8-3 Earth levee example from the Netherlands (California Water Blog, 2015)

8.6 Short-term Implementation

Short-term coastal management actions (i.e., “Options”), for each Management Unit include the following information:

- Recommended risk treatment Option(s),



- Responsibility – the entity will be the risk management owner,
- Planning timeframe,
- Approvals required,
- Inclusion of trigger points and their monitoring requirements into planning schemes,
- Costs, and
- Short-term actions were designed to be compatible with medium and long-term adaptation actions.

8.6.1 Key Assumptions

The timeframes envisaged in the coastal adaptation pathways are not absolute. These timeframes are related to the current state of local land planning, coastal processes knowledge and climate projections, as outlined in the CHRMAP. Therefore, the timeframes are typically not aligned on “worst-case” scenarios but instead consider risk-adjusted and/or consensus-based adjustments and quantifications. Other Options may be envisaged, particularly if land planning practices, coastal processes knowledge or climate projections are changed. Therefore, the implementation pathway will evolve overtime.

The Options have been selected based on information gathered through all the previous CHRMAP project stages. Although the Multi-Criteria Analysis and Cost Benefit Analysis have been key gateway decision points for selecting many Options. The preparation of the MCA and CBA required interpretation and approximations, particularly regarding the criteria and cost quantifications, and have limitations. Also, the proposed Options have been developed only at a conceptual level to draw comparisons between several Options.

The CHRMAP proposed Options should be the subject of further investigations, surveys, policy review, environmental impact investigation, development approval and authorities’ endorsement, local stakeholder and community engagement, preliminary design, detailed design, costing and any other applicable preparation work required prior to be implemented. The Options should be optimised and modified following such additional investigations.

An example of this could be changes to Management Unit boundaries, to optimise Option effectiveness and to reduce costs. It may also be practical to develop a staged implementation approach to some of these management actions to test their effectiveness and to refine design of subsequent stages (e.g., staged installation of a levee or prioritised beach nourishment works). Some interim management Options may also be progressed, such as the development of emergency evacuation procedures and systems, until inundation protection measures can be fully implemented.

8.6.2 Further Investigations

Information gaps identified in the CHRMAP should be gathered early. Some of these gaps can be closed by the collection of data, as discussed previously in Section 8.4. Other information gaps can be closed during the preliminary and/or detailed design phase when specific or detailed analysis of available data, information, modelling, and projections are carried out.

The CHRMAP recommended investigations have been scoped specifically to meet coastal hazard planning elements introduced in the State Coastal Planning Policy 2.6. Recommended investigations are presented in Table 8-4.



Table 8-4 Recommended Coastal Investigations

Coastal Investigation	Overview	Location	Timing
Foreshore asset audit.	<p>Undertake a Foreshore Asset Audit in response to coastal hazard projections to 2047. The City should prepare an RFQ and engage a consultant to undertake an audit to identify existing infrastructure and recreational facilities in the coastal erosion and inundation hazard zone.</p> <p>The audit shall inform subsequent preparation of an Asset Management Plan to identify existing infrastructure and recreational facilities in the coastal erosion and inundation hazard zone and provides direction to:</p> <p>a. Progressively relocate non-critical assets (PMR2) away from the coastal hazard zone once they reach the end of asset life or replace assets with suitably durable and/or sacrificial infrastructure. This may include vulnerable recreational car parks; recreational amenities such as public ablutions; barbeque/picnic/shade areas; playground and other recreational equipment; and access structures such as ramps, stairs and paths and fences, etc.</p> <p>b. Plan for the relocation of critical service infrastructure outside of the coastal hazard zone once they reach the end of asset life, or at a minimum, modify the service infrastructure asset so that it does not run parallel to the coastline where possible and can be progressively removed when exposed to intolerable risk levels.</p>	All MU's.	2027.
Land leasebacks	Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat. Seek legal advice regarding the basis of agreements with landholders and whether opt-ins can be time constrained.	General across study area.	2027.
Sand source feasibility study.	<p>The City should prepare an RFQ and engage a consultant to investigate potential sand sources to use for coastal protection works.</p> <p>Several MU's have recommended Options which require sand nourishment, both for erosion management and inundation management (levee construction). The availability of suitable sand for beach nourishment works is unfortunately not well understood in the study area. It is recommended that a sand source feasibility is undertaken to determine the capacity and cost of local sand supplies. This study should consider both land-based and marine sand sources as well as evaluate potential environmental impacts and approvals required. Cost estimates in this CHRMAP have assumed that a reliable source of sand in reasonable proximity to the study area may be available. If this assumption is incorrect, costs may increase and affect the CHRMAP recommendations.</p>	All MU's.	2027.
Emergency evacuation plan.	The City should prepare an RFQ and engage a consultant to ensure that a preliminary emergency evacuation and response plan is prepared, maintained, and implemented to ensure the safe evacuation of occupants within the City during a severe coastal inundation event and/or severe erosion event.	All MU's.	2028.



Coastal Investigation	Overview	Location	Timing
	<p>A review of emergency evacuation plans in the study area should be undertaken to assess if the evacuation plans are suitable for managing the projected coastal hazards. Existing documents may need to be updated or revised as required. Plans should detail emergency response to coastal erosion and flooding impacts, as well as storm damage causing infrastructure to collapse into the public foreshore or coastal environment. Evacuation planning for inundation should clearly identify appropriate evacuation routes, assess their suitability, and plan for upgrades required to meet future developments. Scenario planning could also be undertaken to test the plans.</p>		
<p>Update Foreshore Management Plans.</p>	<p>The City should prepare an RFQ and engage a consultant to prepare updated Foreshore Management Plans (FMPs). These can increase the protective capacity of the natural dune system and provide an avenue for increased awareness and education for stakeholders and the community about coastal processes and management.</p> <p>Updated (FMPs) may increase the protective capacity of the natural dune system, and should address:</p> <ul style="list-style-type: none"> ▪ The requirements of SPP2.6 and its supporting Guidelines. ▪ The findings of this CHRMAP. ▪ Potential environmental issues such as biodiversity and environmental impacts and detail a weed management strategy for the coastline. ▪ Incorporate findings of Asset Management Plans as appropriate. ▪ Include review of existing beach access points, ensuring appropriately fenced and signed paths, signage for dune repair and clear signage for 4-wheel drive access and permissibility. ▪ Develop an education strategy for coastal and environmental management. The strategy should work to inform the community about the CHRMAP and FMP and their findings and use suitable engagement methods such as infographics, FAQ's. The education strategy should also include appropriate on-ground signage and information for beach access, camping and 4-wheel driving, where applicable. ▪ Monitor impacts of 4WD vehicles (where applicable) and general beach access on nesting habitats and migratory bird species in dune areas. ▪ Determine the need for a bush fire management plan for the dune and coastal areas. 	<p>All MU's.</p>	<p>2028.</p>
<p>Internal prioritisation of Management Units</p>	<p>It is recommended that further work is undertaken to identify priority sections of MU's and consider the use of composite treatment options in these MU's. This may see some sections of the current MU's being managed in different ways rather than one option for each MU. Appropriate supporting analysis is needed to propose preferred treatment options on smaller sections of coastline than the MU's presented in this</p>	<p>All MU's.</p>	<p>2029-2032</p>



Coastal Investigation	Overview	Location	Timing
	CHRMAP as the cost benefit analysis has considered these boundary extents and quantities. It is anticipated the current MU's could be further split based on the identified hazards, management jurisdiction, predominant foreshore use such as urban, residential, undeveloped etc.		
Combining treatment of both hazards	It is recommended further investigation is undertaken to consider the potential for dual-purpose treatment options to address both erosion and inundation hazards. Following prioritisation, and decision-making by the City (post-CHRMAP) dual-purpose treatments could potentially be scoped and designed that may be able to mitigate both hazards at the same time.	All MU's.	2029-2032

8.7 Medium and Long-term Implementation

Medium (25 – 50 years) and long-term (50 – 100 years) implementation provides a strategic consideration of how the City will adapt to long-term climate change impacts. Therefore, medium- and long-term implementation are not described in detail in the CHRMAP. Longer-term responses include:

- Continuing to action the revised planning instruments implemented in the short-term.
- Implementing planned managed retreat.
- Exhausting the SPP2.6 hierarchy of actions, high value assets may be protected where sustainable impacts and funding are identified/prioritised.
- Providing temporary/interim hazard protection may also become more costly and a change in adaptation pathway could be required. For example, as sea level rise progresses, it is possible that Options using sand or rock resources to protect assets near the coast may become economically unsustainable.

Long-term adaptation strategies/pathways have been recommended for each MU for both erosion and inundation that will allow for the continuous function of local communities whilst accommodating the increasing burden of coastal hazards. The long-term strategy informs future planning instruments, supports monitoring, recommends planning reviews and underpins collaboration between coastal land managers, stakeholders and the community.

8.8 Detailed Implementation Plans

Detailed implementation plans for each MU are presented from Table 8-5 to Table 8-9. Recommendations are provided in priority order for each MU. There is overlap with several recommendations across multiple MU's but these have been presented in each table so that readers can focus on a single MU if preferred and in case the City decide to stage works. An overview map of the Study Area and Management Unit locations is provided in Figure 8-4 below for reference. Individual maps depicting each hazard and the extent of proposed treatment options for each MU are provided in Appendix A.



Figure 8-4 Princess Royal Harbour Study Area



Table 8-5 MU1 – Point King to Melville point recommendations in priority order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
INVESTIGATION 1 Update Foreshore Management Plans (FMPs)	<ul style="list-style-type: none"> Prepare an updated Foreshore Management Plan An updated FMP could help increase the protective capacity of the natural dune system. Updates should address the requirements of SPP2.6 and incorporate the findings of this CHRMAP 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 Assumes only undertaken for this MU in isolation, but synergies should be investigated. 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	<ul style="list-style-type: none"> Item cost for investigations and management plans 	<ul style="list-style-type: none"> LGA Southern Ports 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 	<ul style="list-style-type: none"> Operational 	x	x		
Monitoring (NR1)	<ul style="list-style-type: none"> Bathymetric survey to monitor seagrass banks, approximately every 5 years Occasional survey to track inundation extent and levels 	<ul style="list-style-type: none"> LGA Can seek support and assistance from Southern Ports, DoT 	<ul style="list-style-type: none"> Completed CHRMAP Severe storm event(s) 	<ul style="list-style-type: none"> \$10,000 annually 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x	x	x
Notification on title (NR3)	<ul style="list-style-type: none"> Item cost for investigations and implementation plans 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DPLH, WALGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 1% annual maintenance of \$500) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Protection Structure Audit (NR2)	<ul style="list-style-type: none"> Item cost to inspect coastal asset condition, influence on sediment transport and inundation and remaining design life on all coastal management structures Includes Port revetments, Tug harbour and Albany Waterfront Marina breakwaters and revetments for Anzac Peace Park and Princess Royal Drive 	<ul style="list-style-type: none"> LGA, Southern Ports 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$150,000 (Plus 2% annual maintenance of \$3,000) 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 		x	x	
Emergency evacuation plans (NR4)	<ul style="list-style-type: none"> Item cost for investigations and evacuation plans 	<ul style="list-style-type: none"> LGA Southern Ports 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$100,000 (Plus 1% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) 	x	x		
Prevention of further development / prohibit expansion of existing use rights (PMR3)	<ul style="list-style-type: none"> Item cost for investigations and management plans Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat. Seek legal advice regarding the basis of agreements with landholders and whether opt-ins can be time constrained 	<ul style="list-style-type: none"> LGA Southern Ports 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 (Plus 1% annual maintenance of \$300) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Design assets to withstand impacts (AC1)	<ul style="list-style-type: none"> Item cost for investigations and management plans – primarily any case-by-case work needed for public assets 	<ul style="list-style-type: none"> LGA Southern Ports 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$100,000 (Plus 1% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants 	x	x		



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
INVESTIGATION 2 Sand Source Feasibility Study	<ul style="list-style-type: none"> Determine the capacity and cost of local sand supplies, including both land-based and marine sources. Undertake early stakeholder engagement and consider approvals required. Likely require repetition over Medium-term Focus is sand for beach nourishment and appropriate material for levee construction and potentially to raise height of land in inundation hazard zones 	<p>LGA</p> <p>Can seek support from Southern Ports and state departments</p>	Completed CHRMAP	<p>\$150,000</p> <p>Assumes undertaken for all MUs.</p>	Operational Grants (e.g. CAP)			x	
Recommended Short-Term Option to address Erosion Protection with existing Seawalls (PR3)	<ul style="list-style-type: none"> Protection is currently provided by various structures which while maintained are likely to continue to provide adequate protection. 	<ul style="list-style-type: none"> LGA DoT Southern Ports 	<ul style="list-style-type: none"> Coastal Protection Structure Audit (NR2) will identify maintenance required. 	<ul style="list-style-type: none"> TBC following Coastal Protection Structure Audit (NR2) 	Operational Grants (e.g. CAP)	x	x	x	
Recommended Short-Term Option to address Inundation is Monitoring (NR1), Accommodate (AC1) and Emergency Evacuation Plans (NR4)	<ul style="list-style-type: none"> There is no projected impact from inundation during the short-term for this MU. Implementation shall focus on Monitoring (NR1) and should an unexpected inundation event occur it can be managed via Accommodate (AC1) and Emergency Evacuation Plans (NR4). 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> See other recommended actions for their costs. 	N/A	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Assumes suitable sand source available (grain size, volume, cleanliness, proximity) Assumes treatment of 1000m of shoreline west of Albany Waterfront Marina. 2072 implementation is allowed for following the forecast end of the useful life of the Princess Royal Drive revetment, so there are no priority actions to implement this pathway in the short-term 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> Approximate capital cost of \$0.5M at NPV 4% Annual maintenance estimate of approximately \$0.2M 	Operational Grants (e.g. CAP) Direct beneficiaries				x
Recommended Medium and Long-term pathway to address Inundation is Accommodate (AC1)	<ul style="list-style-type: none"> See AC1 Future consideration of erosion protections options should consider their influence on, and capacity to provide protection from, inundation. 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> See AC1 	Operational Grants Direct beneficiaries				x



Table 8-6 MU2 – Melville Point to Rushy Point recommendations in priority order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
INVESTIGATION 1 Sand Source Feasibility Study	<ul style="list-style-type: none"> Determine the capacity and cost of local sand supplies, including both land-based and marine sources. Undertake early stakeholder engagement and consider approvals required. Likely require repetition over Medium-term Focus is sand for beach nourishment and appropriate material for levee construction and potentially to raise height of land in inundation hazard zones. 	<ul style="list-style-type: none"> LGA Can seek support from state departments 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$150,000 Assumes undertaken for all MUs 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x		
INVESTIGATION 2 Update Foreshore Management Plans (FMPs)	<ul style="list-style-type: none"> Prepare an updated Foreshore Management Plan An updated FMP could help increase the protective capacity of the natural dune system. Updates should address the requirements of SPP2.6 and incorporate the findings of this CHRMAP 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 Assumes only undertaken for this MU in isolation, but synergies should be investigated. 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	<ul style="list-style-type: none"> Item cost for investigations and management plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 	<ul style="list-style-type: none"> Operational 	x	x		
Monitoring (NR1)	<ul style="list-style-type: none"> Beach survey for storm behaviour and to track HSD and inundation levels Routine beach profiles every six months 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DoT 	<ul style="list-style-type: none"> Completed CHRMAP Severe storm event(s) 	<ul style="list-style-type: none"> \$15,000 annually 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x	x	x
Notification on title (NR3)	<ul style="list-style-type: none"> Item cost for investigations and implementation plans 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DPLH, WALGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 1% annual maintenance of \$500) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Protection Structure Audit (NR2)	<ul style="list-style-type: none"> Item cost to inspect coastal asset condition, influence on sediment transport and inundation and remaining design life on all coastal management structures Includes revetments along Princess Royal Drive (small section) and Frenchman Bay Rd; and could include consideration of informal structures at the Woolstores site. 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 2% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 		x	x	
Emergency evacuation plans (NR4)	<ul style="list-style-type: none"> Item cost for investigations and evacuation plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$100,000 (Plus 1% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) 	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	<ul style="list-style-type: none"> Preparation of Asset Management Plan To 2047 for public-built assets Maintenance assumes ongoing allowance for foreshore reserve Removal / Relocation of assets as required 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable 	<ul style="list-style-type: none"> \$1,600,000 (Plus 1% annual maintenance of \$16,000) 	<ul style="list-style-type: none"> Operational Grants 	x	x	x	
Prevention of further development / prohibit expansion of existing use rights (PMR3)	<ul style="list-style-type: none"> Item cost for investigations and management plans Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat. Seek legal advice regarding the basis of agreements with landholders and whether opt-ins can be time constrained 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 (Plus 1% annual maintenance of \$300) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Design assets to withstand impacts (AC1)	<ul style="list-style-type: none"> Item cost for investigations and management plans – primarily any case-by-case work needed for public assets 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$100,000 (Plus 1% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants 	x	x		



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Recommended Short-Term Option to address Erosion is to investigate and prepare for Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Undertake a detailed Sand Source Feasibility Study (Investigation 1) to confirm assumptions used in the CHRMAP CHRMAP analysis has found that the Protection Pathway is appropriate for this MU with provision of a sandy beach via nourishment Currently the option assumes the following: <ul style="list-style-type: none"> 7000m of shoreline treated (the whole length of the MU). Suitable sand source available (grain size, volume, cleanliness, proximity). Present day implementation It is noted the old Woolstores Site is subject to localised development plans including consideration of coastal hazards and is likely to become a prioritised sub-section of this MU as discussed in Section 8.6.2. 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP Monitoring Confirmation of design, costs and funding 	<ul style="list-style-type: none"> \$21.9M at NPV 4% for a 100-year timeframe 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) Direct beneficiaries 	x	x	x	
Recommended Short-Term Option to address Inundation is a Levee (PR6)	<ul style="list-style-type: none"> Assumes 3500m of levee required comprising three sections to protect the three areas most at risk of inundation. Other areas not at risk in the short-term. Assumes present day implementation because various asset and values vulnerable 2072 Replacement cost included 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP Monitoring Confirmation of design, costs and funding Confirmation of SLR in accordance with projections to 2047 	<ul style="list-style-type: none"> \$18.8M at NPV 4% for a 100-year timeframe Detailed design and costings estimated at \$200,000 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Direct beneficiaries 	x	x	x	



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Leaving assets unprotected (PMR1)	<ul style="list-style-type: none"> To 2047 for low-value public assets Assumes a clean-up rate following damage/loss No private land acquisition included Maintenance assumes ongoing allowance for foreshore reserve 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Storm damage Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable 	<ul style="list-style-type: none"> \$711,000 (Plus 3% annual maintenance of \$21,330) 	<ul style="list-style-type: none"> Operational 	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Monitoring will determine the need for additional works beyond those recommended in the short-term 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$21.9M at NPV 4% for a 100-year timeframe Annual maintenance estimate of approximately \$0.5M 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) Direct beneficiaries 				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	<ul style="list-style-type: none"> Monitoring and maintenance of infrastructure and design and performance reviews in accordance with new information and CHRMAP updates. Secondary components may include the need for additional levees and drainage improvements as sea level rise progresses 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$18.8M at NPV 4% for a 100-year timeframe Annual maintenance estimate of approximately \$0.27M 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Direct beneficiaries 				x



Table 8-7 MU3 - Rushy Point to Limekilns Point recommendations in priority order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
INVESTIGATION 1 Sand Source Feasibility Study	<ul style="list-style-type: none"> Determine the capacity and cost of local sand supplies, including both land-based and marine sources. Undertake early stakeholder engagement and consider approvals required. Likely require repetition over Medium-term Focus is sand for beach nourishment and appropriate material for levee construction and potentially to raise height of land in inundation hazard zones 	<ul style="list-style-type: none"> LGA Can seek support from state departments 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$150,000 Assumes undertaken for all MUs 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x		
INVESTIGATION 2 Update Foreshore Management Plans (FMPs)	<ul style="list-style-type: none"> Prepare an updated Foreshore Management Plan An updated FMP could help increase the protective capacity of the natural dune system. Updates should address the requirements of SPP2.6 and incorporate the findings of this CHRMAP 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 Assumes only undertaken for this MU in isolation, but synergies should be investigated. 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	<ul style="list-style-type: none"> Item cost for investigations and management plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 	<ul style="list-style-type: none"> Operational 	x	x		
Monitoring (NR1)	<ul style="list-style-type: none"> Beach survey for storm behaviour and to track HSD and inundation levels Routine beach profiles every six months 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DoT 	<ul style="list-style-type: none"> Completed CHRMAP Severe storm event(s) 	<ul style="list-style-type: none"> \$15,000 annually 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x	x	x
Notification on title (NR3)	<ul style="list-style-type: none"> Item cost for investigations and implementation plans 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DPLH, WALGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 1% annual maintenance of \$500) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Protection Structure Audit (NR2)	<ul style="list-style-type: none"> Item cost to inspect coastal asset condition, influence on sediment transport and inundation and remaining design life on all coastal management structures Includes revetments at Princess Royal Sailing Club and informal revetment structures between Rushy Point and the Sailing Club 	<ul style="list-style-type: none"> LGA Princess Royal Sailing Club 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 (Plus 2% annual maintenance of \$600) 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 		x	x	
Emergency evacuation plans (NR4)	<ul style="list-style-type: none"> Item cost for investigations and evacuation plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$100,000 (Plus 1% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) 	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	<ul style="list-style-type: none"> Preparation of Asset Management Plan To 2047 for public-built assets Maintenance assumes ongoing allowance for foreshore reserve Removal / Relocation of assets as required 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable 	<ul style="list-style-type: none"> \$1,095,000 (Plus 1% annual maintenance of \$10,950) 	<ul style="list-style-type: none"> Operational Grants 	x	x	x	



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Prevention of further development / prohibit expansion of existing use rights (PMR3)	<ul style="list-style-type: none"> Item cost for investigations and management plans Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat. Seek legal advice regarding the basis of agreements with landholders and whether opt-ins can be time constrained 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 (Plus 1% annual maintenance of \$300) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Design assets to withstand impacts (AC1)	<ul style="list-style-type: none"> Item cost for investigations and management plans – primarily any case-by-case work needed for public assets 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$100,000 (Plus 1% annual maintenance of \$1,000) 	<ul style="list-style-type: none"> Operational Grants 	x	x		
Recommended Short-Term Option to address Erosion is to investigate and prepare for Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Undertake a detailed Sand Source Feasibility Study (Investigation 1) to confirm assumptions used in the CHRMAP CHRMAP analysis has found that the Protection Pathway is appropriate for this MU with provision of a sandy beach via nourishment Currently the option assumes protection with beach nourishment (PR1) at different timeframes for either side of Princess Royal Sailing Club 1400m shoreline treated to northwest of Princess Royal Sailing Club, with present day implementation Assumes 3850m shoreline treated from Princess Royal Sailing Club to southeast, with 2047 implementation Protection by existing seawalls at the Princess Royal Sailing Club Assumes suitable sand source available (grain size, volume, cleanliness, proximity) Sections of this MU could be considered for further prioritised analysis as discussed in Section 8.6.2 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP Monitoring Confirmation of design, costs and funding 	<ul style="list-style-type: none"> \$8.7M at NPV 4% for a 100-year timeframe Detailed design and costings estimated at \$200,000 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) Direct beneficiaries 	x	x	x	
Leaving assets unprotected (PMR1)	<ul style="list-style-type: none"> To 2047 for low-value public assets Assumes a clean-up rate following damage/loss No private land acquisition included Maintenance assumes ongoing allowance for foreshore reserve 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Storm damage Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable 	<ul style="list-style-type: none"> \$498,000 (Plus 3% annual maintenance of \$14,940) 	<ul style="list-style-type: none"> Operational 	x	x	x	



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Recommended Short-Term Option to address Inundation is Monitoring (NR1), Accommodate (AC1) and Emergency Evacuation Plans (NR4)	<ul style="list-style-type: none"> There is no projected impact from inundation during the short-term for this MU. Implementation shall focus on Monitoring (NR1) and should an unexpected inundation event occur it can be managed via Accommodate (AC1) and Emergency Evacuation Plans (NR4). 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> See other recommended actions for their costs. 	<ul style="list-style-type: none"> N/A 	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Monitoring will determine the need for additional works beyond those recommended in the short-term 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$8.7M at NPV 4% for a 100-year timeframe Annual maintenance estimate of approximately \$0.4M 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) Direct beneficiaries 	■			x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	<ul style="list-style-type: none"> Assumes 1700m of levee required split across four sections across MU to protect the four areas most at risk of inundation. Other areas not at risk in the short-term. Assumes 2072 implementation, so there are no priority actions in short-term 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$1.1M at NPV 4% for a 100-year timeframe Annual maintenance estimate of approximately \$0.13M 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Direct beneficiaries 	■			x



Table 8-8 MU4 – Limekilns Point to Geake Point recommendations in priority order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
INVESTIGATION 1 Update Foreshore Management Plans (FMPs)	<ul style="list-style-type: none"> Prepare an updated Foreshore Management Plan An updated FMP could help increase the protective capacity of the natural dune system. Updates should address the requirements of SPP2.6 and incorporate the findings of this CHRMAP 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 Assumes only undertaken for this MU in isolation, but synergies should be investigated. 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	<ul style="list-style-type: none"> Item cost for investigations and management plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 	<ul style="list-style-type: none"> Operational 	x	x		
Monitoring (NR1)	<ul style="list-style-type: none"> Beach survey for storm behaviour and to track HSD and inundation levels Routine beach profiles every six months 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DoT 	<ul style="list-style-type: none"> Completed CHRMAP Severe storm event(s) 	<ul style="list-style-type: none"> \$7,500 annually 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x	x	x
Notification on title (NR3)	<ul style="list-style-type: none"> Item cost for investigations and implementation plans 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DPLH, WALGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 1% annual maintenance of \$500) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Emergency evacuation plans (NR4)	<ul style="list-style-type: none"> Item cost for investigations and evacuation plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$20,000 (Plus 1% annual maintenance of \$200) 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) 	x	x		
INVESTIGATION 2 Sand Source Feasibility Study	<ul style="list-style-type: none"> Determine the availability and cost of local appropriate material for levee construction and potentially to raise height of land in inundation hazard zones. Undertake early stakeholder engagement and consider approvals required. 	<ul style="list-style-type: none"> LGA Can seek support from state departments 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$150,000 Assumes undertaken for all MUs 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	<ul style="list-style-type: none"> Preparation of Asset Management Plan To 2047 for public-built assets Maintenance assumes ongoing allowance for foreshore reserve Removal / Relocation of assets as required 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable 	<ul style="list-style-type: none"> \$143,000 (Plus 1% annual maintenance of \$1,430) 	<ul style="list-style-type: none"> Operational Grants 	x	x	x	
Prevention of further development / prohibit expansion of existing use rights (PMR3)	<ul style="list-style-type: none"> Item cost for investigations and management plans Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat. Seek legal advice regarding the basis of agreements with landholders and whether opt-ins can be time constrained 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 (Plus 1% annual maintenance of \$300) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Design assets to withstand impacts (AC1)	<ul style="list-style-type: none"> Item cost for investigations and management plans – primarily any case-by-case work needed for public assets 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 1% annual maintenance of \$500) 	<ul style="list-style-type: none"> Operational Grants 	x	x		



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Recommended Short-Term Option to address Erosion is to investigate and prepare for Planned / Managed Retreat by Voluntary Acquisition (PMR4)	<ul style="list-style-type: none"> Acquisition assumed in the same year as hazard line identifies parcels as vulnerable Coastal hazards impact few properties in the short term, so the focus is to manage foreshore reserves and coastal amenities, undertake coastal monitoring, and prepare for implementation in medium to long-term 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$38.4M at NPV 4% for whole 100-year timeframe 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Specified Area Rate Levies 	x	x	x	
Recommended Short-Term Option to address Inundation is a Levee (PR6)	<ul style="list-style-type: none"> Assumes one 1250m section of levee required along coast near Lake Vancouver Assumes 2047 implementation 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP Monitoring Confirmation of design, costs and funding Confirmation of SLR in accordance with projections to 2047 	<ul style="list-style-type: none"> \$2.5M at NPV 4% Detailed design and costings estimated at \$150,000 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Direct beneficiaries 	x	x	x	
Leaving assets unprotected (PMR1)	<ul style="list-style-type: none"> To 2047 for low-value public assets Assumes a clean-up rate following damage/loss No private land acquisition included Maintenance assumes ongoing allowance for foreshore reserve 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Storm damage Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable 	<ul style="list-style-type: none"> \$65,000 (Plus 3% annual maintenance of \$1,950) 	<ul style="list-style-type: none"> Operational 	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Planned / Managed Retreat by Voluntary Acquisition (PMR4)	<ul style="list-style-type: none"> Implement when triggers are met See explanation in Land Use Planning Section of this report 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> HSD within specified distance of property boundary 	<ul style="list-style-type: none"> \$38.4M at NPV 4% for whole 100-year timeframe 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Specified Area Rate Levies 				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	<ul style="list-style-type: none"> Monitoring and maintenance of infrastructure and design and performance reviews in accordance with new information and CHRMAP updates. Secondary components may include the need for additional levees and drainage improvements as sea level rise progresses 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$2.5M at NPV 4% Annual maintenance estimate of approximately \$0.1M 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Direct beneficiaries 				x



Table 8-9 MU5 - Geake Point to Uredale Point recommendations in priority order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
INVESTIGATION 1 Sand Source Feasibility Study	<ul style="list-style-type: none"> Determine the capacity and cost of local sand supplies, including both land-based and marine sources. Undertake early stakeholder engagement and consider approvals required. Likely require repetition over Medium-term Focus is sand for beach nourishment and appropriate material for levee construction and potentially to raise height of land in inundation hazard zones. 	<ul style="list-style-type: none"> LGA Can seek support from state departments 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$150,000 Assumes undertaken for all MUs 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x		
INVESTIGATION 2 Update Foreshore Management Plans (FMPs)	<ul style="list-style-type: none"> Prepare an updated Foreshore Management Plan An updated FMP could help increase the protective capacity of the natural dune system. Updates should address the requirements of SPP2.6 and incorporate the findings of this CHRMAP 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 Assumes only undertaken for this MU in isolation, but synergies should be investigated. 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	<ul style="list-style-type: none"> Item cost for investigations and management plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$30,000 	<ul style="list-style-type: none"> Operational 	x	x		
Monitoring (NR1)	<ul style="list-style-type: none"> Beach survey for storm behaviour and to track HSD and inundation levels Routine beach profiles every six months 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DoT 	<ul style="list-style-type: none"> Completed CHRMAP Severe storm event(s) 	<ul style="list-style-type: none"> \$7,500 annually 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 	x	x	x	x
Notification on title (NR3)	<ul style="list-style-type: none"> Item cost for investigations and implementation plans 	<ul style="list-style-type: none"> LGA Can seek support and assistance from DPLH, WALGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$50,000 (Plus 1% annual maintenance of \$500) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Protection Structure Audit (NR2)	<ul style="list-style-type: none"> Item cost to inspect coastal asset condition, influence on sediment transport and inundation and remaining design life on all coastal management structures Includes Camp Quararup revetment 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$15,000 (Plus 2% annual maintenance of \$150) 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) 		x	x	
Emergency evacuation plans (NR4)	<ul style="list-style-type: none"> Item cost for investigations and evacuation plans 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Completed CHRMAP 	<ul style="list-style-type: none"> \$10,000 (Plus 1% annual maintenance of \$100) 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) 	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	<ul style="list-style-type: none"> Allows for removal / relocation of shed at Camp Quararup Maintenance assumes ongoing allowance for foreshore reserve No other built public assets at risk 	<ul style="list-style-type: none"> LGA 	<ul style="list-style-type: none"> Monitoring 	<ul style="list-style-type: none"> \$82,000 (Plus 1% annual maintenance of \$820) 	<ul style="list-style-type: none"> Operational Grants 	x	x	x	



Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2026-2027	2028-2035	2036-2050	2051-2120
Prevention of further development / prohibit expansion of existing use rights (PMR3)	<ul style="list-style-type: none"> Item cost for investigations and management plans Investigate opportunities for leaseback of land and land swaps in the context of planned and managed retreat. Seek legal advice regarding the basis of agreements with landholders and whether opt-ins can be time constrained 	LGA	Completed CHRMAP	<ul style="list-style-type: none"> \$20,000 (Plus 1% annual maintenance of \$200) 	<ul style="list-style-type: none"> Operational Grants (e.g. CMPAP) 	x	x		
Design assets to withstand impacts (AC1)	<ul style="list-style-type: none"> Item cost for investigations and management plans – primarily any case-by-case work needed for public assets 	LGA	Completed CHRMAP	<ul style="list-style-type: none"> \$30,000 (Plus 1% annual maintenance of \$300) 	<ul style="list-style-type: none"> Operational Grants 	x	x		
Recommended Short-Term Option to address Erosion is to investigate and prepare for Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Undertake a detailed Sand Source Feasibility Study (Investigation 1) to confirm assumptions used in the CHRMAP CHRMAP analysis has found that the Protection Pathway is appropriate for this MU with provision of a sandy beach via nourishment Currently the option assumes the following: <ul style="list-style-type: none"> Protection of Camp Quararup is currently provided by various structures which while maintained are likely to continue to provide adequate protection for the short-term. Assumes treatment of 750m beach and 150m of Camp Quararup shoreline with 2047 implementation Assumes suitable sand source available (grain size, volume, cleanliness, proximity) 	LGA	<ul style="list-style-type: none"> Completed CHRMAP Monitoring Confirmation of design, costs and funding 	<ul style="list-style-type: none"> \$2.0M at NPV 4% for a 100-year timeframe Detailed design and costings estimated at \$200,000 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) Direct beneficiaries 	x	x	x	
Recommended Short-Term Option to address Inundation is Monitoring (NR1), Accommodate (AC1) and Emergency Evacuation Plans (NR4)	<ul style="list-style-type: none"> There is no projected impact from inundation during the short-term for this MU. Implementation shall focus on Monitoring (NR1) and should an unexpected inundation event occur it can be managed via Accommodate (AC1) and Emergency Evacuation Plans (NR4). 	LGA	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> See other recommended actions for their costs. 	N/A	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Protection with Beach Nourishment (PR1)	<ul style="list-style-type: none"> Monitoring will determine the need for additional works beyond those recommended in the short-term 	LGA	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$2.0M at NPV 4% for a 100-year timeframe Annual maintenance estimate of approximately \$0.15M 	<ul style="list-style-type: none"> Operational Grants (e.g. CAP) Direct beneficiaries 				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	<ul style="list-style-type: none"> Assumes 300m of levee required around Camp Quararup and 50m for depression in Isthmus Assumes 2072 implementation, so there are no priority actions in short-term 	LGA	<ul style="list-style-type: none"> Monitoring Updated CHRMAP 	<ul style="list-style-type: none"> \$0.2M at NPV 4% Annual maintenance estimate of approximately \$27,000 	<ul style="list-style-type: none"> Operational Grants (e.g. DRF) Direct beneficiaries 				x

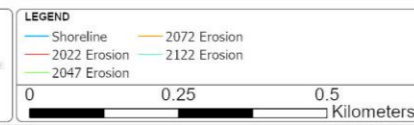


APPENDIX A MAPS OF EROSION AND INUNDATION AND RECOMMENDED ADAPTATION OPTIONS





NOTE:
Water Technology Pty Ltd has prepared this document in accordance with the request of the City of Albany for their specific use.
DISCLAIMER:
Water Technology and Water Technology Pty Ltd does not warrant that this document is suitable for use and does not accept liability for any loss or damage arising from reliance upon information provided herein.
Contains SENSITIVE INFORMATION © State of Western Australia 2024



1:11,000 at A3



Princess Royal Harbour CHRMAP
Erosion - Controlled (MU1)

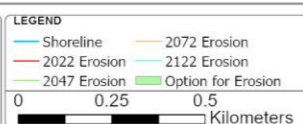
REFERENCE: M:\Temp\2024\0000\Special\Workspaces\2024\0000_Figures\2024\0000_Figures.aprx
DATE: 15/05/2024
SHEET: 34
DRAWING NUMBER:



NOTE:
Water Technology Pty. Ltd. has prepared this document in accordance with instructions of City of Albany and from specific data.

DISCLAIMER:
The City of Albany and Water Technology Pty. Ltd. does not warrant that the information contained in this report and other data and/or information are true, correct or complete, or that the information is suitable for any purpose other than that for which it was prepared.

Copyright © 2024 Water Technology Pty. Ltd.



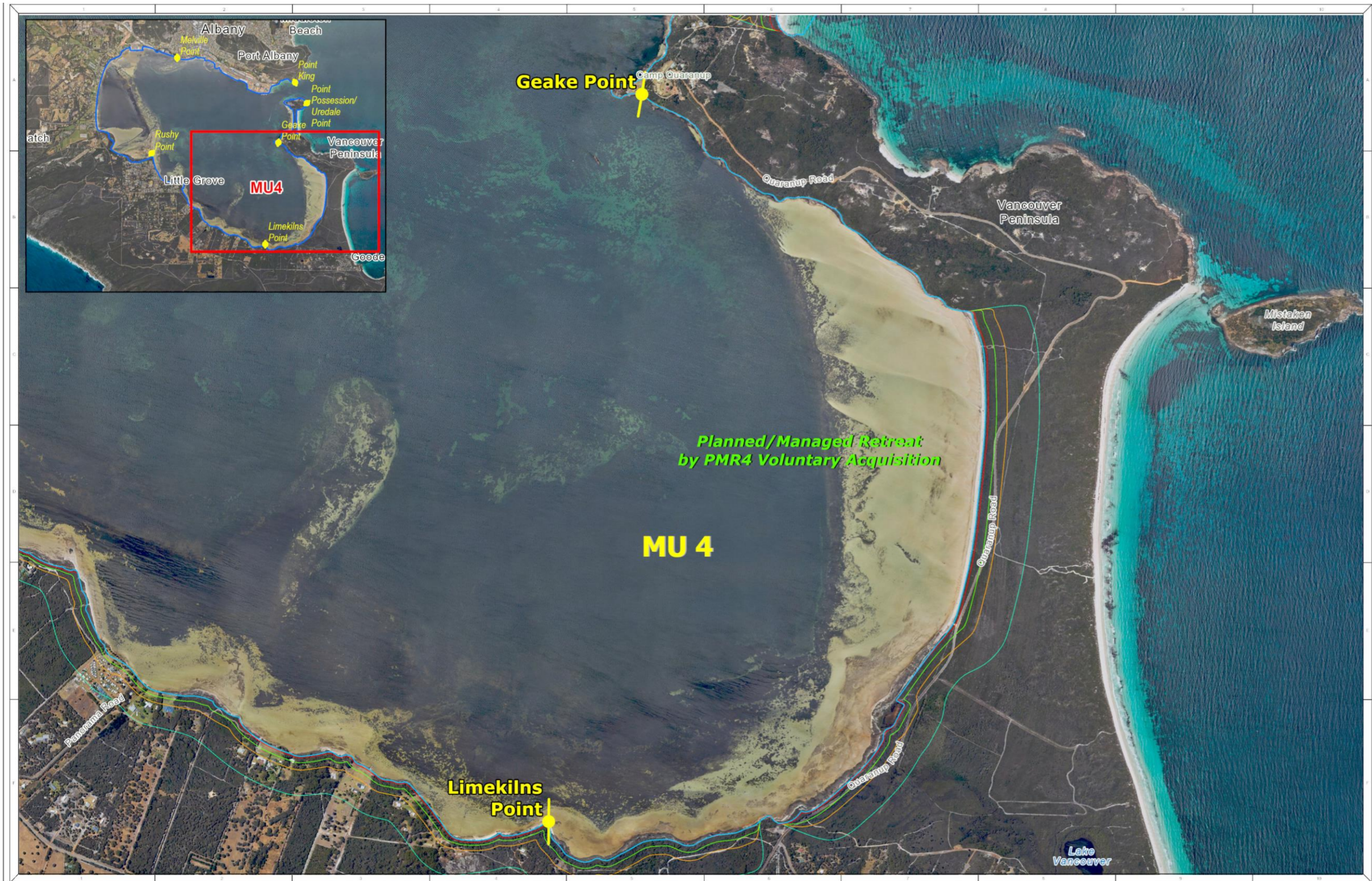
1:17,500 at A3



Princess Royal Harbour CHRMAP
Erosion - Controlled (MU2)

REFERENCE: M1 Temp\A3_1224\0008\0008\Workspaces\2204\0008_Figures\2204\0008_Figures.mxd
DATE: 10/05/2024 SHEET: # DRAWING NUMBER:

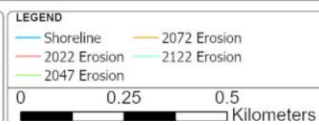




NOTE: Water Technology P/L has prepared this document in accordance with instructions of City of Albany for this specific use.

DISCLAIMER: The City of Albany and Water Technology P/L do not warrant that this document is definitive or free from error and shall not accept liability for any loss caused or incurred from reliance upon information provided herein.

Contains REPLACEMENT Information © State of Western Australia 2024

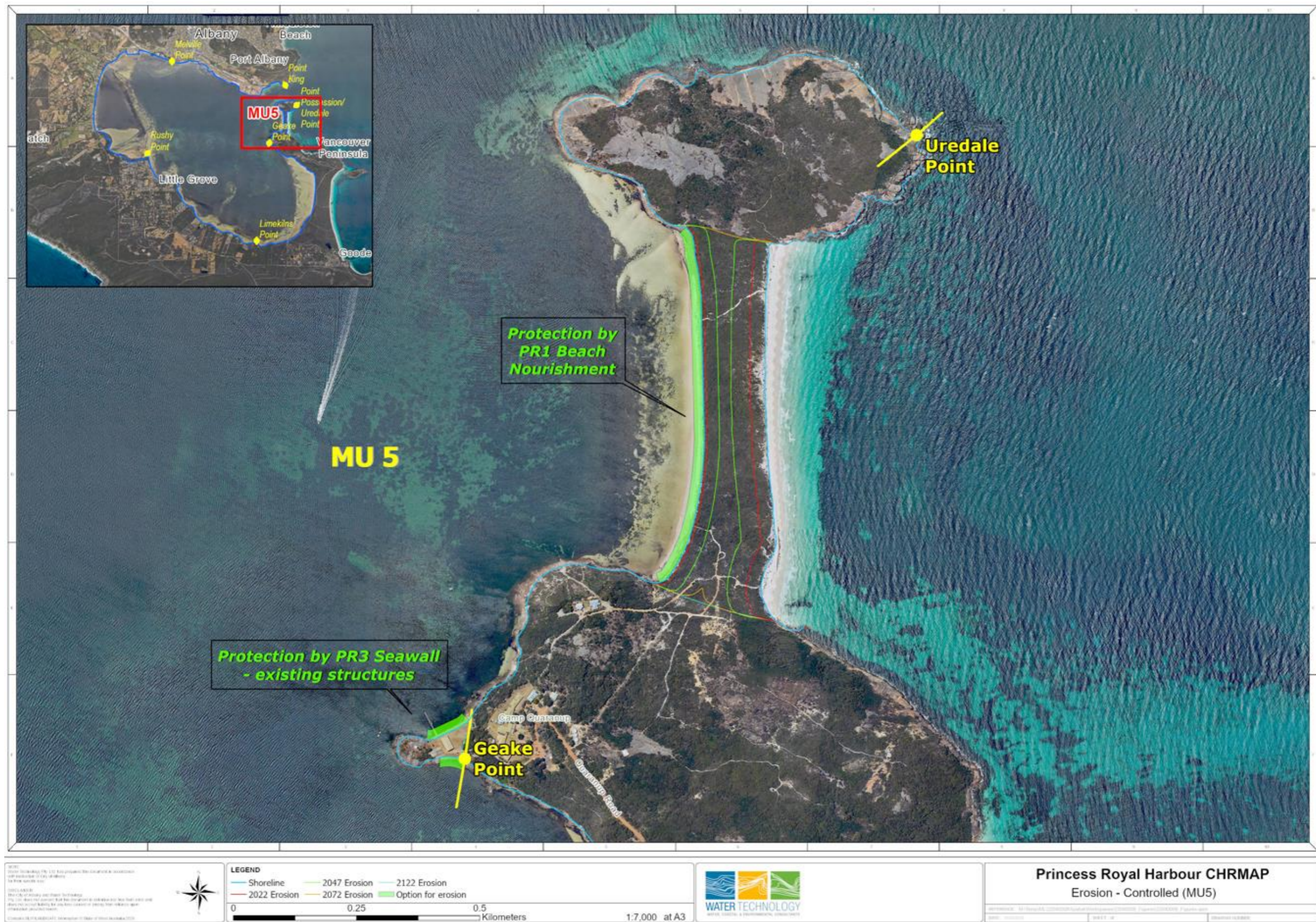


1:16,000 at A3



Princess Royal Harbour CHRMAP
Erosion - Controlled (MU4)

REFERENCE: M:\temp\04_22040008\Spatial\Workspaces\22040008_Figures\22040008_Figures.aprx
DATE: 15/05/2024 SHEET: 4 OF 4 DRAWING NUMBER:





NOTE:
Water Technology Pty. Ltd. has prepared this document in accordance with the instructions of the City of Albany.
The City of Albany and Water Technology Pty. Ltd. do not warrant that this document is complete and accurate and does not accept liability for any loss caused or arising from reliance upon information provided herein.
Copyright © 2024 Water Technology Pty. Ltd.

LEGEND

- Shoreline
- Inundation Extent - 2017
- Inundation Extent - 2022
- Inundation Extent - 2047
- Inundation Extent - 2072

Imag RGB

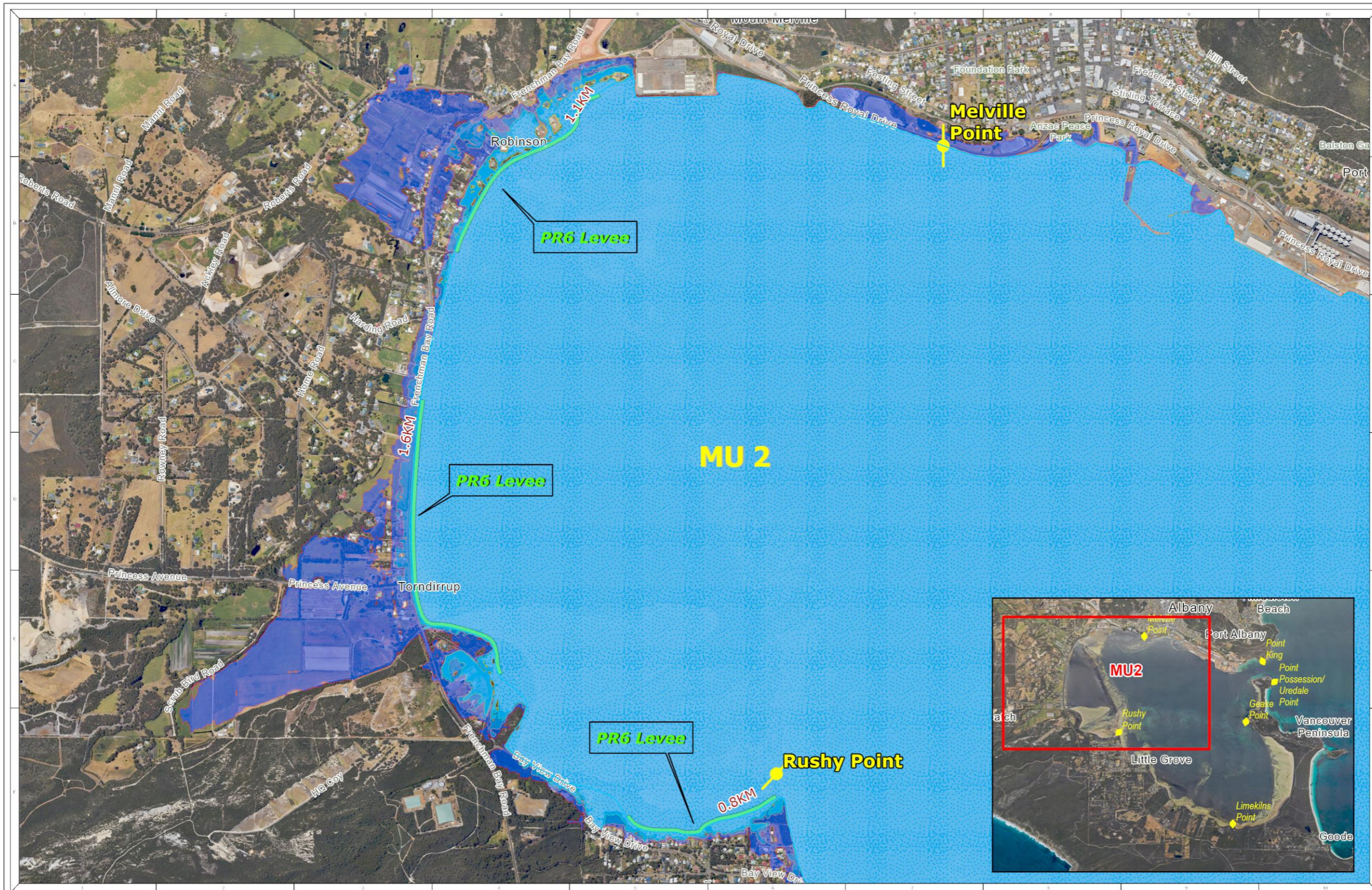
0 0.25 0.5 Kilometers

1:11,000 at A3



Princess Royal Harbour CHRMAP
Inundation - Controlled (MU1)

REFERENCE: M:\Temp\ALB\2024\06\Spatial\Workspaces\2024\06\Figures\2024\06\Figures.aprx
DATE: 11/05/2024 SHEET: 34 DRAWING NUMBER:



NOTE:
Water Technology Pty Ltd has prepared this document in accordance with instructions of City of Albany and their specific use.

DISCLAIMER:
The City of Albany and Water Technology Pty Ltd do not warrant or accept liability for any loss caused or arising from reliance upon information provided herein.

Copyright © 2024 Water Technology Pty Ltd

LEGEND

- Shoreline
- Option for Inundation
- Inundation Extent - 2122
- Inundation Extent - 2072
- Inundation Extent - 2047
- Inundation Extent - 2022

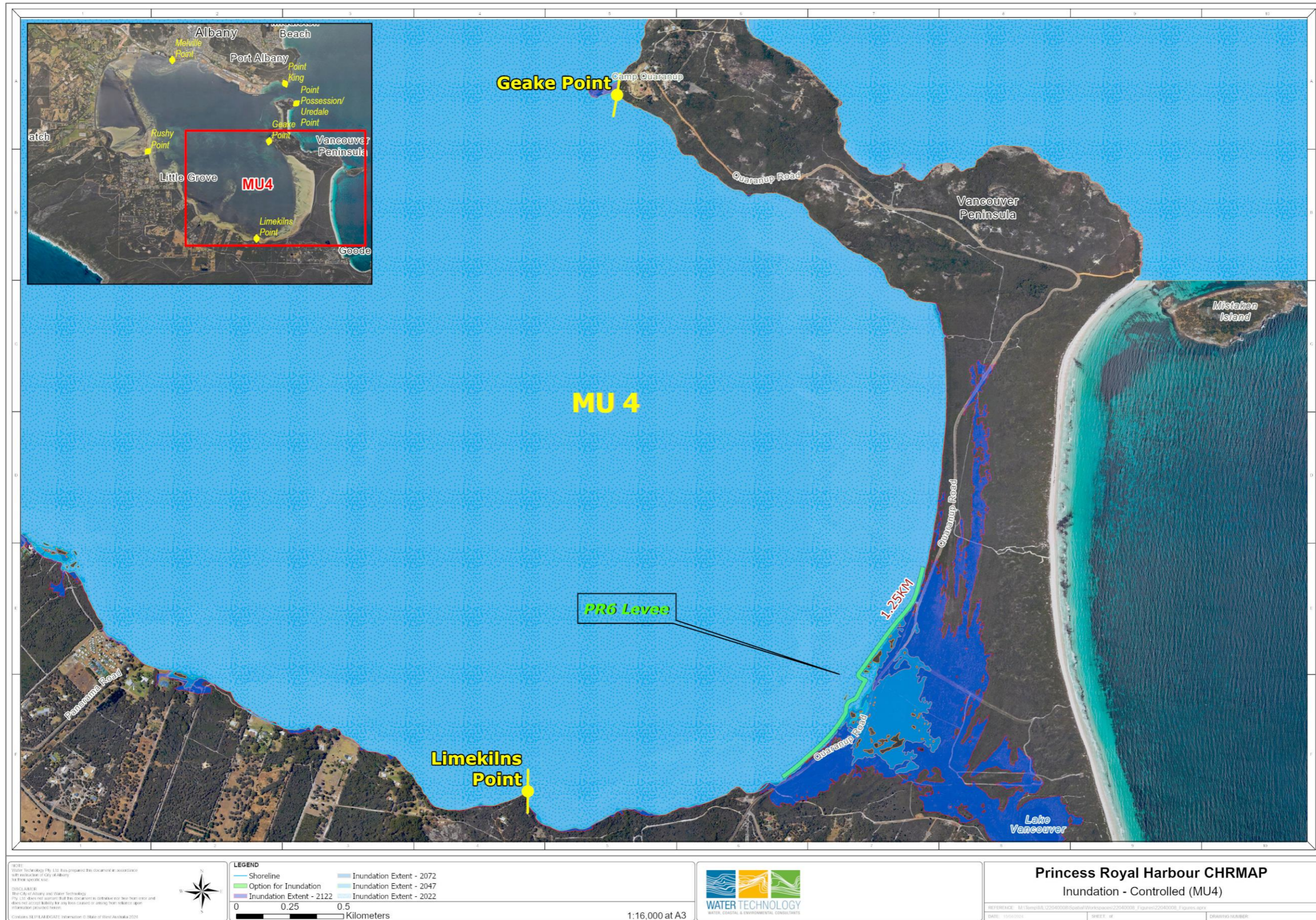
0 0.25 0.5 Kilometers

1:17,500 at A3



**Princess Royal Harbour CHRMAP
Inundation - Controlled (MU2)**

REFERENCE: M:\304000\304000\Spatial\Workspaces\20400008_Figures\2040008_Figures.aprx
DATE: 15/05/2024 SHEET: 1/1 DRAWING NUMBER:







APPENDIX B ESTABLISH THE CONTEXT CHAPTER REPORT





APPENDIX C RISK IDENTIFICATION CHAPTER REPORT





APPENDIX D VULNERABILITY ANALYSIS CHAPTER REPORT





APPENDIX E RISK EVALUATION AND TREATMENT CHAPTER REPORT





APPENDIX F
ASSESSMENT OF RISK TREATMENT OPTIONS
CHAPTER REPORT





APPENDIX G IMPLEMENTATION AND MONITORING CHAPTER REPORT





APPENDIX H COASTAL HAZARD LOCAL PLANNING POLICY





PRH Coastal Hazard Local Planning Policy

Policy Application

This policy applies to all land with Special Control Area 15- Princess Royal Harbour Coastal Hazard Area (SCA 15), which is that land identified as being subject to coastal hazards. The extent of SCA 15 is shown on the plan in Appendix 1.

The policy applies to all strategic planning, subdivision and development proposals for land within SCA 15.

Policy Objectives

1. To identify land within Princess Royal Harbour at risk of coastal erosion and inundation by 2122.
2. To ensure land in the coastal zone is continuously available for coastal foreshore management, public access, recreation and conservation purposes.
3. To ensure public health and safety and reduce risk associated with coastal erosion and inundation.
4. To avoid inappropriate land use and development of land at risk of coastal erosion and inundation.
5. To protect new development from the impacts of coastal erosion and inundation.
6. To ensure coastal process considerations are taken into account in preparing strategic planning proposals and in assessing subdivision and development applications.

Definitions

Annual Recurrence Interval (ARI) means how likely an event is to occur. For example, a 100-year ARI event is an event that occurs or is exceeded on average once every 100 years.

CHRMAP means the Princess Royal Harbour Coastal Hazard and Risk Management Adaptation Plan.

Coastal means the area of water and land that may be influenced by coastal processes.

Coastal hazard means the consequence of coastal processes that affect the environment and safety of people. Potential coastal hazards include erosion and inundation.

Coastal hazard notice means a notice given to the landholder where the local government forms the view that a trigger event has occurred.

Coastal processes means any action of natural forces on the coastal environment.

Erosion Hazard Line means mapped erosion lines identified within the CHRMAP.

Habitable Room has the same meaning given in *State Planning Policy 7.3 Residential Design Codes – Volume 1*.

Horizontal Shoreline Datum (HSD) means the active limit of the shoreline under storm activity, as defined in State Planning Policy 2.6 – State Coastal Planning Policy. It is the line from which a physical processes allowance will be applied from, as identified in the CHRMAP and the City's online mapping tool.

Net Lettable Area has the same meaning given in the *Planning and Development (Local Planning Schemes) Regulations 2015*.

Permanent Development means development that is not time or event limited as determined by the City.

S1 Value means the allowance for the current risk of storm erosion, as identified in the CHRMAP and the City's online mapping tool.

SCA 15 means Special Control Area 15 – Princess Royal Harbour Coastal Hazard Area as defined on the Scheme Maps.

Scheme means the City of Albany Local Planning Scheme No. 2 or any subsequent local planning scheme endorsed by the Minister for Planning.

SPP 2.6 means State Planning Policy 2.6 Coastal Planning Policy.



PRH Coastal Hazard Local Planning Policy

Planning Proposals means a Local Planning Strategy, Local Planning Scheme, amendment to a Local Planning Scheme, Structure Plan or Local Development Plan.

Trigger event means one or more of the following events:

Where the most landward part of the Horizontal Shoreline Datum (HSD) is within the S1 distance of the most seaward point of the development (refer to CHRMAP for the S1 erosion allowance for the subject land).

Public road access to a property is no longer available or able to provide legal access to the property; or

Water, sewerage or electricity to the property is no longer available, or where a reticulated sewerage system has not been available to a property, when the separation distance between groundwater and the discharge point of the onsite sewerage system as set out in the Government Sewerage Policy cannot be maintained.

Requirement for Development Approval

Notwithstanding any other provision in the Scheme, development approval is required prior to commencing or carrying out any works or use of land within SCA 15, unless specified as exempt development in this Policy.

Where development approval is required, applications will need to clearly demonstrate that the proposed development meets the objectives and requirements of this Policy and any other relevant requirements of the City's planning framework.

Exempted Development

Notwithstanding the land being located within SCA 15, unless otherwise required by the Scheme, the provisions of this Policy do not apply to:

1. Alterations and additions to a habitable room of an existing residential building or net lettable area of commercial, retail or community building which does not exceed 50m² cumulatively from the date of adoption of this Policy.
2. A change of use that does not intensify development or use of the land.

General

Coastal hazards must be considered in preparing strategic proposals and when making statutory planning decisions in order to avoid increasing the impacts of coastal processes on inappropriately located land use and development.

Notwithstanding the requirements of this Policy, the City may exercise discretion in its consideration of proposals where a site-specific coastal hazard assessment is prepared in accordance with SPP 2.6 to demonstrate the suitability of the proposal.

Erosion

Subdivision:

1. There is a general presumption against further subdivision of properties on the seaward side of the 2122 Erosion Hazard Line, except where the application is for:
 - (a) a purpose which will not create the potential for additional private development within the erosion hazard area; or
 - (b) boundary realignment, rationalisation of landholdings or lots created for a foreshore reserve which will not create the potential for additional private development within the erosion hazard area.
 - (c) and the subdivision is otherwise consistent with the local and State planning framework.



PRH Coastal Hazard Local Planning Policy

2. A notification pursuant to Section 165A of the Planning and Development Act 2005 is to be placed on the Certificate(s) of Title of the subject land, at the cost of the landholder, advising that the lot(s) are located in an area likely to be subject to coastal hazard within the period to 2122.

Development:

1. Development located seaward of the 2122 Erosion Hazard Line will only be permitted provided:
 - (a) the applicant demonstrates that the design life of the development is suitable for its location with regard to the Erosion Hazard Lines contained within the CHRMAP and the development can be relocated or removed;
 - (b) conditions are imposed as to:
 - i. constrain the location of the development;
 - ii. control the form of construction including foundations and associated works;
 - iii. determine the form, location and construction of access;
 - iv. require a minimum floor level for development;
 - v. limit the term of the approval; and/or
 - vi. require the approved development to be removed and land restored to its pre-development condition to the satisfaction of the City, upon a trigger even occurring.
 - (c) a condition is imposed requiring a notification to be placed on the certificate of title of the subject land pursuant to section 70A of the Transfer of Land Act 1893 to alert prospective purchasers of the limited term of the approval and the requirement to restore the land to its pre-development condition to the satisfaction of the City, upon a trigger event occurring.
2. Wherever reasonably practicable to do so any new development is to be located on the least vulnerable portion of the land.
3. If the local government forms the view that the trigger event has occurred, the local government may give notice to the landholder requiring:
 - (a) the development to be removed, pulled down or altered in accordance with the notice; and
 - (b) the land to be restored to its pre-development condition to the satisfaction of the local government.
4. If a person fails to comply with a coastal hazard notice, the local government may enter the land and carry out the works specified in the notice. The expenses incurred by the local government in carrying out the works may be recovered as a debt due from the person to whom the notice was given in a court of competent jurisdiction.

Inundation



PRH Coastal Hazard Local Planning Policy

Planning Proposals:

1. planning proposals for land identified as being prone to inundation should not provide for more intensive development or use of this land.
2. planning proposals for land identified as being prone to inundation must demonstrate how it is proposed to plan for and appropriately manage coastal hazards, including risk to public utility infrastructure servicing the land and roads which provide public access to the land.
3. planning proposals for land adjacent to the coast must include provision for a coastal foreshore reserve which is to be ceded free of cost to the Crown without payment of compensation. The coastal foreshore reserve width is to include a suitable allowance for coastal processes, in addition to sufficient land which is not vulnerable to coastal processes in order to provide for continued coastal foreshore management, public access, recreation, conservation and landscape amenity.

Subdivision:

1. For subdivision applications for land identified as being prone to inundation, the City will need to be satisfied that the subdivision will not lead to development at risk of coastal hazard, and in particular:
 - (a) for subdivision of land in an urban area, the finished surface level of all new roads and lots within the subdivision area must be at or above 3.02m AHD.
 - (b) public road access to the new lots must not be subject to inundation to the extent that would result in difficulty providing evacuation during a coastal inundation event.

Development:

1. Habitable rooms for residential buildings and net lettable areas for commercial, retail or community buildings require minimum finished floor level of at least 3.02m AHD with a 300mm freeboard, with the exception of the following which may be considered below this level:
 - (a) Minor additions and alterations to buildings which exist at the date of adoption of this Policy, where the minimum finished floor level is not reasonably practicable or desirable in a particular instance; or
 - (b) Non-habitable buildings or floorspace such as outbuildings, carports, or the lower floor level of buildings between the natural ground level and the habitable floor level where the non-habitable purpose is noted on the application for development approval and/or building permit as such and therefore solely used for the labelled purpose.
2. Where the filling of land is proposed to achieve minimum finished floor levels, the design and extent of fill and any retaining walls shall not create an adverse impact of inundation levels on adjacent properties or the amenity of the locality.
3. All utility service connections including power points, light switches, communications connections, sewer vents and the like shall be elevated and/or designed to be protected from the impacts of inundation. The City may require information to demonstrate how this will be achieved or apply conditions to this effect.
4. Buildings designed to withstand structural loads associated with inundation, including water resistant building materials and construction methods. The City may require information from a structural engineer to demonstrate how this will be achieved or apply conditions to this effect.
5. Where reticulated sewerage is not provided to the land, the onsite effluent disposal system must be an aerobic treatment unit with nutrient retentive capacity to the satisfaction of the City and be designed to withstand inundation events.
6. All development approvals will include a condition requiring a notification to be placed on the certificate of title of the subject land pursuant to section 70A of the Transfer of Land Act 1893 to alert prospective purchasers that the land is located within an area likely to be subject to coastal hazard within the period to 2122, except where the coastal hazard will be adequately addressed through the development works or is otherwise suitably addressed.

Appendix 1 – Coastal Hazard Policy Area Map



PRH Coastal Hazard Local Planning Policy





Melbourne

15 Business Park Drive
Notting Hill VIC 3168
Telephone (03) 8526 0800

Sydney

Suite 3, Level 1, 20 Wentworth Street
Parramatta NSW 2150
Telephone (02) 9354 0300

Brisbane

Level 5, 43 Peel Street
South Brisbane QLD 4101
Telephone (07) 3105 1460

Adelaide

1/198 Greenhill Road
Eastwood SA 5063
Telephone (08) 8378 8000

Perth

Level 1, 21 Adelaide Street
Fremantle WA 6160
Telephone (08) 6555 0105

New Zealand

7/3 Empire Street
Cambridge New Zealand 3434
Telephone +64 27 777 0989

Wangaratta

First Floor, 40 Rowan Street
Wangaratta VIC 3677
Telephone (03) 5721 2650

Geelong

51 Little Fyans Street
Geelong VIC 3220
Telephone (03) 8526 0800

Wimmera

597 Joel South Road
Stawell VIC 3380
Telephone 0438 510 240

Gold Coast

Suite 37, Level 4, 194 Varsity Parade
Varsity Lakes QLD 4227
Telephone (07) 5676 7602

watertech.com.au

